The Ergonomics of Hypertext Narrative: Usability Testing as a Tool for Evaluation and Redesign

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Abstract

While usability research concentrates on evaluating informational documents and Web sites, significant insights can be gained from performing usability testing on texts designed for pleasure reading, such as hypertext narratives. This article describes the results of such a test. The results demonstrate that the navigation systems required for such texts can significantly interfere with readers' ability to derive value or pleasure from the fiction. The results emphasize the importance of hypertext authors providing more linear paths through texts and of simplifying the navigational apparatus required to read them.

H.5.4 Hypertext/Hypermedia— hypertext
Keywords: hypertext, fiction, lexia, usability

Introduction

Current usability research concentrates on the evaluation of informational documents and Web pages and on how to design documents so users can find relevant information in the shortest period of time (Nielsen 2000). However, little research exists that focuses on usability studies of online text designed for pleasure reading. It stands to reason, however, that a well-designed entertainment Web site, or electronic novel will enhance the reader's experience, just as a poorly designed document will detract from it. This paper examines a "genre" of electronic literature commonly referred to as hypertext narrative, to see if it requires a special type of interaction on the part of the reader.

A hypertext narrative is best described as an electronic novel (or short story or poem) that changes with every reading (Joyce 1995, p.35). Hypertext narratives consist of two elements: lexias or episodes (topics) and decision points (links) between episodes.

The lexia generally are paragraphs of prose or poetry, they may include graphics, and they may be of any length. At the end of each lexia, and usually within each lexia, the author inserts links to other episodes together with a procedure for choosing which link to follow. Links are provided for each pos-

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sible reader response and, ultimately, readers choose which path to take (Bolter 1991, p. 122).

Researchers have debated whether or not hypertext narrative is, in fact, narrative. To categorize these electronic stories with traditional narrative is, according to Jill Walker (1999), controversial. (p. 111). She cites Shlomith Rimmon-Kenan's definition of narrative fiction: the narration of a succession of fictional events (1983, p. 2). Likewise, Espen Aarseth (1997) argues that hypertext fictions are not narrative, but are rather *ergodic* (from the Greek words for "work" and "path") literature, in which "nontrivial effort" is required of readers to travel the path (p. 1). While it's not the purpose of this paper to debate the "narrativity" of such stories, I am interested in exploring the reader's experience with hypertext narrative. It is true that readers must work harder to read hypertext narratives than traditional stories; they must navigate the narratives much like documents located on the World Wide Web.

The payoff for readers' efforts is that hypertext narrative allegedly provides interactivity, or the ability not only to navigate, but also to modify the story that they are reading (Ryan, 1994, paragraph 23). The reader becomes more keenly aware "of his collaboration with the text in the production of meaning" (paragraph 29). As Ilana Snyder (1997) argues, readers have a greater chance to create stories while reading hyperfiction than they do while reading traditional print narrative due to print's "structural limitations," i.e., definite beginnings and endings (p. 82). But do readers truly have the power to modify the story? We can look at Walker's (1999) first experience with a hypertext narrative, *afternoon*, by Michael Joyce.

The first time I read afternoon, I clicked my mouse haphazardly on any old word, and quickly grew disoriented. Realising I was lost, I began to carefully choose which words to click, but I usually couldn't understand the connection between the word I had chosen and the node to which it led me. I never worked out what was going on, who was narrating what and which names belonged to whom. After an hour or so of frustration, I gave the whole thing up. It took several months before I got up the courage to have another go. (p. 111)

It seems that hypertext narrative certainly takes a "non-trivial effort" by the reader. But does it need to be so intimidating that it scares readers off for "several months"? Can readers' experiences with hypertext narratives be improved? Though authors such as J. Yellowless Douglas (1994) and Walker (1999) have described their own experiences with hypertext narratives, little empirical research has been done on how users interact with a hypertext narrative.

The reader as co-author

The power of the reader to choose his or her reading path allegedly indicates the reader's participation in writing the story. George Landow (1997) writes that reader choice, intervention, and empowerment are key elements of the form of hypertext narrative (p. 180). Hyperfiction, writes Snyder (1997), fosters both passive and active reading, where links provide decision points. The reader chooses to move forward or backward, or to jump ahead. The reader's compulsion to make these choices is a reminder that he or she is "participating in the making of a fiction" (p. 89). While the author must write and segment "bits of experience," readers must decide for themselves how it is to be reassembled (p. 92). It is this act of assembly, some theorists claim, which makes the reader a co-author.

Open-ended fictions

While the reader may or may not enjoy the status of co-author, the unique malleability of storylines in this medium remains unquestionable. Hypertext narrative challenges all literary form based on linearity and calls into question ideas of plot and story current since Aristotle (Landow 1997, p. 180). Snyder (1997) agrees that hypertext narrative diminishes the qualities of linearity, plot, characterization, and closure, and instead provides the opportunity to present "open-ended fictions with multiple narrative strands" (p. 96).

Readers of hypertext narrative fabricate their own structures, sequences, and meanings. A lexia that shows up in a particular place or context in one hypertext reading may occur in a completely different place with different insinuations in another reading. Or, it may not occur at all. The sequence of presentation of the lexias is unfixed and unpredictable.

Definite endings called into question

The multilinearity (or, if you like, nonlinearity) of hypertext narrative introduces the further problem of how an author should provide a sense of completeness and closure in a reading. While most hypertext narratives may have distinct beginnings, these stories avoid the traditional devices for achieving closure (Snyder 1997, p. 100). This is a rhetorical challenge because "beginnings imply endings, and endings require some

sort of formal and thematic closure" (Landow 1997, pp. 190-1).

It might be argued, however, that readers piece together events in every narrative, not just hypernarrative. They integrate details; form and develop hypotheses; modify, confirm, and abandon predictions. Perhaps readers can come away from reading a version of a hypernarrative with the same sense of connectivity and closure found in traditional print narratives. "If individual lexias provide readers with experiences of formal and thematic closure, they can be expected to provide the satisfactions...requisite to the sense of an ending" (Landow 1997, p. 192).

To summarize, hypertext narratives purport to include the reader in the writing process (although his or her status as "co-author" may be in doubt), question fixed sequence (which may still be, in fact, linear), and question definite endings (though not necessarily forgoing closure). Examining hypertext narratives using traditional narratological methods can be a valuable experience that sheds light on the structures and functions of hypertext narrative.

Usability testing of hypertext narratives: a justification

Some readers of this paper may wonder how one can conduct a usability test of a product that is largely aesthetic. But, as Stephen Bernhardt (1993) argues, text is inseparable from the situation and from the machine (p. 153-4). Aarseth (1997) views the text, reader, and machine as an integrated whole. "The boundaries between these three elements are not clear but fluid and transgressive, and each part can be defined only in terms of the other two" (p. 21).

The aesthetic text, accordingly, cannot be separated from the medium of its presentation. The medium in this case is a technology requiring human interaction; therefore, the presentation should take human factors into account. This belief is a fundamental tenet of document design. The layout of the text should be attractive and readable; as Karen Schriver (1997) puts it, "many documents fail because they are so ugly that no one will read them" (p. xxiii). So while hypertext narrative is allowed to challenge the concepts of linear reading and definite endings, it should not challenge traditional document design values if it is to be accepted by readers. Any medium that places the importance of "co-creating" text on the readers' shoulders must provide an ergonomic interface.

Usability testing an aesthetic text

For my usability test, I observed how users interacted with a hypertext narrative, and whether or not they had any difficulties in doing so (Rubin 1994). In order to focus my study, I focused questions on three distinct issues: interface issues, reading behavior issues, and reader attitude issues.

Interface issues

1. Will readers have to use the manual provided in order to navigate the story?
2. What navigation elements will the reader use to read the story, and how intuitive are those elements?

Reading behavior issues

1. Do readers slow their reading rate when reading for long periods online?
2. Do readers speed up their reading rate, i.e., start skimming, when reading for long periods online?

Reader attitude issues

1. Do readers view reading hypertext narratives as actually reading a story?
2. Will readers walk away from the reading experience with a sense of having read a story?
3. Will readers be bothered by reading a story with no set linear plot?
4. Would readers actually consider buying a hypertext narrative to read on their own time?

The text I centered my study on was *We Descend* by Bill Bly. I chose this story because it was relatively recent, published in 1997, and it was created with one of the most recent versions of Storyspace, the most popular tool for hypertext authors. In brief, Bly's futuristic story follows the protagonist, Egderus, as a young boy at the isolated Mountain House; as amanuensis to an interrogator and torturer known as the Good Doctor, during which time he meets a mysterious prisoner; and years later as an old man again at the Mountain House. Throughout his life Egderus attempts to uncover mysteries, such as why the Good Doctor is so relentless in his attack against the prisoner, the Historian, as well as who or what are the mysterious beings that live in the rocky hills surrounding him (Eastgate Systems 2000, online).

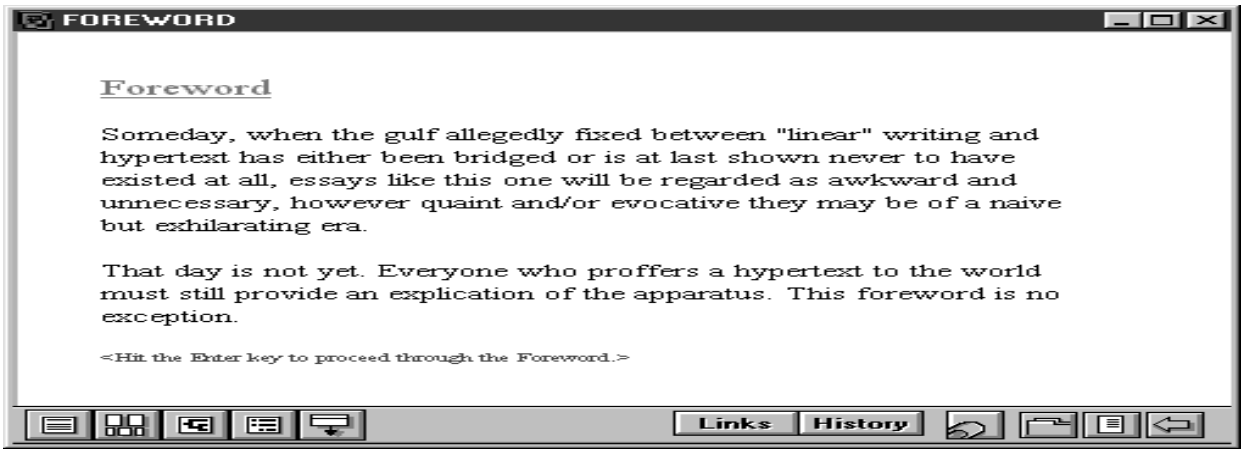

Figure 1: Text window

We Descend's Storyspace interface

In hypertext narratives created with Storyspace (a hypertext writing environment available for Windows and Macintosh computers), readers have two types of windows open on the screen: text windows (Figure 1), which show the text of spaces (pages or hypertext) that users are reading, and map windows, which show a map of spaces and their neighbors. The map windows let readers see which spaces are related, which spaces a space contains or is contained in, and some of the links between spaces. Map windows include the Storyspace Map view (Figure 2), the Tree Map view (Figure 3), the Chart view (Figure 4), which shows the map as a hierarchical chart, and the Outline View (Figure 5), which shows the map as an indented outline. Readers can have several windows of each type open at one time. Every text window has a control bar with navigational buttons. There are icons for every map view, as well as a Links button and a History button. The Links button opens a dialog box listing all the links from the current page. To follow a link, the user selects it in the list and presses Follow link. To dismiss the dialog without following a link, the user presses Done (Figure 6).in the list and presses Follow link. To dismiss the dialog without following a link, the user presses Done (Figure 6)

The History button opens a dialog box listing all the spaces the user has read. The user can return to one of those spaces by highlighting it and pressing Visit (Figure 7).

The Backup button (represented by an arrow on the toolbar) returns the reader to the previous page. Finally, the user can click on any text to follow a link from that text. He or she must hold down the Ctrl key to see all the text links leading from a page—linked text will appear outlined in a rectangle.

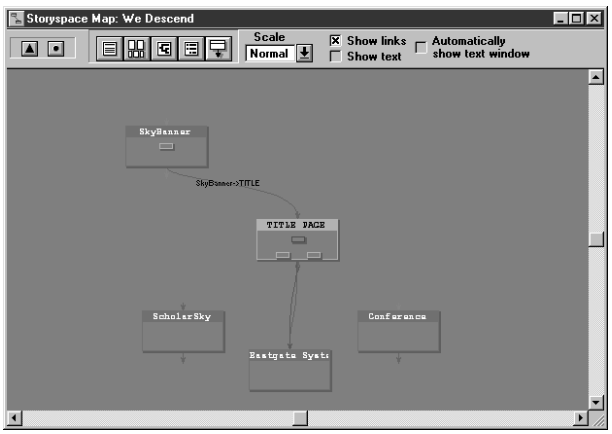

Figure 2: Storyspace map view

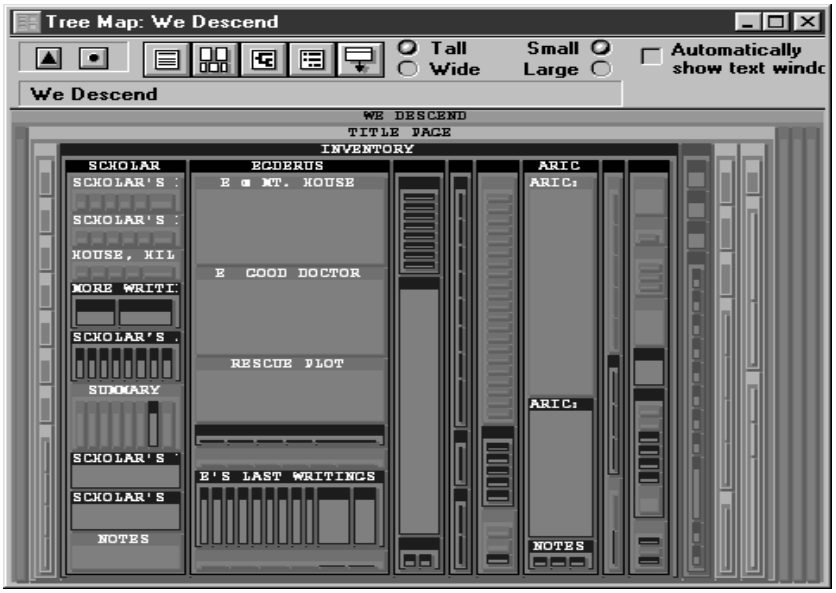

Figure 3: Tree map view

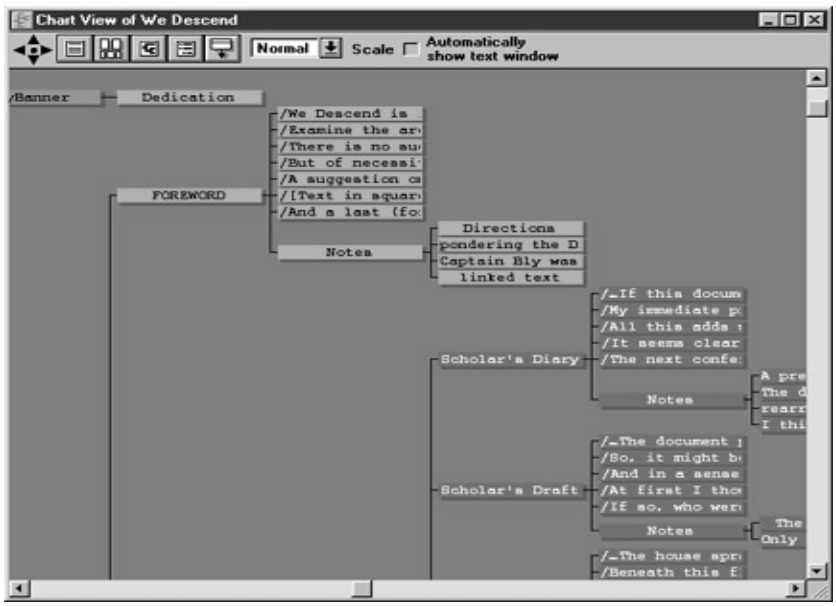

Figure 4: Chart view

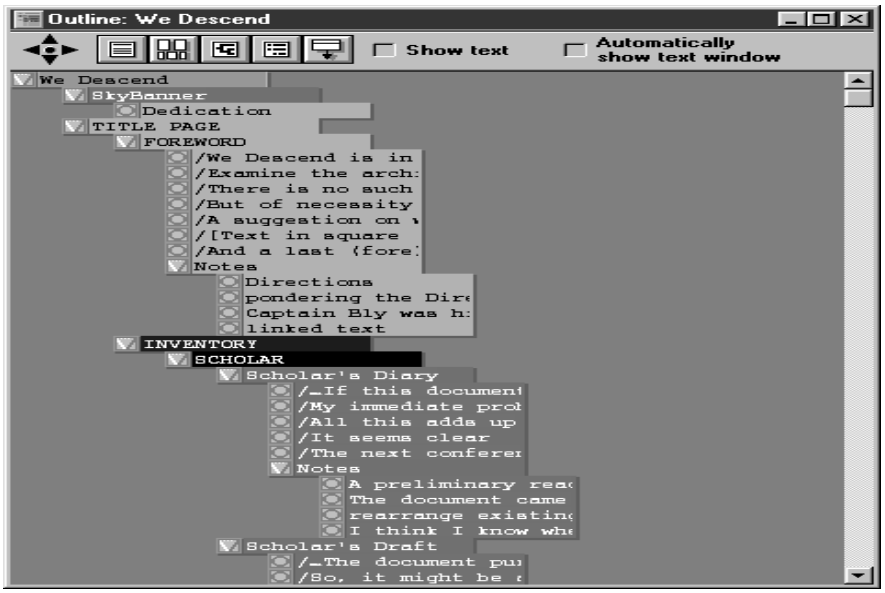

Figure 5: Outline view

Selecting the proper particpants for the test

Usability test results can be skewed if the test participants are not characteristic of the target user population. Therefore, it is vital that the characteristics of the model hypertext-narrative reader be clearly defined. I deduced that such a person would be an avid reader as well as someone who was comfortable working with computers. Therefore, I defined the typical hypertext narrative reader as someone who enjoys reading as a hobby, is familiar with Windows, and spends approximately one hour on the Internet a day.

I tested four participants with these characteristics. All the participants had similar backgrounds; all had at least some college-level education, and most of the participants had backgrounds in English or writing. The participants were very computer literate; all of them had more than 10 years of experience working with personal computers. They all spend an appreciable amount of time on the computer and likewise the Inter-

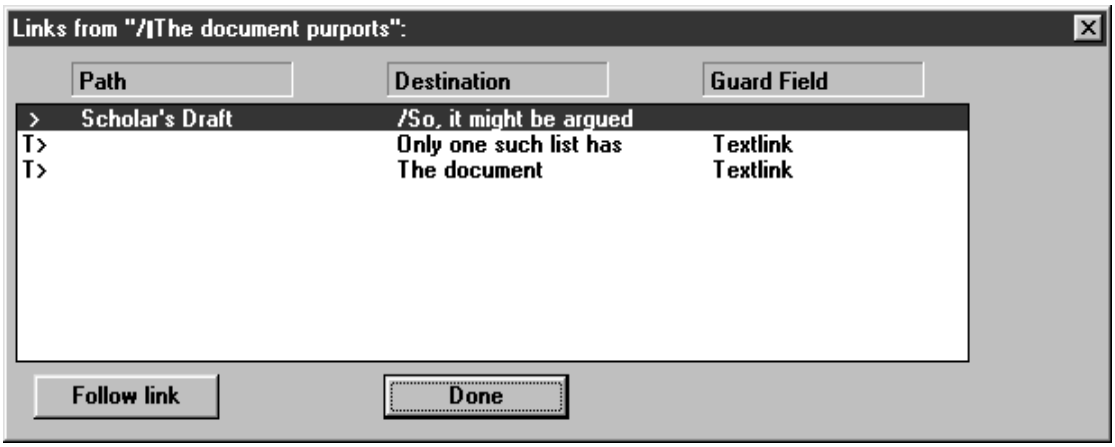

Figure 6: Links dialog box

net. Therefore, these participants fit my profile of an ideal reader of hypertext narrative.

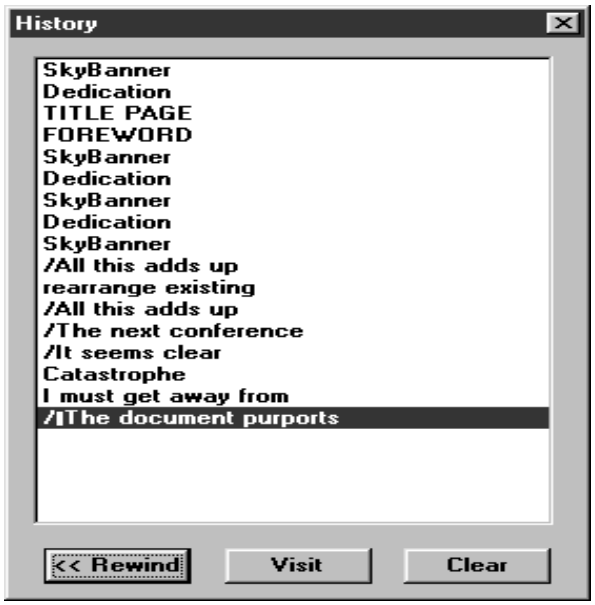

Figure 7: History dialog box

Test environment/ equipment

The usability lab contained two IBM-compatible PCs running Windows NT as an operating system, one for the test monitor (myself) and one for the test participant. The hypertext narrative was installed on the participant's computer before the test. I supplied participants with the hypertext narrative's manual the day of the test. My computer was hooked up to a video recorder and was loaded with Observational Coding System(OCS) software. OCS allows quick collection and analysis of data. A researcher determines what behaviors or events he or she wishes to make note of, and then develops a code for each different behavior or event. These codes are used in a coding session, where data is collected. When I observed a behavior or event during a coding session, I typed in a code that I assigned to that behavior or event. The system marks the code with a timecode showing when the behavior or event started.

Methodology

Orientation

I personally greeted each participant and tried to establish a casual atmosphere. I gave the participants a scripted introduction and orientation to the test, explaining the purpose and objective of the test and what was expected of them. They were assured and reminded that the hypertext narrative is the center of the evaluation and not themselves, and that they should perform in a way that is typical and comfortable to them. At this time I reminded the participants that they were going to be videotaped (I had told the participants that I would be taping them in my e-mail communications with them prior to the test). The participants filled out a very short questionnaire that gathers basic background information, and they signed a videotape consent form. The participants were ready to start the performance test, which consisted of navigating and reading the selected hypertext narrative.

Performance test

After the orientation was complete, I asked the participant to sit at the computer. I had the participant bring up a brief text excerpt online formatted similarly to the hypertext narrative that he or she would be reading. The participant was asked to read this document, and his or her reading rate was recorded and was later calculated in terms of words per minute.

Next, the participant was instructed to start *We Descend*. I presented the participant with a task scenario that asked the user to begin reading (establishing reading rate), to use the different navigational tools in the hypertext narrative's interface, and to freely navigate the hypertext story. I observed the participant to see how and if he or she determined the location and proper use of each navigational tool. Each task had a time limit of two minutes; if the participant did not successfully use the navigational tool in the allotted time, he or she was instructed to stop, whereupon the facilitator sitting with the participant demonstrated how to complete the step. The participant was then instructed to proceed to the next step.

It is not routine in usability tests to show the users what they did wrong while the test is being conducted. But I was faced with some unique problems. First, I needed a way of demonstrating to the readers how to navigate the hypertext narrative so they would be more successful for a later portion of the test (free reading). Also, I found the only effective way to structure this task-oriented portion of the test was to create tasks that were consecutive; in other words, to be able to proceed to the next task required the successful completion of the previous one. Allowing the facilitator to show the participant how to complete the task served to instruct

the participant in the tools and allowed the task-oriented portion of the test to run more smoothly.

Post-test questionnaires

When the tasks were completed, I gave the participant the first of two brief questionnaires, asking for evaluation of the difficulty of each task. This questionnaire consists of positively worded statements regarding the ease of completion of each task. For each statement, there is a Likert scale running from Strongly Agree to Strongly Disagree; the participants mark whether or not they agree that the indicated task was easy (Appendix D).

After the task-oriented portion of the test was complete, I allowed the participant to "free read," that is, to navigate and read the narrative as he or she chose. I requested that the participants read for 20 minutes. During this time, I noted the start times for each lexia (i.e., when the reader opened a new lexia) and when the user used navigational tools. From a lexia's start time to the opening of a new lexia, I could calculate a reading time. The facilitator would make a note of lexia titles so I could refer back to the story in order to get a word count. From this data, I could calculate a reading rate.

After the reading session was over, I had the participant fill out the second post-test questionnaire, which pertained to the user's subjective perceptions of usability and aesthetics of the hypertext narrative, as well as readers' reactions to theoretical concepts of hypertext narrative (e.g., do readers feel like they are "co-authors"). Like the previous questionnaire, this survey consists of positively worded statements followed by a four-part Likert scale. Statements that the user disagreed with potentially indicate problems with hypertext narrative (Appendix D).

Throughout the test, I made notes about relevant participant behavior, comments, and any unusual circumstances that might affect the result (for example, if I had to make comments to the participant that were extraneous to the test).

Debriefing

After the performance test was completed, I took each participant through a debriefing session. The debriefing consisted mainly of open-ended questions that were designed to elicit more detailed feedback about the hypertext narrative. Specifically, I asked the users what they liked and disliked about the hypertext narrative. I also asked them if they could summarize the plot of the story they had read. Asking readers to summarize is a common test of reader comprehension (Pearson and Fielding, 1996). If the readers could not summarize the plot, this failure would represent a flaw in the concept that the reader constructs his or her own story, and would also represent a rhetorical failure on the part of the author. Ultimately, the debriefing session allowed the participants to say whatever they liked, which allowed me to collect subjective preference data about the hypertext narrative.

Evaluation measures

I collected and calculated the number of tasks each participant completed and failed to complete, as well as the specific tasks which gave problems across the board. In addition, I calculated the time required to read certain lexias

and compared this rate to the participant's initial reading rate. I noted the number of times the user referred to the manual (if at all), and I noted participants' rankings of usability and aesthetics of the product.

Results and observations

Task-oriented portion of the test

The participants were able to conduct most of the tasks well under the allotted time of two minutes. There were three tasks that all users failed to complete successfully: the Storyspace map task (#1), the back button (#6), and the highlighted text link (#7). Readers' successes in completing the other tasks were due to mouseover instructions at the bottom left corner of the screen (Figure 8). When a reader passes his or her cursor over the icons for the different navigational tools, text that describes the icon's function appears in the bottom left corner of the program's screen. On-screen instruction made navigating the program's interface easier. As a matter of fact, readers' elapsed task times significantly decreased as they proceeded through the test. When cues are absent from the screen, the task becomes much harder. Absent cues explain the difficulties that users had with two of the tasks they failed: the back button and the highlighted text link.

Users were not used to having to take an extra step to make text links visible (i.e., pressing the Ctrl. key). The participants were obviously used to the HTML

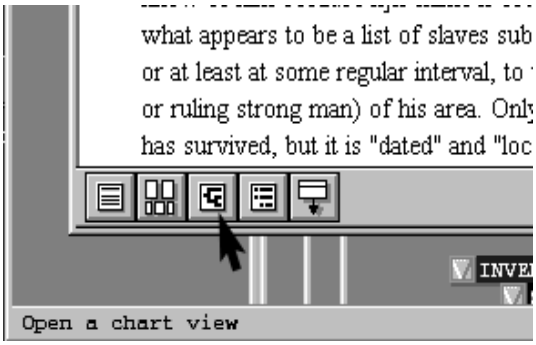

Figure 8: Mouseover instructions for the Chart view icon

paradigm, where text links are underlined and highlighted by color. The lexia from which they were supposed to navigate for this task had words that were underlined for emphasis; these words, however, did not lead to a specific lexia other than the default lexia. Nonetheless, a few users attempted to click on underlined words, believing they were links. Eventually, the users would stumble across the correct lexia by clicking on the words "the scholar's dead" in the lexia (which was the title of the lexia they were supposed to open next), but they did not know how to highlight the link. Therefore, even though they eventually opened the correct lexia, I counted the task as a failure of the interface. The program had a design peculiarity where lexias did not always open fully. As a result, the task bar at the bottom of the lexia did not always show its complete contents. The back button was frequently obscured and would only show up if the user manually stretched the window open fully (Figures 9 and 10). Text in these lexias wrap, so if the lexia is short enough, as in Figures 9 and 10, the complete text shows. This design further compounds the confusion, because the reader has no reason to stretch open the window if he or she can read all of the text.

Figure 9. A lexia with a partially obscured toolbar.

However, the users did not realize that they had to take this step, so they did not realize there was a back button hidden there. The users would flounder around; two of the participants saw arrow icons on the outline view (still open from a previous task) and tried clicking on those. One user succeeded in returning to the previous lexia by using a menu option to go backwards, but my criterion for success was to use the icon, so I counted such a result as a failure. All users had problems with finding the Storyspace map view, even though a Storyspace map view comes up automatically when the story is started (Figure 11). This particular map view is obscured at the beginning by the introductory lexia.

The users wanted to focus on that primary screen instead of the window behind it. And, as with the other tasks, the users passed the mouse cursor over the icons, looking for the mouseover cue. However, the mouseover instructions refer to the corresponding icon as simply a Map tool. I n my view, this constituted a naming error on the part of the software developers or the author, since I was accustomed to seeing the references

Figure 10: The same lexia resized, showing all the toolbar elements.

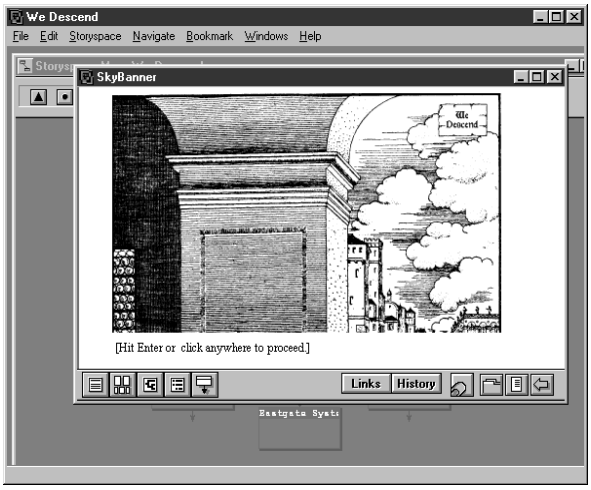

Figure 11: Startup of We Descend

to "Storyspace views" in literature about hypertext narrative. As a matter of fact, in the title bar of the view, it is called a Storyspace Map.

Yet both the manual and the mouseover refer to it as a Map tool. Therefore, the terminology I used in the wording of my task may have not given the participants a fair chance to find the tool and use it. Nonetheless, one reader did get to the Storyspace Map view, and had problems using it.

In order to complete the Storyspace Map task, the user has to double-click on a graphic representation of a lexia. However, the user needs to double-click the *title bar* of this graphical representation to open a new text window. If the user double-clicks the *body* of a space, it will zoom the map in, showing graphical representations of the lexias that lead from that lexia (Figure 12).

The mouseover instructions do indicate the navigational differences between the title bar and the space within the window, but the user did not notice this. She double-clicked in the body area and was taken to another Storyspace map view, instead of opening a text window as she expected. She became confused and disoriented, and she could not subsequently recover in time to complete the task.

Overall, readers referred to the manual rarely. Two users referred to the manual once. One of these participants, as well as another who did not use the manual at all, felt the pressure due to the time limit discouraged them from using the manual. However, most users stated that they usually jump into a program at first and refer to the manual as a last resort. This is in keeping with usability literature about computer users and manuals; Schriver (1997) finds that 53% of the time users will figure out problems on their own or ask another user rather than refer to documentation (p. 382).

Free-reading portion of test: Observations about navigation

In the free reading part, most users favored the default method of moving through the text (Enter key or mouse clicking anywhere). They would try the Ctrl key every now and again and would select alternative hyperlinks, but most seemed unhappy with where that took them, and they would back up to their original starting point.

Reader A (the first participant) was the most adventurous as far as using the other views was concerned; she seemed to favor the chart and outline views. However, she spent a large amount of time playing with the navigation tools and not so much time reading. Reader C also experimented a little with the chart, treemap, and outline views.

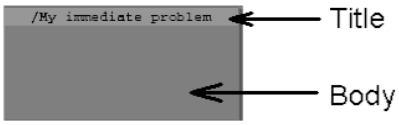

Figure 12. Diagram of Storyspace map's graphic representation of a

Reading rates of participants

I had each reader begin the test by reading an online excerpt of text that was formatted similarly to the lexias found in *We Descend*. I compared this reading rate to the reading rates of a sampling of lexias from the end of the free-reading portion of the test. The purpose of this evaluation is to see whether or not readers experience fatigue from reading online; a dramatic change in reading rate (either slowing down or speeding up) may be indicative of fatigue.

For my sample, I selected the final ten lexias that each user read, discounting lexias that had been repeated and lexias that were not in a typical narrative format (for example, some lexias were set up as menus). All of these lexias were read in the last five minutes of the reading test.

All of the participants' reading rates were faster than their initial reading rates. The median increase in reading rates was 74%. As a matter of fact, readers

often significantly speeded up their reading; reading rates occasionally deviated as much as 1141%. It is reasonable to conclude that readers were not reading "word-for-word," but were skimming the text. Therefore, users may have indeed experienced fatigue from reading online for an extended period. However, there were a couple of factors besides fatigue that may have affected the outcome of this portion of the test.

The sample reading that I based the initial reading rate on ended up being about three times longer than the lexias found in *We Descend* (which averaged about 100 words per lexia).

I did take care to discount lexias that were inordinately short, but I did not consider that perhaps comparing reading rates for dramatically different sized blocks of text may prove inconsistent. It is possible, therefore, that the reason reading rates were faster was that the lexias were shorter than the initial reading. However, I am not convinced that the difference in length should produce such dramatic differences in reading rates.

What I believe is a significant factor is content and the reader's interest in that content. For example, I noticed that the readers seemed to come closer to their initial reading rates or significantly speed up from their reading rates when the topic changed. Reader B's reading rate came closer to the initial rate when he got back to the story of Egderus; he had been reading notes about the layout of Mountain House previously. Reader C was closest to his reading rate when he read Bly's "online instructions" (elements of the manual were integrated into the story). Reader C read exactly at his initial reading rate for two lexias in this topic. When he got back to the story, his rate speeded up again.

The participants may be engaging in what Margaret Mackey (1997) refers to as "good-enough reading," where the reader strikes a balance between needing to understand the text and needing forward momentum (pp. 428-9). Readers will make temporary decisions about what the text represents, and they will proceed with less than complete information, hoping to fill in the holes later (p. 429). The readers favor momentum, speeding up sections that they feel they can afford to gloss over. This is a normal part of reading a large text. "Reading is an event in time," says Mackey, which is "complex, untidy, and inevitably partial" (p. 428). Such reading habits are characteristic not only of online reading, but of traditional print reading as well.

Thus, my conclusions would be that readers may experience some fatigue from reading online; however, it is impossible to completely separate reading rate from interest in the subject. When the reader appeared to have an interest in what he or she was reading, he or she read at a rate that was close enough to the initial reading rate to indicate that online reading for leisure would not be a significant problem.

Post-test questionnaire results

Users' evaluations of the ease of use of the hypertext narrative were generally in line with their performances; they rated tasks they succeeded at as easy and tasks that they failed as difficult. However, two of the users did rate some of the tasks that they failed as easy to complete. I am not certain why they did this. My best guesses are that either showing the participant how to complete the task biased them into believing that the solution was easier than it was, or they had forgotten how they completed the task in the elapsed time between the test and the questionnaire. It is also possible that the wording of the questionnaire did not provide sufficient cues for the participant to recall how he or she performed that task. Such results don't necessarily invalidate quantifying users' evaluations of the product; nonetheless, perhaps testers should take such evaluations with a grain of salt.

The participants found it easy to move from lexia to lexia. They also agreed that they enjoyed the author's writing, so there was no bias against the writing style. However, all of the users said that they would not be interested in purchasing one of these stories, but would enjoy reading a hypertext narrative only if it were available for free on the World Wide Web. None of the users felt as if they were "co-creating" a story with the author. All but one of the readers felt they were reading a coherent story; Participant A, the participant who jumped around using different navigational tools, was the only user who disagreed with this statement.

As for the preferred navigational tools, all users indicated that they preferred to default forward, either by pressing the Enter key or by mouse click. The most popular graphical views were the Chart view and Treemap view, with two votes each.

Debriefing session

I asked the participants what they liked and disliked the most about the hypertext narrative that they had just read. All of the participants found the story intriguing. One user liked the "sense of history" that the story pre-

sented; another found the format suspenseful, which made the story itself engaging. Dislikes were exclusively focused on the interface. Two of the participants found changes in font size (which was a device to show different speakers in the story) distracting. Others agreed that the interface itself was very counterintuitive, and that it was a "chore" to follow a storyline.

Most readers were able to give a summary of what they had just read. Participant A, the user who played with the navigational tools the most, had the greatest difficulty in giving a summary. Participant C also had some difficulty; he also tended to play with the navigational tools.

Since most of the users referred to the manual either rarely or not at all during the test, I asked them if they usually refer to manuals when working with software. One user said she always did, and she felt that the option of using a manual for the task-oriented portion of the test was not sufficiently emphasized to her. The other three participants usually try to work without a manual. Of these three, two participants felt the time limit for the task-oriented portion of the test didn't give them enough time to look at the manual.

Findings and recommendations

Based on the readers' comments and performances, I wish to make a few recommendations that may improve readers' experiences with hypertext narratives. While these recommendations are specific to stories designed with Storyspace, hypertext writers who use different authoring programs may also find this information helpful.

•Make sure all tools are visible at all times

The fact that some tools are obscured due to the size of the window is unacceptable. This would be considered a major design flaw in other software programs, which would have to be redesigned before release to the general public. A floating toolbar such as the kind found in Microsoft products may be a viable solution. Another potential solution: make sure that the lexia windows open to a size that always shows the entire toolbar.

•Use underlined text links

The HTML paradigm is firmly established, especially among computer-literate readers, who are the primary audience for hypertext narratives. None of the readers was used to taking an extra step to highlight the text links. The most recent version of Storyspace (as of early 2000) does have the option of creating underlined text links, but it is an option that authors can to ignore. It is important that authors realize that their readers are more comfortable using underlined links.

•Eliminate the map and chart views

Even though some readers claimed they liked using some of these maps, I didn't see the fluidity of reader movement and comprehension that I saw when readers defaulted through the text. The reader who did rely on these navigational tools had problems assessing the narrative as a whole. The various visual views found in Storyspace narratives are likely a helpful organizing tool for the writers of a hypertext narrative; Joyce (1995) says that the writing process is geographic in nature, and Storyspace encourages attention to form and pattern (pp. 161-2). However, these maps seem to be of little use to the reader.

•Keep font size constant

Bly used different-sized fonts to represent different narrators. At least one reader found the size changes distracting. It would be better to use different visual cues (such as font color) to indicate different voices, if necessary.

•Have options for changing fonts and font sizes

One user expressed a desire during the test to control the size of the font used, making it larger. Storyspace does allow for this, but it is up to the author to enable this feature. For Bly's story, the reader is unable to change either the font size or the typeface. Authors should be encouraged to allow their readers the flexibility to modify the text in this manner.

In addition to interface issues, I recommend that hypertext narrative authors:

•Keep the structure more or less linear, with minimal branching (e.g., for footnotes, asides).

The readers who had the most success summarizing the story were the ones who read in a linear fashion. (In this case, I consider "linear" to mean defaulting forward). This finding may indeed defeat the point of hypertext narrative, at least according to the literature mentioned early in the paper. Perhaps hyperlinks in electronic literature would be better used sparingly, such as for footnotes, which may prove beneficial for readers who want more in-depth information about a particular subject.

•Have a clear, single starting point

Although there is a place where the reader could "just start" in Bly's story, it is buried three lexias deep

at the very end of a menu. One reader in particular felt she did not have a clear starting point. It might be better to "funnel" readers though a single starting point, and start branching out (sparingly) after this point, instead of providing multiple starting points.

Conclusions

While I am confident that my preliminary findings are reliable, more research needs to be done. Testing is an iterative process; for questions answered, just as many are raised.

For future research, hypertext theory would benefit from a comparison of online reading rates of fiction with traditional print reading rates of the same genre, as well as a comparison of hypertext narrative formatted at least two different ways (e.g., one formatted with Storyspace and another formatted in HTML). Testers could examine users' perceptions of the story and see if it differs between the two formats. These tests should be based on a more rigorous examination of the reading research literature.

I conclude that readers are not averse to reading electronic books (although they may not be interested in spending money on them just yet). However, my study suggests that the transparent interface is mythical. The more complex the interface (and hypertext narratives are certainly complex) the more hindering that interface is to the reading process.

In a similar vein, Marie-Laure Ryan (1994) discusses immersion and interactivity in narrative. Her main criticism of hypertext narrative is that it does not sufficiently "immerse" the reader in the narrative, since the reader is too busy navigating. The more interactive something is, the less immersive it is (paragraph 36). Immersion is a quality of narrative that readers generally seek. Readers often want to enter someone else's world more than they want to help them create it. This theory may explain why readers overwhelmingly preferred to default forward instead of choosing their own links randomly.

A reason that readers may want to immerse themselves in a storyline is the way that we construct reality. Jerome Bruner (1991) writes that we organize experiences mainly in the form of narrative—"stories, excuses, myths, reasons for doing and not doing, and so on" (p. 4). In order for a story to be believable and acceptable, it must achieve verisimilitude. It may be easier for a reader to accept a story that achieves this sense of conveying reality; if the storyline is disjointed and disassembled, it's harder to accept the story. And, if the reader cannot accept the story, it is highly unlikely that he or she will become immersed and involved with the protagonist's dilemma.

This is not to say that hypertext narrative is not viable; its structure, however, needs modification. Improvements in the interface will enable the technology to recede into the background, allowing readers unimpeded access to the story. Providing a distinct path through the hypertext, while constraining readers' freedom to construct a story, may enhance their reading experience. Readers do not seem to be clamoring to be "co-authors"; instead, they wish to enter and experience another world, a world created by the author. Perhaps authors should provide these new universes to their readers in a complete and linear fashion, rather than in pieces to be assembled.

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