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VISUALIZING A HYPERTEXT NARRATIVE

by

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A thesis submitted to
the Faculty of Graduate Studies
in partial fulfillment of
the requirements for the degree of

Master of Architecture

Carleton University
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submitted by:Jennifer Fraser..... student no. ...167383.....

in partial fulfillment of the requirements for
the degree of Master of Architecture (Design Studies)

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Director of School of Architecture

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The tradition of storytelling has evolved over time. In the oral tradition the recited story was the result of the teller's interaction with the audience; in print culture the audience interpreted the fixed text of the author; within a hypertext the audience interacts with the author's narrative by choosing their own paths through the story. Readers and writers are freed from the bounds of the printed page and the story exists as an unseen matrix of possibilities. I identify and discuss some of the problems with hypertext as it has evolved over the last two decades and examine attempts to address them by inserting the "story" into an environment. Within both the critical and design portions of my thesis I explore the metaphor of the city as a hypertext environment, one that embraces the multi-dimensional nature of hypertext while providing readers with a navigable environment that entices them to explore.

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Background

The first stories were delivered orally. The storytellers who delivered their tales in songlike metrical and stanzaic patterns were known as bards. There was a mythology of characters and events, familiar to the teller and his audience, from which he would select elements to deliver in poetic meter (Ong 1982). With the development and popularization of systems of writing these oral stories and ideas became fixed in space and time and consequently objectified. Storytelling was no longer an ephemeral experience of a group of people in a specific place on a specific occasion, and instead became an object that fostered the writer's individual expression and the reader's individual interpretation and contemplation.

The novel in its typical form evolved over time into a story with a clear single axis of development from beginning to end. Long after it had gained popularity and unchallenged precedence over other written forms, writers such as Borges and Robbe-Grillet began to subvert the linearity of the novel's singular climactic structure. In examining some of the writings of those authors, one can see how hypertext is well suited as a medium for further experimentation in the delivery of nonlinear narratives: it engenders a blurring of the distinction between the roles of writers and readers as readers select their own paths of navigation through the narrative; and it challenges inherent qualities of the print medium such as fixed sequence, a definite beginning and end, definable magnitude and overall unity.

The term 'hypertext' has been attributed to computer scientist Ted Nelson, who in the 1960's was writing about the computer's ability to create and manage textual networks. He realized that any group of writings on a subject, be it fictional or scientific, was "...a system of inter-connected writings" (Bolter 1991, p.23). This was not a new idea, but Nelson was the first to realize the potential of the computer for creating and managing writing as a textual network. Prior to Nelson, in a 1945 *Atlantic Monthly* article entitled *As We May Think*, Vannevar Bush described his proposal for a machine he named the 'Memex'. He designed this machine in response to the inadequacy of the systems of indexing, both alphabetic and numeric, that were used to retrieve the vast quantities of scientific information that existed. His proposal for the memex was based on the model of the human mind and how it "operates by association" (Bush 1945). The memex, which Bush described but never constructed, was a desk with slanting translucent screens on the top for viewing microfilm. Through a keyboard and a series of levers readers could control the speed at which the pages of the book on the microfilm were projected: a page at a time; ten pages at a time; even 100 pages at a time. But the essential feature of the memex was its ability to "tie" two items together. When viewing two items projected onto adjacent viewing positions, readers could insert a key in the "code space" of the document which would cause the items to be permanently joined. As a result, at any future reading when one of those two items are being viewed the other can be instantly recalled by tapping the button below the corresponding "code space". Bush goes on to describe the "trails" of interest that would be created through the "maze of materials" available to readers (Bush 1945).

Many writers on hypertext consider this article by Bush as the pioneering scientific article on hypertext (Landow 1997, p.7). A hypertext can be described as a series of texts connected by links that offer readers different pathways to navigate intertextually. The pieces of text that make up this hypertext matrix are commonly referred to as "lexia". This term is borrowed from Barthes, who used the term in his book, *S/Z*, to refer to the blocks of text that would make up his "ideal" text, one where the "...text is a galaxy of signifiers, not a structure of signifieds" (Landow 1997, p.3). Some writers on hypertext choose to distinguish between "hypertexts", which they feel are solely text-based, and "hypermedia", which for them could include image, sound and animation as well as other forms of data. I do not follow this distinction and use the term hypertext in this paper to refer to either type of work.

The ephemerality of all digital text, including hypertext, is reminiscent of the oral tradition and brings into question the fixity of text and the authority of the author. In the oral tradition the storyteller would not consciously organize his narrative in a predetermined order, but instead as a series of formulaic and stanzaic patterns (Ong 1982, p.145). While performing, the teller is remembering and reciting themes and formulas that he has heard others intone. These formulaic units of composition would consist of phrases and half-lines, not individual words. The order and combination of these phrases would change depending on occasion and audience; the recited story becomes the result of the interaction between the singer, the audience and the singer's "...remembrance of songs sung" (Ong 1982, p.146). Similarly, the narrative experience of a hypertext varies from reading to reading because of the required interaction

between the text and its readers as they choose links and therefore paths through the story. But there is one crucial difference between the bard's audience and hypertext readers: the bard and his audience share a mythology, a network of characters and events familiar to both. In contrast, hypertext readers may have little indication of the overall narrative network through which they are navigating.

A contemporary purveyor of storytelling, Laurie Anderson, published a CD-Rom entitled *Puppet Motel*, in 1995. It was released in conjunction with her *Nerve Bible Tour* and combined spoken word, music, video and digital environments into a multimedia production. She uses the architectural metaphor of the motel as an organizing element for the disparate narratives contained within the CD. Just as the architecture of a motel strings together various rooms containing various lives with no particular relationship between them into one building, Anderson's stories on the CD are distinct narratives and the associations between them are created within the minds of readers who pass from one story to another. Her piece will be described in more detail later, but the virtual spaces created within her motel, such as the Hall of Time, which is a spatial table of contents, or the Attic, which is an escape route and a point of entry, provide users with points of reference that unify the disconnected narratives. While exploring the motel users can, sometimes unexpectedly, be instantaneously transported from room to room. This can be disorienting, as can the exploration of a simpler web-based hypertext narrative, but at least within *Puppet Motel* the two aforementioned rooms serve to remind users of the bounds of their experience and place it within a definable context. I, too, see a spatial metaphor as one way of supplying navigability; in using Anderson's

work as one of the sources for its inspiration, within this thesis I propose to use the city as the organizational element for a prototype of the spatial representation of a hypertext narrative. Where Anderson chose to employ rooms within a building as her organizational metaphor, I will use the streets within a city. I feel the city is appropriate as a metaphor for nonlinear orientation, because it exists as a cognitive whole within the minds of its inhabitants, like the myths for the bard's audience , yet is simultaneously understood by the inhabitants as a loose conglomeration of spaces and places that can be connected through various paths.

This thesis explores the formal depiction and functionality of hypertext narrative in computer based media and consists of two parts, first, a critical essay on the subject, and second, a self-playing multimedia prototype that can be found on the accompanying CD. By applying techniques afforded by this new technology, such as animation, audio, infinite zoom and translucency I have created a prototype that attempts to transform a narrative into a spatial framework for reader interaction. The narrative is based on an audio recording of my grandfather, William Drummond, who was born here and continues to live here, telling stories about growing up in Ottawa in the 1920's and 30's. His recounting contained many, more or less self-contained, narrative episodes within which he talks about the city, its people and the times. From these episodes I created a hypertext containing 19 lexia. The prototype, described in greater detail below, places the events of the hypertext narrative within the context of the geography of the city. Images from the prototype are included within the body of this text; I recommend viewing the prototype on the CD in the "Addressing the Challenges" section (p.38).

Challenges of Hypertext Navigation

There are fundamental differences between hypertexts and printed texts. While many theorists compare the degrees of linearity versus non-linearity of the reading experience of these two media as their essential difference, what seems more significant is what the text is being read "from" (Aarseth 1997, p.3). The book is a tangible object with an immutable number of pages that are always accessible to its readers. In contrast, for readers, hypertexts contain an indeterminate number of lexia within each of which they must select a link in order to proceed. This need for selection is a constant reminder to readers of the unknown nature of the matrix from which they are choosing. The indeterminacy of the hypertext network through which readers are navigating can give them orientation problems. The issue of orientation is an architectural one, that I, trained as an architect, attempt to address through the design of my spatial representation of the hypertext.

There are three shortcomings of most current hypertexts that my prototype attempts to address: first, a multi-dimensional structure is being presented as two-dimensional information, similar to a book; second, readers are not provided with a balance between overview and detail to place the individual lexia within a meaningful context; and third, there is no structure provided to give readers a sense of stability within the disjunctive hypertext. Because of these issues, readers are disoriented and destabilized, which causes them, ultimately, to lose interest. I feel that they need to be provided with a structural/spatial metaphor that provides them multiple views of the narrative matrix in

order to orient and ground their experience. This would afford readers a sense of comfort that would enable and motivate them to explore. Web browsers use a page metaphor for the delivery of information: sites on the Internet are referred to as web 'pages'; the browser toolbar navigation arrows take the reader forward and back a 'page'; and favourite sites on the web can be marked with a 'bookmark' for easy future access. Part of the difficulty with web-based hypertext is that, by being delivered through the browser, one is trying to display a multidimensional structure as a two-dimensional one, which is the previously mentioned first shortcoming of current hypertexts. Within the context of a book, the page as a unit of delivery makes sense as part of a prescribed order of reading, but within a hypertext that order changes according to the actions of the reader. While the pages within a printed book can theoretically be read in any order ("random access" is the term literary theorist Espen Aarseth uses to describe books) the physical construction of the book as an object impedes random shuffling (Aarseth 1997, p.46). Moreover, in Western culture, the linear structure of the book implies a 'correct' reading order of front to back. As hypertext theorist Ilana Snyder describes it, the "printed sequence is suggestive and controlling" (Snyder 1996, p.45). This is due in part to its physical construction, but also to the nature of the written content itself.

2D versus Multi Dimensional Information

When presenting his ideas regarding hypertexts, Aarseth finds that he is constantly challenged with three points from different literary theorists on the similarities between

printed texts and hypertexts: first, that all literature to some extent is nonlinear and different for every reading; second, that the reader has to make choices to make sense of any text; and third, that no text can really be nonlinear because the reader can only read one sequence at a time (Aarseth 1997, p.2). After reflecting on these statements, Aarseth identified the term 'nonlinear' as a stumbling block. It is a term that is commonly used to describe hypertexts, and which in the past had been used to describe certain avant garde twentieth century literary works. So, to avoid this pitfall, Aarseth uses the word "ergodic" to describe hypertexts, a term which he defines as "...a work that requires non-trivial effort to traverse" (Aarseth 1997, p.1).

Having been repeatedly challenged on the similarities between printed texts and hypertexts, Aarseth was forced to consider what the essential difference was between these two written forms. He concluded that the key difference was not between what was being read, with respect to the linearity or non-linearity of the reading sequence, but instead between the network, whether the bound pages of the book or the hypertext linked lexia, that the narrative is being read from (Aarseth 1997, p.3). With a hypertext, readers are constantly forced to make decisions. With each of these decisions they are reminded of paths they did not take and/or those that are no longer accessible. For Aarseth it is this "absence of possibility", which he refers to as "aporia", that is the fundamental difference between the two writing forms (Aarseth 1997, p.3). Reflecting on these spatial notions of paths not taken, or ones that are no longer accessible, it is easy to imagine a hypertext, freed from the bounds of the printed page, more appropriately represented as a multi-dimensional structure instead of a two dimensional page.

An example of the typical two dimensional appearance of a web-based hypertext lexia is shown in Figure 1, a screen capture from the story *24 HOURS* by Philippa Burne. Many of the hypertext fictions available on the web are text based, with minimal graphics to reduce the download time, and employ the standard HTML convention of underlined hyperlinked words within the text to interconnect the lexia. Figure 2 is a screen capture from one of the first hypertext fictions written, *afternoon, a story*, by Michael Joyce. The story is not web based; instead it was written using the *Storyspace* software from Eastgate Systems, in 1987. Predating the widespread use of the Internet, this interface provided users with a toolbar to facilitate their navigation by allowing them to back up, answer questions, or print out the current “page”; this same functionality is available through the standard web browsers used for viewing current web-based fictions.

For the hyperlinks Joyce chose to employ “words that yield” within the lexia. These links are not visible to readers and in the “Getting Started...” instructions that accompany the disks, Joyce suggests that readers “Click on words that interest or invite (them)” and explains that this might or might not bring them to a new line of the story (Joyce 1995, p.4). The toolbar also contains a browse button that lists all of the invisible outgoing links on the currently active page from which the readers can select. Most web-based hypertext fictions make links visible to readers as underlined text. This is an accepted convention and reduces what one might imagine as the futile clicking in *afternoon* by users searching for invisible links. But whether or not the links are identified, neither example provides readers with information explaining where they are within the story,

Figure 1: A screen from Philipa Burne's hypertext fiction "24 Hours"

I had a friend once, he knocked against the steering wheel, while drinking coffee on the way to the station at Westport. Swerved into the oncoming lane and that was that.

In a Bimmie no less. Somebody said that at the wake:

<He'd be alive still if he'd had the station car. Wasn't used to the clearance in the Bimmie. >

My wife said she thought I'd be willing to die for my coffee too. But that was in Connecticut. In those days.

Figure 2: A screen from Michael Joyce's hypertext fiction "afternoon, a story"

the size of the narrative, or the number of lexia it contains, and/or where they are going when they have selected a link. In some cases, such as with Joyce, this disorientation may be a part of the authorial "intent" but I contend that all of these notions of place, space, and proximity are necessary to orient readers within the story and cannot easily be achieved within the constraints of the two-dimensional representation of the text.

Micro versus Macro

Creating an understandable relationship between an individual lexia and the overall network within which it is contained is the second challenge faced in the spatial representation of a hypertext. In one of his on-line essays, *Pushing Back: Living and Writing in Broken Space*, hypertext author and professor Stuart Moulthrop describes the hypertext link as having two components: the visible, realized connection, and "the unseen matrix or structure of possible structures" (Moulthrop 1997). These are the detail and overview, respectively, that are involved in the second shortcoming of current hypertexts. Each time users choose a link and are presented with a new lexia, one of the possible connections within the hypertext narrative is realized. But implicit in each connection should be a reminder of the unseen matrix of possible connections and of paths not taken. In the same essay, Moulthrop describes the link as "...wrapping the semantic space around the reader's perspective"; that perspective being infinitely recentrable as the reader's point of focus shifts from one lexia to another (Moulthrop 1997). The second challenge, then, is to provide a balance between the macro and the micro, creating a means of delivering the narrative's lexia while maintaining their relation

to each other and to the story as a whole. An interesting example of an attempt to achieve this balance can be seen in the Smithsonian Institute's first exhibition created specifically for the Internet, *Revealing Things*. The site was produced by smithsonianwithoutwalls in collaboration with the design firms Razorfish and Plumb Design Inc. The site navigation was developed using Plumb Design's *THINKMAP* software. It provides users with an interactive visual representation of the matrix of objects within the virtual exhibit, as shown in Figure 3. The lines between the object names link those that are related either through object type or era. In order to bring an object into focus, users select a word by clicking on it. The content displayed on the right hand side of the window changes to information relating to the newly selected word/object while the navigation on the left dynamically adjusts itself. The newly selected text moves to the centre, or focus, of the navigation window while the remaining object names reshuffle themselves. Those most closely connected to the new selection are brought to the foreground while those less relevant decrease in size and opacity in proportion to their relation to the new selection, ultimately disappearing into the background. This dynamic shift of the navigational matrix can be seen as a visualization of Moulthrop's aforementioned notion of "wrapping the semantic space around the reader's perspective"; the content fluidly changes its position as readers re-centre their point of focus.

On a much simpler scale some web-based hypertext fictions try to incorporate a means of obtaining this balance between the micro and the macro. Figure 4 shows an example, a screen capture from *GRAY MATTERS*, a collaborative hypertext project. Beneath the

Figure 3: A screen from the smithsonianwithoutwalls on-line exhibit "Revealing Things"

Figure 4: A screen from the collaborative hypertext "GRAY MATTERS"

text is a series of small squares indicating the number of lexia within that specific narrative thread, with the marked box representing the one currently being read. While not being able to convey the complexity of the interrelations between lexia achieved in *Revealing Things*, this device does provide its readers with a sense of the scale of the narrative and their place within it.

Dislocation versus Orientation

Crucial to the issue of orientation, however, is the fundamental contradiction between the nature of hypertext and the notion of an established place within it. This is at the root of what I believe to be the third challenge facing most contemporary hypertexts, which are, by definition, dislocating. The hyperlink connects disparate pieces of information that are instantaneously associated within the minds of readers when they are transported from one lexia to the next. John Tolva, a professor at University of North Carolina, describes the hyperlink as adding space to two-dimensional documents for the instant that readers are moving from one lexia to another (Tolva 1996). In selecting a link, readers cannot be sure where it will take them or if they will be able to get back, should they want to. Some critics find this lack of certainty disconcerting and distracting, but Terence Harpold quotes web usability specialist Jakob Nielsen when he describes hypertexts as “belief networks”. Harpold explains that when two lexia are linked, readers assume that they must relate in some way for the author to have created the hyperlink between them (Harpold 1994, p.194). This forces readers to invent a reason for the connection, with respect to the narrative. But however intentional it might be, the lack of

narrative certainty and general disorientation can be frustrating and confusing for readers. This confusion and frustration cause readers to lose faith in the author's intentions and, ultimately, lose interest in further navigation.

As mentioned earlier, in her CD, *Puppet Motel*, Laurie Anderson uses specific rooms within the motel to act as landmarks, or fixed points of reference, for users. The Hall of Time and the Attic help to unify the narratives as well as orient or reorient users. Shown in Figure 5, the Hall of Time is the first room they enter after "signing in" to the motel. On the left wall of the hall a series of twenty icons appear, one after the other, as if part of a slide show. It becomes apparent to users that these icons act as the links out of the hall to different rooms in the motel. The fixed number of twenty links provides users with a sense of boundary and scale of the interaction. The Attic can be discovered by users if they use the keyboard escape key to try to exit the motel, or if they read the documentation that accompanies the CD. Where the Hall of Time contains the twenty projected icons, the Attic, shown in Figure 6, contains a single object from each of the twenty rooms. Each object acts as a link to transport users directly to the room from which it came. Once inside a room, the way out can be difficult to uncover, and, to further complicate the navigation, hidden "worm holes" unexpectedly transport users from room to room. One can imagine a scenario in which bewildered users who have passed through multiple "worm holes" take themselves to the Attic as a means of reorientation; the finite number of objects it contains would serve to remind them of the bounds of the network through which they were navigating and places their experience within a definable context. As users explore the *Puppet Motel* both the icons in the Hall

Figure 5: A screen from Laurie Anderson's "Puppet Motel" showing the "Hall of Time"

Figure 6: A screen from Laurie Anderson's "Puppet Motel" showing the "Attic"

of Time and the objects in the Attic become recognizable characters from the various narratives. When clicking on the link provided by one of these characters, users can, with some degree of certainty, predict their destination lexia. By organizing her stories around the metaphor of a motel, Anderson creates a hypertext that maintains its disjunctive essence while providing users with a needed sense of stability to balance the disorientation that is implicit in the nature of hypertext. This stability affords users a degree of comfort that enables and motivates them to explore.

While in the process of reading a book, readers are constantly predicting the narrative outcome of the story. It is this act of prediction that enables them to move forward, continually modifying their response to the text based on those predictions (Douglas 1994, p.159). The narrative clues or pieces of the puzzle that the writer leaves are what readers use to inform these predictions. It is the need for more of these pieces to complete the author's narrative puzzle that propels readers through the text. But, the three previously mentioned shortcomings of current hypertexts all too often disorient and destabilize their readers. Readers are not provided with enough of the 'pieces' or an understanding of the overall puzzle through which they are navigating and ultimately risk losing interest. With these three challenges in mind: first, how to represent the hypertext in a way that reflects its multi-dimensional nature; second, how to achieve a balance between the macro and the micro; and third, how to maintain the inherent disjunctive essence of hypertext while providing a sense of stability to users, I undertook to design a prototype to address these issues.

Design Precedents - Information Visualization

I began this design process by reviewing publications by writers, such as Edward Tufte, and researchers, such as Xerox PARC's Stuart Card, who discuss some of the fundamentals of information visualization. Two of Tufte's books, *Visual Explanations* and *Envisioning Information*, provide overviews of the design of information. In his introduction to the latter book, Tufte poses a question to his readers regarding the challenge of information representation:

"The world is complex, dynamic, multi-dimensional; the paper is static, flat. How are we to represent the rich world of experience and measurement on mere flatland?" (Tufte 1990, p.9)

Tufte goes on to explain that the examples he has selected for his book are ones that he wanted to celebrate as displays of complex data that "escape from flatland". The examples in his book come from around the world and from throughout history. Using sources as varied as a visitor's guide to a Japanese shrine to a parts manual from an IBM photocopier, Tufte describes these works as "the intersection of image, word, number, (and) art" (Tufte 1990, p.9). These books acted as a primer for me on the subject of information visualization as well as a resource for graphic examples of representations of multidimensional information.

When producing his own work in this area, Tufte reflects on the lessons that can be learned from historic precedents. Tufte explains that he finds the seduction of using three dimensional computer modelling as a tool for information visualization all too often results in an oversight of the fundamentals of scale, orientation and labelling, which

have been included for centuries in maps and statistical graphics. Thus, while promoting an escape from flatland, Tufte puts forth some of his reservations regarding the implementation of computer generated 3D worlds. According to Tufte, the addition of this new dimension often results in an unfortunate oversight of fundamental 2D graphic design principles. These principles can easily be applied to improve the efficacy with which the layers of information within these 3D models are interpreted (Tufte 1997, p.20).

Stuart Card and fellow researchers from Xerox PARC are equally critical of three dimensional computer visualizations that ignore fundamental graphic design principles (Card 1999). Both in the information they presented and the software they demonstrated, Card and his colleagues emphasized the importance of displaying any information within its context. One of these colleagues, Stephen Eick, demonstrated a database visualization software created by his company *inxight* that incorporated real-time zoom. This type of zooming avoids 'jumps' in zoom levels while viewing a document and instead users are smoothly zoomed in or out of the data as if they were looking through a camera lens and adjusting its zoom level. This technique allows for the exploration of large data structures while maintaining a balance between the display of detailed information and the display of the database as a whole. He also demonstrated a "hyperbolic browser" his company designed called *MagniFind*. It was created in response to usability problems with the hierarchical tree structure of Microsoft's Windows Explorer browser, which is shown in Figure 7. The same information from Figure 7 is displayed using *MagniFind* in Figure 8. As opposed to

Figure 7: The "Explorer" dialog from Microsoft Windows NT Operating System

Microsoft's collapsible and expandable tree that seems to conceal information from users, *MagniFind* brings the files or folders users have selected into focus while the other less relevant information disappears into the periphery. Similar to the Smithsonian's *Revealing Things* interface described earlier, users can click on the name of a file or folder or click and drag it to the center of the window to bring it into focus. When a folder is brought into focus, the first level of files contained within it also appear connected by lines to its parent directory; from them expand more radial lines to their child directories and files. Conceptually it is as if the entire content of the computer is arrayed in front of its users, viewed through a fish eye lens. The connections between a folder and its parent and child directories remain intact and navigable as users browse for a file. Throughout the programs and examples demonstrated was a concern that a balance be maintained between the macro and the micro in order to allow users access to various levels of detail of information without having to remove it from its context. Like Tufte, Card and his colleagues emphasized the importance of context. Small changes in how and what data is presented can have a profound impact on the viewer's perception of that information.

Design Precedents - Information Landscapes

Muriel Cooper and David Small applied similar ideas of context and scalability to much different content at the Visible Language Workshop in MIT's Media Lab. Cooper coined the phrase "information landscape" to describe a space through which the reader flies and where information hangs like clusters, similar to the glowing walls of data in the

“matrix” described in William Gibson’s canonical cyberpunk novel, *Neuromancer* (Small 1996, p.516), (Gibson 1984, p.5). As the reader moves from place to place within Cooper’s landscape, the experience of the journey is continuous. Readers maintain their sense of place while exploring because it is through that context that new information is understood and related to what was already known.

In designing their information landscapes, the students of the Visible Language Workshop examined the problems with presenting typographic forms in three dimensional space. Historically fonts were developed and designed to be viewed on a flat, two dimensional surface; translating them into three dimensional space poses problems with legibility, integrity of the letterform, relational hierarchy, scale and resolution (Small 1996, p.517). In the *Virtual Shakespeare Project* Small chose to visualize the complete works of William Shakespeare in such an information space. As he explains:

“Each character in the play *A Midsummer Night’s Dream* is marked in a different color, and different typefaces are used to distinguish stage direction, names, dialogue, and commentary. Each scene is laid out in a single column of text.” (Small 1996, p.516)

Following Small’s example using *Midsummer Night’s Dream*, he applies a filter that highlights Titania’s dialogue. Readers are able to see the pattern of her interaction with the narrative structure of the play as a whole, where she is introduced and where she appears throughout the play. The entire project includes somewhere in the order of one million words. When readers zoom into an area of the text, it appears fully rendered, as readers zoom out there are various degrees of “greeking” applied to the text; at first the

overall shape of the line is maintained but, with further zooming, the shape becomes abstracted until the dialogues merge together and the entire scene is rendered as a rectangle, as shown in Figure 9 (Small 1996, p.520).

Small explored different ways of modifying the text in order to assist readers in visually filtering the information while it remained within the context of the entire play. He used brightness to highlight portions of the text to distinguish it visually from unselected text. Freed from the bounds of the printed page, Shakespeare's plays float within the information landscape. Visually filtering the information while it remains within the context of the entire text allows readers to see patterns and structures that were not previously discernable (Small 1996, p.522). Using the computer to render the texts permits readers to view them within a meaningful context and to see the text in ways that were not previously possible.

Keeping with this notion of delivering the information in context, Small also explores how footnotes and or supplementary material can be presented within the information landscape. He acknowledges the shortcomings of the conventions for footnotes in traditional book design, where the note is physically separated from the information to which it refers and is constrained by the margin and size of the page (Small 1996, p.522). With hypertext systems these constraints are removed as the footnote becomes a lexia unto itself of unlimited length. The problem of context persists, however, as, having selected the link, the footnote appears and completely obliterates the original text. One solution Small proposes is to place the footnoted text perpendicular to the

Figure 9: Image of the Virtual Shakespeare Project from David Small's article in the IBM Systems Journal

primary text as shown in Figure 10. This allows both texts to be displayed simultaneously, but when the text is rotated back to give the primary text focus, the footnotes, having no depth, disappear. One could imagine a series of these perpendicular related texts stretching infinitely throughout the information landscape.

One of the researchers who collaborated with David Small in the Visual Language Workshop was Suguru Ishizaki, now a professor at Carnegie Mellon University. Part of the focus of Ishizaki's work is what he calls "kinetic typography". Examples of his student's work in this area can be seen at his course web site; through the use of font, colour, scale and motion, their projects imbue text with an emotive, oral quality. Figure 11 is a frame from an emotional piece called "Why" that depicts a monologue by a breast cancer survivor. Due to the oral quality it lends the text it seemed appropriate to apply some of the techniques of kinetic typography to the design of a prototype for representing an oral narrative.

Also relevant to my research on information landscapes is an MIT Media Lab thesis by Robin Kullberg, who drew upon work from Small and the Visible Language Workshop to inform her design. Kullberg experimented with the use of computer based media to display historical information, specifically a three-dimensional visualization of the history of photography using 256 images from the collection of the George Eastmann House. Recognizing the problem of conventional two-dimensional time lines in presenting multi-dimensional information, Kullberg studied how the computer could be used to facilitate the layering of different information types, such as the photographer's name, the date of

Figure 10: Image of "footnotes" in the Virtual Shakespeare Project from David Small's article in the IBM Systems Journal

Figure 11: A screen from a movie entitled 'Why' by a kinetic typography student of Suguru Ishizaki

the photograph, its size, the geographic origin of the photographer and important world events, without compromising the legibility of the information for the viewers (Kullberg 1995). In her project, Kullberg grouped the individual photographs by photographer, while the photographers were themselves grouped according to country of origin. She then applied many of the visual filtering techniques developed by Small such as the use of colour and transparency to highlight information for the viewers. Figure 12 shows the photographs being filtered in response to the viewers' request to "Show me portraits." Many of the conclusions that Kullberg drew with regard to visualizing and filtering information and providing visual stability to users can be applied to the creation of a spatial representation of a hypertext narrative.

Design Development

Using the research from the aforementioned areas of information visualization, information landscapes and kinetic typography to inform my design I began designing a prototype for the spatial representation of my hypertext narrative. For me, Tufte and the researchers from Xerox PARC emphasized the importance of displaying information within its context and how real-time zoom can be used to facilitate this action. As well, their criticisms of three-dimensional computer modelling as a tool for information visualization forced me to be critical of my own use of it in the design of my prototype. From the MIT's Media Lab, Small's and Kullberg's experiments provided research into the implementation of visual filters and real-time zoom, as well as precedents for three-dimensional visualizations of information landscapes. While Small's walls of text floated

Figure 12: An image from Robin Kullberg's thesis "Dynamic Timelines"

in the seemingly infinite black space of its landscape, Kullberg chose to ground her model on a spatial time line. Both Small's and Kullberg's experiments incorporated a simulated immersion of users into the information landscape. This allowed the users continuous panning and real-time zooming of the space. However, the experiments of Small and Kullberg did not include the additional challenges of incorporating hyperlinked navigation, as I do in my prototype. For a precedent in addressing those challenges I referred to the design of Anderson's *Puppet Motel*, more specifically her use of an architectural metaphor as the organizational element. As mentioned earlier, the experience of Anderson's CD retains its disjunctive hyperlinked essence while the motel provides users with a comforting sense of stability and structure, without being too controlling, that enables them to navigate and explore. Where Anderson uses the metaphor of a motel, I have incorporated the plan of a city in my prototype. This decision to use the map of Ottawa as the ground plane seemed appropriate for several reasons. The city of Ottawa relates directly to the content of the narratives and the city as an archetype seems metaphorically appropriate as a model for nonlinear orientation, but these issues will be addressed in more detail later.

The prototype was designed to try to address the three questions raised by problems with conventional hypertexts described earlier. First, there is the question of how to represent the hypertext in a way that reflects its multi-dimensional nature; second, how to achieve a balance between overview and detail to place the lexia within a meaningful context; and third, how to provide a sense of stability to readers without losing the dislocative characteristics of hypertext. My prototype is not a definitive answer to these

questions, but is, instead, just one example of how hypertext can be spatially represented in a way that is both understandable and interactive. Before going into the details of the design of the prototype, with regards to how I tried to address the questions, there are two points I would first like to discuss that are more global in nature. The first point relates to the choice of narrative content for my prototype and the second to the choice of media employed to deliver it.

Literary theorists see interactive hypertext fictions as the "inevitable next step" in the evolution of the novel (Bolter 1991, p.132). The electronic medium of the computer allows contemporary writers to be freed from the form of the novel they have been experimenting with and fragmenting. Not being a writer myself, I felt that I would not do justice to the medium if I tried to write a hypertext fiction as the narrative content for my prototype. Having reflected on the nature of the medium and its affinity with the oral tradition, the solution to the question of content became apparent; I decided to elicit from my grandfather stories of his life in Ottawa. When recounting a series of stories to someone our memories are associative (Kullberg 1995). The order of the individual episodes we retell does not necessarily follow a chronological or prescribed path, but instead flows associatively from event to event. A person's name, an event, a smell, an interjection from the listening audience can all create associations between different memories in our mind. Similarly, hypertext authors provide their readers with links that associate lexia in different combinations depending on the path they choose. Although the various paths provided to readers are not as innumerable as the connections between memories in one's mind, the notion is similar. The order in which memories are

retold and their details also vary from telling to telling. Similarly, hypertexts can be read in different ways depending on the links selected by readers. Within some more elaborate hypertexts, depending on what lexia within the narrative matrix readers have visited, the hypertext modifies itself. For example, Joyce's *afternoon* can be fairly recursive with readers frequently returning to the same lexia, but the outgoing links from those same lexia change depending on what other lexia have been visited in the interim. As Joyce explains in the "Getting Started..." section of the accompanying instructions for *afternoon*,

"...the story changes depending on decisions you make. A screen you have read before may lead to something unfamiliar, because of a choice you make, or choices you have made on other screens of the reading." (Joyce 1987, p.4)

Because of these similarities I chose a recording of my grandfather as the source from which I created the hypertext matrix that would form the basis for my prototype.

The second decision I would like to discuss with regard to the design of the prototype is the types of media I chose to incorporate. The fear that "this will kill that" has been bantered about in many different contexts since Victor Hugo wrote the line in his novel, *Notre-Dame de Paris, 1482*. With his musing, "ceci tuera cela", the archdeacon was referring to printing and literacy undermining the authority of the church (Bolter 1991, p.1). But the printed book did not eradicate religious tradition, nor did it replace communication with pen and paper. As history has shown, new technologies do not necessarily supplant older ones. In her book, *Hypertext: The electronic labyrinth*, Ilana Snyder quotes Marshall McLuhan in his observation that "the 'content' of any medium is always another medium". She goes on to explain that writing "contains" speech, print

“contains” writing, film “contains” both the aforementioned media, and hypermedia, a term she uses for a specific form of what I have been referring to as hypertext, unites sound, graphics, print and video (Snyder 1997, p. 2). In order to incorporate these different media into the design of a narrative space I did the following : I digitized portions of the audio recording of my grandfather; collected images from various sources that would act as appropriate representations for the various lexia; scripted the text that would be visually presented to the readers within each lexia; and created animations from the computer model of the spatial representation of the narrative.

As described above, one of the reasons I incorporated “kinetic typography” into the prototype is that it lends an oral quality to the text; another reason is because it both introduces and augments the notion of temporality within the narrative space. Another example I found that plays with these ideas is Stuart Moulthrop’s 1995 web based hypertext *Hegirascope*. Within that piece, which he describes as “not a novel”, he takes the interactivity of hypertext and adds to it the notion of temporality (Moulthrop 1995). While all other hypertext fictions I have encountered could be contemplated at a reader’s pace, each of *Hegirascope*’s lexia are subject to time. While they are presented to readers with several clearly identified links out of the text, if readers pause and do not select a link, after a certain predetermined amount of time has passed, the text changes on its own accord. This ephemerality of the text is reminiscent of the oral tradition. With *Hegirascope* the text of the currently selected lexia is no longer permanently fixed in space and time, no longer objectified for repeated contemplation by its readers. It becomes, instead, an ephemeral experience that leaves readers with only their memory

of what they have seen or heard.

Addressing the Challenges

Having selected the narrative content for the prototype and the types of media to be incorporated within it, I began working through different designs for the narrative space to try to address the three questions raised by the problems with conventional hypertexts described earlier.

For the purpose of creating a hypertext from his recording I separated my grandfather's narrative into distinct lexia between which I made connections, or hyperlinks, through people, locations and/or events. Each lexia, while linked to others, was edited to be self-fulfilling with regards to its narrative content. Images that thematically related to the content of each lexia were selected to represent physically each node of the story within the narrative space. By having the lexia presented in this manner, as distinct objects, readers can easily gain an understanding of the scale of the entire hypertext. This begins to address the first of the problems I described with conventional hypertexts, that of representing a multi-dimensional structure as two dimensional. Unlike a book, a hypertext has no physical, volumetric presence. When reading a book readers can easily gauge their location within the story by visually measuring their place relative to the overall volume of the physical object. Some of the criticisms levied against hypertexts relate to the perceived lack of a definitive end or sense of closure (Fauth 1995). When readers reach the end of a book, they know that the narrative physically

has nothing left to reveal to them and they are free to make sense of the work as a whole (Douglas 1994).

Since there is no physical last page or end to most hypertexts that is easily perceivable by readers, the notion or definition of closure within these texts has been a subject for many literary theorists. Professor Barbara Herrnstein Smith suggests that one solution to the problem of the indeterminacy and narrative closure within hypertexts would be to write each lexia with a sense of thematic closure (Landow 1997). This would provide its readers with a sense of satisfaction and narrative fulfilment that would enable them to leave the hypertext with a sense of closure regardless of how many of the lexia they read. By spatially representing all the lexia, as shown in Figure 13, I am presenting readers with an easily perceivable means of understanding the overall scale of the narrative and where they are within it. There are two aspects to this latter notion of place, first, place within the space, and second, place within the narrative. Following the standard colour conventions for 'visited' links in HTML, the photographs representing lexia that have been visited change to purple. This provides readers with a clear visual cue as to where they are within the narrative by indicating the number of lexia yet to be read. And by spatially representing all the lexia, readers can easily gain an understanding of where they are within the space, either relative to the map, which is used as the ground plane, or relative to the images representing the other lexia, which act as landmarks or points of reference. These notions of place, space and proximity, help orient readers within the hypertext and are easily visualized within my narrative space. This is not easily achievable within the constraints of the conventional two

Figure 13: An overall 'view' of my prototype

dimensional representation of a hypertext, which risks leaving readers disoriented and eventually disinterested.

The second question I attempt to address with the prototype is how to achieve a balance between overview and detail in order to place the individual lexia within a meaningful context. In order to attain a balance between the macro and the micro within the narrative space, I chose to incorporate real-time zoom controlled by the readers. Earlier in the paper I discussed David Small's investigations with the Visible Language Workshop into the design of information spaces and his belief in the importance of maintaining the readers' idea of context while they explore the space. Likewise, Robin Kullberg incorporated real-time zoom into the design of her "dynamic timelines" to permit users to move between various levels of detail of information while retaining its context (Kullberg 1995).

As well as providing them with the ability to maintain their context while exploring the narrative space within my prototype, by giving readers the ability to zoom in and out in order to determine where they are within the matrix of the narrative, I have provided them with a sense of control not available in conventional hypertexts. Many advocates of hypertexts tout them as the democratization of text and as the subversion of the authority of the writer because they allow readers to choose their own paths through the story (Landow 1997). But this notion of increased control for readers is debatable because, although the paths are ultimately chosen by the readers, they were all initially created by the author. In his book *Cybertext: Perspectives on Ergodic Literature*, Espen

Aarseth also questions this subversion of the author's authority by explaining that at times hypertexts can be even more controlling than traditional printed texts. In hypertexts the writer provides readers with specific fixed links out of the text whereas with a book, readers are always free to randomly turn to any page; this is a freedom of movement and control not available to readers of conventional hypertexts but one that is included in my design through the incorporation of real-time zoom.

The ability to “zoom out” to an overview position allows readers to place the individual lexia within the context of the narrative representation as a whole. By visually filtering the information, through the use of transparency, readers are able to see what lexia are most closely related, with regards to narrative content, to the currently active one; the most closely related lexia appear the most opaque, while the others decrease in opacity in proportion to their narrative relation to the selection. To see an image of this refer to Figure 14. In the narrative space all the lexia within the hypertext are displayed to ensure that the individual pieces are always seen within the context of the entire structure. This ability to view the narrative relation between the various lexia by visually filtering them is not possible within conventional hypertexts. Instead, when presented with the outgoing links within a lexia, readers are left to wonder where the links will take them and how closely it will relate to what they have just read. Readers are in essence blindly choosing paths through the story, constantly having to make judgements with regards to what link to choose and whether it might take them along the narrative path they hope to pursue. This act of weighing the possibilities of various links leaves readers wondering if they have made “right” or “wrong” choices. Ultimately, it is a futile

Figure 14: An overall 'view' of my prototype showing the use of transparency to visually filter the lexia

comparison they are making between the known text of what they have read and the unknown text of the narrative they have missed because of paths not taken. Stuart Moulthrop describes the action of selecting a hypertext link as,

“...an experience that combines the matter transporter of science fiction with the slot machines of Las Vegas: instantaneous transition with the possibility of surprise.” (Moulthrop 1997)

or, as “diving boards into the darkness”, using hypertext pioneer Ted Nelson’s phrase in describing links on the World Wide Web. When selecting a link within a conventional hypertext, readers have little, if any, information as to where it will take them and how that narrative will relate to where they are within the story. By giving readers the ability to control their view, which places the individual lexia within the context of the entire narrative, and to view the narrative relation between the lexia, they are better able cognitively to structure the information being delivered to them. They are able to visualize the macroscopic information, or the context of individual lexia within the whole, as well as the microscopic information, or the narrative interrelations between the various lexia.

The third, and final, question I am addressing in my design is how to provide a sense of stability for readers without losing the dislocative sense of the hypertext. As discussed earlier hypertext by nature is disjunctive; the hyperlink, as a device, connects disparate pieces of information. It is this ability to combine and recombine the text in different ways that attracts writers to this new medium. Twentieth century avant garde writers experimented with altering the linearity of plot structures and the conventions of the

novel. These experiments with plot and character led to the subversion of the physical form of the printed novel itself. But the question of whether a text can ever be nonlinear is debatable, as the experience of readers through the text is ultimately linear. It is interesting to note that in Derrida's *Of Grammatology* he expresses his belief that "modern experience could not be recorded adequately in linear forms." (Bolter 1991). Bolter sees statements such as that by Derrida and works by authors such as Laurence Sterne or Jorge Luis Borges not only as musings or explorations on the form of the printed novel, respectively, but also as unwitting predictions of the electronic writing space of hypertext. As well he sees their work as "models for electronic writing" for contemporary hypertext authors (Bolter 1991). Therefore, the third challenge in my design is to maintain a balance between the disjunctive nature that attracts writers to this medium and a sense of stability for readers immersed in it. This is a fine balance, as readers need to be provided with a sense of structure that affords them the comfort to investigate and explore the hypertext, but the stability cannot become too stable. If the interaction of readers within the hypertext becomes too prescribed, the very essence that attracts readers and writers to the medium is lost.

Following the results of the usability testing done by Kullberg for her information visualization, I needed to design a mechanism for grounding the story within the narrative space. This ground plane serves to orient readers within the three dimensional space as well as providing them with a stable point of reference when zooming in and out of the model. Initially, I considered arranging the pieces of the story chronologically within the space, but this, ultimately, became too linear, and the path through the stories

too controlling. It also seemed to contradict the nature of orally recounted memories which, as discussed earlier, is associative, not chronological. In examining the content of the lexia themselves there were two constants, my grandfather and the city of Ottawa. As just discussed, the chronology of the life of my grandfather seemed too linear a means of organizing the lexia, whereas the city seemed a more appropriate mechanism for many reasons.

As discussed earlier, one of the precedents for my design was Laurie Anderson's *Puppet Motel*, in which she used the architectural metaphor of the motel as her organizing principle. For the hypertext I was spatially representing, a similar organizing principle was achieved through the use of the city. Represented by its street map, the city of Ottawa acts as the ground plane for the model and structures the representation of the narrative's lexia. The photographs, each representing a lexia, were strategically placed at a location on the map that related geographically to the narrative contained within its lexia. Metaphorically the exploration of the story becomes the exploration of the city, which at times can be as "nonlinear" as a hypertext. Similar to a landmark within the city, the active lexia becomes a point from which one compares the position and relation of the other lexia within the narrative space. As readers proceed from one lexia to the next they are cognitively structuring what they have read, mentally placing the pieces of information into a sequence that shifts and adjusts as new lexia are read. As changes of setting, narrator, subject and chronology are understood, they are placed in appropriate relation to one another. This is similar to the experience of a city where disparate locations and events are placed in relation to each other in the minds of its

inhabitants. The shifting points of view within the story, depending on either the vantage point of the selected character or the revelation of new narrative information that puts previous assumptions into question, is reminiscent of how one's perception of the relations of things within the city changes relative to one's point of view. For example, consider the difference in the experience of a pedestrian walking down the street versus that of a passenger in a car. But within these fluctuations in perception are the landmarks of the buildings within the city and the lexia within the hypertext that help to structure the interaction. The multiplicity of paths through a hypertext also relates metaphorically to the numerous ways that one can traverse the city; the lexia are fixed pieces between which the hyperlinks connect in various ways, just as the streets of the cities provide numerous ways for a driver to travel from one place to another.

But to return to the importance of the dislocative nature of hypertext within the design of the narrative space of my prototype, readers are given two means of navigation through the space. As shown in Figure 15, at the conclusion of each lexia, readers are presented with the links provided to them by the author. If readers choose to follow these links as the mechanism for their navigation they are instantaneously transported from one lexia to another, much in the same way as readers of conventional hypertexts. A comparison can be drawn between exploring the text this way and the exploration of a city without a map. Making sense of both these experiences relies on the creation of a cognitive map in the mind of the readers or travellers. As the main character in Michel Butor's novel *Passing Time* discovers, assumptions made regarding relative locations of buildings and occurrences are constantly shifting as a new visitor without a map tries to

Figure 15: An close-up 'view' of a lexia with its outgoing hyperlinks

make sense of his experiences within the city. But, with the purchase of a map, which is similar to the addition of the tools that give the readers the ability to gain an overview of the interaction, visitors are able to place their experience within a more definable context. Some hypertext authors, such as Joyce in *afternoon*, create recursive structures where certain lexia must be repeatedly visited while others are completely inaccessible until certain lexia have been read. This authorial intent is emphasized within the narrative space I am proposing where readers can more easily visualize the narrative cycle within which they are seemingly trapped, or can visually perceive that there is an entire portion of the narrative that they for some reason have not gained access to. Within the conventional hypertext this type of insight is hidden from its readers in the matrix of the unseen hypertext structure.

Within my design, readers are also given the option of bypassing the links prescribed by the author and are able to select any of the lexia within the narrative space. This type of freedom of control for readers would be left to the discretion of the author who may want to keep certain lexia visible, but inaccessible, for narrative purposes, but within the narrative space created for this thesis, readers would be free to select any lexia within the space. As discussed earlier in this paper, hypertexts can at times be more controlling, with regards to options available to readers, than traditional printed texts. By allowing readers to view and access all the lexia within the hypertext narrative they are free to choose how they want to travel through the story, just as readers of a book are free to flip between its pages. But, just as written content can be engaging enough to lead readers through a book, perhaps so too will be the links provided by the author to

the hypertext readers. By providing both means of navigation through the story I hope to achieve a balance between the dislocative nature of hypertext and a sense of stability for readers, with the map of the city acting metaphorically and physically as a mechanism for grounding the hypertext within the narrative space.

Conclusion

By creating a prototype that attempted to address three of the shortcomings of conventional hypertext narratives I hoped to create an environment for readers that would both keep their interest and enable them to explore a hypertext that maintained its disjunctive nature. My response to these shortcomings was to represent the hypertext as a multi-dimensional structure, achieve a balance between the macro and the micro of that structure and maintain the qualities of hyperlinked navigation while providing a sense of structure to readers. In this way I hoped to entice readers to explore the narrative space without being too prescriptive.

The city provided a rich metaphor for hypertext; it acts a model for nonlinear orientation since it is understood as both a fixed and a fluid entity in the minds of its inhabitants. Cities are made up of a series of landmarks or points of reference, spaces and places can be connected in a multitude of ways. Similarly, a hypertext can be traversed many ways depending on the paths chosen by readers. This act of choosing links/paths within the hypertext leaves readers questioning whether they have made the "right" or "wrong" choices. Because the hypertext is represented spatially within the context of a city, narrative "dead ends", or lexia with no outgoing links, do not seem so final or inescapable to readers. Instead, readers are able to turn down another "street" or navigate towards another landmark that intrigues them, or in other words, are able to explore. This addresses the frustrations that can occur in conventional hypertexts where readers are confronted by a lexia with no outgoing links forcing readers either to quit, or

backstep their way through the narrative using the 'back' button on the browser.

The desire, on the part of readers, to explore is capitalized on in computer games such as *Myst* and its sequel *Riven*. In these games, players are provided with pieces of a narrative puzzle while they search for clues; it is the exploration of the intricacies of the three-dimensional space that helps maintain the players' interest. Within the worlds that are created for their users "dead ends" do not appear as evident or inescapable. The origin of the computer adventure game can be traced back to a game created in the 1970's entitled, fittingly enough, *Adventures*. It was a text based game inspired by its board game predecessor, *Dungeons and Dragons* (Aarseth 1997, p.98). This style of text based games was created using formulaic fiction genres, such as detective stories. They provided players with objects to manipulate, characters with which to interact and multiple outcomes depending on their decisions. Players were allowed to input commands such as "go north" and could progress through the game until they quit, won, or "died". As computers became more powerful, these text based games were replaced by graphic ones that could better spatially represent the game to its players. The original adventure games inspired other text genres such as multiuser dungeons and hypertext novels (Aarseth 1997, p.102). This notion of gameplaying or the solving of narrative puzzlement is important in maintaining readers' interest. Similar to the environments in games, using the city as a metaphor for its representation provides my hypertext with a framework for structuring its narrative clues without seeming too constraining to its readers.

As mentioned earlier, the prototype I created for the design portion of this thesis was not intended to be a definitive proposal for the spatial representation of a hypertext, but instead to provide one example for exploration and open avenues for future research and experimentation. For example, within my prototype, the map has remained as a flat two dimensional representation of the city with the lexia's photographs bringing the third dimension to the space. One could, however, begin to play with the topography of the city. By "pulling" the vertices that create the surface of the map into the third dimension, the topography would begin to affect sight lines and points of view for readers immersed in the space. One could also play with the size and the significance of the images chosen to represent the lexia. For example, a steeple or tall building within a city becomes significant through its visual prominence; within my model this increase in height could translate into the representation of a more significant lexia within the narrative structure. Significance could further be emphasized through recursive hyperlinking that would frequently return readers to that same 'place'. Not only vertical prominence, but spatial orientation could be used as a visual cue of narrative importance. With the regular grid of the city as their background, placing objects intentionally off the grid would bring them into relative spatial prominence and perhaps, by extension, into narrative prominence. Depending on the subject of the hypertext narrative, one could play with the conventional notion of the map itself. It could become a thematic map instead of a street map of a city, one of passions or trouble, which could lend significance to the narrative lexia it structures.

Ultimately it is this exploration into the spatial representation and structuring of the

information that I, trained as an architect, find interesting. The computer as a tool provides us with new ways of interpreting and presenting the information around us, allowing us to contemplate the fixed word while reintroducing some of the nonlinear, associative and ephemeral aspects of orality. With digital text, the words have been freed from the confines of the printed page and we have the opportunity to explore their representation in new ways. But these representations need to be examined and reordered with regards to the experience of readers who will be exploring them. One must be sensitive to and cognizant of notions such as orientation, place, and context and the effects that their inclusion or negation incur. The hyperlink introduces the dimension of choice and change to the fixed flatland of printed text. While this convention provides an effective mechanism for inter and intra document navigation, this type of dimensionally enriched environment must look to new paradigms with which to nurture order. Architecture, whether *Puppet Motel* or the islands of *Myst*, is an excellent place to start. It is in conjunction with these more spatial and inhabitable explorations that our experience of digital representations of information will be enriched.

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APPENDIX

The following paper was written as part of a Directed Studies summer term course I completed in August 1998 under the direction of Professor Benjamin Gianni. It has been included as an appendix to my thesis to provide supplementary information about the relationship between hypertext and print literature.

The term "hypertext" is commonly attributed to the computer scientist, Ted Nelson, who in remarking on the mainframe computer's ability to manage "textual networks", wrote that literature could henceforth be understood as an ongoing system of interconnecting documents. (Bolter, p.23) Today, the very use of a computer is synonymous with the use of hypertext, be it through following links on the world wide web or accessing the index to a help menu in a word processing application. With one click of the mouse, these mysterious links transport the user from one "place" to another or, using the Roland Barthes term commonly employed in writings on hypertext, from one *lexia* to another, often, however, providing the user with no mechanism to return from whence they came, and little way of knowing precisely "where" that was. (Leary, p.18)

For the proponents of the technology, the impact of hypertext on literature will rival that of photography on painting or that of Gutenberg's printing press on Western culture. But, as it took several generations of printers to depart from the traditional techniques established by the history of scribes that preceded them and discover what new writing space Gutenberg's technology afforded them, similarly hypertext authors are currently exploring the new electronic writing surface provided to them by the computer. Consequently, while emphasizing the revolutionary impact that hypertext will have on linear narrative, many sources on hypertext writing inevitably discuss the hypertext qualities of printed works by authors such as Jorge Luis Borges or James Joyce. Perhaps hypertext authors hope to lend some legitimacy to the new information technology they utilize for their writing by establishing its roots in the great works of literature by the aforementioned authors. Or, instead, perhaps this notion of hypertext

provides us with what George Landow describes as a lens through which these renowned experiments in writing can now be re-examined, to reveal qualities difficult to articulate before the advent of the term hypertext and the technology that engendered its popularity. (Landow,p.102) There are, undeniably, aspects of print novels that have hypertext qualities, and we will examine four of them.

The first of these qualities, is to be found in the style with which the novel is written. *Jealousy*, by Alain Robbe-Grillet, is an example of such a text. The way in which the novel is written intentionally subverts the linearity of its narrative. The reader is repeatedly presented with scenarios and situations that are the same, yet slightly different each time as more information is revealed to and accumulated by the reader. This repetition of familiar scenes is a mechanism employed by writers of hypertext novels. Michael Joyce, the author of one of the first examples of interactive fiction, *Afternoon*, warns the reader that in a hypertext fiction, what seems like a loop does not necessarily imply closure, because a word that is not a link the first time the reader encounters it, may take them somewhere if they select it when they encounter it a second time, and what seems like a loop can suddenly head off in another direction. (Bolter, p.123)

While some novels subvert the linear narrative through the style with which they are written, other novels do so through their graphical layout and their physical construction. *The Dictionary of the Khazars*, by Milorad Pavic is one example of a book whose arrangement of content evokes a certain hypertext quality. There are two editions of the

dictionary, a male and a female, which, according to the frontispiece, differ only in one crucial paragraph. The introduction gives a fantastical historical account of the mythical Khazar tribe. According to legend their ruler, the kaghan, had a dream and he called upon three sages for their interpretations: a Muslim; a Christian; and a Jew. The kaghan had decided to convert himself and all his people to the faith of the sage who gave the most satisfactory interpretation, thereby assimilating and destroying the autonomous and nomadic Khazar culture. The introduction does not reveal the outcome of the sages' interpretations, but the dictionaries are each divided into three sections: The Red Book, or Christian sources on the Khazar; The Green Book, or Islamic sources; and The Yellow Book, or Hebrew sources. The entries are arranged alphabetically within each of the three books and graphic symbols are used to cross reference entries which appear in more than one of the books. For example, the name Ateh is marked with a symbol indicating that it appears in all three books thereby allowing the readers, if they so choose, to compare very different entries regarding the life of the same person. In the introduction the author instructs the readers to examine the book in any order they choose, and tells them that the book never needs to be read in its entirety. The author believes that each reader puts the book together for him or herself, as in a game of cards, and, he also writes that as with a mirror, the readers will get out of the dictionary as much as they put into it. (Pavic, p.13)

The deck of cards analogy used by the author brings to mind *Composition No.1* a work published in 1962 and written by Mark Saporta. It consists of 150 unnumbered and unbound pages, each containing one or a few paragraphs printed on one side. The

introduction on the box asks the readers to shuffle the pages like a deck of cards or for them to cut the cards like a fortune teller, emphasizing for the readers the role that they play in creating the outcome of the story. But, also in the introduction while casting the readers in the role of seers, Saporta acknowledges that any particular reading is only one of a multitude of possible combinations; he writes of life being composed of a finite number of elements, but that the number of possible compositions is seemingly infinite. (Bolter, p. 140) Saporta's work is similar to today's hypertext novels through its delivery of individual lexia on separate cards, and how the readers move from one card to the next, uncertain of what it will bring. But, there is a physical presence to this work of Saporta that is not available to readers of hypertext, and while the readers cannot predict the order of the cards, they are cognizant of the immutable number of cards that they have rearranged, and they are aware of where they are within that stack of cards in relation to the beginning and end of the story.

While the aforementioned examples were unconventional at the time of their publication in either their style of writing or their physical form, the third hypertext quality occurs in more traditional scholarly writing through the use of footnotes or endnotes. There is a hierarchy implicit in the standard graphic notation used to represent endnotes and footnotes. The small superscript referring numbers and the physical separation of the notes from the body of the text emphasizes the importance of the latter and the subservience of the former. There is an undeniable parallel between following a numbered reference from the body of an essay, for example, to its numbered endnote information, and following a hyperlink provided within an electronic text that offers direct

access for the reader to another website or article to which the text refers. But, the graphical hierarchy of primary text and secondary text implicit in published academic print is lost to the readers of most hypertext sites as they click from reference to reference losing sight of what is the primary text.

The final, and perhaps most obvious, hypertext quality of the novel to be discussed here is evident only through the act of reader interpretation. As Paul Valery wrote, "I write half the poem. The reader writes the other half." (Columbo, p.22) In a webzine dialogue examining hypertext and its future, Michael Joyce speaks of "graph theorists" describing hierarchy as a specific type of a network.(Feedmag,Dialog2,p.4) Joyce then extends that description to say that the linear is merely a special case of the multiple. Returning to the quote by Valery, the printed novel can be perceived as one form of a story that had many forms in the imagination of its author. That one story is then consumed by the readers, whose own experiences and associations influence their interpretation of the written words. With the quote of Valery in mind, one can understand Joyce's position when he says that "All text is hypertext".(Feedmag,Dialog2,p.3)

In contrast, other theorists question the relevance of comparing hypertext novels to traditional books. They feel that the experiences are so different that they cannot justly be compared. Similarly, others question the common comparison between hypertext and the theories of post-structuralist writers such as Barthes and Derrida. The critics feel that it is a convenient misappropriation of ideas because the concepts of those philosophers were meant for the technology of print, not the digital medium. One can

see merit in questioning the relevance of comparing the two media, if one reflects on the centuries of prejudiced scholarship concerning Homer's epics. The literary bias of academics focused studies on the written texts of the poems instead of examining the texts within their rightful oral context. (Ong, p.21) One wonders if similar inhibitions will interfere with our examination of the impact of hypertext novels, due to their continuous comparison to print novels. Nevertheless, there are undeniably four fundamental parts of a traditional story that hypertext calls into question that are mentioned in passing in Landow's book: the fixed sequence of events; the definite beginning and ending point; the definable magnitude of the story or its boundary; and the unity of the three aforementioned parts into a single whole. (Landow, p.102)

Today, it is common convention for a story to contain a single plot that the reader follows from beginning to end. Walter Ong writes about the development of the linear narrative in literature in his book, *Orality and Literacy*. He describes how the advent of systems of writing fixes words in space and time, and objectifies them. Today, once writers outline their stories, the written words are available to them for reconsideration, revision and manipulation. Due to the increased control for the writer, the climactic structures that they create become tighter and tighter. Readers have come to expect each line to either refer to what they have already read, or to reveal something about what is yet to come. In literate culture, people tend to think of narrative as an ascending linear plot, with actions building tension, rising to a climactic point followed by denouement. Ong sees the peak in the development in this structure of narrative in the detective story. In the ideal detective story the ascending action builds up towards the climax, at which point

the readers realize that every single detail in the story had been skilfully misleading, yet crucial. (Ong, p.149)

But with an electronic novel, there is no bound volume, there are no numbered pages and the fixity of the text is questionable. Is it therefore reasonable to demand that it provide a linear plot for its readers to follow? Does the linearity of the reading experience disappear or merely shift in its definition? Hypertext author Robert Coover sees the linearity of the story shifting from a prescribed plot to becoming a quality of the individual reader's experience as he or she chooses specific paths to follow through the text. Many advocates of hypertext tout the dismantling of the single linear plot as a democratization of the text and a subversion of the authority of the writer. Admittedly the readers do become more of a writer as they participate actively in the "creation" of the story, but it is questionable whether or not this undermines the authority of the writer, as all potential narrative paths and links are established for the reader by the writer. Maybe it is a result of our being conditioned to the climactic plot, but one must question if in a society where authors such as John Grisham and Stephen King sell books by the millions, whether or not these same readers will be willing to customize their own narratives. (Feedmag, Dialog2, p.5) The lack of prescribed linearity of the reading experience may also affect the complexity of the plots that can be supported by electronic texts. No longer does every part of the text build in tension towards a single climactic resolution. The readers are no longer able to go back and reread specific passages for clarification as new information is revealed. The text may still be there, fixed somewhere, but the readers may not be able to retrace their links to where it was, and even if they do, upon

a second visit the text may have changed. One critic noted that this indiscernible past and future within the storyline caused her to read more quickly and, one can infer, with less attention to detail.^(rssiilver) One can arrive at any point from a multitude of directions, and, therefore, paying attention to any particular segment may not play a role in understanding what comes next. In hypertext fiction the readers are constantly faced with a multitude of links to choose from in their participatory roles of readers/writers. This requirement for continual decision making prevents the readers from becoming absorbed in any one thread of the story, as they continually critique the nature of the choices with which they are faced, and wonder how it will affect the outcome of the story.

This brings us to the second fundamental part of a traditional story that hypertext novels bring into question, the definite beginning and end. These two notions imply linearity, so how can one apply them to the experience of a hypertext reader? The hypertext author Michael Joyce finds the notion of closure in fiction "highly suspect" and states this fact in a lexia entitled "work in progress" within his hypertext fiction *Afternoon*. In the same lexia he also explains his notion of "ending" to the readers. He tells them that when the story no longer progresses, or when it cycles, or when they tire of the paths, the experience of reading it ends.^(Bolter,p.143) To one accustomed to and expecting a climactic resolution of the plot, Joyce's suggested end by indeterminate boredom seems somewhat unsatisfying. In her book, *Hamlet of the Holodeck*, Janet Murray, a hypertext author and professor at MIT, provides an interesting insight into notions of closure in Joyce's *Afternoon*. Not satisfied with the author's notion of closure as exhaustion, many

who experienced Joyce's interactive fiction likened the notion of closure in the story to the solving of a maze.(Murray, p.174) Murray proposes that with electronic fiction closure occurs when the structure of the work is understood, though its plot may still be unresolved. Similarly, Bolter and Landow write about the mental puzzle with which hypertext readers are presented.(Bolter,p.127)(Landow,p.113) The readers follow a one dimensional path through the large networked chains of narrative in a hypertext fiction. As the readers proceed from one lexia to another, they begin cognitively to structure what they have read, mentally placing the initially puzzling pieces of information into a sequence that shifts and adjusts as new lexia are read. Changes of setting, narrator, subject and chronology are encountered and need to be understood and placed in appropriate relation to one another. Closure for the readers is achieved when their cognitive puzzlement disappears and they are satisfied that they understand the spatial structure of what they have experienced.

But, while the readers are left to wrestle with the pieces of the story they experience, they are given no notion of where the paths they chose fit within the network of the fiction as a whole. This is the third aspect of a traditional story that is questioned by hypertext writing, the definable magnitude of a story or the establishment of its boundaries. I have already discussed the hypertext quality of footnotes and how the graphical convention used to represent them clearly signifies to the readers that they are leaving the body of the text to look at subordinate information. As an interesting aside, a similar oral convention was employed by Herodotus in "ring composition". While telling a story, Herodotus would digress on an interesting detail, he would then notify the

listener when he returned to the main story. (Bolter, p.112) But within a hypertext fiction there is no implicit hierarchy to the links provided, and while the readers may be attempting to follow one narrative thread, with a click of the mouse they may end up somewhere quite different and never discover how the previous thread resolved itself, if at all. There is a software application called "Storyspace", created by Jay David Bolter, Michael Joyce, and John Smith for Eastgate Systems Inc., that assists hypertext authors in their creation of interactive fiction. Each lexia is mapped out as a dialogue box on the screen with radiating lines representing all the hyperlinks to other lexia, refer to Figure1. While this tool is provided to the authors to aid in the construction of their fictions, no such map is given to the readers to aid them in their navigation through the story. For hypertext readers there is no indication given illustrating where they are within the story and where they can go.

Figure 1: a screen capture of Storyspace for Windows

Shelley Jackson is the author of a hypermedia story called *Patchwork Girl*. In an interview regarding her piece, she described the paths through her fiction as being neither random nor predictable. She tells the reader that if they are going to follow her, and one can infer her story as well, then they have to learn to move the way she does,

and think the way she does, there is just no way around it. But, it was interesting to read in the same interview how she described the comfort she finds in reading a book. She explains the act of reading a book as spatial and volumetric. She measures her place within a novel as a third of a way through the rectangular solid of the book and a quarter of the way down the page.^(rssiilver) But Jackson and other hypertext authors don't allow their readers the same comfort of knowing where they are within the bounds of the hypertext fiction they create for them. All too often the links on a page become empty signifiers, with the readers left to wonder what they signify. Perhaps this desire to understand where one is within the context of the whole story is a product of existing within a literate society, and it is possible that for the next generation of hypertext readers this will no longer be an issue. But for now, as 20th century readers we are prepared for the focus to shift as we read from one disjointed lexia to the next because we are intrigued by the juxtaposition and try to interpret them, but ultimately we want to find a reason for these shifts. (Bolter, p.141)

With the lack of what one can consider traditional linearity, ending and boundary in a hypertext fiction, one needs to examine how a sense of unity can be achieved for the readers. In a traditional print story, there is a logical or temporal organization and if any one part is omitted or dislocated the whole then becomes incomprehensible. In Landow's book, Barbara Herrnstein Smith suggests that a paratactic structure could be used in organizing hypertext stories. With this type of structure, thematic units can be added, omitted or exchanged without destroying the coherence or the thematic structure. She names two forms that the paratactic structure can take: variations on a

theme; and the list. (Landow, p.106) These are two devices that were commonly employed in the tradition of storytelling. Landow makes the analogy between the hypertext reader and the bard, as they both construct meaning and narrative from fragments provided by someone else. (Landow, p.117) The audience for ancient epic stories came to understand them through the repeated hearings of different poets. The audience learned the repeated phrases and the fundamental mythological tales upon which the stories relied. At any particular telling, the bard would assemble a selection of these formulaic blocks involving the characters of the different gods and heroes and the adventures in which they took part, and improvised in traditional phrases on these themes according to the reaction of the audience. The bard would have at his disposal groups of memorized phrases used to describe something, and he would then select the appropriate phrase depending on the metrical requirements of the passage he had stitched together. But, therein lies a crucial difference between the bard and the reader of a hypertext novel. The bard, as well as his audience for that matter, have a network of familiar characters and events that are known to them. In contrast, the hypertext readers are given no indication of the overall network through which they are navigating. Smith's variations on a theme could be employed within the writing of the text, or it could be incorporated as a navigational space that the reader returns to; in either case it would afford the reader a sense of familiarity and comfort in navigating through the overall fiction. As a thematic device it would help the severed lexia from becoming too distended. Smith also suggests that each individual lexia could be written in a way that gives the readers a sense of thematic closure. Similar to the episodic tellings by the bard, each lexia could provide the readers with a sense of narrative completion and thereby compensate for

the lack of an overall grand unity.

In relation to the four issues just discussed, it is interesting to examine Laurie Anderson's *Puppet Motel* to see how successfully and unsuccessfully she addresses the traditional ideas of linearity, ending, boundary and unity within her hypermedia narrative. The *Puppet Motel* CD was released in 1995 in conjunction with Anderson's *Nerve Bible* tour. In 1993 she had released the book *Stories From the Nerve Bible* which was a twenty year retrospective of her career. Anderson contacted Voyager to see if they would be interested in sponsoring her *Nerve Bible* tour and to her surprise they agreed with the condition that she create a cd-rom for them with some of her stories on it in return; that is the story of how *Puppet Motel* came to be.

As implied in the name of the CD, *Puppet Motel* contains a collection of distinct rooms and stories. Once the readers have "signed in", refer to Figure 2, they are immediately taken to the "Hall of Time", Figure 3. This space will be discussed in more detail later, but suffice to say for now that it acts as a table of contents. The different paths available to the readers are presented as abstract graphic icons displayed on one wall of the hall. There is a fundamental hierarchical significance implicit in the role of this room for the readers. The readers are not required to begin along a specific narrative path only to be faced with a decision and forced to branch off in some direction. This forking path type of structure would imply the existence of a fixed sequence of events of which the readers are not cognizant. Each choice is weighed by the readers as to whether it is the "right" or the "wrong" decision. Anderson avoids this dilemma for her readers through

her design of the Hall of Time. The readers choose their own path from the onset of their journey, and there is no hierarchy implicit in the options from which they decide. The linearity of the narrative experience does become, as Coover suggested, the experience of the readers as they navigate through the spaces in the Motel. The stories delivered in each of the rooms juxtapose against one another and the readers try to discern if there is a narrative thread that ties them together; this interpretation would vary from reader to reader and experience to experience.

Figure 2: Puppet Motel "sign in"

Figure 3: the Hall of Time

After easily accessing one of the lexia from the Hall of Time, the most complex and perhaps unsuccessful part of the CD is the means of navigation out of each room. Anderson openly criticizes the navigational devices that she employed and admits that the ways of navigating through the rooms can be tricky and not easy to discover.^(multimedia japon) She also admits her own frustrations with using cd-roms; she describes clicking on everything and the frustration in having nothing happen. At least with *Puppet Motel* if the users resort to reading the printed guide that accompanies the

CD, it provides some navigational clues and explains that within each room there is a, sometimes hidden, electrical plug face that will return them to the Hall of Time. The challenge of the navigation through *Puppet Motel* can be related back to Janet Murray's proposal for the redefinition of closure in electronic fiction. From personal experience with *Puppet Motel*, the frustration with the problematic navigation becomes an impediment to the enjoyment of the narratives. But once the means of exit for each of the rooms is discovered, then one can go back and enjoy the narratives, explore the spaces for "worm holes" that transport one instantaneously between rooms, and search for other hidden surprises, because one is liberated with the knowledge that one can easily leave the room if one so chooses. This is reminiscent of my earlier discussion concerning closure in electronic fiction and how it occurs when the reader's cognitive puzzlement with regards to the spatial structure of the narrative is resolved. One could argue that with *Puppet Motel* this sense of closure occurs when the navigational puzzlement disappears.

The third aspect of hypertext novels I discussed was their lack of definable magnitude or boundary. This issue is addressed in two spaces within Anderson's *Puppet Motel*, the Hall of Time and the Attic. The latter is a room that the users discover if they try to escape (esc) out of the CD. As mentioned previously, the Hall of Time is the first space that the users enter after "signing in" to the Motel. One notices a series of icons that are projected on the left wall of the Hall as if they are a part of a slide show. The speed with which the images cycle can be controlled by the user, but it becomes apparent that there are twenty icons that cycle through in a consistent order. This provides the user

with a sense of boundary and scale not available to readers of most hypertext novels. There are two ways of entering the aforementioned Attic, either by trying to escape out of the CD, or via worm holes between some rooms and the Attic. Similar to the graphic icons displayed in the Hall of Time, the Attic contains objects that have seemingly escaped from each of the rooms, refer to Figure 4.

Figure 4: the Attic in Puppet Motel

These objects are immediately recognizable to the users who have visited the rooms from which they came. If the users are in a room and they are unable to uncover the plug that will take them back to the Hall of Time, this attic escape route provides them with an easily accessible secondary means of navigation through the rooms in the Motel. In relation to the idea of boundary, one can imagine the reassuring role that the Attic could play for users. Envision bewildered users that have passed through multiple worm holes and have arrived in the Attic, the finite number of objects in the attic would

serve to remind them of the bounds of the network through which they were navigating and places their experience within a definable context.

Anderson's use of the Hall of Time and the Attic also embody some of the unifying qualities Barbara Smith described. The users repeatedly access these two spaces and through this repetition, these rooms become landmarks that unify all the disparate narrative spaces within single rooms. As users experience different rooms in the Motel, they become familiar with symbols that Anderson repeatedly employs, for example the electrical plug cover. The iconic symbols that are displayed in the Hall of Time become familiar characters that the users recognize and associate with their respective narratives. The stories presented to the users are done so as self-contained thematic units. The users are never forced to follow a narrative thread through different links to discover its resolution. Instead, in *Puppet Motel* the users choose to explore the links for the challenge of uncovering the means of navigation between various spaces and for the pleasure of experiencing Anderson's eclectic narratives.

Aside from the problematic navigation that users encounter within the rooms of the *Puppet Motel*, Anderson's CD is an interesting piece to examine with regards to how she delivers narrative within a hypermedia environment and with what mechanisms she provides the users to facilitate their navigation. I found her CD informative to scrutinize when I began to imagine a prototype for a navigational model that could be used by hypertext readers. This model would visually represent the digital narrative for the readers, and would allow them to navigate through a spatial representation of the story.

In thinking about the design of this system, I looked at it in the context of the four qualities of hypertext fiction that I have discussed: the lack of linearity; the absence of a definable end; the establishment of a boundary; and how these things become, if they can, a cohesive whole. I have described how the linearity of a story, which was previously its prescribed plot, has now become the experience of the readers as they navigate through the digital story. Our desire for the fulfilment of a narrative can be satiated if each lexia is created with its own sense of thematic closure. *Puppet Motel* is an example of how this can be achieved, each of Anderson's lexia are scripted as individual fictions that, in terms of their narrative, can stand alone.

Janet Murray put forward the proposal that the sense of "ending" in a hypertext fiction occurs when the reader has a cognitive sense of the structure of the interaction. But within *Puppet Motel* my frustration with the navigation prevented me from gaining such an insight and became an impediment to my enjoyment of the content. The narrative model I am discussing becomes a mechanism through which the user can always navigate, similar to the hidden Attic in the Motel. Perhaps a more challenging secondary means of navigation could be incorporated, and its cognitive solution would provide a sense of end or completion for the user.

This notion of providing a model of the narrative structure to the users is inherently to the idea of the establishment of a boundary for the interaction. When designing a prototype for this navigational model, I found Robin Kullberg's masters thesis from MIT's Media Lab to be informative. One of the questions she was addressing was how to

provide an overview of information to users while simultaneously identifying their place within the context of that information. In general, Kullberg was examining the use of computer-based media for the visual communication of historical information, specifically a three dimensional visualization of the history of photography from 1830 to 1950 using 265 images from the collection of the George Eastman House. Kullberg recognized the problems of conventional two dimensional time lines trying to present multi-dimensional information. For example, in a time line of artistic movements, the dimension of time can be placed horizontally across the page and bars can be used to represent the various artistic movements. As the art movements begin to overlap chronologically, they have to stack down the y-axis of the page. It becomes difficult visually to compare different art movements occurring synchronously, refer to Figure 5.

Figure 5: part of a timeline of history of art

This problem is compounded if one tries to include names of artists or specific works of art or important world events to place the aforementioned within a relational context.

Kullberg was studying how dynamic visualization techniques available with the computer, such as infinite zoom, translucency and animation, would facilitate the layering of different types of information while maintaining their legibility for the viewers. (Kullberg, Chapter1) One can imagine how the same visualization techniques that she employs could be used in the creation of a navigational model for the readers of a hypertext narrative. This navigational model would be similar in principle to the narrative map provided to hypertext authors using the "Storyspace" software, refer to Figure 1. Each lexia would appear as a node within the network and radiating lines from each node would represent the paths linking that node to other lexia, refer to Figures 6 and 7.

Figure 6: prototype for model

Figure7: different view of prototype

Infinite zoom would allow the users to distance themselves far enough away from the node so as to view its boundaries, then zoom in to view a specific lexia, refer to Figure8 and 9. The users would continue to zoom in until they enter the object representing the

node; within this space the narrative information would be delivered to the users, refer to Figure 10. Hyperlinks would directly transport the readers from one lexia to another, but at anytime the readers would be able to zoom outside the node and establish their bearings relative to the entire model.

Figure 8: zoom

Figure 9: zoom

Figure 10: inside node

The ability to view a model of the entire narrative structure would aid in the creation of an overall sense of unity for a hypertext fiction. This model makes concrete the connections between the lexia for the readers to see. In a story more complex than the one I used in my prototype, this model would become a labyrinthine web of nodes and links. It is interesting to again refer to Kullberg's thesis to see how she experimented with transparency to visually filter the information. In one of her prototypes, if the users request to view information regarding a specific topic, portraits for example, elements not related to that topic change from 100% opacity to 20% opacity. The users can then zoom out to see an overview of their particular area of interest while the information remains within its overall, albeit dimmed, context, refer to Figures 11 and 12. (Kullberg, Chapter 3) A similar device could be used to aid the hypertext readers. In a complex narrative model transparency could be used to visually filter the web of links and nodes. When readers zoom out of an active lexia, the nodes and links directly

related to that piece could be represented at 80% opacity, all others would appear with decreasing opacity as they distance in relevance to the active node. This use of opacity would also aid the users in ascertaining their place within the network of information as they zoom out to have an overview of the entire interaction.

Figure 11: opacity information filter

Figure 12: zoom in with opacity

The aforementioned prototype I designed was created after examining the four aspects of the traditional novel that hypertext stories bring to question: linearity; end; boundary; and unity. This research is part of a larger issue regarding the impact of hypertext on narrative, and implicit in that is the impact of computers on narrative. With this in mind there is another aspect of how the computer can affect the delivery of information that I felt could not be excluded, although it does not directly relate to the four aspects I have been discussing. This is the notion of dynamic text. In most of the hypertext narratives I examined the words were still, no different than within a book. But with a computer, these words can be given emotive qualities, seeming to laugh or cry, through simple animation and graphic techniques. One example is a project by a student of Suguru

Ishizaki, a professor at Carnegie Mellon, refer to Figures 13 and 14.

Figure 13

Figure 14

This person created an emotionally moving piece entitled “why” that is a story of a breast cancer survivor.^(kdg) The words are presented in a simple and restrained fashion, yet the use of motion and transparency in conjunction with the monologue being presented evoke a strong empathetic response from its viewers. After seeing some of the examples of dynamic text from Ishizaki’s Kinetic Design Group, one can imagine how this device could be employed in the delivery of narrative within each lexia of a hypertext fiction. The word is no longer objectified and fixed as it was with print technology. In many ways hypertext allows the narrative to regain some of its ephemeral oral qualities, but this would form another investigation in itself.

My research this past semester was focused on the impact of hypertext on narrative. This started with an investigation into some of the hypertext qualities of the print medium, and led to a study of the qualities of this same medium that hypertext calls into question. Having looked at many of the contemporary examples of hypertext fictions, I must return to a statement from the beginning of this paper: hypertext authors are still

currently exploring this new electronic writing surface provided to them by the computer. From reading hypertext fictions myself and from reading critical discourse on the subject it became apparent that the fundamental issues of navigation and context for the readers of these electronic fictions are still evolving and being evolved. After examining Laurie Anderson's *Puppet Motel* and looking at other examples of visualizing information, such as Robin Kullberg's thesis, I created a prototype of a navigational model for the readers of hypertext narratives. In doing so I tried to address issues relating to clarity of navigation, context and place, matters that are somewhat inherent in the physical presence of print medium, but are issues that become more ephemeral and elusive when they are translated into the digital medium of hypertext.

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Illustrations:

- Figure 1:** a screen capture of Storyspace for Windows showing a map of a section from Diane Greco's *Cyborg: Engineering the Body Electric*
<http://www.eastgate.com/storyspace/maps.html>
- Figure 2:** a screen capture of the opening screen of Laurie Anderson's *Puppet Motel*
<http://www4.viaweb.com/voyagerco/ltcpuppem.html>
- Figure 3:** a screen capture of the Puppet Motel's Hall of Time
- Figure 4:** a screen capture of the Puppet Motel's Attic.
- Figure 5:** an portion of a timeline of the history of art from Kullberg's thesis
 original image is from:
 Janson, H. W. History of Art. 4th edition revised and expanded by Anthony F. Janson. Englewood Cliffs, N.J.: H.N. Abrams, 1991.
- Figure 6:** rendering from prototype I modeled in 3D Studio Max
- Figure 7:** rendering from prototype modeled in 3D Studio Max
- Figure 8:** rendering from prototype modeled in 3D Studio Max
- Figure 9:** rendering from prototype modeled in 3D Studio Max
- Figure 10:** rendering from prototype modeled in 3D Studio Max
- Figure 11:** image of a prototype created by Robin Kullberg for her thesis at MIT
 Chapter 3, Fig. 29
<http://robin.www.media.mit.edu/people/robin/thesis/chapter3.html>
- Figure 12:** image of a prototype created by Robin Kullberg for her thesis at MIT
 Chapter 3, Fig. 30
<http://robin.www.media.mit.edu/people/robin/thesis/chapter3.html>
- Figure 13:** still image from a quicktime movie by a student in the Kinetic Design Group
http://www.cmu.edu:8001/cfa/design/kdg/kt_examples/why.mov
- Figure 14:** still image from a quicktime movie by a student in the Kinetic Design Group
http://www.cmu.edu:8001/cfa/design/kdg/kt_examples/why.mov
 note: to see other student projects
http://www.cmu.edu:8001/cfa/design/kdg/kt_examples/kt_kid.html