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Designing the Printed Book as an Interactive Environment

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Abstract: Reading a book demands a certain level of interaction from the reader. The cover must be opened and pages turned to navigate the information inside. Conventions have been developed over the life of the book to assist the reader in this navigation and provide orientation. The evolution of electronic reading material has given readers greater opportunities for interacting with their reading material, but many readers still prefer reading from a printed book. This paper investigates how the interactive organizational paradigm of hypertext can be implemented in a printed book to give the reader the opportunity for greater interaction and benefit from some of the advantages that electronic reading environments provide. The investigation in this paper follows an iterative design process in consultation with a panel of four experts. Through four rounds of consultation and refinement two potential solutions were developed for the incorporation of hypertext methods in a printed book.

Keywords: Book Design, Hypertext, Interactive Books

Introduction

BOOKS ARE A traditional reading environment which require interaction from the reader to consume the knowledge within the pages. In contrast, hypertext is a comparatively recent method for presenting written information that is consumed in an associative manner, requiring a different type of interaction from the reader. The acts of opening a book and turning the page with a physical book become mouse clicks and swipes in a digital environment. Paper books still have many advantages; Bolter states that, “No one technology of writing has ever proven adequate for all needs” (Bolter, 1991, p. 39). Books and hypertext both have advantages, yet both also have their disadvantages as people develop new expectations of their reading environments. “The book still functions as a most discrete educational resource, a traditional object which nevertheless is capable of the most contemporary adaptation, yet remains an aesthetic dimension, not only for bibliophiles, but also appeals to the average reader and the general public” (Kaufman, 1983, p. 40). The printed book continues to evolve, even with the popularization of electronic reading environments.

This paper discusses the important design considerations that need to be made in applying the methods of hypertext to a non-fiction printed book from the perspective of book design and the design of interactive and hypertext environments. This theory is then applied in the design process to explore potential visual representations of this theory. Two potential solutions were developed from six initial design ideas through an iterative design-analyse-refine process.

The Book as an Interactive Environment

Many of the features that typify a book have been developed over hundreds of years to aid readers in orientation and navigation through the printed pages. These visual landmarks assist the reader in many ways including searching for information. Tom McArthur ventures that the structure of books is not 'natural' and took 4,000 years to develop (Landow, 1997). "Over the last 600 years the Western printing and publishing industries have developed an elaborate set of protocols and cues that guide readers as to a book's internal structure and contents, as well as its external references" (Woodhead, 1991, p. 98).

The way in which many physical documents are designed give a multitude of cues to orient the reader; common searching systems in books include tables of contents, indices, bibliographies, chapter headings, page numbers and footers. Hierarchy (paragraphs, sections and chapters) is an attempt to create an order from the network of ideas (Bolter, 1991).

These orientation features are not essential to the content of the work, but aid the reader in navigating the linear text. They enhance the process of navigation and information retrieval as well as assisting with providing structure. A clear structure will facilitate perception, interpretation, understanding, learning and memory. For creating accessible information an appropriate index or search feature should be provided as well as context for important information contents, regardless of the medium (Pettersson & Tullinge, 2010). An index invites the reader to read the book in an alternative, non-linear way (Bolter, 1991) and referring notes in an index such as 'see also' can help establish connections between different subjects, and in particular can be used to send the reader from a general to a particular entry (Thomas, 1970). This goes some way to supporting the needs of readers who wish to consume the linear content of a book in a non-linear manner.

The interaction used to read a printed book is different to that of reading material in an electronic form. The vertically cumulative nature of print is created by the reader turning pages, reading down the pages through the information which is organised to shape the reader's comprehension (Birkerts, 2006). Turning the pages of the book is an interaction that has become instinctive and unconscious. The physical interface of a book is familiar to readers and each reader has developed ways in which they interact with a book that are effective for them. The average reader is comfortable with the form of the book and the type of interaction that they must use in order to read its contents. In mediating the printed page new interaction tools can be given to the reader of the printed book.

Designing Interactive Environments

The design of an interface for a book should be as carefully considered as one in an electronic media. A good interface design should take the user on a journey where they are gently encouraged to experience the interface and explore its content. "There is no single kind of user environment which suits all applications or all users; the choice of an appropriate interface depends on the users and their familiarity with particular software" (The British Computer Society Schools Committee, 1995, p. 61). Good interfaces will aid users in their decisions, without restricting where they will go; each individual's own needs and prior experiences will ultimately dictate how they will interact with an interface.

Navigation aids need to be consistent, such as always having the navigation aids in the same place and making their function obvious (Handler, Dana, & Moore, 1995) for ease of

usability. When designing links, potential problems with a cluttered display and ambiguity need to be considered. Links need to be clear and give information to the reader about the type of link and where it will take them. Links should definitely not decrease the legibility of the text. Busy displays should be avoided as users can become overwhelmed by too many distinct attributes. Kirsh (1997) explains that much research acknowledges that good interfaces should be highly visual; actions that are available should be visible to users.

Hypertext Design Considerations

Hypertext is the non-linear structural organization of information that communicates relationships and can be seen as an organisational paradigm (Nurnberg, 2003). Hypertext also gives data a structure, making access more efficient or the data more convenient to retrieve. The data in a hypertext system gains meaning and context through the relationships it has with other data. The non-sequential accessing of information through links allows the author and the reader to participate in the document through the connection of related items. (Bernstein, 1988). The system of relationship management that is hypertext, actively engages the reader in the creation of both meaning and structure. “Hypertext is frequently said to mimic the associative properties of the mind” (Jonassen, 1991, p. 83); it imitates the way the human brain uses referential links to store and retrieve information. This quick and intuitive access to information means that knowledge can be represented for learners in meaningful ways.

In the design of hypertext systems, consistent and coherent design is essential so that the reader can immediately understand the text and remain oriented. A consistent navigation model within the hypertext can help to achieve coherence (Elsom-Cook, 2001). Bernstein (1988) explains that three distinct types of information are provided by a hypertext environment at any time; cues for orientation, links to further information, and additional information such as text or graphics. Hypertext pages should be designed to reflect the three distinct functions it should perform.

Typically, hypertext pages have high information density and this can pose a significant challenge for the designer (Bernstein, 1988). Visual cues need to be given to the reader in regards to their current position within the document, and links need to be easily identifiable. As discussed by Timpany (2009), in the paper *Developing Key Concepts for the Design of Hypertext for Printed Books*, there are six key concepts to consider when applying hypertext methods to a printed book. The six concepts consider five design factors: structure, visual attributes, orientation, links and searching. The six concepts to be considered are:

1. Readers should be given an overview of the structure of the text before they begin.
2. The placement and function of navigation aids should be consistent and obvious and should not distract the reader.
3. Visual indicators should point to pages commonly referenced or familiar to the reader.
4. Readers should be able to identify where they currently are within the structure of the book.
5. Links should be easily identifiable and their purpose clear.
6. Searching facilities should be easily accessible and clearly laid out.

The guidelines provided by these 6 key concepts give a framework for a theoretical basis for the design of a printed book which employs hypertext methods for the benefit of its readers. Most importantly, hypertext systems need to be easy for the user to navigate without disorientation.

Developing the Interface Design

To investigate and develop the best methods for applying hypertext to the printed book an iterative ‘design-analyse-refine’ process was undertaken which involved the design of a range of potential methods for creating a hypertext system in a printed book. For each round a series of layouts was created that employed the key methods of designing hypertext for printed books with consideration of the analysis given by the experts in the previous rounds of the process. Non-fiction content was chosen for the book as readers are more likely to read non-fiction in a non-linear manner. The way non-fiction texts are organized will effect how readers engage with them, where this non-linear interaction is encouraged it is often familiar to the reader from encounters with the Internet (Gamble, 2008).

The six key concepts for the design of hypertext books outlined in the paper by Timpany (2009) were applied in various ways to a series of prototypes and were carefully considered throughout the iterative process. The recommendations by Elsom-Cook (2001), Handler et al. (1995), Kirsh (1997) and Rubenstein & Hersh (1987) were also carefully considered to ensure a sound theoretical base for the design of the interface. These prototypes were then analysed by experts, with improvements made based on their comments and suggestions.

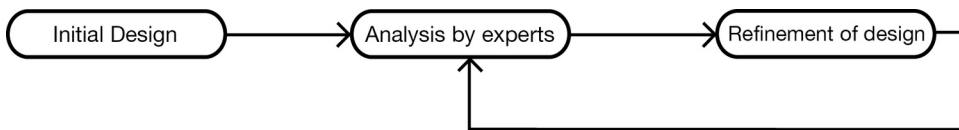


Diagram 1: Stages of the Design-Analyse-Refine Process

This process was developed over four stages with the application of the key concepts for the design of hypertext books being refined at each stage. Experts in design, hypertext, and interactivity provided feedback on the effectiveness of the designs regarding their layout, ease of navigation, and fulfillment of methods used in hypertext. The feedback given was then analysed and used to redesign the prototypes before gaining further feedback. The four experts were chosen for their specialist perspectives. Expert 1 was an adult literacy and learning specialist, Expert 2 was an online media and user interface specialist, Expert 3 was an interactive software and Human Computer Interaction (HCI) specialist and Expert 4 was a specialist in arts and language education.

Six designs employing hypertext methods in different ways were created for analysis in the first round. Through the guidance of the experts this was reduced to four in the second round, three in the third round and two in the fourth round, as outlined in Diagram 2. The development of each design through each of its prototypes will be described in turn.

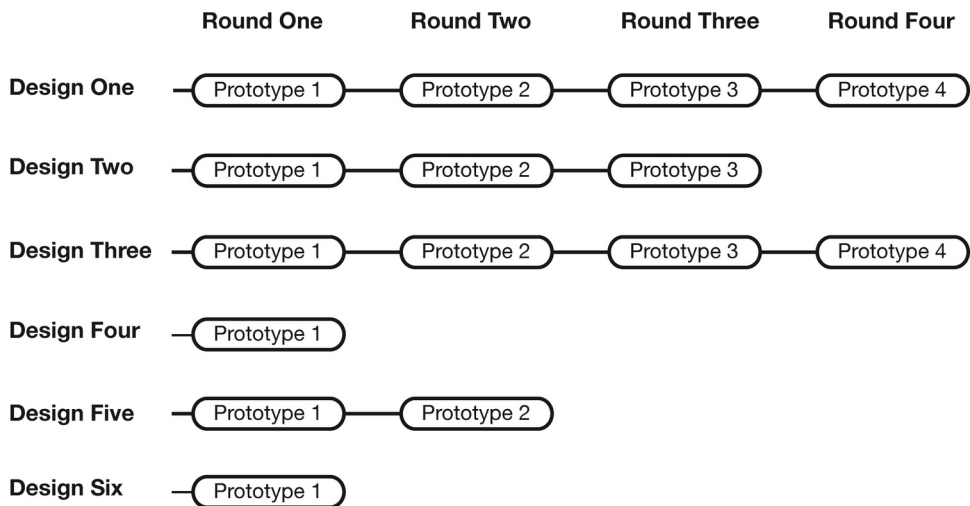


Diagram 2: Progression of Each Design from Round One

Design One

Prototype 1 (Round One)

The purpose of the first of the six prototype designs was for it to be straight forward with potential links at the bottom of each page with additional information after each linking page number; this was done to give the reader an idea about what type of information they will find if they follow that link. Easy reference tabs down the outside edge of the page were given to orient the reader with which section of the book they were currently in. The first prototype (Figure 1) was considered straightforward and logical by the experts, but the relationship between the text in the body copy and the links at the bottom needed to be clearer. It was suggested that this could be done using footnote style numbering.

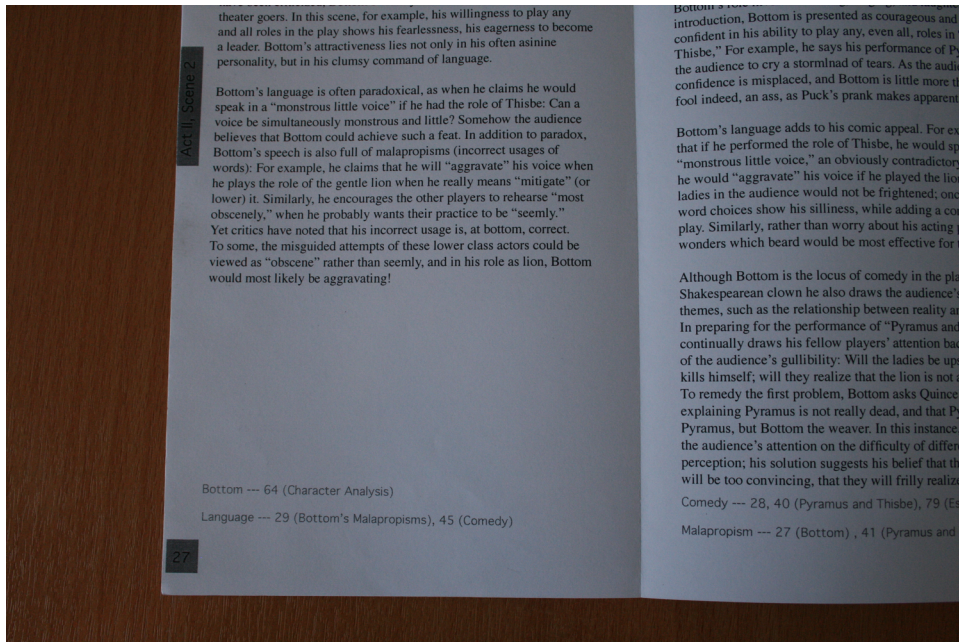


Figure 1: Spread Showing Prototype One of Design One

Prototype 2 (Round Two)

The second prototype of Design One (Figure 2) took into account several suggestions from the experts in the previous round. Links were fitted into the flow of the text and arrows used to indicate the direction of links; a footnoting system was designed to indicate link anchors within the text. Navigation was kept clear and easy to read. The suggestion to indicate where a reader came from were included, with numbers in the margin on the left indicating the pages the reader may have come from to get to this point, this could also be considered to be a 'back' link. Issues of proximity and the ability to easily scan the links were considered in the design of this prototype. Within the text body links are indicated with underlining. Superscript arrow icons before the underlined word were used to indicate to the reader that there is a link coming in to this word and the superscript arrows after the link were used to show that there are links going from this word and their direction. Details of the links were given in the right hand margin. A directional arrow along with the page number and supporting information was given to aid the reader in deciding which link to follow. This prototype was generally considered functional, but improvements were suggested, including reconsidering the placement of the indicating arrows, how the inline superscript icons are shown, the treatment of the information in the margins and the treatment of links. For the next round this prototype was developed further taking these suggestions into consideration.

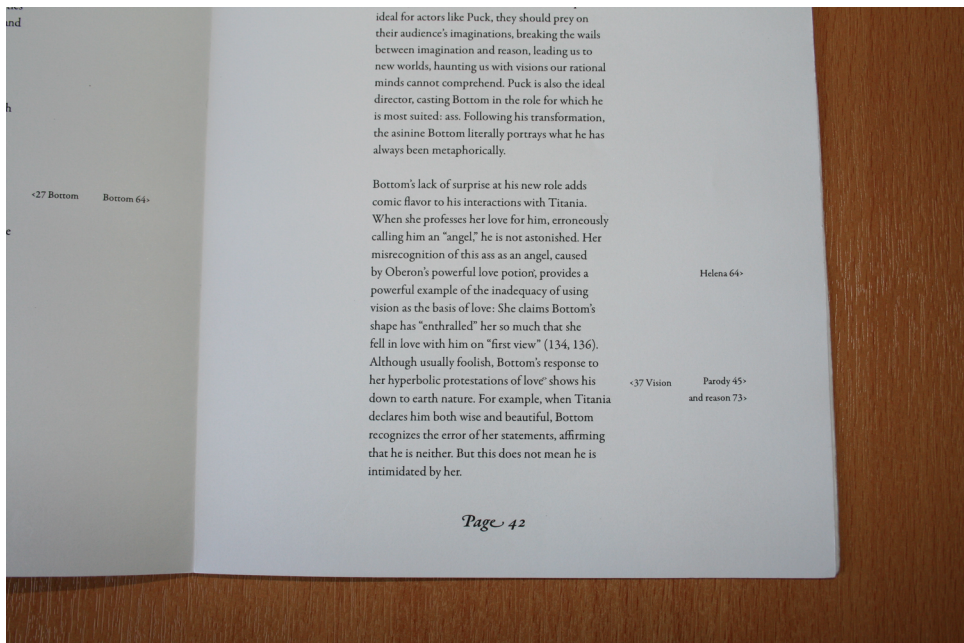


Figure 2: Spread Showing Second Prototype for Design One

Prototype 3 (Round Three)

For the third prototype of Design One the key considerations were the placement of arrows, the treatment of the superscript icons and how the information in the margins is dealt with, especially that in the left hand margin. The main improvement that made was letters were used to identify and follow links through. Each underlined link within the text had letter with an arrow next to it, in the right hand column the letters are repeated with the arrow along with a page number to follow the link, and it's supporting contextual information. When a reader follows a link to a page the destination link in the left margin has an arrow and letter corresponding with the link they followed to get there. The reader can then follow this link into the body where the letter and arrow are repeated with the underlined destination. Indicating the ends of information sections (nodes) was also a factor in the design of this prototype and this is done by placing the letter corresponding to the given section inside a square at the end of the passage. There are also potential follow on links placed in the right hand margin at the ends of nodes. Many suggestions were made by the experts about how this prototype could be improved.

Two suggestions were common in the feedback on prototype three. The most significant of these was that it was too complex. The second comment was that the reader may experience difficulties with remembering page numbers, making the links difficult to follow. Many differing suggestions were made concerning the way this prototype could be improved, including removing the arrow icons, minimising clutter and reducing the cognitive load on the reader. A positive comment was that the indicators to give a clear start and end to each node. It was also mentioned that the "in" links were useful, but opinion was divided over

this feature, as this is generally not a feature of hypertext. Having multiple links per anchor was also considered to be something that was not generally a feature of hypertext. There were many suggestions as to improvements that could be made for this prototype so it was developed with a fourth prototype.

Prototype 4 (Round Four)

The primary consideration in the fourth and final prototype for Design One (Figure 3) was simplification, improving the visual aspects of the navigation was also be important. This included revision of how the arrows were used, and making the navigation less intrusive, especially for the node end indicators. Links remained underlined in this iteration and were followed by a superscript arrow to indicate that there was a link from this word and the reader should consult the right margin. In the right margin, there were details of the links and the reader could choose their link with the aid of elaborations. Next to each description was a page number, an arrow to indicate direction and a reference letter, to indicate which link they will be going to on the destination page. At the destination page letters with arrows in the left margin inline with the underlined destination indicate the link word. The ends of nodes were indicated by a superscript dot. It was generally agreed by the experts that design one had been developed to a point where it was effective and understandable. The design was said to be simple and the navigation clear and unobtrusive. There were minimal changes recommended, concerning refinements to the general layout, but not the overall usability or design. Overall, it was considered to be an effective and elegant solution.

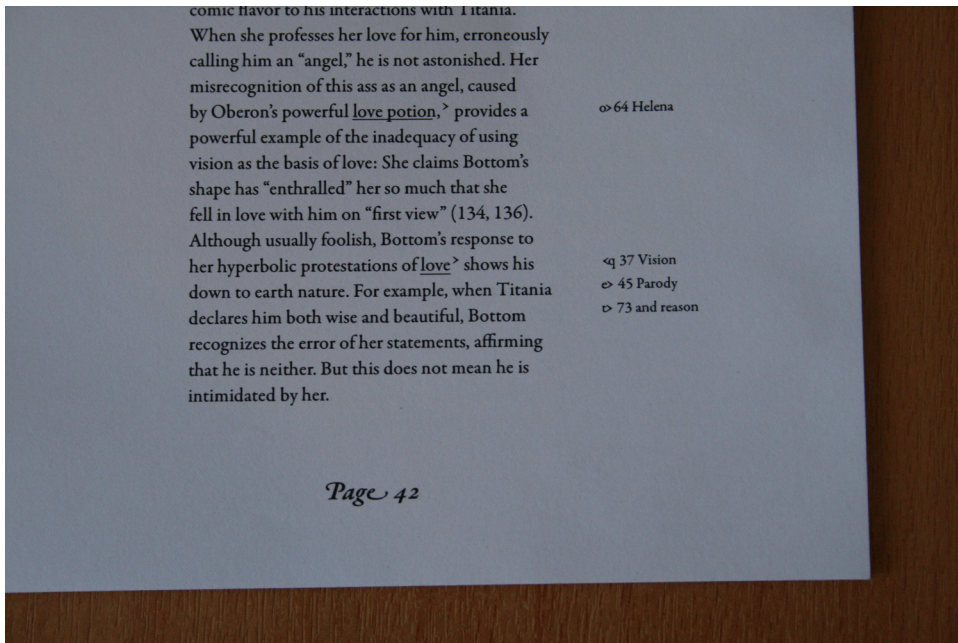


Figure 3: Spread Showing Prototype Four of Design One

Design Two

Prototype 1 (Round One)

For Design Two the first prototype was based on the way hypertext links are often presented online, with the text underlined. In this print-based design a broken line then leads the reader's eye from the underlined link to the margin where there are page numbers to follow as links. Information was given next to each page number, helping the reader to make an informed decision about which links they wish to follow. The experts agreed that there were distinct advantages to Design Two, but it needed improvement. This prototype was considered by the experts to increase the readers ability to scan the document, but the links down the side needed to be less cramped and the guiding lines needed to be lighter so they are less distracting.

Prototype 2 (Round Two)

The second prototype for Design Two was developed from feedback on making the categories more scannable and including indications within the flow of the text as to where the links were. Greater interaction and immediacy were also important factors in the design of this prototype. This design iteration has a single column of text on each page with links underlined within it. The right margin is dedicated to the navigation. Running down the far right of the page was a list of the key themes of the book. Each theme had two circles, which can be die-cut to indicate whether the theme is present on that page. This meant that the next two pages where the theme is present show through. In the margin, extending from the underlined links were lines which run the extent of the node and to the holes related that node's theme. An advantage of this prototype is that it clearly shows the extent and nesting of nodes. This iteration was considered by the experts to have good underlying ideas, but had issues that needed addressing. The issues were that the current prototype was not bi-directional and the number of possible links was limited by the size of the page. Greater proximity was also needed between the underlined word and the line extending to the circle. The benefits were considered to be that it was easy to move through the text, it had good quick reference and overview advantages and the underlining made the links clear. Many suggestions were made for how this prototype could be improved so a third prototype was created for this design.

Prototype 3 (Round Three)

The primary considerations for the development of prototype three of Design Two (Figure 4) were the ability for the linking to be bi-directional, meaning that the reader could follow links both forwards and backwards through the linear order of the book. Tabs relating to the main themes were placed down the fore-edge of the book and were cut out if that theme was not present on the page. When a theme was present on a page the tab was black and had a line extending from it to either end of the related node, these lines also indicate the extent of the node. The beginning of a node is indicated by a black square placed in the left hand margin and the end of a node is indicated by a black square in the right hand margin. Underlining of the node's key linked word is used to increase coherence. The overall feedback showed that it was very limiting and was not accurately utilising the principles of hypertext.

The number of topics is fixed and limited, meaning that it would be difficult for readers to add their own links or follow routes other than those related to the main themes. The iteration was considered to be very linear as the pathway is somewhat dictated, with the reader going forward and backward to the next sequential occurrence of a theme. The ability to follow a theme through was strong so it would be good for that purpose. It was noted that this prototype could be beneficial for books where learning information in a specific order was important. There were problems with cut-out tabs being used on both sides of the page. The tabs introduced a tactile sense to the reading environment, but they were also considered by one expert to be too numerous, making them small and fiddly. The overall feeling was this design had many limitations so it was not developed further.

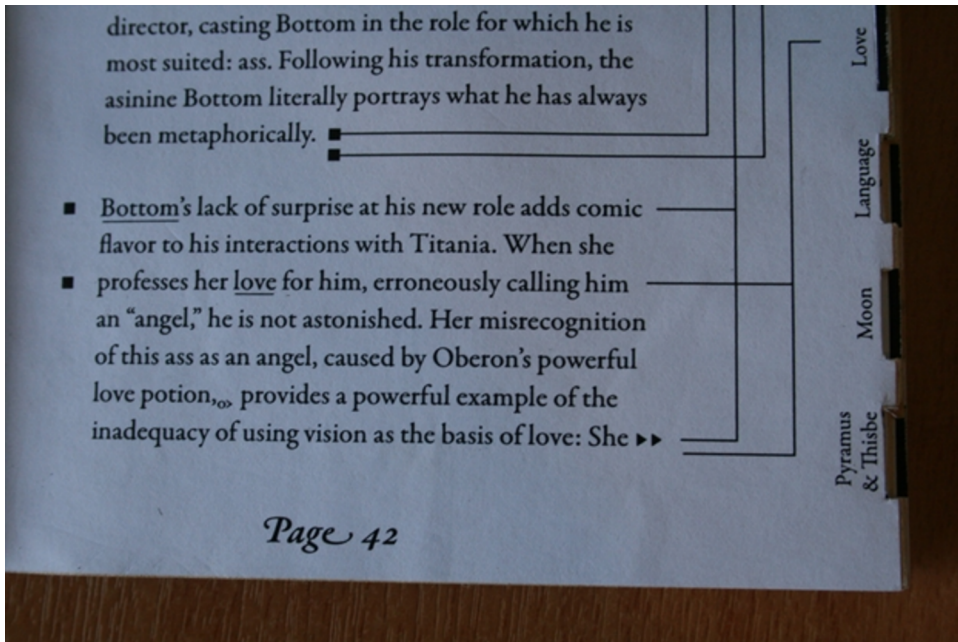


Figure 4: Close Up View of the Third Prototype of Design Two

Design Three

Prototype 1 (Round One)

For the first prototype of Design Three, topics covered on each page were written at the top to help the reader gain context. At the bottom of the page were links and pages with arrows to indicate the direction within the text the link would take them. Tabs were also used down the page edge to orient the reader as well as section names at the foot of the page with the page number. The main benefit of Design Three, according to the experts, was that the navigation was separated from the text and this made it clear; however, the black boxes surrounding the navigation information were visually too heavy. The use of the arrows to indicate direction was good, and it was suggested that a 'continue' link could be used for

readers who wanted to pursue the linear order of the book, a 'back' link was also suggested. The list of topics was considered a good feature as it helps the reader link to their prior knowledge and prepares them for what they are about to read. This prototype was developed for the next round, with consideration given to the concept of a back button and arrows being useful for indicating direction.

Prototype 2 (Round Two)

The second prototype (Figure 5) was developed from recommendations given by the experts regarding the idea of making an electronic link a physical link in a physical environment. Inline linking was also a consideration in the design of this prototype. The physical links are created in this prototype by threading a piece of coloured string from the link origin to the link destination. The string was threaded through the centre margin of the book until it reached its destination page. Each end of the link was identified with a circle in the corresponding colour around the points of origin and destination. This design was considered a great idea that was unique, but it had usability issues. It is too complex and has major scalability issues as there would be a limit to the number of links one book could contain. The strings also disturb reading as they run across the words, and it was difficult to discern the direction of the links as well as the reliability on colour matching potentially being an issue for some readers. Suggestions made for improvements to this design included running the threads along the bottom, and employing flipbook style navigation. An issue associated with this design that was not discussed by the experts was that there were also limitations to the number of possible links, as the number of colours that could be used is limited. This prototype was developed in the third round with the experts suggestions taken into consideration.

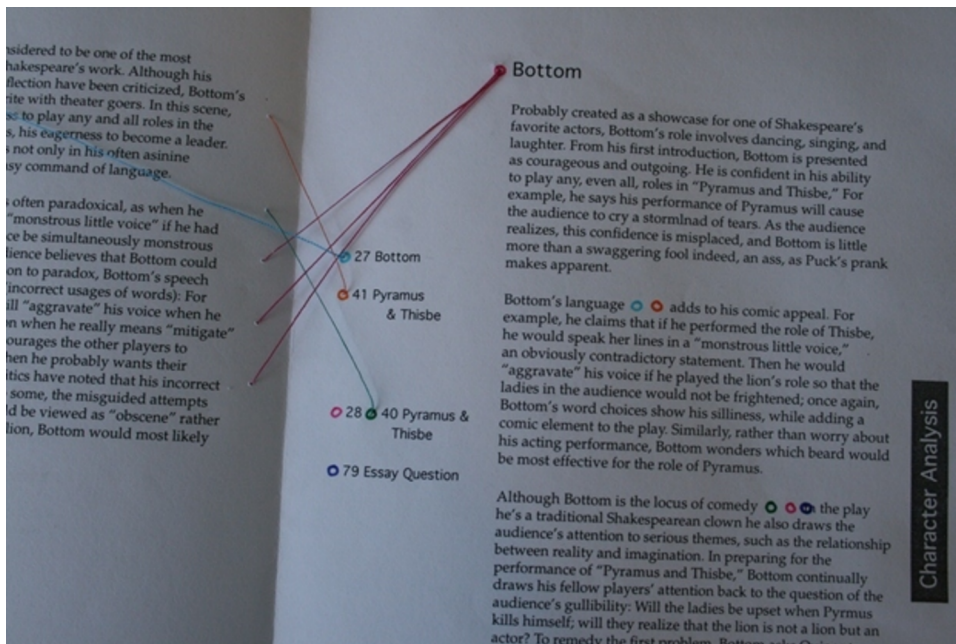


Figure 5: Close Up View of Prototype Two for Design Three

Prototype 3 (Round Three)

Comments considered in the design of prototype three were that the string lying across the text created reading disruption and the use of colour as a primary indicator may be an issue for some readers. Two suggestions made by one expert were incorporated, these being the idea of a flipbook and the suggestion made in round one about the use of symbols alongside page numbers to indicate a link. This third prototype attempted to use hypertext methods through each main theme having a symbol assigned to it. These symbols were printed in the bottom outer corner of the page if the theme is represented on that particular page. There was then the same symbol printed in the left margin to indicate the start of the node related to that symbol and one printed in the right column in line with the conclusion of the node. This means links could be nested and there could be multiple links per line. Readers could flip through the book looking for an occurrence of a theme or they could turn to the next consecutive page that had the theme they were following. The feedback on prototype three was mixed. It was considered to have some positive aspects, but there were also many features that either made reading difficult or did not mimic hypertext principles. One of the experts preferred this solution as it was simple, tactile and elegant. The prototype was also good as the start and end of nodes were clear as well as enabling the ability to skim for information. It also gave the reader additional contextual information both when the page is static and when the book is being flipped through. The main issues raised were that it is limited in its scalability as the number of themes is limited because of space and readers may have difficulty in remembering the icons. It was suggested that the way symbols used be reconsidered and the limitation of only going forward and backward to the next node be revised. The feedback

on this prototype was varied, but it was developed for the fourth round with consideration given to scalability and linearity.

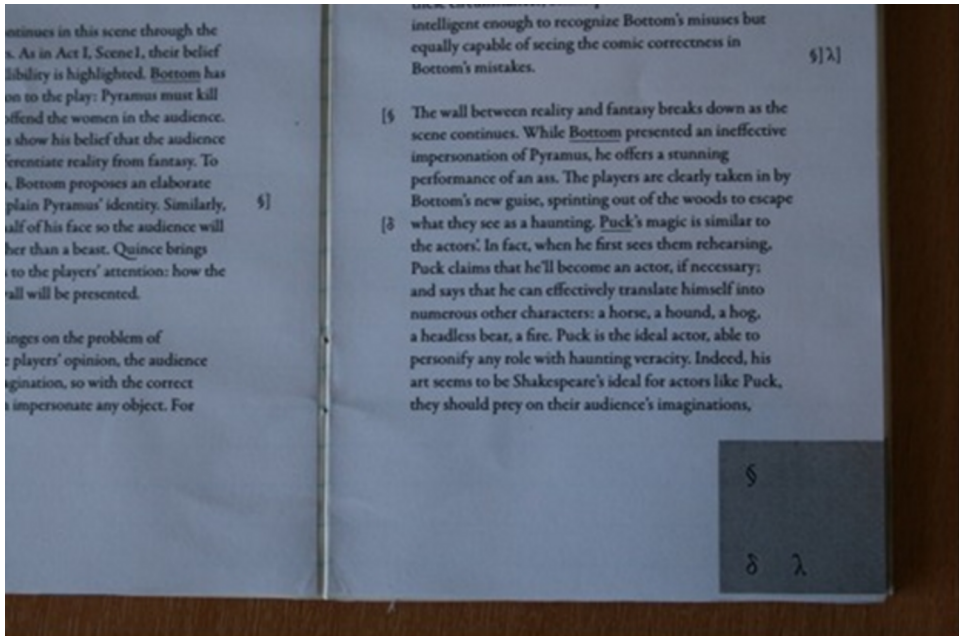


Figure 6: Spread Showing Prototype Three of Design Three

Prototype 4 (Round Four)

There were two aspects to the design of the fourth iteration of Design Three (Figure 7), the navigation of the book can be conducted through two means, each one addressing a different granularity. Down the foredge of the page were tabs corresponding to the main themes of the book. These could be used as an overview, to discover the context of the themes or to search for instances of the theme through the book. Each theme is associated with a symbol and these are printed next to their corresponding tab and also in the margins. The symbols in the margins are used to indicate information related to a given theme. The symbol in the left margin indicates the beginning of a node and the symbol in the right margin indicates the end of that node. Page numbers are printed beneath the node end symbols to indicate the page of the next most relevant node. The experts believed that this design solved many of the previous problems with this design. The layout gave a good overview of topics and the tabs aided the reader by giving them additional contextual information through the presence or absence of symbols in the bottom corner. This solution was commended by the experts for its balance between authorial direction and reader navigation. The extent of nodes was also considered to be well defined and easy to identify.

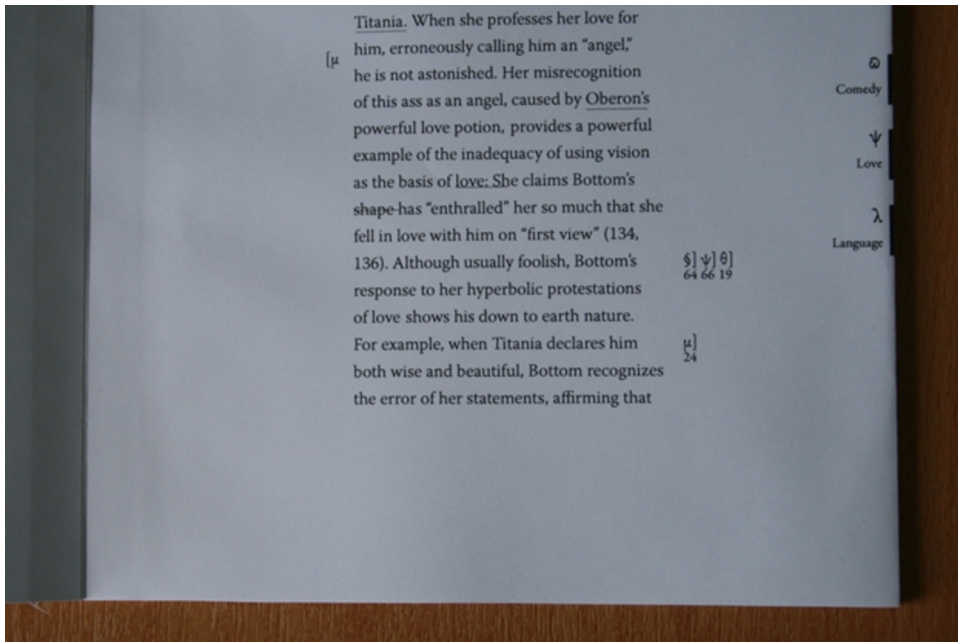


Figure 7: Close Up View of the Fourth Prototype of Design Three

Design Four

Prototype 1 (Round One)

The theory behind the Design Four prototype was to give the reader an overview at the top of the page of all concepts covered in the book and highlight those applicable to the current page. A similar theory was used at the bottom of the page with the reader being able to view all possible linking topics throughout the book and see the ones that applied to the current page with linking page numbers so that the reader could follow these. The design was considered too busy and cluttered. It was proposed that only the relevant links should be shown on each page, or they could be placed only at the section start. The method of overview was said to be a useful aid to navigation, but it would work better if it were more scannable, perhaps listing the topics vertically. This prototype was not developed further based on the expert feedback.

Design Five

Prototype 1 (Round One)

The idea with initial Design Five prototype (Figure 8) was to reduce the clutter on the page of text so that there were fewer distractions for the reader. This was achieved by removing the linking information from each page of text and placing it on transparent overlays so the reader could access the linking information only when they needed it. The style implied an

notation and was designed to encourage readers to create their own links and annotations. Encouraging the reader to make their own annotations was one of the two main benefits described by the experts. The other key benefit was that it supports scanning as well as linking. The inline highlighting also gave the reader the locus of the idea. Thinner overlay paper would need to be used if this prototype were to be developed further. Inclusion of a summary box at the end of each section was recommended, as this would give a beneficial overview. The main drawback of this prototype was considered to be that it does not emphasise the methods of hypertext enough, this was addressed when it was developed in the next round.

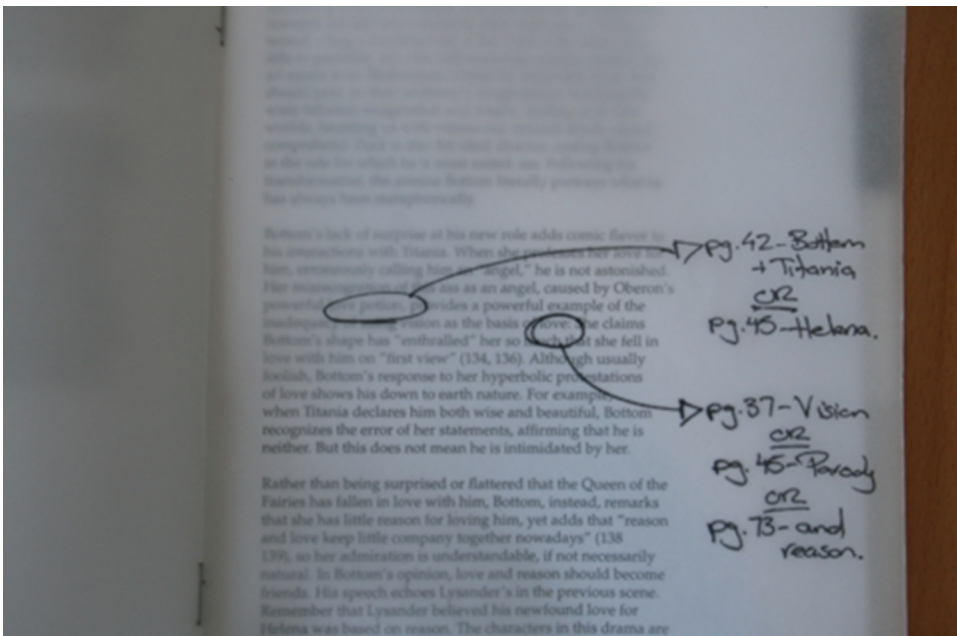


Figure 8: Close Up View of Prototype One for Design Five

Prototype 2 (Round Two)

For the second prototype of this design all of the linking information was made invisible by writing it in an invisible ink that can be viewed by the use of a black light. The design mimics the “mouse over” function that is sometimes used in hypertext environments to give the reader additional information when they hover their mouse over an item. This was considered beneficial by the experts as its focus was on the text with the navigation being supplementary. However, two of the experts commented that it was hard to read because of the dark lighting conditions needed to see the links with the black light, making it difficult to read the text. It was suggested that using an overlay could be a development from here, as was used in the first round. Another major downfall of the design is that the benefit of being able to easily scan the document for links and see the relationships between the text and the links is lost. This design was not developed further.

Design Six

Prototype 1 (Round One)

The sixth design was designed to reflect the common web page format with the navigation across the top of the page. As with other prototypes, the information in brackets following the page number was designed to help the reader make an informed decision about following the link. Although mimicking the layout of a web-based hypertext page, this design was not considered successful by the experts, as there are different user behaviours and expectations in print media. The links at the top were not logical for print and are visually too top heavy. Other drawbacks of this design were that it was hard to relate the ideas in the body to the links, and the number of links per page was limited.

Summary of Results

The design-analyse-refine process undertaken developed six designs through a series of prototypes through to two final prototype designs. Many factors were discussed through the four rounds of refinement. The solutions created for the fourth and final round were considered by the consulted experts to be good resolutions to the problem of applying hypertext methods to a printed book. Of the two solutions the second (Design Three) was considered by the experts to have more instinctive navigation, and was a more elegant and viable solution. While there is potential to further refine the solutions, the key elements required to solve the problem of applying the six key concepts for applying hypertext methods to a printed book, as outlined by Timpany (2009). With the first solution (Design One), concept five is fulfilled as it has obvious navigation and an uncluttered layout. The links provide additional information to assist the reader with choosing paths to follow and the overall navigation design gives the reader clear directions and orientation cues; this indicates that concept two of the key concepts is also being met by this solution. The pages can be scanned easily by the reader to find key ideas related to their interests; this benefit fulfils the needs of concept six, however, not as strongly as the second solution.

The second solution uses a combination of tabs, for overview and context, and symbols to indicate the nodes within the text. This combination of navigation methods gives the reader two levels of granularity for interacting with the book. Searching within the pages of the book is aided through the use of the tabs. Additional information could be added to give the reader information about the importance of the links. The inclusion of a structural introduction to the book would aid the reader in their understanding of the layout and use of the book. All of these factors in combination contributed to this being considered the most successful solution by the experts.

Conclusion

This investigation into how hypertext methods could be applied to a printed book has been explored through an iterative design process. Factors influencing the design included: the importance of the book as a physical object and how a reader interacts with it; effective design of interactive environments; and important considerations in designing hypertext systems. The research of Timpany (2009) and the key concepts for designing books with

hypertext navigation were applied in the process undertaken in developing the design of the interface.

Two successful design solutions were developed through this research with one considered to have a slight advantage in its navigation. Further investigation could be conducted into the aesthetic qualities of the navigation and orientation aids provided, as well as the development of specific layout guidelines for hypertext books. The proposed interface designs could be more carefully considered as the design of an effective interactive environment was given more weighting in the process of this research. Future research could also investigate other potential designs for implementing the key concepts for the design of hypertext books, specifically investigating the ways in which the potential design solutions can be adapted to be utilised by texts with different contexts and purposes.

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About the Author

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Claire completed her Masters in Computer Graphic Design at Wanganui School of Design, New Zealand. She is currently a lecturer in Computer Graphic Design at the University of Waikato, New Zealand, teaching both print and screen based papers. Claire's main areas of interest and research are typography, print design and physical interaction design. Because of her love for both printed books and interactivity this is where her research interests lie. Her research is currently focussed on the way in which people interact with printed material and how the benefits of electronic media can be applied to traditional media, such as print, to aid it in developing and become more beneficial and keeping up with the digital age.

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