ESL Readers' Perceptions of Reading in Well Structured and Less Structured Hypertext Environment

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ABSTRACT

Current electronic text formats can hinder the acquisition of main ideas or the central representation of a text unless some structural cues are embedded in the reading environment. This principle is based on the premise of cognitive psychology that learning is a reorganization of cognitive structure and that readers are most likely incapable of performing such a task in a loosely structured presentation or one that lacks explicit organizational devices or structural cues.

The present study qualitatively examines how second language (L2) readers, particularly ESL readers, perceived the efficacy of displaying the underlying structure of hypertext and the ways in which its units or nodes are organized and interrelated help those readers develop a unified, coherent mental representation of hypertext content.

The participants, 40 ESL learners, were assigned to read two hypertext programs—well structured and less structured hypertext—and then sat for semistructured interviews (about 15-20 minutes). During the interview sessions, participants were asked to describe their perceptions of the effectiveness of explicitly showing the underlying structure of hypertext and how marking the organization and interrelationship of information in the hypertext helped them to grasp the main idea or central point of the hypertext.

The interviews were recoded, transcribed, coded, and categorized. The results showed that the ESL learners unanimously favored reading well structured over less structured hypertext and maintained its usefulness of showing the underlying structure of hypertext and how it is organized, thereby enabling them to develop a coherent mental representation of hypertext content, ultimately leading to successful hypertext processing.

INTRODUCTION

The prerequisite to understanding and acquiring knowledge from an electronic text is the ability to develop a coherent representation or conceptualize an overview

of the structure of the text under study. In other words, the key to comprehending a text delivered by computer is to reorganize the underlying structure of the text. This is less likely to be accomplished by readers unless program designers consider some measures to facilitate its occurrence. This assertion is attributable to the fact that the distinctive features of electronic texts such as segmentation or multiple texts, linkages or multiple paths, size of the database, and the separation of content and structure are assumed to make the process of developing a coherent representation difficult and, as a result, hinder comprehension.

The aforementioned features impose a higher cognitive load on readers. In this cognitively demanding environment, readers are required to remember their current location, make decisions about where to go next, keep track of pages previously visited, figure out the semantic relations among units, integrate information from various text segments and, finally, develop a coherent representation of the meaning of the text. These cognitively demanding activities can drain mental resources, which, consequently, are not available for text processing because they are directed to organizing the information in question. Thus, present electronic text formats can hinder the acquisition of main ideas or the central representation of a text unless relevant structural cues are embedded in this environment. This argument is based on the premise from cognitive psychology that learning is a reorganization of cognitive structure and that readers are most likely incapable of performing reorganizational tasks in a loosely structured presentation or one that lacks explicit organizational devices or structural cues.

A way to resolve this significant problem is to provide structural cues to reduce cognitive overhead. The presence of explicit content structure would free mental resources that would otherwise have to be devoted to determining how the text is organized and finding ways to reorganize its structure. Free from this mental exercise, resources can then be used to engender deeper text processing.

This calls attention to the importance of examining the potential role of providing structural cues in an electronic text. Structural cues could help readers develop a coherent representation, ultimately leading to successful text processing. In addition, it is helpful to illustrate some of the technical features that L2 reading program designers can include in their programs to help readers develop a coherent representation of the content of a text. These theoretical assumptions are investigated here by examining ESL readers' perceptions of whether the presence or absence of author-defined organizational devices leads to developing a more coherent mental representation.

SURVEY OF THE RELATED LITERATURE

One of the factors that appears to have a specific impact on constructing a coherent mental representation and a general impact comprehension of hypertext documents is readers' beliefs about multiple texts. The beliefs L2 readers carry with them to the hypertext environment is presumed to make a difference in this process (Davis & Lyman-Hager, 1997; Hoffman, 1998). L2 readers' understanding of and perceptions about hypertext can also be influenced by their first language and cultural background. In this regard, Jacobson and Spiro (1996) argued in their

study that learners' beliefs played an important role during the process of learning. Their beliefs determined the way they approached new and differently presented material. Similarly, Loyd and Gressard (1984) maintained that students' attitudes toward computers was an important factor because it affected the success or failure of using a computer as an instructional tool.

Some researchers have empirically tested the theoretical assumptions under consideration here. In a study aimed at investigating the interactions between cognitive styles and navigation maps in a hypertext environment, Leidig (1992) examined readers' degree of satisfaction toward the design of hypertext documents. The 282 participants were assigned to one of four treatment groups: (a) linear text only, (b) hypertext without a navigation map, (c) hypertext with a textual navigation map, and (d) hypertext with a spatial navigation map. After reading the text, participants responded to a questionnaire which was designed to measure the amount of material they had learned and their levels of satisfaction with reading in hypertext environments. The results indicated that while it was not certain that learning styles affected learning outcomes or levels of satisfaction, the design of navigation methods for hypertext documents did. Leidig found that active learners differed from their reflective counterparts. Reflective learners were less satisfied reading hypertext that merely had links as opposed to hypertext that had a navigation map.

Dee-Lucas and Larkin (1995) studied participants' perceptions of reading hypertext documents. After studying the experimental text, participants were asked to perform different tasks and given the opportunity to express their opinions concerning the ease or difficulty of reading traditionally printed text as opposed to hypertext. The results showed that participants preferred the hypertext over the traditional text. These perceptions were attributed to the ease of determining the organization of the information and ease of access to information.

Hoffman (1998) investigated the effect of a hypertext environment on the reading comprehension of L2 learners. The study's aims were to investigate the potential effect of hypertext on L2 readers' comprehension and whether the frequency of errors they made differed depending on whether they read a print text or hypertext. The participants, 14 intermediate-level college students studying German, were randomly assigned to a printed-text or hypertext treatment. The performance of the participants was measured by asking them to respond to a set of probing questions, to write free recalls, to sit for one-on-one interviews, and to complete a questionnaire. Aside from the main goals of the study, Hoffman attempted to investigate participants' perceptions of hypertext environments. Most of the participants indicated that reading hypertext was not an easy task but that it was faster. They also mentioned that their reading skills had improved over the course of the 9-week study.

A sociocognitive study was undertaken by Altun (1999) that examined the nature and functions of different hypertext readings used in an academic reading classroom and how students approached hypertext. One purpose of the study was to examine the perceptions and beliefs of L2 readers pertaining to the hypertext environment and how those perceptions and beliefs affected the way they ap-

proached hypertext in the meaning-making process. The 6 undergraduate students who took part in the study were asked to read linear and nonlinear texts over 11 weeks and to keep weekly journal entries to register their experiences and feelings. They also participated in structured and semistructured interviews, one in the middle of the quarter and the other at the end of the quarter. Each interview lasted 35 minutes and was conducted to solicit reflections after the participants had read hypertext. In addition, the author observed classes, made audio and video recordings, and exchanged email messages with individuals. The study demonstrated that participants generally viewed the richness and speed of the hypertext environment as very positive and specifically viewed the environment differently according to the type of hypertext they read. When participants were assigned to read linear hypertext, they saw it as a valuable bank of information. Conversely, when they encountered a nonlinear hypertext with a more complex design, they perceived it as a maze and experienced considerable disorientation.

Thus, it can be deduced that readers expressed mixed perceptions toward the experience of reading in a hypertext environment. They perceived its richness, ease of access to information, and quickness of locating the target information positively, but, at the same time, they expressed some concerns about the issue of disorientation and the complexity of the hypertext environment.

THE CURRENT STUDY

Text in an electronic environment such as hypertext is divided into two distinct levels: local and global. The local level refers to the individual hypertext unit or node, and the global level refers to all hypertext units together. Thus, readers are expected to concurrently build a detailed representation of the content at the local level and develop a more general representation for the global meaning of the hypertext.

The importance of investigating the issue of building up a mental representation of the text content is due to the fact that it is an essential element deemed necessary for text comprehension. Integrating text content into a unified representation enables readers to appropriately construct a model of the presented information, determine the central ideas of the text, and, as a result, develop a coherent global text representation, which ultimately leads to hypertext comprehension.

In current hypertext research, it is asserted that depicting the representation of the underlying structure of the hypertext and displaying its organization could provide a conceptual framework for readers to use in organizing the information into a coherent representation. The research, however, does not addresses how L2 readers, particularly ESL readers, perceived the efficacy of displaying the underlying structure of hypertext and how its units or nodes are organized and interrelated with respect to helping those readers develop a unified coherent mental representation of hypertext content. Learners are highly attentive to what assists their learning and what hampers their learning. Because learners often approach learning tasks differently, obtaining insights from a wide range of potential users would enable researchers to broaden the scope of their inquiry. In addition, obtaining such insights from potential users would help L2 reading program

designers create effective electronic reading environments and provide a better understanding of the nature of the cognitive aspects involved in reading hypertexts and specifically structuring and integrating hypertext content into a unified representation. The main question that guides this study is

How would ESL readers perceive an author-defined structure of a hypertext document or predesigned organizational devices embedded in a hypertext environment?

Method

Participants

The study participants consisted of 40 ESL learners who were enrolled in the English Language Institute (ELI) at the University of Pittsburgh. These participants represented several different cultural backgrounds and languages (10 different language groups were identified). The participants included 13 females and 27 males aged from 19-35 years (mean age of 24 years). All of the participants were studying English for academic purposes and were planning to enroll in undergraduate or graduate studies as soon as they were able to pass the language requirement. There were 30 graduate and 10 undergraduate students in 36 major fields of study. All participants were identified as having approximately the same level of proficiency in English by virtue of their placement in the ELI, TOEFL scores, and teachers' evaluations.

In order to qualify for the study, participants were required to meet a number of criteria or conditions. Each was expected to have spent at least two semesters in the host environment and to have attained intermediate proficiency TOEFL scores of 450-530. In addition, each had to be placed in level four, the intermediate level, based on their performance on the reading section of the institution's placement (The Michigan Test), scoring in the range of 60 (out of the 100 points) on that test. The participant's instructors were asked to indicate whether they had attained the intermediate proficiency level in reading, regardless of the language backgrounds.

Setting

All of the study's sessions took place at the Robert Henderson Language Media Center (LMC) at the University of Pittsburgh. The center has PC and Mac labs, a multimedia development area, a recording studio, and an area for administration. The center was equipped with 44 computers, including 25 Pentium II PCs and 16 Mac G4s. There were also 5 computers in the multimedia area, 1 PC, 4 Macs, and 1 Macintosh G4 for digitizing audio, as well as 3 servers: 1 Windows NT server, 1 Macintosh OSX server, and 1 Macintosh G4 Webserver. The LMC was the lab most students in the ELI used for school assignments and other related computing needs.

Procedures

The experimental procedures involved various meetings. In the first meeting,

which lasted 30 minutes, participants individually met with the researcher at the LMC at the University of Pittsburgh. Each was informed about the purpose of the study and asked to fill out the informational background questionnaire. The participants were asked to provide demographic information (age, gender, country of birth), length of time studying English, length of stay in the United States, previous experience with computer use, and their perceptions and attitudes toward reading on the computer. Upon completing the informational background questionnaire, each participant was given a brief introduction to the developed hypertext reading programs, their objectives, and their methods. The investigator demonstrated how the hypertext reading programs worked to each participant.

In the second (reading) meeting, which lasted approximately 90 minutes, each participant was asked to read two identical expository hypertexts on the computer screen under two different conditions (30 minutes for each), one with organizational devices included (well structured hypertext) and one without (less structured hypertext). After reading both hypertexts, the participants were shown both programs on the same computer screen and asked to talk about their impressions of them. Each interview session lasted between 5 and 20 minutes.

Materials

Passages

The programs contained identical passages selected from an undergraduate sociology textbook entitled *Sociology: Experiencing Changing Societies*. The first passage, "Human Interaction," argued that interactions between two people are open to their creativity, but they are governed by the cultural values and norms of a society. The second passage, "Verbal Symbols and Language," discussed the verbal symbols used by people of any given society to communicate with each other. The main argument of this passage was that verbal symbols used in a society are important not only because they provide information but also because they convey social rules and values.

The two passages were selected according to a number of criteria: they (a) shared the same subject matter, (b) shared the same literary style, (c) shared the same length, (d) shared the same degree of difficulty, (e) were authentic passages, (f) required minimal background knowledge, and (g) had logical rhetorical ordering of ideas.

The two passages were converted into hypertext documents. Each of the eight paragraphs in each text served as a single unit. Content, length, and syntactical structure of the paragraphs remained as in their original versions. Thus, there were 16 units (8 for each), each one being able to stand alone. Readers could move among them using links. In the case of the "Human Interaction" text, readers were able to click on the overview map titles to display the content of the selected unit on the screen, along with the included organizational devices. In the "Verbal Symbols and Language" text, they were able to click on the alphabetical list of titles to display the content of the selected unit on the screen.

Software: Overview of Content and Organization

In order to carry out the study, two hypertext reading programs were developed by the researcher. One was considered a well structured hypertext due to the inclusion of organizational devices and declaration of the underlying hypertext structure. The other was considered a less structured hypertext because it did not have organizational devices or display the underlying hypertext structure. The two programs included the same reading, similar introductory sections, the same kind of aesthetic features, but different main (reading passage) sections. The introductory section was divided into two subsections: the introductory and tutorial sections. The introductory section provided general information about each of the hypertext reading programs, and the tutorial section explained and depicted ways to interact with the program's features. Both hypertext reading programs were developed with *Flash MX* (2002) software. The audio component was recorded and processed with *Digital Performer* 3.02 (2001) software.

Overview of the Well Structured Hypertext Reading Program

The well structured hypertext contained the "Human Interaction" text. Before readers were permitted to read the well structured hypertext, they were shown a static overview map that displayed the main topics of the hypertext and the relationships among them. To maximize the benefits of the overview map, explanations of the map and how it was organized and connected were provided. After readers studied the static overview map, they were asked to move on and read the hypertext. Each of the eight windows contained one unit of 80-100 words at a time. The window, which showed the main title of the text at the top, was divided into two major sections. The left-hand section displayed the overview map of the hypertext, and the right-hand section displayed the reading text along with the local and global headings for each unit. At the bottom of the right-hand section, navigation buttons included a review button that displayed a brief review of each unit's content and a previous button that took users to the previously visited point in the program.

   To maximize proper interaction with the program, readers were provided with concise directions. The instructions on the overview map directed users to study the overview map of the text and click "continue" when ready. The instructions for the main section informed users of the sequence of actions they were to follow, including the target unit, review, logical connective, and next units. After users completed the final reading unit, they could view all of the hypertext units presented in one window. They could also return to the overview page. A message informed users that they could select any of the units for review (see Figure 1).

Overview of the Less Structured Hypertext Reading Program

Upon completion of the introductory section in this program, users were instructed to click on the continue button to start reading the unstructured hypertext reading. This particular type of hypertext design was believed to resemble typical instructional hypertext environments with a menu-like list of the unit titles. The

list overview, which filled the whole screen, presented the major topics and segments of the text without indicating the relationships among them.

The main section contained the "Verbal Symbols and Language" text. Each of the eight windows showed the title of the text, a left-hand section displaying the list-like overview of the main units of the text, and a right-hand section displaying the hypertext units. In the right-hand section, one navigation button allowed users to go back to the previous unit, and the other took them to the next unit (see Figure 2).

Figure 1
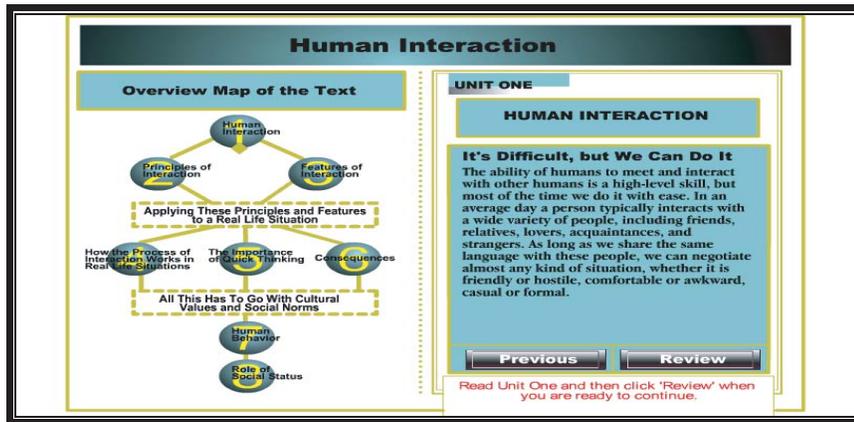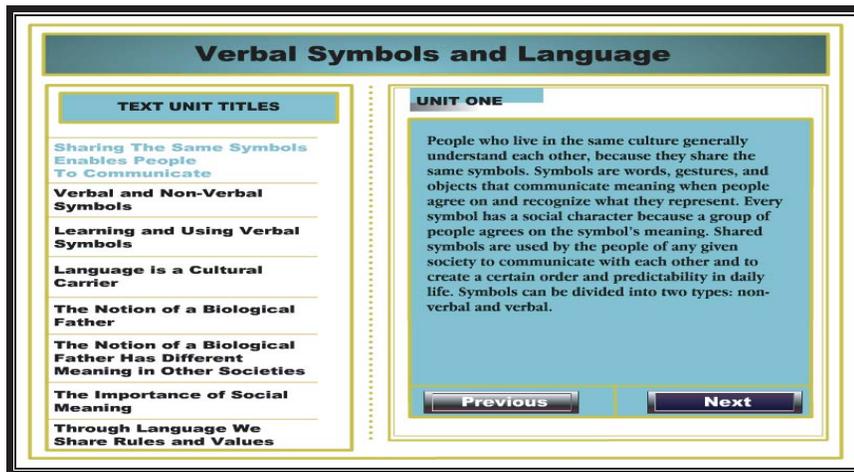Main Section of the Well Structured Hypertext Reading Program

Figure 2
Main Section of the Less Structured Hypertext Reading Program

INSTRUMENT

Evaluation and Perception

After reading the hypertexts, the participants were interviewed in the LMC. All participants were shown both programs on the same computer screen and asked to talk about their impressions of them.

A semistructured interview format was used to allow participants to express their perceptions of the facilitative effect of organizational devices. A semistructured interview format was used because of its advantages over other qualitative data collection formats. Questionnaires or other written formats were avoided because such methods can limit participants' offering detailed responses. This same limitation also applies to strictly structured interviews. In strictly structured interviews, the researcher presents a set of structured questions or asks each respondent exactly the same questions in exactly the same order. Unstructured interviews also present problems. In unstructured interviews, which usually involve casual conversations, the researcher does not necessarily specific types of questions which may result in the omission of important information (Fraenkel & Wallen, 1996). Semistructured interviews allow the researcher to ask for clarification and elicit more information and also enables interviewees to elaborate on their perceptions regarding the issue in question. Such advantages made the semistructured interview the preferred technique for this study.

Participants were asked two main questions and a number of other questions for clarification. They were also encouraged to give additional information and explanations. The first question was whether or not they felt that author-provided organizational devices were effective in showing how textual information was related and, thus, helpful in showing the main idea of the hypertext. The second question was why they thought these devices were or were not effective. Participants were also asked other related questions such as which design (well structured or less structured hypertext reading program) they liked more and why; whether the overview map guided their reading, helped them in any way to get the main point of the hypertext document, to understand better, or did not help at all; what they thought of having an interactive overview map; whether including titles for each unit (well structured) or not (less structured) helped them to get the most important information about each unit. Further questions probed whether or how students, as readers, found the review and logical connective statements useful and any other thoughts concerning both hypertext reading programs.

Procedure for Analyzing Evaluation and Perception

The semistructured interviews were recorded, transcribed, coded, and categorized. Analysis of the interview transcripts went through several phases. The first phase involved getting a general sense of all of the interviews by closely reading through all of the transcripts. The second phase, or initial coding phase, entailed making a list of all topics and clustering similar topics together. For instance, some of the generated topics were "I gain time," "indicates clearly the structure of the text," "helps me get the main points of the text," and "shows me the relation-

ship among the text units." The third or focused coding phase[1] involved two steps: (a) abbreviating the topics as codes and writing the codes next to the appropriate segment of the transcripts (e.g., GC [general comments], SC [specific comments], GCEU [general comment: easy to use], and SCM [lets me know the main point of each unit]), and (b) coining descriptive words for topics and turning them into categories. For example, the "visualization" topic was turned into a category named "visualized presentation increases understanding." The fourth, or grouping, phase consisted of grouping topics that were related to each other. The final, or theme, phase required assigning the related topics or categories to emerging themes.[2] For example, under the theme of "With this kind of environment, I am in a better position to know how the text is organized and what it contains," a number of categories were sorted out, such as "showing how the hypertext is organized" and "showing what the hypertext is all about."

To ensure the trustworthiness of this method, credibility was confirmed. Credibility was one of the main criteria of trustworthiness proposed by Lincoln and Guba (1985), who suggested its establishment by means of a technique called "debriefing." A colleague of the researcher was given the transcripts and asked to examine the recorded interviews following the same procedures to arrive at possible categories and themes. The results showed that both the researcher and the colleague identified similar categories and themes.

RESULTS

The research question investigated in this study focused on the perceptions of ESL readers of reading well structured and less structured hypertext and the effectiveness of displaying the underlying structure of hypertext along with the organization and interrelationships of its units or nodes for helping learners understand the main idea of hypertext. The findings presented in this section were derived from an analysis of the participants' responses during the interviews.
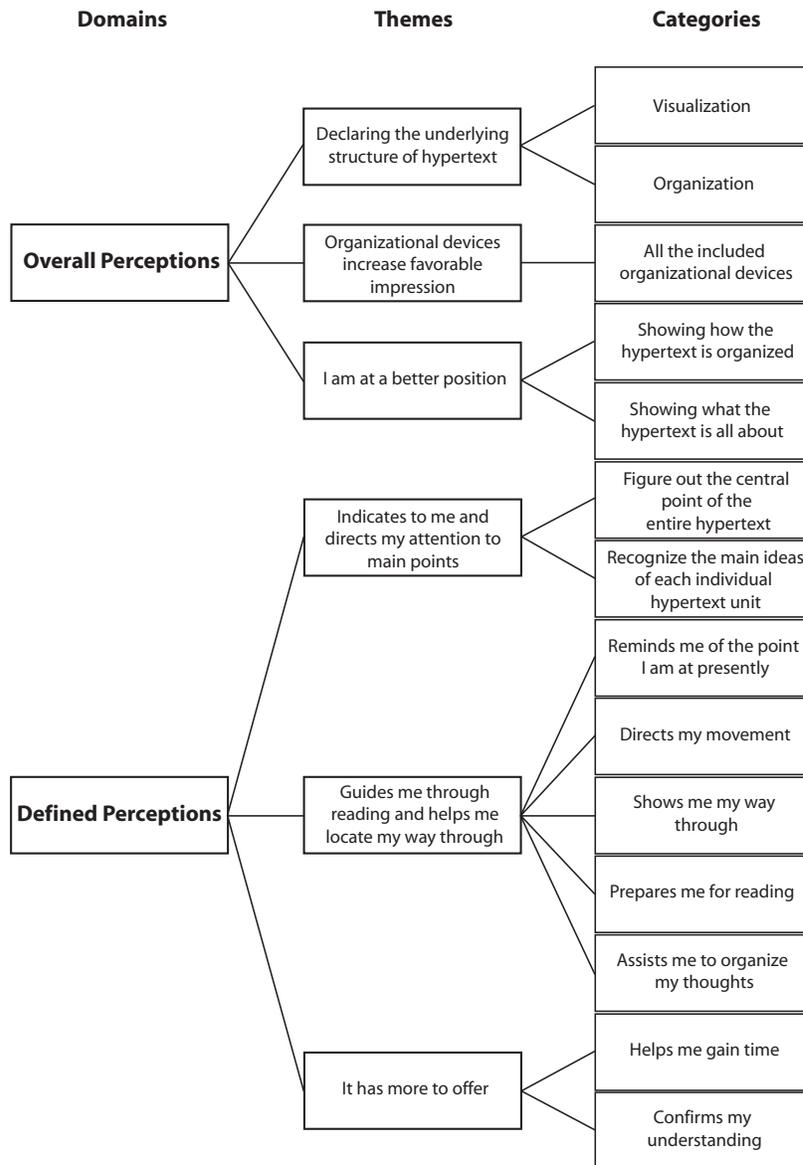
All 40 participants were interviewed after reading both the well structured and less structured hypertexts. Each interview lasted approximately 10-15 minutes. The total time used to interview all participants was approximately 450 minutes (7.5 hours). Participants made a total of 265 remarks in which they shared their perceptions of the hypertexts. Fifty-six (21%) of these remarks were general or overall comments, and the remaining 209 (79%) comments specifically concerned the organizational devices in the hypertexts. Of the total number of remarks, the majority were positive (243 = 92%), while only a few were negative (22 = 8%). The two general domains, overall perceptions of the programs and specific perceptions of the organizational devices, engendered certain ideas significant enough to be used as themes (see Figure 3). The emerging themes associated with each domain will be considered in turn.

Overall Perceptions

The themes associated with the domain of overall perceptions were that: (a) declaring and organizing the underlying structure of hypertext paves the way for

my understanding, (b) incorporation of various organizational devices increases and contributes to my favorable impression of well structured over less structured hypertext, and (c) with this kind of environment I am at a better position to know how the text is organized and what it contains.

Figure 3
Participants' Perceptions of the Effectiveness of Displaying the Underlying Structure of Hypertext

Domains	Themes	Categories

Overall Perceptions

- Declaring the underlying structure of hypertext
  - Visualization
  - Organization
- Organizational devices increase favorable impression
  - All the included organizational devices
- I am at a better position
  - Showing how the hypertext is organized
  - Showing what the hypertext is all about

Defined Perceptions

- Indicates to me and directs my attention to main points
  - Figure out the central point of the entire hypertext
  - Recognize the main ideas of each individual hypertext unit
- Guides me through reading and helps me locate my way through
  - Reminds me of the point I am at presently
  - Directs my movement
  - Shows me my way through
  - Prepares me for reading
  - Assists me to organize my thoughts
- It has more to offer
  - Helps me gain time
  - Confirms my understanding

The first theme evolves around the notion that explicit illustration of the structure of the hypertext and the relationships among its parts helps readers understand the meaning of the text. The theme can be stated as: declaring and organizing the underlying structure of hypertext paves the way for my understanding. This theme generated 27 of the 56 (48%) overall perception remarks made by 13 participants. The components of this theme can be classified into two main categories, visualization and organization.

The first category that emerged from the interview responses indicated that the organizational devices that were embedded in the well structured hypertext helped participants visualize and recognize how the hypertext was organized, thereby supporting better understanding. The number of remarks that were related to the visualization category was 18 of 27 (67%) made in response to the first theme by 13 of the participants. Participants made several related comments. One interviewee said,[3] "The diagram [overview map] shows the relationship of each topic [unit] so I can easily understand the structure of the text." Another participant agreed that "You can easily understand the structure by only looking at the figure [overview map]. The graphic [overview map] helped to visualized how the text is organized." Yet another stated, "I feel that the display of each section help me understand better." Another participant commented that "I can see the structure of the overall context and I can see how the text is organized so I think it's better to understand the content."

The second related category, organization, showed that structuring and organizing the hypertext enabled participants to gain a better understanding of its content. This category engendered 9 remarks out of the 27 (33%) comments made by 9 readers in response to the first theme.

On a number of occasions, participants' comments reflected this perception. One person said, "I can understand better because the content is better organized," and another said that "It [well structured hypertext] show how the text is composed of so it's more easy for me to understand this way." In a more direct remark, a participant made the following statement: "Summary of each unit and some hint to the next unit are better for readers to understand the whole passage and grasp the whole structure of the passage." An even clearer indication that organized hypertext increased understanding was revealed in the comment of a participant who said, "The presentation of the second program [well structured hypertext] helps me to understand all the meaning or to understand the purpose of this article."

The second theme in the overall perception domain can be stated: incorporation of various organizational devices increases and contributes to my favorable impression of well structured over less structured hypertext. Ten of the 56 (18%) overall perception comments made by 10 participants produced this theme. The theme of incorporation of devices recurred frequently over the course of the participant interviews. Different aspects or features of the programs led participants to unanimously favor well structured over less structured hypertext. Specifically mentioned features included the overview map, defining structure and order, review and connective statements, and audio components. Participants frequently prefaced their comments by stating: "I like this [well structured] better than the

other one [less structured] ... ." The following examples of their comments depict their favorable perceptions of the well structured hypertext. One interviewee said, "I like the second one [well structured] because it's very helpful to understand the text is organized." Another stated, "I like this one because there is an order," and another said, "I like the one I just read today [well structured] because the repetition, recording, and connecting the previous one with next." Yet another participant reported, "I like this because there is a map so it's more detail."

The third theme in the overall perception domain can be stated: with this kind of environment, I am at a better position to know how the text is organized and what it contains. This theme is derived from the fact that raising the reader's awareness of how hypertext is structured and how its components are interrelated eases the processing and comprehension of the textual information. This theme was expressed by 20 of the 56 (36%) overall perception comments made by 15 participants and had two main categories: showing how the hypertext is organized and showing what the hypertext is all about.

The first category associated with this theme, showing how the hypertext is organized, involved the notion that well organized and connected hypertext helps readers determine how the hypertext that they are about to read is organized. This category was generated by 10 of the 20 (50%) comments made in relation to the third theme by 10 participants. One participant's remark provided the best example of agreement with this theme: "It's so easy with this kind of design to understand how units are organized." A similar statement was made by another participant, "You know when I look at this it help me to understand the relationship and sequence of the units." Yet another participant said, "This program [well structured] tell me the relationship between unit and that's why I now understand the structure of the text."

The second category associated with the third theme, showing what the hypertext is all about, centered around the issue that displaying the global structure of the hypertext increases the likelihood that readers will be prepared for the content of the hypertext. The remarks that suggested this category were 10 of the 20 (50%) comments made by 10 participants related to the third theme. The following participant comments validate this assumption. One participant stated, "... it gives me a general idea about the text." Another said, "It gives an idea about what I have to read," and still another interviewee asserted, "I can anticipate the content by watching [by looking at the overview map] what I see on the map."

Defined Perceptions

The remarks related to the domain of specific or defined perceptions also produced insights that constituted various themes. After the participants spent some time talking about their general or overall impressions concerning the hypertext reading programs, they shared their reactions to specific features that were included in both programs. More precisely, the participants discussed how effective the features displaying the structure and interrelatedness of hypertextual information were in showing the central point(s) of the texts and thereby helping them to

increase their reading comprehension. The following themes were associated with the specific domain: (a) indicates to me and directs my attention to the main points locally and globally, (b) guides me through the reading and helps me locate my way through, and (c) has more to offer.

The first theme deals with the benefits of reading in a well structured hypertext environment in terms of making the central point of an individual unit as well as the text as a whole more overt to readers. This theme can be stated: indicates to me and directs my attention to the main points locally and globally. This theme generated 54 of the 209 (26%) defined comments made by 62 participants. This first theme was built around various categories that were raised by the participants. The first category was made up of 26 of the 54 (48%) remarks related to the first theme made by 18 of the participants. In it, participants indicated that reading well structured hypertext made it easy to perceive the main idea of the entire hypertext. They attributed this to a number of factors, including the representation of the text structure in the form of an overview map, local and global titles, and review and logical statements. One participant said, "It gives you idea and summary for you what the text is about and then leads to the details and so you don't think of how the text is organized." Similarly, according to another participant, "before you read the article, you can receive a little summary of the article so it can help you understand the main body."

The second category was the notion that well structured hypertext enabled participants to recognize the main ideas of each hypertext unit easily. This category was generated by 28 of the 54 (52%) remarks on the first defined theme made by 20 participants. Participants remarked that review statements and placing the titles of each unit in the overview map along with each unit made it easy for them to discover the central points of the units. The following statements were made by some participants concerning this feature. One interviewee stated that "Titles are helpful to get the main ideas for each unit." Another participant said, "They help me because they have key and important words about each unit," and another asserted, "I like them because they help me understand what each unit has inside." Still another participant said, "Titles on the map explain the main idea of almost any unit." Finally, a participant stated that, "it's [referring to the review statements] helpful because it summarized the main ideas for each unit so if I don't understand a unit, this direct my attention to the most important idea about the unit I just read."

The second theme of the specific domain concerned the consequences of situating readers in well structured hypertext, that is, making it possible to proceed with ease and thus provide better understanding. This theme can be stated: guides me through the reading and helps me locate my way through. This theme is comprised of 96 of the 209 specific remarks (46%) made by 80 participants. The five categories that make up this theme are: reminds me of where I am, directs my movement, shows me my way through, prepares me for reading, and assists me in organizing my thoughts.

The first category, reminds me of where I am, showed that the inclusion of organizational devices in hypertext resulted in helping to remind readers their current

point in the overwhelming hypertext environment. This category consisted of 11 of the 96 (11%) remarks made regarding this second theme, which were made by 7 participants. In one comment regarding where the reader was at the moment, a participant said, "It gives titles and you remember which unit you're reading right now." Another interviewee said, "Well, I think the number of the units [each unit on the overview map was assigned a number] and changing of the color of the unit I already read helps to know which point I am at."

The second related category, directs my movement, refers to showing readers the direction they need to follow. This category resulted from 25 of the 96 (27%) comments made in relation to the second theme by 19 participants. As a result, readers do not need to determine how to proceed by themselves. For instance, one participant said, "This map show how to which direction I need to go next." Another participant noted, "Interactive action [referring to the employed interactive overview map] helps me to make sure that I'm going in the right direction." And a third said, "I like a lot the directions at the bottom because they tell me exactly what to do next."

The third category of this theme, shows me my way through, pertained to the ease with which participants found their way around the hypertext environment. This category consisted of 21 of the 96 (22%) remarks in response to the second theme that were given by 14 participants. In a number of instances, participants acknowledged the relative ease of locating information in well structured compared to less structured hypertext. The following are examples of some of the comments made by participants. One person said, "In this kind of design we can very easily find the information that we want." Another participant stated, "I really like this program [well structured] because it's more easy to find things." Yet another said, "This program is more convenient and faster if I want to look for something I want."

The fourth category was: prepares me for reading. This category was suggested by 26 of the 96 (27%) remarks on the second theme made by 24 participants. Through their use of the hypertext aid, readers were able to predict the content in advance. As one participant said, "The map gives an idea about each unit before reading." Another stated, "This organization prepare us before reading the text," and another interviewee commented, "The connections that this program has gives a summary of what I read and also prepare you for the next unit so I can make connection before I read the second unit."

The final category was: assists me with organizing my thoughts. This category was the product of 13 of the 96 (13%) remarks made by 13 participants. A number of participants indicated that they favored the well structured hypertext reading program over the less structured program because it helped them organize their thoughts. With respect to this issue, one participant made the following statement, "It gets confused so when I read the review [statement] I can organize my thoughts." This was echoed in a similar statement by another participant, "You know what you read and what you're going to read so it really makes you organize yourself."

The third theme of the specific domain was that well structured hypertext offers

various related advantages. The theme can be stated as: It has more to offer. This theme generated 23 of the 209 (11%) specific perception comments made by 20 participants. This theme encompasses two main categories: helps me gain time and confirms my understanding.

This first category, helps me gain time, pertains to time readers saved that they would otherwise have needed to spend to figure out how the hypertext information was organized and interrelated. This was the result of 9 of the 23 (39%) remarks about the third theme made by 7 participants. A number of participants indicated that when reading in a well structured hypertext environment, they did not have to spend much of their time thinking of how hypertext units are connected, organized, and related. Instead, they placed their concern on understanding because the underlying structure of the hypertext and the interrelationships among its units were clearly displayed. Along these lines, a participant stated, "I think the second program [well structured hypertext reading program] the map [the overview map] gives an idea about the text before reading it helps to gain time and to have a global idea about each unit separately." Another participant stated, "The second program [well structured hypertext reading program] gives you an idea and summarize for you what the text is about and then it leads you to the details so you do not need to think at all of how the text is organized." Yet another said, "In this program [well structured] I don't need to organize things by myself and so I decided to go and read the text. This map show how to organize so I can guess what next unit will talk about."

The second category under the third theme, confirms my understanding, deals with the issue of confirming or checking the reader's understanding of a previously encountered hypertext unit. This category is made up of 14 of the 23 (61%) remarks made about the third theme, which were given by 13 participants. Among the advantages that well structured hypertext offered participants was that it helped them to make sure that their understanding of what they had read was accurate. This was due to the inclusion of a summary of each unit as well as connective statements regarding the relationship between the previous and upcoming units. The following comments are examples. One interviewee said, "It ... let me confirmed about the unit again and what is the next unit is going to be about." Another participant commented, "Review is very helpful because this shows summary so when I read summary I check my understanding of the text." Yet another said, "We again know what was the last unit to told us."

As indicated earlier, some participants made a few negative statements concerning some aspects or features of the well structured hypertext reading program. Sixteen participants made a total of 22 negative remarks. These negative remarks focused on the uselessness of providing logical connective statements. The participants' unfavorable position toward the presence of this feature may be attributed to the fact that it did not provide valuable information to them. They had completed reading one unit and were ready to move on to the next. A participant summed up this position by saying, "I don't think I need this one [logical connective statement] because I already read the previous unit so I know what they are talking about and next I can click on unit 2, so I don't need it." Another stated

similarly, "I don't think it's very useful because we know this unit and we will see the next unit. I think it's not necessary."

DISCUSSION

Analysis of the interview transcripts revealed that participants perceived the well developed hypertext as superior to less developed hypertext. This conclusion was derived from the overall as well as the specific comments participants made during the interview sessions. The favorable impressions may have arisen from a variety of factors, most notably, the nature or characteristics of the hypertext environment and language ability. Features such as segmentation, linkage, multiple paths, size of the database, dynamic presentation, and unclear text structure were among the attributes that made the task of reading even more difficult and imposed a higher cognitive load on ESL readers. The level of difficulty seemed to be reduced considerably, most likely due to the provision of a visual and verbal conceptual orientation to the structure of hypertext at both the local and global levels. Therefore, participants appreciated the fact that they did not need to exert extra effort to interrelate the information or determine how the hypertext was organized.

Favorable responses may be attributed to the fact that the embedded organizational devices had the potential to lower the language barrier and make the input of content knowledge more comprehensible. Participants did not need to remember their current location, make decisions about where to go next, keep track of pages previously visited, or figure out the semantic relations among units. Thus, they devoted their mental resources to processing and understanding hypertext content. This result was consistent with previous research studies (e.g., Altun, 1999; Dee-Lucas & Larkin, 1996; Hoffman, 1998; Leidig, 1992).

IMPLICATIONS

The aforementioned findings and discussion have pedagogical and technological implications for L2 reading and specifically L2 computerized reading. This section will undertake to identify and highlight such implications.

Pedagogical Implications

The results of this study showed that L2 readers of hypertext, particularly instructional hypertext, should be equipped with organizational devices to assist them in their construction of a coherent mental representation that ultimately leads to successful hypertext processing. Provision of such organizational devices is not itself a means to an end; rather, some instructional techniques warrant further attention. The novelty of hypertext as an instructional tool requires L2 reading instructors to devote some class time to familiarizing their students with hypertext and explaining the unique nature of hypertext documents. Particularly, they should direct learners' attention to how hypertext documents are structured and how given hypertext units are interrelated. Instructors also need to help learners adjust their reading strategies to the specificity of hypertext environments.

Instructors can help students acquire specific strategies such as knowing where they are in a document and what to do next, considering relationships between hypertext units, and building a coherent representation of the overall content of the hypertext. Arming learners with such knowledge puts them in a better position to interact effectively with hypertexts and benefit fully from the access facilitators they offer. This is especially true considering the fact that recent commercially developed ESL reading textbooks commonly make reference to existing Web sites but do not provide instructions on how to read on-line materials (e.g., *Readers' Choice*, 2002; *Workplace Plus: Living and Working in English*, 2001; *Tapestry Reading Series*, 2000).

A further pedagogical implication that surfaced from this study was the implementation of instructional techniques designed to improve L2 learners' sensitivity to the hypertext structure. Explicitly declaring or displaying hypertext structure was not sufficient to ensure that its organizational devices were being used effectively by readers because readers needed to be aware of the nature and function of the structure. The results of this study showed that increasing the readers' sensitivity and making them aware of hypertext structure enabled them to better form macrostructures for the instructional hypertext they were reading. One approach to fostering awareness of hypertext structure is to ask learners questions concerning how hypertext is structured by the author or the developer. Another technique would be to ask learners to produce concrete representations of hypertext structure in the form of an outline or some type of diagram. Additionally, learners could be asked to identify important relationships that define a given hypertext structure.

Technological Implications

In technological terms, the results of the present study have implications for L2 instructional designers of reading materials in three areas. First, in order to bring more coherence to the intended instructional hypertext document, designers need to ensure that textual information flows together in a coherent manner both locally and globally. Coherent hypertext presentation can be implemented by embedding local and global organizational devices. In addition, coherence can be accomplished by undertaking certain measures, such as explicitly revealing the semantic relationships among hypertextual units, carefully sequencing related hypertext units so that they can be browsed one after another, coding links so that readers are only allowed to jump to the next related unit, and providing recommendations to readers as to which sequence they should follow. It may be argued that the foregoing measures may negate or work against the unique nature of hypertext environments which allow free exploration of the text in question. This is partially true, but it is also important to bear a number of issues in mind. Instructional hypertext as opposed to reference hypertext is read with the intention of selecting and integrating information, rather than merely locating specific pieces of information. This instructional task of constructing a coherent mental representation of hypertext content is expected to be difficult to accomplish in a less coherent hypertext environment. Assigning a less structured instructional hypertext to intermediate-level ESL readers makes this even more difficult due to the fact that

readers at that level lack the necessary skills to identify important information and integrate it into a unified whole. In such a hypertext environment, intermediate-level ESL readers are expected to devote their mental resources to determining the structure of the loosely organized hypertext at the expense of processing the hypertext information.

The second technological implication derives from inducing readers to take advantage of the included organizational devices. Readers need to be informed of what to do and where to go next. In this way, readers remain aware of their place in the hypertext environment, they receive help in making the right decision, and they are induced to use the structure of the hypertext to guide their reading. The directions or instructions to be given to readers should be concise, appear on every screen and in the same place throughout, and be placed in an area where they do not interrupt the process of reading. In addition, nontextual hints also should be considered to complement verbal instruction in order to guide readers' movements through reading hypertexts. A substantial number of participants stated that a visual indication of the currently visited unit and the previously visited unit was very valuable. In this study, the currently visited unit was shaded green on the miniature overview map and a small triangle attached to the bottom of the ball represented the currently visited unit; units already read were shaded in red.

A third technological implication that arose from the study was the importance of signaling the thematic content at both the local and global levels. The complexity and segmentation of hypertext documents requires instructors and computer designers to include organizational devices that alert readers to the important information locally, assist them in identifying the interrelation among hypertext units, and then organize the macrostructural representations of all the units into a coherent representation. It is important to consider including interactive local and global organizational devices as opposed to static devices to insure active engagement of readers and to attract their attention as well. Drawing learners' attention to the organizational devices can be accomplished also by making them typographically distinguishable or visually salient.

SUGGESTIONS FOR FUTURE RESEARCH

This study was an attempt to draw out the perceptions of ESL readers on the facilitative effect of organizational devices on the construction of a coherent mental representation of hypertext content. Further research is needed for a thorough understanding of this issue and confirmation of the findings. This is especially true when considering that there may be additional variables that were excluded from this study and that could add different intrapersonal effects based on learning style preferences.

Another area of research is to look at the cognitive process exhibited by L2 readers while reading well structured and less structured hypertext documents. This can be explored through a process-oriented approach, which this study chose not to use. Perhaps one way is to track and study participants' navigation strategies. Another possibility is to interview participants and ask them whether they utilized and took advantage of the organizational devices provided. In addition,

think-aloud techniques may be used to reveal other simultaneous aspects while learners are engaged in reading.

Another suggested line of future research would be to explore the effect of the varying linguistic backgrounds of ESL readers on their development of a coherent mental representation of hypertext content. The question that should guide this endeavor is whether the various native languages of ESL readers make a difference in developing an integrated representation of hypertext content.

These suggested avenues of research might shed more light on L2 reading acquisition involving the computer. They should enlighten us as to how hypertexts might be designed to facilitate L2 reading comprehension. Finally, it is hoped that the outcome of this study will be of some use to future research studies and that it will bring improvement to texts mediated through hypertext technology.

CONCLUDING REMARKS

Questioning the effect of the computer on L2 reading and reading comprehension in particular and how it can be used to facilitate reading is no longer an appropriate question in the field of L2 computerized literature. A large number of studies have shown it indeed has a profound impact on L2 reading acquisition. It is imperative, therefore, that we move on from considering this question in future research and pay substantial attention to investigating issues that help practitioners determine for whom hypertext is effective and under what circumstances. Efforts should be made to examine variables that influence readers' processing of a hypertext document. Unless we move in this direction, we will fall far behind by underestimating the potential capability of instructional hypertext on L2 reading acquisition.

NOTES

[1] The initial and focused phases were introduced by Glaser (1978).

[2] These were adopted from the steps suggested by Tesch (1990).

[3] In all the quoted remarks, the researcher has made no effort to correct the participants' grammatical inaccuracies except to insert bracketed comments where needed for clarification.

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