2005

Comprehension AIDS, Internet Technologies, and the Reading of Authentic Materials by Adult Second Language Learners

Fleming Louis Bell
THE FLORIDA STATE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES

COMPREHENSION AIDS, INTERNET TECHNOLOGIES, AND
THE READING OF AUTHENTIC MATERIALS BY ADULT SECOND
LANGUAGE LEARNERS

By

FLEMING LOUIS BELL

A Dissertation submitted to the
Department of Modern Languages and Linguistics
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

Degree Awarded:
Spring Semester, 2005
The members of the Committee approve the dissertation of Fleming Louis Bell defended on December 10, 2004.

_________________________________________
Elizabeth Platt
Professor Directing Dissertation

_________________________________________
Gretchen Sunderman
Professor Co-Directing Dissertation

_________________________________________
Carolyn Piazza
Outside Committee Member

_________________________________________
Brenda Cappuccio
Committee Member

The Office of Graduate Studies has verified and approved the above named committee members.
I dedicate this work to my wife Penny. Her patience and support have made the completion of this project possible.
ACKNOWLEDGEMENTS

I would like to acknowledge and thank the members of my committee for their invaluable assistance throughout this project. I would also like to acknowledge and thank Dr. Marty Spears, Associate Professor of Mathematics at Harding University, for his assistance with the statistical analyses in the course of this project and the preparation of this dissertation.
# TABLE OF CONTENTS

LIST OF TABLES .................................................................................................................. vii

LIST OF FIGURES ............................................................................................................... x

ABSTRACT ............................................................................................................................ xii

CHAPTER I
Introduction ......................................................................................................................... 1

   Research Questions ........................................................................................................ 4
   Technology Applications In Second Language Learning ........................................ 5
   Limitations ...................................................................................................................... 7
   Predictions ...................................................................................................................... 7

CHAPTER II
Theoretical Framework and Previous Research ............................................................ 10

   What Reading is and Why Reading is Difficult ......................................................... 11
      Top-down, Bottom-up, and Interactive Processing in Reading ..................... 11
      The Nature of Hypertext ..................................................................................... 18
   What Breaks Down When L2 Learners Read ....................................................... 21
      Differences Between Skilled and Less Skilled Bilingual Readers ............. 21
      The Linguistic Threshold Hypothesis ............................................................... 23
      The Principle of Least Effort ............................................................................ 24
   What Can Help L2 Readers ....................................................................................... 25
      Paper Versus Computer ..................................................................................... 26
      The Internet and Language Instruction ......................................................... 27
      Instruction and the Use of Authentic Materials ............................................ 28
      The Comprehension Aids Readers Use and their Resourcing Strategies ...... 31
   The Need For Further Research ............................................................................ 38

CHAPTER III
Research Study Design ..................................................................................................... 42

   Introduction to the Chapter ..................................................................................... 42
   Setting ......................................................................................................................... 44
   Participants ............................................................................................................... 44
<table>
<thead>
<tr>
<th>Chapter IV</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Comprehension Aids</td>
<td>61</td>
</tr>
<tr>
<td>Amount of the Story Read</td>
<td>65</td>
</tr>
<tr>
<td>Level of Instructed Second Language Experience</td>
<td>69</td>
</tr>
<tr>
<td>Post Hoc Analyses</td>
<td>76</td>
</tr>
<tr>
<td>Moderating Variables</td>
<td>76</td>
</tr>
<tr>
<td>First Language Reading Skills</td>
<td>77</td>
</tr>
<tr>
<td>Text Difficulty</td>
<td>77</td>
</tr>
<tr>
<td>Written Recall Protocol as a Global View of Comprehension</td>
<td>78</td>
</tr>
<tr>
<td>Summary</td>
<td>79</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter V</th>
<th>Discussion and Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion of Results</td>
<td>80</td>
</tr>
<tr>
<td>Use of Comprehension Aids</td>
<td>81</td>
</tr>
<tr>
<td>Level of Instructed Second Language Experience</td>
<td>84</td>
</tr>
<tr>
<td>Further Explanations of Readers’ Behavior Patterns</td>
<td>90</td>
</tr>
<tr>
<td>Post Hoc Analyses</td>
<td>94</td>
</tr>
<tr>
<td>Tracking Reading Behavior</td>
<td>96</td>
</tr>
<tr>
<td>Implications</td>
<td>98</td>
</tr>
<tr>
<td>Foreign Language Instruction</td>
<td>98</td>
</tr>
<tr>
<td>Future Research</td>
<td>100</td>
</tr>
</tbody>
</table>

| APPENDICES |
|-----------------|----------|
| A | 102 |
| B | 109 |
| C | 111 |
| D | 114 |
| E | 117 |
| F | 120 |
G ................................................................. 123
H ..................................................................... 125
I ..................................................................... 134
J ..................................................................... 138

REFERENCES ..................................................................... 141

BIOGRAPHICAL SKETCH .................................................. 151
# LIST OF TABLES

1. Research Questions, Data Collected, and Methods of Analysis ....................... 59
2. Participants who Accessed Each Type of Comprehension Aid ............................. 62
3. Frequency of Access of Comprehension Aids .................................................. 64
4. Frequency of Access of Aids Grouped by Category ......................................... 65
5. Distribution of Linked Lexical Items by Section of the Story ............................. 66
6. Distribution of Sections of the Story Completed ............................................... 67
7. Participants’ Use of the Lexical Aids Presented to Them ................................... 68
8. Use of Comprehension Aids According to Level of Experience ....................... 70
9. Use of Comprehension Aids Grouped by Category According to Level of Experience .................................................................................................................. 71
10. ANOVA for Level of Instructed L2 Experience ............................................... 72
11. ANOVA for Level of Instructed L2 Experience: Aids Grouped by Category ... 74
12. Means for Comprehension Aids by Experience Level Group ......................... 86
13. Patterns of Resource Consultation for Each Language Experience Group ....... 87
14. Level of L1 Reading Ability ............................................................................. 126
15. Level of L1 Reading Ability: Aids Grouped by Category .............................. 127
16. ANOVA for L1 Reading Ability ..................................................................... 127
17. ANOVA for L1 Reading Ability: Aids Grouped by Category ....................... 128
18. Perceived Difficulty of the Text ................................................................. 129
19. Perceived Difficulty of the Text: Aids Grouped by Category .................. 129
20. ANOVA for Perceived Difficulty of the Text ............................................. 130
21. ANOVA for Perceived Difficulty of the Text: Aids Grouped by Category .... 131
22. Recall Protocol Word Count by Level of Instructed L2 Experience .......... 132
LIST OF FIGURES

1. Introductory screen ........................................................................................................ 54
2. Story screen .................................................................................................................. 55
3. English version of the essay on historical context ......................................................... 56
4. English version of the literary commentary ................................................................. 56
5. Bata alcochada pop-up ................................................................................................ 57
ABSTRACT

For second language teachers and theorists alike, there is a need to understand the processes involved in the second language learner’s pursuit of comprehension during the act of reading in the target language. This study seeks to provide insights into issues such as how second language readers approach the task in terms of how they use resources in the form of comprehension aids, how and if readers at different levels of instructed second language experience differ in their use of resources, and what advantages computer tracking confers on the analysis of data concerning reading behavior. Specifically, it addresses the problem of determining what comprehension aids second language readers actually use when reading an authentic text on computer and the role that the readers’ level of instructed second language experience plays in their choice of aids. Additionally, it focuses on the core problem of how to gain access to the reading process. To this end the study utilizes the constructs put forward in the top-down, bottom-up, and interactive processing metaphors and the linguistic threshold hypothesis to address four questions: 1) Given several comprehension aids as resources, a) what resources will second language readers use when reading a text on computer? b) with what frequency will they use them? 2) What role does level of instructed second language experience play in strategy choice? 3) What advantage(s) does the tracking of reading behavior confer on data analysis in second language text processing? 4) What implications do these findings suggest for future studies of text processing and comprehension? The dependent variable in the study is the number of times that comprehension aids are consulted, and the independent variable is the level of instructed second language experience of the various participants. In this way it focuses on issues of concern, not only to second language teachers, but to language learners as well.
CHAPTER I
INTRODUCTION

As a teacher I have found reading to be a fascinating activity. Among the four communication skills reading and writing are distinguished from listening and speaking in that, while there are exceptions, they tend to be acquired through tutored instruction. On the other hand, listening and speaking, again exceptional cases notwithstanding, are acquired by children through contact with others in their social environment, independent of the tutelage of any specific teacher. The vast majority of individuals learn to read in their first language because of the dedication of those parents, teachers, or friends who care enough about them to instruct them in the skill. Yet, reading itself imparts an independence to the individual. The importance of the ability to read and write cannot be underestimated; it allows access not only to the everyday working of modern societies, but also to the accumulated knowledge of the human race. The ability to read and to write allows us to record an act of communication and preserve it to communicate again and again across time in a way that oral communication cannot. The temporal preservation of communication through reading and writing is one of the characteristics that make human language unique, and is, therefore, of paramount importance.

Because of its nature as a tutored skill, reading presents its own set of challenges to those who would instruct others in a second language. Although writing is also a tutored skill, reading generally precedes writing for both first and second language learners, and is foundational to the learning of writing. Especially for those learning a second language, reading seems to represent a continual challenge that remains present far beyond the elementary levels of the acquisition process. I have observed the frustration of advanced students who struggle with comprehending texts that native speakers take on without a second thought. Furthermore, I have noticed that a breakdown in comprehension occurs for virtually all second language readers at some point in the reading process. I have often heard second language learners complain of “reading” a
short story, but not understanding it. And I have been intrigued by their various strategies for coping with this phenomenon. For most, it is a sign of improvement in the skill that the breakdowns occur less frequently than they did at earlier stages of the language acquisition process, or that they occur only when dealing with more sophisticated types of text than those confronted at the earlier stages. But for all second language (L2) readers facing a text written in one’s L2 becomes a pursuit not unlike detective work. For some the piecing together of linguistic clues seems to be a rewarding challenge, well worth undertaking, but for many it seems at times to be a disappointing experience and at others a discouraging chore.

With a goal of making the task of reading less burdensome on L2 readers, pedagogical materials often present texts which are written specifically for learners or are simplified versions of a previously published original. Texts are also often accompanied by comprehension aids such as vocabulary lists, translations provided in the form of glosses, pre-reading activities, and advance organizers. Although simplified versions of reading texts may lesson the burden somewhat, L2 learners still find them taxing. Moreover, the learner will eventually be faced with authentic reading materials which were written by native speakers and intended for native speakers without any simplification. In recognition of this, many current pedagogical materials also incorporate authentic texts accompanied by the same types of comprehension aids mentioned above as a means of increasing readers’ level of skill.

Reading an L2 text is fraught with pitfalls and breakdowns, and in the end one may actually understand little of the text at hand and have enjoyed the experience even less. Because of this continuing struggle with a lack of comprehension, it is important to learn how people read in general. And more specifically, it is critical to learn what individuals do when they read. For the language teaching practitioner it is important to know what is going on in the thought processes of readers that causes the breakdown to occur, what strategies readers use to achieve comprehension, and at what points in the process the strategies prove to be successful and unsuccessful. In order to determine how to better instruct L2 learners in the reading of their second language, we, as teachers, are concerned about why the breakdown occurs. However, this question has already been addressed in various ways by a number of theories of reading. At an even more practical
level, language teaching practitioners are concerned with whatever can be done to improve L2 readers’ comprehension. In this study I focus on these issues by means of the constructs put forward in the two theoretical frameworks of the top-down, bottom-up, and interactive processing metaphors and the linguistic threshold hypothesis. These frameworks provide the theoretical tools needed to interpret the behaviors of L2 readers in terms of both more successful and less successful reading strategies. By concentrating on the behavior of L2 learners during the task of reading an authentic L2 text, I hope to identify some of the strategies they employ and bring some insight into how better to prepare both the reader and the text.

Here we turn to the computer in order to take advantage of the hypertext format of presenting text. This capability of computers provides an advantage over paper in a number of ways. For one, the number of computer-mediated texts that are available to language learners is continually rising, and language teaching practitioners need good information about learners’ reading strategies in this medium. Also, hypertext allows the reader to get hold of a variety of comprehension aids with an increased speed of access relative to the printed page by bringing them together into one body of text. In this study I will be concerned with providing L2 readers with a number of aids that will support the theorized reading strategies that are commonly referred to as top-down, bottom-up, and interactive reading processes.

How to gain insight into the reading process has long been a source of frustration for language teaching practitioners and second language acquisition theorists alike. A means to observe a mental process, such as reading, in real time without the loss of detail inherent in post-event reconstructions, and without destroying the process itself by stopping it in mid course, has long been a goal of the educational profession at large. The use of computer based hypertext allows us to peer inside the reading process in new ways. Without interrupting the reader or the reading process, the computer can track the way readers access comprehension aids accurately and in real time. The unique tool of computer tracking provides a window into the reading strategies being used as the L2 reader endeavors to achieve comprehension. I chose to present L2 readers with a text in hypertext format in order to make comprehension resources readily available to them and to take advantage of the tracking data that the computer provides. Thus, the computer
plays a dual role in this study: 1) by presenting the reading text in hypertext format, the computer mediates the reading process for the reader, and 2) by tracking the actions of the reader, the computer mediates the research process for the researcher.

The use of computers to observe readers’ behavior is not unique to this study. A small number of previous studies have employed computer tracking technology as a tool in second language research. The research of Bell and LeBlanc (2000), Davis and Lyman-Hager (1997), and Lomicka (1998) used computer tracking to gain insights into reading strategies. Liou (1996) used computer tracking as a means to observe L2 learners while viewing a video program as opposed to reading text. But the present study is distinct from this handful of other studies in a number of ways which will be specified in Chapter 2.

Briefly stated, the major constructs of the study are the reading of authentic second language texts, reading strategies vis-à-vis comprehension aids, relative level of experience with a second language, the use of computers as a means of presenting text for reading, and the use of computers as research tools in second language reading. These constructs pertain to the need to understand the second language learner’s quest for comprehension during the act of reading so as to be able to provide the most effective aids to reading. Each one is, in its own right, a topic of practical concern to the second language teaching practitioner as well as to the second language learner.

**Research Questions**

This study will focus on the behavior of second language learners during the task of reading an authentic second language text and the insights provided by the computer’s ability to track readers’ movements between the text and various comprehension aids. This is achieved by means of creating an experimental procedure involving reading an authentic Spanish-language short story on computers. It aims at the overlap that lies between the constructs of second language reading and reading strategies with regard to comprehension aids, both of which lie within the larger sphere of an individual’s personal
second language acquisition, or learning. In so doing I will address the issue of how readers at different levels of instructed second language experience use resource strategies to cope with reading tasks. The study addresses four questions: 1) Given several comprehension aids as resources, a) what resources will second language readers use when reading an authentic text on computer? b) with what frequency will they use them? 2) What role does level of instructed second language experience play in strategy choice? 3) What advantage(s) does the tracking of reading behavior confer on data analysis in second language text processing? 4) What implications do these findings suggest for future studies of text processing and comprehension and for classroom applications?

For the purposes of this study, these definitions are to be understood: an “authentic second language text” is as a text created by native speakers of the target language for purposes other than language instruction, as described in Chapter 2; “second language readers” are adult learners enrolled in modern foreign language courses at the university level that have as a subject matter a language other than the students’ native language; and “instructional experience level” is prior study of the target language by the learner with levels determined by the number of semesters of instructed study the individual has completed.

**Technology Applications In Second Language Learning**

Among the major constructs of this study are the use of computers as a means of presenting text for reading and the use of computers as research tools in second language reading. Given this reliance on computer technology, it is imperative that we consider this use of technology within its historical context. Horn (1983) counts the advent of the computer among the top five milestones in the preservation and dissemination of information. Those are, in chronological order: the occurrence of speech; the invention of written communication; the invention of movable type; the introduction of radio wave transmission of messages; and the development of the computer (p. 282).

---

1 For purposes of this study second language learning and second language acquisition will be considered a single construct.
Computer assisted instruction cannot still be considered a new concept after more than three decades of existence (Miech, Nave & Mosteller, 1996). However, the computer’s impact on the teaching profession remains a topic of much interest and research (Ahmad, et al., 1985; Askov & Bixler, 1998; Avent, 1993; Chapelle, 1998; Cho, 1995; Fulton, 1996; Furstenburg, 1997; Gettys, Imohof & Kautz, 2001; Hulstijn, 2000; Jones, 1997; Kelly & Leckbee, 1998; Nieves, 1994; Wright, 1992). The Internet as we know it today became a reality in 1990, and the possibility of worldwide communication that it provides has intrigued educators and students alike. Like computer assisted instruction in general, the implications of this web of linked computers are the topic of considerable body of research (Dewar, 1997; Downes, 1997; Fraser, 1996; Garner & Gillingham, 1998; Gettys, Imohof & Kautz, 2001; Green, 1997; Lafford & Lafford, 1997; Peraya, 1994; Warnock, 1996).

For the field of second language instruction, the Internet offers a source of authentic materials and two-way communication unlike anything that came before it. The authenticity, immediacy, and scope of materials now available via the Web are unprecedented in history. The Web is an integrated delivery system that has opened up access to resources and information which were previously beyond reach, or at least only available at considerable cost or expenditure of time. In keeping with the goals and concerns of the proficiency movement, a number of researchers have turned their attention to the means of communication offered by the Internet (Chism, 2000; Lee, 1997; LeLoup & Ponterio, 1995; Miech, Nave & Mosteller, 1996; Negretti, 1999; Peraya, 1994; Salaberry, 1996). Perhaps the most intriguing aspect of the Internet is that it brings culturally authentic materials into the schoolroom, the library, the “cyber café,” or the home. It is still undetermined if Internet resources and particularly those of the Web have a place in the instruction and acquisition of a second language. If they do, what aspect of the Web is best suited to which aspect of acquisition? This study is an attempt to consider one role that the Web, or a technology similar to it, may play in the language acquisition process.
Limitations

Based on the four specific research questions previously delineated, I propose to identify what resources second language readers use and prefer in an electronic reading environment by making use of the capabilities of computer tracking to measure readers’ behavior when reading a computerized text. Through the study I aim to elucidate the advantages of this ability and to use it to explain any pattern of resource use based on readers’ instructional experience level in the second language. In brief, the purposes are: 1) to examine what individuals do when they read, 2) to consider what can be done to improve reading comprehension for L2 learners, and 3) to reflect on the value of the computer as a tool to observe reading processes. I do not undertake an analysis of readers’ motivations and beliefs, which are beyond the scope of this study. Likewise, the computer merely tracks which pages are viewed without offering subjective conclusions as to the value of those pages’ contents or their benefit to the reader.

A specific limitation arising from the design of the study is that due to the number of participants who participated in the experimental procedure, intact classes were used. However, neither the course nor the course level in which participants were enrolled were used as variables in the study. Furthermore, for similar reasons, a time limit of thirty minutes was imposed on the reading activity within the experimental procedure. Although the imposition of such a time limit is common in studies of similar design, it may have been too little time for the particular story used in this study.

Predictions

The first experimental question is composed of two related parts: a) What resources will second language readers use when reading an authentic text on computer? and b) With what frequency will they use them? Pertaining to what resources will be used by L2 readers, based on top-down and bottom-up processing models, I predict that all resources will be used, but with a tendency for some readers to rely more heavily on certain types of resources based on their level of instructed second language experience and individual reading strategies. Concerning how frequently readers use particular
resources, considering the data that are currently available (Bell & LeBlanc, 2000; Davis & Lyman-Hager, 1997; Laufer & Hill, 2000), I predict that readers will refer to first language translations most often, second language definition next, followed by the visuals (i.e., photos or drawings representing concrete nouns in the text), historical context and literary commentary essays in English, then the historical context and literary commentary essays in Spanish.

With regard to the second experimental question: ‘What role does level of instructed second language experience play in strategy choice?’, I predict that readers will follow one of two types of strategies which result from a combination of top-down and bottom-up processing models along with the linguistic threshold hypothesis. These theoretical models indicate that learners with less instructional experience, such as lower proficiency second language learners, lack skill in identifying vocabulary which will lead them to rely heavily on bottom-up processing strategies. Therefore, in the first possible scenario, readers who rely on bottom-up strategies will seek more aid in the lexical resources (i.e., English definition, Spanish definition, and visual). Likewise, learners with more instructional experience are likely to be higher proficiency readers who are above the linguistic threshold, have more automatic vocabulary recognition skills. In the first possible scenario more experienced learners will rely more on top-down processing strategies and will seek less aid in the lexical resources and more aid in the more global, background, and overview resources (i.e., historical context essay in English, historical context essay in Spanish, literary commentary essay in English, and literary commentary essay in Spanish).

It is also likely that all readers, regardless of their level of experience in Spanish, will begin the reading task with a more basic bottom-up processing strategy until some item or fact in the text activates their background knowledge and consequently the use of the more global top-down strategies. The second scenario posits that precisely because learners with more instructional experience possess more completely formed mental lexicons for the L2 and more automatic vocabulary recognition skills they will find lexical, bottom-up type strategies sufficient for their needs and be able to comprehend the text adequately without need of the more global, top-down type resources. However, learners with less instructional experience could find their initial, bottom-up strategy
insufficient, not comprehend the text adequately, and as a result abandon their default strategy in search of another one that allows them to build a mental model of the text. During this process of strategy shifting, readers might pass through a period in which they use the various types of resources somewhat randomly. Moreover, if the reader does not settle on a new reading strategy that leads to adequate comprehension the random use of comprehension resources might continue indefinitely.

In summary, the topics addressed in this study are the reading strategies employed by second language learners at different levels of language learning experience and the use of computers as tools to see into what the reader is actually doing during the reading process. The problem addressed is one of determining what comprehension aids second language readers use when reading an authentic text on computer and the role that the reader’s level of instructed second language experience plays in their choice of aids. Additionally, at its core, there is the problem of how to gain insight into the reading process.

Likewise, the topics addressed in this study are of importance to both the language learning and the language teaching processes. This study attempts to address every-day concerns of language teaching practitioners concerning reading materials and comprehension aids in a theoretically principled way. It seeks to provide insights into practical issues such as how second language readers approach the task in terms of what comprehension aid resources they use, how and if readers at different levels of language experience differ in their use of resources, and what advantages computer tracking confers on data analysis of reading behavior. The greatest importance of this study is that it takes advantage of technology in a way that allows researchers to capture the reading and resource accessing processes in progress, in real time.
As we consider the reading of authentic second-language texts, reading strategies with regard to comprehension aids, the use of computers as a means of presenting text for reading, and the use of computers as research tools in second language reading, the four research questions posed by the present study are as follows: 1) Given several comprehension aids as resources, a) what resources will second language readers use when reading an authentic text on computer? b) with what frequency will they use them? 2) What role does level of instructed second language experience play in strategy choice? 3) What advantage(s) does the tracking of reading behavior confer on data analysis in second language text processing? 4) What implications do these findings suggest for future studies of text processing and comprehension and for classroom applications?

This chapter presents the theoretical framework underlying the examination of the research questions and examines major constructs which have some bearing on the study in terms of three conceptual categories: 1) what reading is and why reading is difficult, 2) what breaks down when L2 learners read, 3) what can help L2 readers. The first section, addressing the topic of what reading is and why reading is difficult, will consider the foundational theoretical framework of top-down, bottom-up, and interactive processing in reading and the nature of hypertext as constructs associated with the third research question. The second section, addressing the topic of what breaks down when L2 learners read, will take up the differences between skilled and less skilled bilingual readers, the linguistic threshold hypothesis as a principle cause of lack of comprehension in L2 reading, and the principle of least effort as it applies to the readers’ resourcing strategies, which are constructs related to the second research question. The third section, addressing the topic of what can help L2 readers, will consider the issue of reading on paper versus reading on computer, what is known about the Internet and language instruction,
instruction and the use of authentic materials, and the comprehension aids readers use and their resourcing strategies in doing so, which are constructs associated with the first research question. The chapter will close with a consideration of the need for the research which led to the present study.

What Reading is and Why Reading is Difficult

A conceptualization of what reading is and how it takes place is foundational to any attempt to study what people do when they read and what can be done to improve reading comprehension as is proposed by the third research question. Goodman (1972) described reading as a process in which partial information is processed and tentative decisions are either confirmed, rejected, or refined. Goodman views reading as an interaction between thought and language and characterizes the tentative decisions of readers as “guesses” and the act of reading as a “psycholinguistic guessing game.” According to Goodman, and later Hudson (1998), efficient, successful reading is not the result of scrupulous perception and identification of all the items in a text; rather successful readers are those who are adept at selecting the fewest, most productive cues necessary to produce correct guesses the first time. With this conceptualization of reading in hand, we turn our attention to describing in fuller detail the inner workings of this guessing process. One such description is provided by the concepts of top-down, bottom-up, and interactive processing.

Top-down, Bottom-up, and Interactive Processing in Reading

As a guiding theoretical perspective for this study, the concepts of top-down, bottom-up, and interactive processing provide valuable insights for approaching the issue of reading resourcing strategies. These concepts are more often referred to as metaphors for the reading process, rather than as a theory elaborated by a single proponent or group of proponents (Chun & Plass, 1997; Grabe, 1991). These concepts originated within the framework of schema theory (see discussion below of Dual Coding Theory) and are metaphorical corollaries of schema theory, but have grown to be somewhat independent of that framework and are no longer considered dependent on schema theory for their
own validity (Hadley, 2001; Chun & Plass, 1997; Grabe, 1991; Rumelhart, 1980). The terms “top-down” and “bottom-up” are metaphors borrowed from computer terminology (Smith, 1988). Bottom-up processing occurs when the reader pays attention to details, specifically the decoding of individual words and other types of linguistic cues. This process can be succinctly described as identifying an unfamiliar word, to say what it is (Smith, 1988). This type of processing is considered to be data driven and to move the reader’s understanding of a text from the parts to the whole conceptually (Hadley, 2001; Hudson, 1998; Rumelhart, 1980; Singhal, 1997). Essentially, the bottom-up metaphor, as described by Hudson (1998), posits that readers construct a mental model of a text’s meaning starting with the letters and words, then phrases, clauses and sentences, sequentially processing the text and building meaning in a linear manner. Or, as Smith (1988) described it, the text is in charge and the letters on the page dictate the reader’s responses.

Top-down processing occurs when the reader makes predictions based on existing background knowledge and then goes about searching the text to fill in the anticipated specifics of the situation. This type of processing is considered to be conceptually driven and to move the reader’s understanding from the whole of the concept to the parts of the particular case discussed in a specific text (Hadley, 2001; Rumelhart, 1980; Singhal, 1997). In short, according to the top-down metaphor, the reader approaches a text with preexisting knowledge and conceptualizations, which are considered “background knowledge,” and through an encounter with the text builds a mental model of its meaning by working downward. A reader’s background knowledge may include topic-specific knowledge, general knowledge of the world, abstract conceptual knowledge, or a combination thereof (Barnett, 1989; Bernhardt, 2000; Chun & Plass, 1997; Goodman, 1972; Laufer, 1997).

Grabe (1991) pointed out that the term “interactive processing” has developed two distinct meanings. The first meaning refers to the construction of a new version of the text from a combination of the building blocks provided by the reader and the text. The new text is a result of the interaction which takes place between the reader and the written page. The second meaning of interactive processing is the interaction of lower-level processing skills (i.e., word identification and decoding) and higher-level
comprehension skills (i.e., interpretation, inferencing, and general knowledge associations) through background knowledge as they occur simultaneously to construct the reader’s understanding of the text (Chun & Plass, 1997; Grabe, 1991). The second meaning is the more widely accepted use of the term. Indeed, schema theorists have pointed out that bottom-up processing and top-down processing occur at the same time (Hadley, 2001). A continuing issue is the matter of whether one or the other of these sets of processes is more important in the achievement of fluent reading. We now turn to a discussion of the three types of processes and their necessity to successful reading comprehension.

Certain scholars argue that reading is not at all a matter of word identification. They see top-down processes as preeminent in the reading process and assert that readers can go straight into building a mental model of a text’s meaning by means of top-down skills such as prediction (Goodman, 1972; Smith, 1988). Conversely, lack of successful top-down processing strategies leads to dictionary dependency and word-for-word reading, which in turn discourage self-reliance when reading second language texts and discourage reading for pleasure in an L2 (Swaffar, Arens & Byrnes, 1991). Discussing readers’ failure to comprehend a text from a schema theoretic perspective, Rumelhart (1980) suggested that a primary cause of failure is readers’ lack of appropriate background knowledge to understand the idea being communicated. Without adequate background knowledge, the reader has no way of comprehending the concept about which he or she is reading, even if every word of the text is familiar.

Like top-down processes, bottom-up decoding processes are also essential to the comprehension of text. A number of scholars see the lexicon as playing a principal role in language decoding and lexical identification skills as paramount in reading comprehension, which is more strongly related to vocabulary knowledge than to any other component of reading (Chun & Plass, 1997; Gettys, Imohof, & Kautz, 2001; Laufer, 1997). A clue as to the importance of bottom-up processing comes from eye movement research which shows that readers notice most of the words on a page and efficient readers can identify the great majority of words automatically. The link between efficient bottom-up processing and lexical knowledge is so strong that most words are recognized before higher-level information can be utilized to influence the lexical
identification process (Chun & Plass, 1997). Essentially, if a reader has a large vocabulary on which to draw, word sampling and identification becomes rapid and efficient. However, in the absence of a sufficiently large vocabulary, as is the case for most L2 readers, the reader will frequently appear to be word-bound. According to Grabe (1991) L2 readers become word-bound because they are not efficient in bottom-up processing skills and there is no amount of guessing that can overcome this deficiency.

Thus, it is desirable to have a high level of proficiency in each set of reading processes. This high level of proficiency is often described in terms of “automaticity” and “automatic processing” (Grabe, 1991; Spiro, 1980; Swaffar et al., 1991). A low degree of automaticity in the execution of either set of processes during reading can result in inadequate comprehension of the text. Several researchers point out the need for bottom-up processes to become automatic (Chun & Plass, 1997; Ganderton, 1998; Grabe, 1991; Laufer, 1997). A low level of proficiency in bottom-up processes results in memory overload, slower comprehension, and less memory available to allocate to other context factors (Swaffar et al., 1991). However, top-down processes can also be automatic. Spiro (1980) asserted that, for adult readers, top-down processes, and specifically the generation of inferences, are both essential and automatic. Thus, while less skilled readers may become impeded by too heavy a reliance on one set of processes or the other, likewise, both sets of processes can become automatized.

A number of scholars have concluded that, in reality, interaction between the two sets of processes is necessary for successful reading to take place, and that failure to maintain efficient interactive processes without a bias toward one or the other is a common cause of break down in L2 reading (Ganderton, 1998; Grabe, 1991; Swaffar et al., 1991). Taking into consideration the fact that an interaction between both sets of processes is essential, less skilled readers may become impeded by too heavy a reliance on one set of processes or the other and the efficient interaction between the two types of processes is reduced, resulting in poor reading comprehension. A pattern of reliance on one set of processes more heavily than the other is predictable because L2 readers tend to adopt a reading strategy that focuses on bottom-up processes such as word identification, while more proficient readers adopt strategies that give more attention to more abstract top-down processes such as the generation of inferences and general knowledge.
associations and make better use of background knowledge (Chun & Plass, 1997). An over-reliance on top-down processes can lead the reader to fill in details which are not stated in the text, to make unwarranted inferences, and to miss relevant cues in the text (Hadley, 2001; Swaffar et al., 1991). Conversely, an over-reliance on bottom-up processes can inhibit inferential thinking and lead the reader to focus on the decoding of individual words, becoming text-bound (Hadley, 2001; Swaffar et al., 1991). The general inability to employ top-down processes while reading in a second language is one of the major distinctions between first language (L1) and second language (L2) reading. A critical difference in the reading of texts in L1 versus texts in L2 is that L1 readers focus much of their attention on higher level, top-down processes, more so than L2 readers, who pay more attention to lower level, bottom-up processes (Chun & Plass, 1997; Horiba, 1996).

Along with a sufficiently large L2 vocabulary, reading ability in one’s L1 also is known to be a primary factor in successful second language reading (Alderson, 1984, Bernhardt, 2000, Bernhardt & Kamil, 1995, Chun & Plass, 1997). Therefore, attention has turned to the issue of determining how much of a contribution each of these factors make toward successful reading. Efforts to quantify the influences that bear upon second language reading, based largely on the work of Bernhardt and Kamil, have produced the following distribution of factors: general literacy ability accounts for approximately 20% of any given reading comprehension measure; grammar accounts for approximately 30% of any given measure (the category of grammar is further broken down so that 27% is word knowledge, 3% is syntax); and approximately 50% remains still unexplained (Bernhardt, 2000). The finding that word knowledge (e.g., vocabulary) contributes approximately 27% of a reader’s ability to comprehend a second language text is strong support for the argument that lack of second language vocabulary is the greatest deterrent to L2 reading comprehension (Chun & Plass, 1997; Gettys et al., 2001; Laufer, 1997). However, this finding does not obviate others that show that it is also necessary for L2 learners to attain a high level of proficiency in both the top-down set of processes and the bottom-up set (i.e., efficient at interactive processing) in order to be successful readers.

Visuals such as drawings and photographs are effective as comprehension aids according to concepts posited by dual coding theory. Dual coding theory, as proposed by
Paivio (1971, 1983), is a conceptual model for both memory and comprehension. Sadoski, Paivio, and Goetz (1991) proposed dual coding theory as an improvement to schema theory. Schema theory, which is also the conceptual origin of the top-down and bottom-up metaphors, held sway for some time as an overarching theory of the representation of meaning in memory (Kearsley, 1999). Since dual coding theory grew out of schema theory, in order to describe it properly we must first elucidate the concept of schema (plural: schemas). The concept of schemas, on which schema theory is based, dates back to Immanuel Kant, with a more recent application in the field of psychology by Bartlett, and by Rumelhart and Ortony (Rumelhart, 1980). A schema is a structure for representing the information associated with generic concepts stored in memory; it contains the network of interrelations that exists among the constituent pieces of a given concept. Schemas are employed in the process of interpreting all incoming sensory data and in retrieving information from memory among other functions (Rumelhart, 1980). Comprehension is viewed as the activation of various schemas which relate to an object, word, or action that has been perceived.

Sadoski, Paivio, and Goetz (1991) criticized schema theory as an incomplete construct for understanding knowledge structures, comprehension, and learning. They credit schema theory for making two contributions to reading research: 1) the constructive nature of comprehension and 2) the crucial role of the readers’ prior knowledge in that construction. Nevertheless, Sadoski et al. critique the suggested encoding and abstraction processes posited by schema theories as excessively reducing the amount of information stored in memory. Therefore schema theories are unable to account for certain phenomena often observed in memory research such as the plentiful and accurate detail of complex episodes and events (Sadoski et al., 1991). They go on to propose dual coding theory as an alternative. Dual coding theory holds that cognition consists of the activity of two separate but highly interconnected subsystems. One subsystem is specialized for the representation and processing of information concerning nonverbal objects and events, while the other subsystem deals with language. These two systems can function either independently, in parallel, or in an integrated manner. Stimuli are sorted by an individual’s sensory system as either verbal or nonverbal in nature. The verbal system contains structures called logogens arranged in sequential, syntactic
hierarchies. The nonverbal system is considered to have a holistic, nested organization to its structures, which are called *imagens* or *iconogens*. As stimuli enter the sensory system, they are recognized as belonging to one class or another. For example, a written or spoken word would be recognized as a logogen, while an odor or a visual image would be recognized as an iconogen (a.k.a. imagen). When the characteristics of a perceived stimulus sufficiently match those of an existing logogen or imagen in one’s memory, the thing is recognized, which in turn allows for access to further semantic, phonemic and/or pictorial information that is associated with it (Bleasdale, 1983).

One key feature of the theory is that it posits three types of processes inherent in meaning: representational, referential, and associative. These processes are similar to the concept of spreading activation in connectionism in general and specifically in traditional schema theory. The primary departure from schema theory is that memories (i.e. schemas) are theorized to be stored in two separate collections, those dealing with verbal representations such as language, and those dealing with non-verbal, iconic, representations such as images. Representational processing occurs through the direct activation of either verbal or non-verbal representations by the sensory system. The concept of spreading activation, commonly associated with connectionism and inherent to schema theory, is also broken down into two types of processes in dual coding theory. Referential processing is the activation of the verbal system by the nonverbal system or vice-versa. Associative processing is the activation of representations within the same system (Kearsley, 1999). Consequently, perceiving the written word dog may, through associative processing from one schema to another, activate another word such as cat, and through referential processing across representational systems, it may activate the image of a specific dog in one’s past experience, or it may simultaneously activate both of these and many other associated words and images.

Among these three processes, the most significant is the inclusion of referential connections that provide for the interconnectedness of the two subsystems. Because of the interconnectedness of dual coded memory through referential processing, upon introduction to one subsystem, crossover may occur to produce a referent in the other, so that words (either written or verbal) may be assigned an image in the iconic memory system and pictures (or any object, drawing, or image) may be assigned a name in the
verbal memory system (Bleasdale, 1983). Thus, as associated schemas are activated in one memory system and then the other, they complement each other so as to cause the activation of even more schemas throughout both systems, verbal and non-verbal, simultaneously. The interconnectedness of the two subsystems is of interest because it has heuristic power to explain the advantages that ancillary aids, particularly visuals, provide for reading comprehension. The findings of research done with pictures, picture naming, and words, suggest that the two subsystems have an additive effect on recall. In fact, the additive value of a picture (or image) which has been encoded by the cognitive system is approximately twice that of encoded verbal information (Paivio & Lambert, 1981). Consequently, activation of a schema via the perception of an image has been found to strengthen the presence of the concept in memory so as to double one’s ability to recall it at a later time as compared to a purely verbal activation of the same concept. This additive effect on recall suggests that a reading passage which is accompanied by a rich array of contextualizing ancillaries and especially visuals should provoke superior comprehension by the reader. In the present study, since comprehension is not assessed directly, dual coding theory serves as a rationale for the inclusion of visuals and an explanation of their use by participants.

Because of the ability to present a seamless mixture of media such as text and visuals, along with other advantages to be discussed later, the text used in this study was presented via computer in hypertext format. However, the use of hypertext itself may be considered a different type of reading or even a factor in making reading more difficult rather than less difficult. I will now briefly discuss the nature of hypertext and its advantages and disadvantages for the reader.

The Nature of Hypertext

Much of the recent research in the field of computer assisted language learning (CALL) reading focuses on the interaction between reading strategies and text presented via computer, a format that can be called a “computer-mediated text” (Reinking, 1987). Specifically, investigation has focused heavily on the phenomenon of “hypertext” and the nature of reading in a nonlinear fashion. This research is pertinent to the issue of what reading is and why it is difficult because the first and third research questions introduce
the construct of reading a computer-mediated L2 text. Presenting a reading text in a type
of hypertext format affords two advantages. With regards to the first research question, it
provides increased ease of access to the comprehension resources on the part of the
reader, and with regards to the third research question it allows for the tracking of the
reader’s movements through various portions of the text and associated comprehension
resources.

A true hypertext is generally considered to be a text that is presented in a manner
that offers the reader various options for viewing its components in a nonlinear, random,
or personalized order. Because multiple related sections of the text are connected to each
other, a reader may browse through the parts of a text, jumping from one section to
another (Foltz, 1993). Ganderton (1998) saw the crucial difference between reading of
printed text and true hypertext as the nonlinear nature of hypertext which contrasts to the
sequential nature of print media and allows the reader to choose his or her own route
through the hypertext material. A common example of hypertext is the format of many
web sites found on the Internet’s World Wide Web component. Although the content of
some Web pages is more fragmented and others offer more of a singular whole, by virtue
of being connected to other pages which are in turn connected to still others, every Web
page constitutes a type of hypertext, if not hypertext in its purest form.

Computer-based hypertexts have been compared to encyclopedias in that the text
is arranged in chunks or nodes (McHoul & Roe, 1996). Nonlinear reading is likened to
reading an encyclopedia thematically or reading a printed passage that is accompanied by
various figures, diagrams, and photos. The reader must leave the text itself in order to
focus on the ancillary materials and then return to the same location in the reading.
Computer technology has only increased the nonlinear possibilities, which were already
present to some degree in printed materials such as encyclopedias (Foltz, 1993). While
McHoul and Roe (1996) found nothing new in computerized hypertexts, other scholars
such as Foltz (1993) and Feustle (1997) considered them to be revolutionary. Feustle
states: “Hypertext is a technology that uses a logical device, a computer, for an illogical
end: not for analysis but for analogy. Its view of things is essentially poetic and irrational
and when combined with the ever-growing presence of CD-ROM and network
technology, hypertext will bring about fundamental changes in the teaching of literature as we move into the next century” (p. 216).

Rouet and Levonen (1996) focused on the issue of linearity versus nonlinearity when reading hypertext material and argue that the major drawback is reader disorientation. Rouet and Levonen review five studies on reading in hypertext (Foss, 1989; Gray, 1990; McKnight, Dillon & Richardson, 1990; Rouet, 1990; Wright, 1991) and conclude that “looping” (that is, going back to the same unit of the material several times) and “jumping” (that is, not viewing units in an order based on the relations between them) were common problems even in very simple hypertexts. Because of the disorientation factor, they propose that authors of hypertext documents provide structure, provide coherence, and gain expertise in the modality. In contrast, disorientation was not a factor for readers in the study conducted by Foltz (1993). Foltz found that all participants in his study tried to maintain a coherent path through the reading material producing equivalent reading times and comprehension in three text formats (i.e. linear text, hypertext, and coherent hypertext).

In summary, because of the disconnected nature of texts presented in a hypertext format, researchers such as Rouet and Levonen (1996) have found that some readers experience a potentially crippling disorientation due to their looping and jumping among the parts of the text. Consequently, they have recommended that authors using this modality pay special attention to structure and coherence. Foltz (1993), in turn, found that a coherent hypertext document is practicable and that reading times and comprehension are not adversely affected. The weight of the evidence suggests that while the presentation of reading materials in a hypertext format has the potential to contribute to a break down in comprehension, it does not necessarily do so, especially if there is a clear structure to the materials which makes them a unified, coherent text.
What Breaks Down When L2 Learners Read

Differences Between Skilled and Less Skilled Bilingual Readers

Because the construct of language experience level essentially deals with a matter of relative skill at various stages of the language learning process, a general description of the characteristics of skilled and less skilled readers is foundational to the development of an explanation of L2 readers’ strategies vis-à-vis comprehension resources as posed in the second research question. Perfetti (1994) maintained that reading is a type of structure building process in which the reader goes about laying the foundation for comprehension in response to the early portions of a text, then builds on that initial understanding of the text’s meaning by mapping subsequent information onto this foundation. Thus, reading is essentially the process of building a mental model within the mind of the reader. Perfetti considers a failure to construct a meaningful mental model of a text as a defining characteristic of less skilled comprehenders.

Jiménez, García, and Pearson (1995) set out to describe and understand the reading processes of good and poor bilingual latino readers, particularly bilingual children. They closely observed a proficient, bilingual reader, a marginally proficient bilingual reader and a proficient monolingual reader, all three of whom were students in the sixth grade. Four trends were identified as characteristic of the proficient bilingual reader. The first trend was logocentricity. As an example of logocentricity, researchers identified searching for cognates as a specific strategy. The second trend was concern with meaning construction. Within this feature, Jiménez et al. identified three specific strategies employed by the proficient bilingual reader: 1) she stopped and monitored her current level of understanding, 2) she tried to summarize what she knew about the text, and 3) she showed a willingness to make inferences. The third trend was awareness of relationships between Spanish and English. The final trend was a multistrategic approach to reading. This characteristic of the proficient bilingual reader indicated that she did not rely on a single strategy or even on one strategy at a time, but one strategy led to the use of others until each hindrance to comprehension was solved.

By contrast, although the less proficient bilingual reader used a variety of strategies, including restating the text, focusing on vocabulary, monitoring, and
questioning, using one strategy did not lead to the use of other strategies. For the proficient bilingual reader, vocabulary was a bridge to understanding. She thought of reading in terms of a process of learning word meanings to enable comprehension. Conversely, vocabulary represented a barrier to comprehension for the less proficient bilingual reader, who demonstrated a goal of finishing the reading. Along the way to reaching the end of the text, she was able to identify but not repair her own comprehension problems.

Jiménez, García, and Pearson’s 1995 study was a part of a larger project involving fourteen sixth- and seventh-graders that focused on the identification of the reading strategies of successful Latino readers and the differences between the strategies of successful and less successful Latino readers. The results of this larger study were similar to the findings of the 1995 study, outlined above. The successful bilingual Latino readers differed from the unsuccessful ones in a number of ways as well. Although all participants received the same instructions and prompted during the think-aloud procedures, the less successful readers still seemed to consider finishing the reading task as more important than comprehension. The successful readers were determined to understand what they read, while the less successful ones could identify the problems which arose during reading but did not frequently resolve them. The less successful readers tended to adopt a single interpretation of the meaning of a text even when contradictory information was present. Likewise, they would try to force later information to fit the earlier, erroneous interpretations. Even when the less successful readers invoked prior knowledge, they were likely to employ irrelevant prior knowledge in an attempt to comprehend a text. These observations are corroborated by those of Auerbach and Paxton (1997) who found that reader’s conceptions of the reading task show a relationship with their reading strategies. The bulk of the evidence suggests that a focus on bottom-up reading processes such as lexical decoding is not in itself a negative for bilingual readers. Furthermore, a key component in successful reading for bilinguals is a determination to comprehend the text at hand rather than merely make one’s way through it with reaching the end of the text as the primary goal in spite of erroneous understandings along the way.
Two theoretical constructs provide additional detail for explaining the behaviors of both skilled and less skilled readers. These are the linguistic threshold hypothesis, which posits a principle cause of poor L2 reading comprehension, and the principle of least effort, which has heuristic value in describing readers’ resourcing strategies.

The Linguistic Threshold Hypothesis

An explanation for the breakdown of comprehension that typifies less skilled L2 readers is provided by the linguistic threshold hypothesis (Alderson, 1984; Bernhardt & Kamil, 1995; Clarke, 1980; Laufer, 1997). The linguistic threshold hypothesis, formerly known as the short circuit hypothesis, posits that in order to successfully read in an L2, a specific minimal level of L2 linguistic ability must already be achieved (Bernhardt & Kamil, 1995). Alderson (1984) argued that reaching some threshold appears to be necessary before other abilities, such as one’s first-language reading ability, can be utilized in the task of L2 reading. That threshold for reading comprehension is, to a large extent, lexical. (Laufer, 1997). It seems that low proficiency in L2 reading is both a reading problem and a language problem (Bernhardt & Kamil, 1995; Laufer, 1997). Even though reading ability in one’s L1 is known to be a primary factor in successful second language reading (Alderson, 1984, Bernhardt, 2000, Bernhardt & Kamil, 1995, Chun & Plass, 1997), good L1 reading skills often do not help readers compensate when reading in an L2 because a lack of L2 grammatical/linguistic knowledge ultimately short-circuits the L1 reading knowledge. Thus, a certain amount of L2 grammatical/linguistic knowledge is necessary in order to get L1 reading knowledge to engage.

Nagy and Herman (1987) postulated that there is an interconnectedness between lexical knowledge and global knowledge such that a person who knows more words knows more about the world in general, a fact that facilitates efficient interactive processing skills. However, an insufficient vocabulary can prevent bottom-up processing from becoming automatic and cause the reader to fixate on word-by-word decoding. On the other hand, if the reader is able to build an adequate mental model of the text through the application of a bottom-up strategy there is not a high degree of motivation for the reader who is successfully constructing a mental model of a text using a lexically driven reading strategy to abandon that strategy (even briefly if there is a time constraint placed
on the reading activity) in order to seek broader, more generalized knowledge. The linguistic threshold hypothesis posits that those readers with weak vocabularies below a certain threshold will experience a breakdown in bottom-up processes such as word sampling and decoding, will not be able to apply first language reading strategies, will not be able to apply top-down reading processes such as background knowledge, and will ultimately not construct a mental model of the text. However, the heuristic power of the linguistic threshold hypothesis to describe reading strategies is two-sided. First, those readers who are unsuccessful because of a weak vocabulary may reach out, out of a sense of desperation, and take advantage of any other comprehension aid available. Second, those who have a strong vocabulary and have well automated bottom-up processes may find a word-based strategy and their own background knowledge sufficient to build a mental model of the text and not be willing to lose time by consulting non-lexical comprehension aids.

The Principle of Least Effort

An insight into the behavior of all readers’ resourcing strategies, both skilled and less skilled, is provided by the principle of least effort, alternately called least effort principle. The principle of least effort is a refinement of the related, but relatively dissimilar, least action principle, and was first articulated by George Zipf (1949). The principle of least effort has been recognized more recently because of its application to the production of spoken language, especially language produced during a conversation (Clark, 1992; Wilkes-Gibbs & Clark, 1992). In the context of verbal conversations it is best illustrated by the economy of words demonstrated by speakers, such as applying names to objects, for example “the Allen wrench” as opposed to a more lengthy description such as “the small metal thing shaped like an L” (Wilkes-Gibbs & Clark, p. 183). Thus, in principle, in a conversation the two partners use the least total effort possible to communicate. In other words, they do not use any more total effort than is necessary. One of the factors identified as a cause of this use of least effort is time pressure (Clark, 1992). Zipf (1949) defined the principle of least effort in general, non-language specific terms:
…a person in solving his immediate problems will view these against the background of his probable future problems, as estimated by himself. Moreover he will strive to solve his problems in such a way as to minimize the total work that he must expend in solving both his immediate problems and his probable future problems. That in turn means that the person will strive to minimize the probable average rate of his work-expenditure (over time) [italics original]. (p. 1)

It is important to note that this does not imply that an individual will not temporarily work more than is absolutely required. In Zipf’s terms, least effort is considered to be equal to the least average rate of probable work. The principle of least effort must be considered in terms of the least average rate of probable work because, in some cases, by expending more work than necessary today one may save a greater amount of work tomorrow. Stated succinctly, “it is the person’s average rate of work-expenditure over time that is minimized in his behavior, and not just his work-expenditure at any moment or in any one isolated problem, without reference to his future problems” [italics original] (p. 6). Zipf further identified three types of effort which a person seeks to minimize as those of distance, time, and work. The principle of least effort applies to reading in that if a time constraint is imposed on the reader he or she might not necessarily perceive a savings of present or future work by taking on the additional task of reading an additional text, such as a comprehension aid, which is clearly ancillary to the main text. In fact, there may be a type of “Catch 22” effect at work in that the reader cannot adequately determine whether expending the additional work to read a given ancillary resource will actually save future work until after reading such a resource. Therefore, the principle of least effort postulates that the reader will only consult an ancillary resource if he or she feels that it is absolutely necessary and will save time in the long-run. A possible exception would be in the case that an abundance of time permitted to complete task allows for the luxury of satisfying a mere curiosity about the ancillary resource.

**What Can Help L2 Readers**

Having considered what reading is and why it is difficult and what breaks down when L2 learners read, we now consider the topic of what can help L2 readers to achieve
better comprehension. The first research question is concerned with the strategies that readers use to help themselves build a reliable mental model of the text at hand.

**Paper Versus Computer**

The first research question introduces the construct of computer-mediated reading. The computer is employed because of its ability to display images and text in an integrated fashion and, most importantly, because of its ability to record the movements of readers as they view the contents of a large number of pages of text, or even among various texts.

In order to adequately justify taking advantage of the computer’s unique ability to track readers’ movements among various pages of text, it must first be demonstrated that there is no qualitative loss dealt to the reading experience by virtue of presenting texts via computer; at least that there is no loss which would be great enough to impede the readers’ comprehension. If it is the case that the medium of presentation of text does not carry with it a qualitative loss in the reading experience, then the computer can be used as a tool to observe that process with the confidence that reading a text presented via computer is essentially the same as reading a printed page. Computers are able to perform many of the functions of various paper media such as books, newspapers, spreadsheets, maps, etc. These media taken collectively can be considered “paper” for purposes of comparison (Dillon, 1994; Rice, 1990).

The question of paper versus computer is part of the larger issue of efficacy. As noted above, one might wonder how something new differs from its predecessors. However, questions of efficacy involving broad methodologies and technologies are always filled with pitfalls for educators and theoreticians alike. Garrett (1991), concerned with the issue of efficacy, questioned whether using technology actually facilitates language teaching and learning. However, impediments to determining the effectiveness of new technologies abound. Garret considered it impossible to design a study which would be both valid and practicable that would compare the language learning of two groups of randomly chosen students, one group using the computer and the other not. Rather than focus on the, in her view, unanswerable question of “Does it work?”, she
suggests that we need to break down the issue of efficacy into a set of questions about smaller, more manageable research variables.

Concerning the issue of the medium of presentation for a reading text (computer versus paper) the work of Dillon (1994) and Rice (1990) exemplifies current understanding. In a comprehensive review of studies undertaken in various research fields that study electronic text, Dillon (1994) identified certain outcome measures such as reading speed, reading accuracy, fatigue, and comprehension that constitute an understanding of the paper versus computer question. As to the issue of reading comprehension, Dillon concludes that comprehension is not negatively affected by presentation medium and may even be improved under some circumstances.

Rice (1990) addressed reading comprehension under two text presentation modes (i.e. paper versus computer) as well as reading comprehension using highlighting as an on-line measure of a study skill. Although Rice found mixed results, on the critical issue of comprehension, there was no significant effect based on the mode of presentation. Furthermore, he is in line with the opinion of Blake (1992), who considered reading print and reading computer-mediated text to involve roughly equivalent cognitive processes, and finds no particular advantage or disadvantage to either medium. Therefore, in light of the fact that Dillon’s (1994) metareview of studies found that reading comprehension is not negatively impacted and may actually be improved by the medium of the computer, it is reasonable to conclude that the use of the computer as a research tool will not bring unwanted detrimental effects to the reading process. By using the computer as a research tool we are able to exploit two significant advantages which the computer provides. First, a computer mediated text allows the reader to access comprehension aids with greater ease. Second, computer mediated tracking allows the researcher to unobtrusively observe readers’ activities during the actual reading process.

**The Internet and Language Instruction**

The use of the computer envisioned in the first research question is most similar in format to reading texts on the Internet. With regard to the first research question, the Internet is seen as both a source of authentic L2 reading materials and, more importantly,
as a tool for language instruction. Therefore, we will briefly consider the construct of the Internet as a tool in language instruction.

Several studies have reported positive findings for the use of Internet technologies as a means of carrying out various functions. Lee (1997) found that using the Internet to mediate communication between students via e-mail increased students’ interest and motivation for learning a second culture and a second language. Ganderton (1998) cited three specific advantages of the Web for L2 teaching: 1) increased access to authentic language documents, 2) enhanced learning opportunities for language and cultural knowledge, and 3) increased learner motivation. Osuna and Meskill (1998) reported several encouraging statistical findings concerning World Wide Web activities used by college students enrolled in the first quarter of Elementary Spanish, including that 88% felt that the activities had increased their knowledge of Spanish language and culture, and that 77% felt that they had made gains in language learning apart from culture. In the affective realm, 85% reported an enjoyment of the Internet activities.

Although many educators tend to view language, literature, and culture as separate issues, some scholars question that separation and see a potential benefit in Internet technology for their integration. Garrett (1991) saw a possible solution to the difficulties many learners experience in making the transition from reading texts written for pedagogical purposes to reading authentic texts. The solution to making this a smooth transition is found in the form of computer-based interactive technologies that allow language instructors to select authentic materials of various kinds, support them based on learners’ needs, and thus better support the L2 reader while he gains reading expertise.

In summary, the usefulness of the Web for language learning in general has been demonstrated by Lee (1997) and Osuna and Meskill (1998). Garrett (1991) noted its potential for helping to alleviate a felt weakness in L2 reading instruction, especially by allowing for more customization of individualized strategies.

**Instruction and the Use of Authentic Materials**

Because the first research question broaches the construct of authentic L2 materials as opposed to pedagogically adapted materials, it is necessary to define further what constitutes authentic materials and their possible roles in the language acquisition
process and in applications for language instruction. In the area of materials development alone, the Web represents a proliferation of primary resources and authentic materials. In developing materials that deal with the Web, it is not so much a question of what one is limited to; rather it is a question of finding the authentic material one wants. The activity itself can then be composed in such a way so as to make the most of those authentic materials for the level of learner in question (Hadley, 2001; Hemard, 1997; Rogers & Medley, 1988). This approach stands in contrast to the more traditional method of creating simplified materials for educational purposes (Yano, Long & Ross, 1994). However, there is a clear and easily applicable principle involving the use of authentic materials in second language instruction as articulated by Furstenberg (1997): it is the tasks, rather than the materials, that are used in instruction that need to be tailored to learners’ various levels of L2 ability.

Definitions of “authentic” are quite varied. There is a general division into two classes of materials: simulated authentic discourse and unmodified authentic discourse. Simulated authentic discourse is language produced for a pedagogical purpose, that exhibits features which have a high probability of occurring in actual acts of communication such as the naturalness of form, and an appropriateness of context as in the language of native speakers (Geddes & White, 1978; Rogers & Medley, 1988). Unmodified authentic discourse is oral or written language which was originally written or spoken for a non-pedagogical purpose and which is created by native speakers and for native speakers of a language as a genuine act of communication aiming to convey information or entertain (Bacon, 1992; Geddes & White, 1978; Paramskas, 1983; Rogers & Medley, 1988). Further classifications are proposed by Rings (1986) who suggested a sixteen-level authenticity ranking for types of unplanned conversations and Joiner (1984) who suggested the classification of written texts into three tiers: “authentic” (unaltered either linguistically or culturally), “contrived” (designed to include specific structures, and vocabulary for a pedagogical purpose), and “controlled” (an authentic text that is simplified in order to make it more manageable for L2 readers). However, in most discussions of research or instructional practices when putting aside contrived materials and focusing on authentic materials in isolation, it is sufficient to classify materials into either simulated or unmodified authentic discourse. Of these two types, it is unmodified
authentic discourse that most language teaching practitioners envision when thinking of “authentic materials” and likewise the definition of “authentic” which is referenced in the first research question. Examples of materials in this category are: video, audio, realia, short stories, fables, fairy tales, newspaper and magazine articles, television and radio broadcasts, advertisements, pop songs, record jackets, labels, statistics, correspondence, flyers, brochures, interviews, etc. (Osuna & Meskill, 1998; Zeller & Melvin, 1984).

The pedagogical use of authentic materials, as opposed to artificially created, contrived materials, has been an area of interest for both practitioners and researchers. This was not always the case, but in recent years, language teaching has seen a substantial increase in the use of authentic texts (Young, 1993). This increase seems to be the result of a growing disenchantment with pedagogically produced and simplified authentic texts which seem to not offer the reader sufficient preparation for the “real world” and the uncontrolled situations that exist outside the classroom (Bernhardt, 1991; Geddes and White, 1978). Authentic texts are considered to be more culturally rich, more interesting, and more redundant along with having a higher number of other natural cues. Authentic texts are also more likely to reflect the complexities of language. They are more ecologically valid (in a foreign country one would have to cope with such texts from the day of arrival) and more appealing to an instinctive desire for what is real (Joiner, 1984). Joiner (1984) offered an insightful example of misguided simplification from a language teacher’s perspective:

If, for example, I take a menu from a French restaurant and decide to adapt it for the classroom, I may with the very best of intentions, leave out something of potential importance to the students. I may decide, for example, to delete the word coca-cola under boissons, thinking that there is no use to expose the student to a word he already knows. In the real world, however, the traveler who sees coca-cola [sic] listed under a heading, may use that information to make intelligent guesses as to what the other words under that same heading might be. Orangina should not be hard to figure out if one has coca-cola to use as a clue. [underlining original] (pp. 8-9)

Joiner’s example is particularly poignant because it clearly demonstrates one of the natural cues that authentic texts may provide, grouping. When confronted with a menu,
the reader expects to use the skill of looking for groupings of similar items as a clue to
the meaning of an unknown member of the set. The example demonstrates that removing
that cue from the text complicates rather than simplifies. Since the 1980s numerous other
scholars have offered a rationale for, or advised using, authentic texts over pedagogically
adapted or simplified ones (Bernhardt, 1991; García, 1991; Hadley, 2001; Hemard, 1997;
Lee, 1997; Rogers & Medley, 1988; Zeller & Melvin, 1984).

The work of three researchers, Bedi (1995), Mainenti (1997), and Young (1993,
1997), provides empirical support for the use of authentic texts as reading materials. In
each case authentic materials were preferred by readers, rendered superior results on
proficiency or comprehension measures, or both. Two studies, Bedi (1995), and Young
(1997), found increased comprehension when using authentic materials. However,
although Bedi’s findings are of interest as anecdotal evidence, they lack the rigor of
design and quantitative measurement necessary to generalize from them. Mainnenti
(1997) and Young (1993) found both a preference for authentic materials over
pedagogically developed ones and superior results on proficiency or comprehension
measures.

The Comprehension Aids Readers Use and their Resourcing Strategies

A key construct that is raised in the first research question is that of the use and
usefulness of comprehension aids to L2 readers. The concept is further expanded in the
second research question to include the strategies involved in readers’ choice of
comprehension aids (i.e., readers’ resourcing strategies). Second language readers often
consult a number of resources as they attempt to understand texts as varied as a literary
work and a newspaper article. Aids that are external to a text are of value in
understanding features such as its lexicon, historical context, literary genre, linguistic
style, syntax, themes, and intertextual connections. Language educators have also been
interested in the power of the computer to put many resources at a user’s disposal, and
the objective of consolidating many resources into one convenient tool has begun to be a
reality. Given parallel versions of a given text, it is this integrated package of resources
and media that separates a hypertext edition from all others by offering the reader a
multiplicity and combination of aids, immediacy of access, and an absence of
interruptions while being unobtrusive and allowing the reader to obtain as much or as little detail about a specific topic as is desired (Al-Seghayer, 2001; Davis, 1989; Feustle, 1997).

Like authors and publishers, researchers have taken note of the potential of these resources that are available to language learners. They have begun to ask questions about what strategies second-language readers might employ when given a virtual menu of helps to aid them through the reading process, as distinct from more cognitively based learning strategies these behaviors are labeled “resourcing strategies” (Liou, 1996). Because the following studies focus on issues similar to those addressed in the first and second research questions, I will review them with more detail and more critically than those cited previously.

An area of interest to a number of researchers is the acquisition of new vocabulary through reading. Two studies are of interest here primarily because of their findings which pertain to the legitimacy of asking the first and second research questions and secondarily because of their methodologies. Laufer and Hill (2000) addressed the issue of incidental vocabulary learning. Participants in the study read a 120-word, English-language essay, which was presented via computer. Glosses were provided for a total of twelve words, 0.1% of the total words, as determined through a pilot test. Laufer and Hill found no relationship between the number of lookups and retention. Kost, Foss, and Lenzini (1999) investigated the effect of two types of glosses, pictorial and textual, on vocabulary learning using a text that was 272 words in length; of those, twenty target words were identified and glossed, which constituted 7.35% of total words in the text. Marginal glosses appeared in three formats: English translation (textual), pictures (pictorial), and combined English translation and pictures in the gloss. Kost et al. found clear evidence for the superiority of glosses containing both text and pictures in both a picture and a word recognition task. Furthermore, it seems that marginal glosses facilitate L2 readers’ vocabulary development. A likely weakness of the study was that the text’s difficulty level was assumed, and assumed to be slightly higher than the subjects’ L2 proficiency, probably from the target level of the reader in which it was published although this is not stated by the researchers and not measured by any objective means. The findings of Kost et al. are in line with the dual coding theory of memory and learning.
(Bleasdale, 1983; Paivio, 1971; Paivio, 1983); however, it is unclear what theoretical perspective informed their research. In summary, with regards to resourcing strategies and vocabulary acquisition, L2 vocabulary is best learned through a combination of pictorial and textual glosses (Kost et al., 1999). Nevertheless, the empirical evidence to date shows that there is not a relationship between the number of lookups and retention of lexical items (Laufer & Hill, 2000) or, at best, that computerized glosses to be no better or worse than traditional paper-printed glosses at enhancing vocabulary acquisition (Bowles, 2004), and so the use of lexical comprehension aids does not provide the benefit of teaching new vocabulary effectively. This leaves interest in the use of aids focused to a lesser degree on vocabulary acquisition and more focused on the goal of comprehension.

Besides those that dealt with vocabulary acquisition, a number of studies have focused on the types of comprehension aids readers use to facilitate their own comprehension as well as their resourcing strategies in choosing the aids. Six empirical studies and one conceptual article are presented with details of each study as they pertain to the first research question. I will then present critiques of these and some previously mentioned studies which point to a need for further research in the subsequent section.

Roby’s (1999) is the conceptual piece and presents a six category “taxonomy of glosses” in which he synthesizes a number of concepts relating to glossing in the field of foreign language teaching. With regards to linguistic glosses two subcategories are proposed: lexical and syntactical. Lexical glosses are further refined into two types: signification glosses and value glosses. Roby describes these two categories of lexical glosses based on the meanings ascribed to them by Widdowson (1978). Signification glosses give the definition of the item they refer to while value glosses give the meaning of the item as it is used in the context of a particular text.

Blake (1992) investigated how students actually use a computer assisted language learning (CALL) lesson presented in pure hypertext. Participants for his study were eight college Spanish students. Materials consisted of a Hypercard program created by the researcher for the Macintosh platform named Recuerdos de Madrid. The program contained a combination of “graphics, Spanish text, grammar tutorials, English glosses, digitized sound, and review questions in a nonlinear fashion” (Blake, p. 17). Four first-semester students and four second-semester students used the Hypercard program
throughout a semester. The software kept logs of students’ use of the various parts of the program, giving special attention to students’ look-up strategies (i.e., dictionary searches) for unfamiliar words and answers to review questions. Blake found that noun searches constitute a basic reading strategy at the beginning level. Blake observed that beginning second-language readers, who are at an early stage of lexical development, seemed to use a strategy analogous to that followed in the early stages of learning a first language as such as naming objects, owing to the fact that other grammatical and cultural information cannot yet be utilized in the reading task. Both first- and second-semester readers searched for an equal number of verbs, but with a notable difference. The second-semester students tended to look for verbs under their citation or infinitive form. The beginners were less able to sort the verb out from its inflected forms.

Liou (1996) studied resourcing strategies that second-language learners employed when viewing an interactive videodisc program rather than while reading. A self-paced interactive video was accompanied by eight types of on-line aids: a Chinese script, an English script, gist, background information, idiom search, word search, repetition of the current sentence, and repetition of the previous sentence. Concerning whether participants used the video controller functions and on-line aids and if so, what kinds of functions and aids did they use, Liou found that rewind, English script and Chinese script were used the most, however only the use of the rewind function was significantly different between groups. Furthermore, Liou found that frequency of use of specific aids did not have a significant impact on comprehension.

Davis and Lyman-Hager (1997) studied readers’ use of various types of comprehension aids when each type was made equally accessible via a computerized format. Unlike Liou’s video viewing study, in this case the focus was on reading a short story presented on computer. The choice of comprehension aids was based on Bernhardt’s (1991) model of reading, which states that comprehension results from a combination of six factors: 1) Basic word recognition (understanding the meaning of individual words); 2) Phonemic/Graphemic decoding (recognizing words based upon their aural or visual characteristics); 3) Syntactic feature recognition (understanding grammatical relationships among words); 4) Intratextual Perception (reconciling statements in a passage with the statements that precede and/or follow them); 5) Prior
Knowledge (awareness of subject matter that the reader brings to the text); 6) Metacognition (the reader’s awareness of cognitive processes during reading) (Davis & Lyman-Hager, 1997). Participants were forty-two third-semester undergraduate French students. The passage used was a digitized version of Ferdinand Oyono’s Une Vie de boy.

Using specially developed software, the text was accompanied by seven types of information, each accessible by highlighting a word or phrase on the monitor and clicking a digitized button, a format Davis and Lyman-Hager call a “computerized gloss.” The seven accessed the various comprehension aids: pronunciation, English definition, French definition, cultural reference, grammar, relationship, and picture. These aids ranged from a tree diagram of intratextual relationships of referents and antecedents to a clip of audible digitized speech giving the pronunciation of a given French word. The computer program invisibly tracked participants’ use of these various aids. Davis and Lyman-Hager found that 85% of the information accessed was the English definition of individual words and expressions. In order to measure participants’ choices of glossed information as compared to comprehension Davis and Lyman-Hager used two post-reading instruments, a written recall protocol and a multiple-choice test. However, the type of information accessed from the computerized gloss had no effect upon comprehension.

Lomicka (1998) specifically asked whether multimedia annotations aid comprehension, but also examined resourcing strategies in terms of readers’ behavior. Twelve second-semester university French students were asked to think aloud during reading of a text on a computer. The text used consisted of an excerpt from the poem Femme Noire by Léopold Senghor. Participants were divided into three groups consisting of four students each: control (no glosses), definitions in English and French, six types of comprehension aids (glosses). For the third condition, aids included: definition in French, images, references, questions, pronunciation and translation into English. Think aloud protocols were analyzed according to clause type (e.g., paraphrase, association, explanation, prediction, evaluation, and metacomment). The amount and type of glosses consulted was measured through computer tracking. Lomicka found that the group given the option of English and French definitions chose the L2 glosses more frequently than glosses in the L1 (73.4% versus 26.6%). The group that had access to six types of glosses consulted the definitions (English or French) more than the other four types. However,
this group consulted the L1 definitions more often than the L2 (30.6% versus 22.0%). Only one participant consulted the image glosses at all. Concerning reading comprehension, Lomicka found no significant differences based on the percentage of explanations generated. Lomicka observed that vocabulary may have been the major obstacle for this group of L2 readers since their use of the comprehension aids was oriented toward translation and paraphrasing with a minimal level of comprehension as the goal.

Bell and LeBlanc (2000) sought to clarify the question of second language readers’ preferred language for glosses. Participants were forty university students enrolled in third semester Spanish. Participants were assigned to one of two groups: Group One (N = 18) read a Spanish language text with glosses available in English only while Group Two (N = 22) read the same text with glosses available in Spanish only. The text used was Primer Encuentro, a 409-word short story. Glossed items consisted of sixty-seven individual words or two-word phrases for a total of seventy-eight glossed words. The number of glossed words represented 19% of the total number of words in the text. Tracking data were gathered by the computer without the participants’ knowledge and showed how many glosses each individual consulted. Results of the tracking data showed that the English gloss group consulted the glosses a significantly higher number of times. Specifically, the English gloss group referred to approximately twice as many glosses as the Spanish gloss group (M = 49.67 versus 26.50). Concerning comprehension, no significant difference was found between the two gloss conditions. Responses to an exit survey indicated that the majority of participants (95%) preferred to have glosses in the L1. The finding of a strong preference for L1 glosses is instructive; however a potential weakness of the study was that the instrument used to measure comprehension (a ten-question multiple-choice test) was inadequate.

Gettys et al. (2001) sought to determine the optimal on-line glossing format between either a basic dictionary form in the first language (D) or a sentence-level translation equivalent in the first language (SLE). Given the researchers’ descriptions, these two types of glosses seem to be equivalent to categories established in Roby’s (1999) taxonomy of glosses. The form described by Gettys et al. as the basic dictionary form is equivalent to Roby’s signification glosses. Gettys et al.’s sentence-level
translation equivalent is the same as Roby’s *value glosses*. Working from a theoretical orientation of top-down, bottom-up processing, Gettys et al. hypothesized that the SLE would be more beneficial for global comprehension due to faster processing times allowing for faster bottom-up processes. They further hypothesized that the basic dictionary form would provide better vocabulary retention due to deeper processing which increases retention. Participants were twenty-two university students in a second-year Russian course. The material for the study was a ninety-seven word excerpt from a short story by Anton Chekhov. Participants read two sections of the excerpt in a cross participants design each in a different sequence. Gettys et al. found that the basic dictionary form took more time to read, but that students performed better in terms of vocabulary retention under this condition. However, in terms of global comprehension, no significant difference was found between the two conditions. Subjectively, most students preferred the technique that gave them access to a sentence-level translation equivalent.

To sum up, a number of studies have addressed the question of the interaction between resource type and learners’ behavior with regards to resourcing strategy: Blake (1992) used a pure hypertext format to present a number of media and Liou (1996) used video. The remaining studies addressed resource type and learners’ behavior from the standpoint of reading strategies using reading texts as the principle experimental materials (Bell & LeBlanc, 2000; Davis & Lyman-Hager, 1997; Gettys et al., 2001; Lomicka, 1998). Two of the studies reviewed in this section, Bell and LeBlanc (2000) and Davis and Lyman-Hager (1997) found that L1 translations were, by far, the most popular comprehension aids consulted, with only Lomicka (1998) finding that in some cases the L2 definition is more popular. Gettys et al. (2001) determined that for vocabulary retention sentence-level translation equivalent in the first language was best. However, of the six empirical studies that have focused on the types of comprehension aids readers use, none found a difference in comprehension based on either resource type or resourcing strategy.
The Need For Further Research

In seeking to understand second language readers’ use of resourcing strategies, several studies have addressed the issue from a variety of theoretical bases and employed a number of comprehension aids. However, gaps in the field’s understanding leave questions for further investigation. Liou (1996) considered what was known in this area, concluding: “...the meager empirical evidence currently available means that the questions of whether on-line help is useful, how often learners tend to use it and what kind of help is crucial for particular types of tasks still remains unclear” (p. 85). I will now summarize key previous research in chronological order, highlighting the distinct characteristics and potential weaknesses of each study.

Among the studies reviewed previously in this chapter, Blake’s (1992) is the first to address directly the behavior of second language learners while reading on the computer. Blake’s Hypercard program provided a range of resources to the readers: graphics, Spanish text, grammar tutorials, English glosses, digitized sound, and review questions in a nonlinear fashion. His study involved participants representing two proficiency levels as defined by their enrollment in either first-semester or second-semester college Spanish courses. Reported findings are limited to readers’ behavior with regard to only one of the resources available to them: noun and verb look-up strategies. In reality, Blake’s participants, all first-year students, represent a narrow spectrum of experience in the target language. Furthermore, the small number of participants (eight) severely limits the ability to generalize from his findings.

Liou (1996) addressed the behavior of language learners in two instructional experience categories: first year and second year. In his study, eight types of on-line help were available: a Chinese script, an English script, gist, background information, idiom search, word search, repetition of the current sentence, and repetition of the previous sentence. However, Liou’s study is distinct in that it addresses behavior while viewing an interactive video rather than reading a passage of text. Again the small number of participants (twenty) limits the ability to generalize from his findings.

The Davis and Lyman-Hager (1997) study is distinguished from the other studies by its application of a principled argument for the choice of comprehension aids used in
their research. Working with participants who were drawn entirely from third-semester French courses, they provided resources as supplements to a reading text based on Bernhardt’s (1991) model of L2 reading. In their research design, Davis and Lyman-Hager provided seven types of comprehension aids: pronunciation, English definition, French definition, cultural reference, grammar, intratextual relationship, and a picture. Due to the overwhelming popularity of the L1 translation resource (85% of references to aids were to L1 translation), Davis and Lyman-Hager grouped the other six categories together into “one nondefinitional information variable” for analysis (p. 61). Thus, data were not independently analyzed for such items as L2 definition (1.35% of information accessed), cultural background reference (3.27%), and pictures (0.59%).

The small number of participants in Lomicka’s (1998) study, and the conflicting results as to preference for L1 or L2 definitions are likely weaknesses in Lomicka’s research and suggest a need for further study. Specifically, conflicting results as to preferred language of glosses stand in contrast to Davis and Lyman-Hager’s (1997) findings and confuse the issue considerably. Furthermore, her study did not consider instructional experience level.

Ganderton (1998) observed students (all high school intermediate learners enrolled in year ten French) while they carried out tasks on the World Wide Web and used discourse analysis to evaluate their activities. His research offers some valuable insights into learners’ strategies for using web sites in a second language, but does not involve reading of extensive texts. The sites used for the study were authentic web sites themselves and therefore did not intentionally offer comprehension aids to those whose L1 was not that of the authors. Also, the small number of participants (six) severely limits the ability to generalize from his findings.

Laufer and Hill (2000) were primarily concerned with incidental vocabulary learning; however, their findings concerning resourcing strategies are notable. They, like Davis and Lyman-Hager (1997), found a preference for L1 translation (75% of all resources referenced) out of five types of comprehension aids offered. They did not consider proficiency level or previous instructional experience in any form. However, the contrast between the behavior of Israeli and Chinese subjects, where Israelis chose L1 translation 72% of the time and Chinese chose L1 translation only 12.5% of the time, is
remarkable. With this finding in mind, readers’ strategies in using comprehension aids must be considered to be culturally variable.

Like Laufer and Hill (2000), Bell and LeBlanc (2000) did not consider instructional experience level in any form, but did find that students (all American university-level learners enrolled in third-semester Spanish) preferred L1 glosses over L2 glosses in that the L1 gloss group referred to approximately twice as many glosses as the L2 gloss group (a mean number of 49.67 versus 26.50). The meaning of this finding for vocabulary learning is attenuated by Laufer and Hill’s finding that extensive use of glosses does not correlate with vocabulary retention; as for its meaning for text comprehension, the case is still unclear.

Gettys et al. (2001) chose comprehension aids based on the theoretical perspective of top-down and bottom-up processing. They compared two types of on-line glossing, L1 basic dictionary form and L1 sentence-level translation equivalent. These were the only comprehension aids available to second language readers in their study. They found that basic dictionary forms were more beneficial to incidental vocabulary learning, but took longer in the reading process. They also found no significant difference in comprehension. However, they did not consider instructional experience level as a variable at all and participants were all university level learners enrolled in second-year Russian. Also, the small number of participants in the study (twenty-two) limits the ability to generalize from their findings.

To date, most research has presented a menu of aids based on the researchers’ personal inclinations, rather than a menu of aids chosen for theoretically or empirically grounded reasons. Likewise, little or no consideration has been given to how a menu of comprehension aids might be utilized differently based on the individual L2 reader’s level of instructed experience in the language. The studies cited above embody a narrow range of learners’ levels of instructed second language experience, being confined to, at most, students representing two different years of current enrollment, having undertaken no consideration of prior instructional experience. Two studies in particular, Davis and Lyman-Hager (1997) and Gettys et al. (2001), focused on the resources provided to readers and present them based on theoretical foundations. The present study is similar to an extent to that of Davis and Lyman-Hager (1997) in that it provides readers with a
variety of resources. It is also similar to that of Gettys et al. (2001) in making use of the metaphors of top-down and bottom-up processing. The similarities of the present study with any one of these previous studies represent some of the differences that it bears with the other study. Furthermore, neither of these studies considered learners’ levels of instructed second language experience.

Rouet and Levonen (1996) determined that “there have been few attempts to study the cognitive processes involved in reading hypertext or to provide controlled evaluations of the impact of hypertext on learning. Therefore, little is known about the effectiveness of hypertext as a learning tool” (p. 10). Each of the seven studies, briefly outlined again here, has led to an increased level of understanding of second language learners’ preferences for definitions in the L1 and the data now available concerning various cultural differences in this regard. However, a common thread throughout the critique of these studies is a lack of variety in language experience level, which is precisely the phenomenon noted by Kost et al. (1999) as they suggested that in future research “various L2 proficiency levels could be assessed under” similar conditions to their own study (p. 96). The point that the present study addresses is how learners with differing levels of L2 instructional experience approach the reading task, specifically in their use of resources in the form of a principled set of comprehension aids and, furthermore, how we can gain access to this process by using the computer as our research tool.
CHAPTER III
RESEARCH STUDY DESIGN

Introduction to the Chapter

As suggested by Garrett (1991), in the present study I will attempt to break down the issue of efficacy into a set of questions about smaller, more manageable research variables and to begin to fill in some of the foundational information concerning reading comprehension and resourcing strategies. I seek to refine further the understanding of second language readers’ use of strategies when using resources in the form of comprehension aids by analyzing use of the resources by proficiency level as suggested by Kost, Foss, and Lenzini (1999). This refinement in understanding is necessary due to the absence of data concerning how second language learners of varying proficiency levels react to the reading task, and in light of Gettys, Imohof, and Kautz’s (2001) observation that it will be possible to identify learners’ actual needs “only after a careful examination of the specific role that on-line glosses play in L2 reading” (p. 92).

In reviewing previous research into resourcing strategies three contrasts arise between previous studies and the present study. First, none of the studies reviewed mentioned any attempt to empirically determine text difficulty when selecting a reading text. In the present study I do so by applying the Fry readability graph adapted for use on Spanish-language texts. Second, although the present study uses a longer text than any other study reviewed, it also employs a higher percentage of glossed words than in any of those studies. Finally, most of the aforementioned studies articulate no theoretical basis for the selection of resources provided to readers, nor any theoretical perspective through which to interpret the findings of the studies. The present study does both by means of the concepts of top-down, bottom-up, and interactive processing, the linguistic threshold hypothesis, and the principle of least effort. The concerns raised by Rouet and Levonen (1996) concerning readers’ disorientation, jumping, and looping may be mitigated by the
use of a central story which is presented in its entirety on a single page, as in the present study. Thus, structure and coherence flow from the integrity of this main text. However, the format of the ancillary comprehension aids still resembles true hypertext in that they are made accessible at any point in time and in any order that the reader chooses.

The focus of the present study is on the behavior of L2 learners during the task of reading an authentic L2 text. A limited number of things are known about L2 reading and L2 readers’ behavior when contending with a text presented via computer. Like all readers, people who are reading in a second language sample a text and engage in predicting meaning based on their understanding of the words and sentences combined with their background knowledge of the topic, setting, and constructs contained in the text. These predictions are then tested against the information contained later in the text and either accepted, rejected, or revised to actively construct a mental model of the text’s meaning. Where L2 readers differ from L1 readers is primarily in the rapid recognition of words which in turn limits the use of background knowledge. At times L2 readers also lack adequate and culturally appropriate background knowledge by which to interpret the topic, setting, and constructs contained in the L2 text. When reading in a computer mediated environment, readers can experience disorientation as to their location with a text, as well as jump about randomly within a text and loop back over the same material. However, comprehension has not been shown to suffer when reading on computer. In a computer mediated environment L2 readers generally have access to a number of different types of comprehension aids; of these they prefer lexical help over other types of aids. In most but not all cases, readers choose L1 translations for unfamiliar L2 words more often than L2 definitions. However, the effect of this strategy on comprehension is still unclear. Equally unclear is what combination of types of comprehension aids provides the best support for L2 readers. In this study I present findings related to one combination of resources in the form of comprehension aids that has been selected based on the theoretical principles of the top-down, bottom-up, and interactive processing models and dual coding theory in order to determine how L2 readers go about using them.

In order to focus on the behavior of L2 readers, I address the issue of how readers at different levels of instructed second language experience use resourcing strategies to
cope with reading tasks based on four questions: 1) Given several comprehension aids as resources, a) what resources will second language readers use when reading an authentic text on computer? b) with what frequency will they use them? 2) What role does level of instructed second language experience play in strategy choice? 3) What advantage(s) does the tracking of reading behavior confer on data analysis in second language text processing? 4) What implications do these findings suggest for future studies of text processing and comprehension and for classroom applications?

The theoretical underpinning for the study rests on schema theory, and more specifically on the metaphor of top-down, bottom-up, and interactive processing, which arose from it. The theoretical framework of top-down, bottom-up, and interactive processing is utilized both as a guiding principle in the design of the experimental treatment and as a means of interpreting the actions taken during the reading process by second language learners at different levels of language learning experience. Dual coding theory provides an additional theoretical rationale for the use of visuals (i.e., photos or drawings representing concrete nouns in the text) as comprehension aids in the study, and the linguistic threshold hypothesis provides an explanation for the commonly observed lack of comprehension in L2 reading. Likewise, the principle of least effort applies to behavior during second language reading in an informative way. These are the constructs that will serve as tools in the interpretation of results.

This chapter details the design of the research study undertaken with these goals and questions in mind. I will describe the setting of the study including the participants and materials involved. Then I will detail the methodology of the study, which will include the design, instruments, general procedures and statistical procedures used.

Setting

Participants

For purposes of data analysis the participants in this study were 186 students enrolled in Spanish courses at Florida State University during the summer semester 2000. Participants were defined as non-native speakers of Spanish who are learning Spanish in a tutored setting. The pool of participants consisted of thirteen sections representing four
distinct courses: 4 sections of Elementary Spanish II (SPN1121), 7 sections of Intermediate Spanish (SPN2200), 1 section of Reading and Conversation (SPN3201), and 1 section of Spanish Grammar and Composition (SPN3311). Instructors for the participants’ concurrent Spanish classes were both native and non-native speakers of Spanish with previous college-level teaching experience.

Out of an initial pool of 232 students who participated in some phase of the research, 198 completed each of the phases of the study. Additionally, to ensure that all participants were non-native speakers of Spanish the question Did you grow up speaking Spanish at home? was posed on a Language Experience Survey prior to the experimental treatment (see Appendix B). Those who responded in the affirmative were excluded from the statistical analysis of the study, but were allowed to complete the experimental treatment along with their classmates. Eleven participants were excluded on this basis. None of the participants reported having a diagnosed reading disability, and so none were excluded for that reason. One additional participant was excluded because of equipment malfunction during the experimental procedure itself. The remaining 186 participants were those whose data were used for purposes of analysis. These were drawn from the following Spanish courses respectively: 54 were enrolled in Elementary Spanish II, 110 were enrolled in Intermediate Spanish, 12 were enrolled in Reading and Conversation, and 10 were enrolled in Spanish Grammar and Composition. Thirty-eight participants were concurrently enrolled in sections taught by me (SPN2200-04 and SPN2200-05), which constituted 20.43% of the overall number of participants in the study, and 34.86% of the participants drawn from among students enrolled in the Intermediate Spanish course. The courses in which participants were enrolled were not used as a basis for determining level of instructed second language experience. These data are presented merely as a description of the composition of the pool of participants and of the method employed to obtain university students as participants. Further discussion of instructional experience levels will be undertaken in the section devoted to the independent variable of the study.
Materials

Experimental materials consisted of an authentic Spanish-language short story entitled “Un día de febrero” written by José Luis Martín of Ohio State University and published on the Internet on the Proyecto Sherezade web site, which is owned by Enrique Fernández and is hosted by the University of Manitoba. The story is reproduced as adapted for this story in Appendix A and may be found in its original form on the Internet at: http://home.cc.umanitoba.ca/~fernand4/undia/access.html. The text was accompanied by seven types of supporting materials, which constituted comprehension aids: 1) English translations of certain terms, 2) Spanish definitions of the same terms, 3) an essay in Spanish explaining the historical context, 4) a translation of the essay into English explaining the historical context (see Appendix F), 5) an essay in Spanish of literary commentary, 6) a translation into English of the literary commentary essay (see Appendix G), and 7) photographs or drawings of certain lexical items and historical characters mentioned in the story. All of these materials were uploaded to Florida State University’s computer network in HTML format at an unpublished address so as to make them available for viewing using web browsing software. I obtained permission from both the author and the web site owner to temporarily archive the text of the story and accompanying materials on the university’s local server computer for purposes of security and reliability. The experimental procedure was carried out in the computer lab of the Department of Modern Languages and Linguistics using Windows equipped IBM compatible computers with screen dimensions set at 800 x 600 pixels. The specific software employed was the Netscape Navigator web browsing program.

The text of the story was 2,602 words in length, including the title and scene headings. The text was divided into six sections, which were labeled with Roman numerals. The Fry readability graph (Fry, 1968, 1977) was employed to determine a reading level for the story. The Fry graph was chosen because of its wide use among elementary and secondary educators and because of the published literature documenting its adaptation to Spanish for use with bilingual students (Gilliam, Sylvia & Mountain, 1980). On the Fry readability graph adapted for use on Spanish-language texts the story falls within the eighth-grade reading level. However, the text has been used in intermediate college courses at Princeton and other institutions by several instructors and
by the *Proyecto Sherezade* web site owner, Enrique Fernández (J. L. Martín, personal communication, February 17, 2000). I adapted the comprehension aids from their original, published version in five ways: 1) the essay on historical context was translated into English; 2) the essay of literary commentary was translated into English; 3) the number of lexical items with glosses was increased from 64 to 75; 4) English translations were created for each of the lexical items which had glosses; and 5) graphic illustrations in the form of photographs or artistic sketches were added as glosses for 20 items. The total number of items with links to glosses was 75, including individual words or short phrases. The total number of words with links to resources, taking into account the words that comprised glossed phrases, was 152. Thus, 5.84% of the words in the text had links to glosses consisting of a choice of English translation or Spanish definition. Among the 75 lexical items with glosses, 20 offered an additional choice of a visual in the form of a photograph or artistic sketch of the item. Of the 75 glossed items 26.67% had this additional visual available as a gloss type.

**Methodology**

**Design**

The general model of the study was an ex post facto design (Hatch & Lazaraton, 1991), with the dependent variable as the number of times that comprehension aids in the form of resource materials are consulted. The dependent variable consists of nine levels: 1) English Translation, 2) Spanish Definition, 3) Visual (i.e., Picture), 4) Historical Context Essay—English, 5) Historical Context Essay—Spanish, 6) Literary Commentary Essay—English, 7) Literary Commentary Essay—Spanish, 8) Resources associated with bottom-up processing grouped together (i.e., English Translation, Spanish Definition, Visual), and 9) Resources associated with top-down processing grouped together (i.e., Historical Context Essays—English and Spanish, Literary Commentary Essays—English and Spanish). The Spanish Definitions were those used by the author of the story in the glosses accompanying the published version with the exception of the seven that I added. Definitions of the seven additional items were taken from the *Pequeño Larousse Ilustrado* by Ramón García-Pelayo y Gross (1984). English translations which matched
the Spanish definitions as closely as possible in length and detail were developed using translations taken from Cuyás’ (1972) *Appleton’s New Cuyás English-Spanish and Spanish-English Dictionary* and *The Wordsworth Spanish Dictionary: English-Spanish, Spanish-English* (Wordsworth, 1995).

The Spanish-language versions of the essays on historical context and literary commentary were used in their original form as published by the same author as the short story. I prepared the translations of the essays into English. The Spanish versions of the essays originally accompanied the story. However in the experimental treatment the essays were available to readers in both their Spanish-language versions and in English translation. The information contained in the historical context essay provided factual information about the historical events which make up the setting and motivation for the story (see Appendix F). The literary commentary essay consisted of a basic literary description that included point of view, time, setting, characters, tone, and major points of the plot (see Appendix G).

These seven specific resources were chosen as comprehension aids in the present study in consideration of how the menu of comprehension aids might be utilized differently based on L2 readers’ levels of instructed experience in the language, as informed by the foundational theories of the study. Successful L2 readers must be proficient at the interactive utilization of both the top-down and bottom-up sets of reading processes. Therefore, a menu of comprehension aids that support an interactive reading strategy would represent the most valuable set of resources to accompany an L2 reading text (Chun and Plass, 1997; Gettys et al., 2001; Plass, 1998). Three lexical resources were chosen because they map directly onto resourcing strategies involving bottom-up processing. They are English translation, Spanish definition, and visual (i.e., picture). These three lexical resources aid the reader who lacks a sufficient L2 lexicon to successfully read the experimental passage in view of the fact that bottom-up reading processes involve vocabulary recognition and word-by-word decoding of the text. The remaining four non-lexical, global-type resources were the historical context essays in English and Spanish, and the literary commentary essays in English and Spanish. These resources were chosen because they map directly onto resourcing strategies that involve top-down processing by assisting the reader who lacks prior knowledge of the recent
history of Spain or who, at some point in the reading, lacks a sufficiently developed mental model of the unfolding plot.

Certain resources are known to have been used in similar studies but were not included among the comprehension aids in the present study. Such resources as grammar tutorials, specifics of levels of formality, prepositions which follow specific verbs, related meanings, pre-reading brainstorming activities, pre-reading questions, and review questions, were all excluded because they did not support one of the two general types of text processing strategies envisioned in the top-down / bottom-up processing metaphor. Other resources which might have tenuously fit the parameters of the study such as morphological root, phonemic transcription, and digitized sound, were not employed because of practical considerations such as the relative value to the reader in the short amount of time allotted to the experimental treatment. For the same reason the lexical aids in the form of English translation and Spanish definition were devised in the more expeditious form which Roby (1999) labels value glosses, that is, glosses that “give the meaning of an item in a particular context” (p. 95) and Gettys, Imohof, and Kautz (2001) label as a “sentence-level translation equivalent” (p. 91). Finally, only twenty of the seventy-five glossed items were accompanied by photographs or drawings because they were concrete nouns, the most representable in iconic form, whereas others were either too abstract or pertained to lexical classes other than nouns.

The independent variable of the present study is the level of instructed second language experience. The independent variable consists of three levels, defined as the self-reported number of semesters of instructed Spanish study. Participants were assigned to one of the three levels of instructed second language experience based on their answers to the question How many semester-length Spanish classes have you had before this one? For purposes of group assignment, two semesters of secondary school study were considered equal to one semester of post-secondary study, and a total number of semesters of previous instructed second language experience was assigned to each participant. Group 1, the Less Experienced Group (\(N = 58\)), consisted of participants who had previously studied Spanish for 0-2 semesters. The actual number of semesters of previous study for participants assigned to this group ranged from 0.5 to 2 with a mean of 1.54 semesters. Group 2, the Moderately Experienced Group (\(N = 89\)), consisted of
participants who had previously studied Spanish for more than 2 and up to 4 semesters. For the Moderately Experienced Group, the actual number of semesters of previous study ranged from 2.25 to 4 with a mean of 3.49. Group 3, the Most Experienced Group (N = 39), consisted of participants who had previously studied Spanish for more than 4 semesters. For this group, the actual number of semesters of previous study ranged from 4.5 to 12 with a mean of 5.86.

Given the stated variables, the null hypothesis could be stated thus: H₀: A=B=C. In sentence form, H₀: There is no relation between the number of times that resource materials of specific types are consulted and level of instructed second language experience (given the viewing of authentic L2 reading material and associated resource materials presented in HTML format via computer). The alternative hypothesis is Hₐ: There is a relation between the number of times that resource materials of specific types are consulted and level of instructed second language experience.

A number of factors influencing the reading process were considered as moderating variables and analysed through information obtained either in advance of or immediately after the experimental procedure. These were: 1) a participant’s residence in a mainly Spanish-speaking country or environment for an extended period of time; 2) participants’ L1 reading ability; and 3) participants’ perceived difficulty of the reading text.

Growing up speaking Spanish in the home and residence in a mainly Spanish-speaking country or environment for an extended period of time were both considered to be a basis for exclusion from the study. Both deal with the a priori definition of participants as non-native speakers of Spanish who are learning Spanish in a tutored setting. If participants stated that they had grown up speaking Spanish at home, they were automatically excluded. However, given that there was not a single yes/no answer to how long participants had lived in a primarily Spanish-speaking environment, and given the inevitable range of responses that would be obtained, residence was considered as a moderating variable only to the extent that was necessary to determine whether or not to exclude specific participants from the study. Therefore, the first moderating variable taken into consideration was the potential for participants in the study to have resided in a mainly Spanish-speaking country or environment for an extended period of time. In order
to address this issue the language experience survey contained the two questions *Have you lived in a mainly Spanish-speaking country or environment for an extended period of time? If yes, for what period of time?* Responses were converted to years in order to obtain a standard basis for comparison.

The second moderating variable was first language reading ability. Consideration of L1 reading ability as a moderating variable was prompted by the findings of Alderson (1984), Bernhardt (2000), Bernhardt and Kamil (1995), and Chun and Plass (1997), concerning the importance of the role of L1 reading ability in L2 reading. This factor was addressed on the language experience survey in the form of the question *How would you evaluate your reading skills in English?* Responses were recorded using a Likert-type scale by marking one of the following options with a circle: *Weak, Less Than Average, Average, Better Than Average, Strong.* Data obtained through this question was used to determine if a correlation exists between participants’ reported L1 reading ability and their use of the comprehension aids. For purposes of data analysis, participants’ responses were coded using a scale with Weak = 1, Less Than Average = 2, Average = 3, Better Than Average = 4, and Strong = 5.

Likewise, consideration of participants’ perception of the difficulty of the experimental text was prompted by findings indicating that text difficulty is a key factor in L2 reading (Bernhardt, 2000; Davis, 1989; Harper, 1990; Rogers & Medley, 1988). Text difficulty was considered in the selection of the text for use in the study and further considered by means of two questions on the exit questionnaire. The first of these questions asked *How difficult would you say the story was compared to readings in your current Spanish course?* Responses were recorded on a Likert-type scale by marking one of the following options with a circle: *Much More Difficult, Somewhat More Difficult, About The Same, Somewhat Less Difficult, Much Less Difficult.* Participants’ responses were coded, for purposes of analysis, using a scale with Much More Difficult = 5, Somewhat More Difficult = 4, About The Same = 3, Somewhat Less Difficult = 2, Much Less Difficult = 1.

The second of the questions on the exit questionnaire that addressed text difficulty was aimed at soliciting information from the participants as to how much of the story
they actually read. This question was *How much of the reading did you complete? Through section: 1 2 3 4 5 6.*

The exit questionnaire also addressed the affective consideration of participants’ reading enjoyment using a Likert-type scale by means of the question *How would you rate your enjoyment of the story?* Responses were recorded by marking one of the following options with a circle: *Did Not Enjoy The Story, Did Not Enjoy The Story Much, About Average For A Spanish Text, Enjoyed The Story Somewhat, Enjoyed The Story Very Much.* Although this question was posed to participants on the exit questionnaire, it was deemed to have no theoretical relevance to the research questions of the study and no analysis was performed using the data obtained by it.

Another possible moderating variable was sex based differences. Although sex differences have been shown to be significant in reading in terms of background knowledge of topics of more interest to one gender than the other (Bügel & Buunk, 1996) and in L1 word recognition (Majeres, 1999); sex has not been shown to be a significant factor with regard to L2 reading (Brantmeier, 2003; Grace, 2000; Paivio & Lambert, 1981), nor with regard to reading and computer technology (Dillon, 1994; Grace, 2000). For this reason it was not considered as a moderating variable in the present study.

**Instruments**

The following three measurement instruments were employed.

1) Language experience survey (see Appendix B). The language experience survey was administered to participants approximately one week prior to the experimental treatment and immediately after participants had read and signed the informed consent form (see Appendix E). The survey included five questions that were grouped into three categories. Category I concerned the participant’s Spanish language background in an instructional setting and contained one question. Category II concerned the participant’s language background in a natural language setting and contained two questions. Category III concerned the participant’s reading abilities and contained two questions. The questions posed by this survey pertained to the a priori bases for exclusion from the study and to the moderating variables discussed above.
2) Computer tracking system. Tracking data (i.e., information on who is accessing specific files on a computer system) for each page that was accessed on the Web server was gleaned from the university's UNIX operating system. The operating system automatically collects data on every request for a page or file that is hosted on the university’s Web server. This data collection activity is a normal part of the operation of the Web server and was not developed specifically for research purposes. The data collected includes the unique Internet protocol (IP) number of the computer requesting to view a file and the location on the Web server of the file requested. The fixed IP number for each computer in the lab was thus used as a machine identifier to match each participant with the specific pages that he or she viewed during the experimental procedure. Furthermore, the Web server collects these data invisibly without the participants' knowledge. I downloaded data for the specific computers used by each participant in the study according to the date, time, and computer lab identifier. Once collected from the UNIX system, the tracking data were used to determine which of the participants consulted which pages of the experimental materials. Using these data I was able to determine the specific pages each participant viewed. The data collected were then used to address both parts of the first research question, as well as the second research question.

3) Exit survey questionnaire (see Appendix C). The final instrument was a written, paper and pencil, questionnaire concerning participants’ experience with the project. The exit questionnaire was administered post-reading, but it was announced prior to reading that there would be a comprehension follow-up activity. The questionnaire consisted of two sections. The first section was dedicated to a free recall activity in the form of a written recall protocol which asked participants to retell the story, in English, with as much detail as possible in the lines provided on the page. The second section consisted of five items that allowed participants to self-report on 1) their use of resources and strategies, 2) the difficulty of the story, 3) their enjoyment of the story, and 4) how much of the story they completed reading. The final item was a space in which to offer any further comments. The contents of the exit survey provided a goal for reading the text in the form of a comprehension check activity and also pertained to the moderating variables discussed above.
General Procedures

Approximately one week before the experimental procedure, participants were given an informed consent form (see Appendix E) and the language experience survey. These instruments were administered by the various instructors and in the regular classrooms of the classes involved in the study. The instructors were given page one of the experiment script (see Appendix D) to read to their students at this time. Although participants were selected as intact classes, efforts were made, via the informed consent form and oral instructions (i.e., experiment script), to stress that participation was totally voluntary. After these initial forms were completed, all other experimental activities took place in the computer lab of the Department of Modern Languages and Linguistics.

For the actual experimental procedure, participants came to the computer lab on pre-specified days with their regular classes during their regular class time, or for a part of that time if the class met for more than one hour. Page two of the experiment script determined what was said and done in the computer lab, with the exception of Step 1, which envisioned assigning participants to computers as they entered the room. Rather than assign participants to a computer and record who was seated at which machine, the participants themselves selected a seat at the computer of their choice and signed a sheet of paper that was in front of each monitor identifying them with that particular computer, class, day, and time.

The screens presenting the experimental materials were designed with two vertical frames. In a narrow frame to the left, links were provided that remained constant and accessible throughout the reading process. The links in the left frame included: Cuento/Story, Contexto Histórico, Historical Context, Comentario Literario, Literary Commentary, and Return to Start Page. Clicking on a link in the left frame made the text associated with that link appear in the wider frame to the right. When participants first sat down at the computers, an introductory screen, the Start Page, was presented on the monitor of each computer as shown in Figure 1:
Figure 1: Introductory screen

Clicking on either *Un día de febrero* in the right frame or clicking on Cuento/Story in the left frame produced the entire text of the story in the right frame as shown in Figure 2:

![Story screen](image)

**Figure 2: Story screen**

Clicking on any one of the links in the left frame replaced the text of the story in the frame to the right with the corresponding text. The links in the left frame were primarily those associated with the non-lexical, global-type resources, and they remained in place.
and available throughout the reading process regardless of which screen was being displayed in the right frame. Below, the English version of the essay on the historical context of the story is shown in the right frame in Figure 3:

Figure 3: English version of the essay on historical context

Likewise the English version of the literary commentary is displayed in the right frame in Figure 4:

Figure 4: English version of the literary commentary
In the story text, words or phrases that had glosses available were underlined and highlighted in blue. Unlike the links in the left frame, clicking on a highlighted word or phrase within the text of the story produced a small, pop-up window with a menu of gloss options as shown in Figure 5. The gloss options represented the lexical aids and included Spanish Definition, English Definition, and Picture (if available). Clicking on one of these choices produced the described information within the small pop-up window.

![Figure 5: Bata alcochada pop-up](image)

Oral instructions were given as indicated in the experiment script, including the announcement of a comprehension activity to follow the reading. Participants were allowed thirty minutes to complete the reading and investigate the various resources at will. The participants were informed of the lexical resources, (i.e., those which were not constantly available, rather, accessible only through a pop-up window), in two ways. First, the following information was given in the oral instructions: “Along with the text are several other resources which might help you as you read the story. You may access the other helps by clicking on terms which are highlighted in blue and underlined.”

Second, the following notation appeared at the beginning of each of the six sections of the story (underlining is original): “NOTE: You may view definitions for highlighted
words by clicking on them; a small window will appear. When you are finished using the
small window, close it by clicking on the ‘X’ in its upper-right corner before continuing
the story.” The notation refers to the pop-up window as shown above in Figure 5;
however the means of closing the pop-up window appears in the upper-left corner rather
than the upper-right because of a platform difference in the computer from which the
figure was taken. I was present and available to answer technical questions about the use
of the computer or program during the entire period allotted to reading.

As each participant completed the reading portion of the procedure, they indicated
that they had finished reading by raising their hand. I verified that the computer was
returned to the introductory screen, then gave the participant the paper and pencil forms,
composing the exit questionnaire, to complete. Once the exit questionnaire was
completed, participation in the experimental procedure was ended and the participant was
free to leave the computer lab. After thirty minutes, I said, “It is time to complete the
questionnaires. Raise your hand when you are ready” as indicated by the experiment
script.

**Statistical Procedures**

In order to determine if a correlation exists between the number of times that
resource materials of specific types are consulted and level of instructed second language
experience, three statistical tests were used: Analysis of Covariance (ANCOVA),
Analysis of Variance (ANOVA), and $t$ test. The ANCOVA test was employed to adjust
the frequency of resource consultation for the amount of the story actually completed.
The ANOVA was employed to determine the relationship between the frequency of
resource consultation and the amount of the story actually completed, and also to
determine the level of variability in the relationship between the frequency of resource
consultation and level of instructional experience, and for post hoc analyses of the
moderating variables. If the ANOVA detected a statistical difference in a given model as
a whole then a multiple comparison $t$ test, the Fisher’s Least Significant Difference
(LSD) test, was used to determine which of the specific means with in the model were
different.
Table 1 summarizes the research questions for which data were collected, the method of data collection relevant to each question, and the method of analysis for each set of data.

Table 1  
Research Questions, Data Collected, and Methods of Analysis

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Method of Data Collection</th>
<th>Method of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.a. What resources will second language readers use when reading an authentic text on computer?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.b. With what frequency will they use them?</td>
<td>Computer tracking data</td>
<td>Descriptive statistics, ANCOVA and ANOVA</td>
</tr>
<tr>
<td>2. What role does level of instructed second language experience play in strategy choice?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Computer tracking data</td>
<td>Descriptive statistics, ANOVA and t test</td>
</tr>
</tbody>
</table>

Research questions three and four deal with the relative advantages of the method of data collection that was employed in the study and the implications of the study. As such, they were not subject to analysis by quantitative means, but could only be addressed after speculating about the data that had been collected.

Owing to the fact that reading is a complex activity involving a number of processes and factors, it was also necessary to consider some important moderating variables in the analysis of the data. Because of this complexity it is difficult to narrowly
examine one aspect of reading without taking into account other factors that might or might not impact the principal aspect under consideration. In order to properly focus on the behaviors involved in answering Research Questions One and Two, a number of factors which were outside the scope of the research questions but that had the potential to confound the findings were identified in the literature and treated as moderating variables.

To summarize, in this chapter I have presented the ways in which this study contrasts with previous research, detailed the setting and methodology of the experimental procedure, and presented the means of data analysis that were used and rationales for each of them. The results of the data analysis will be addressed in the following chapter where I will discuss the findings pertaining to each of the experimental questions and moderating variables.
CHAPTER IV
FINDINGS

The purpose of this chapter is to present findings concerning the patterns of use of resources in the form of comprehension aids by L2 learners during the reading process. The findings presented here are the result of analyses of data collected in the study through the means outlined in the previous chapter. I will present the findings in the categories of: general use of comprehension aids, level of second language experience, and post hoc analyses to include the possible effects of participants’ residence in a mainly Spanish-speaking country or environment, participants’ L1 reading ability, and the perceived difficulty of the experimental reading text.

Use of Comprehension Aids

In order to address the issue of how readers with different levels of instructed second language experience use comprehension aids to cope with a reading task, the first part of the first research question was: Given several comprehension aids as resources, what resources will second language readers use when reading an authentic text on computer? The most commonly used resources were determined based on computer tracking data. As Table 2 demonstrates, when listed in order by most number of participants to use each type of aid, they ranked as follows: English translations, Spanish definitions, visuals, the English version of the Literary Commentary essay, the English version of the Historical Context essay, the Spanish version of the Historical Context essay, and the Spanish version of the Literary Commentary essay. The data presented in Table 2 show the number and percentage of participants who viewed each of the specific comprehension aids at least once ranked from highest to lowest number of viewers.
Table 2
Participants who Accessed Each Type of Comprehension Aid

<table>
<thead>
<tr>
<th>Type of Comprehension Aid</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Definition</td>
<td>184</td>
<td>98.92%</td>
</tr>
<tr>
<td>Spanish Definition</td>
<td>137</td>
<td>73.66%</td>
</tr>
<tr>
<td>Visual</td>
<td>125</td>
<td>67.20%</td>
</tr>
<tr>
<td>Eng. Literary Commentary</td>
<td>87</td>
<td>46.77%</td>
</tr>
<tr>
<td>Eng. Historical Context</td>
<td>74</td>
<td>39.78%</td>
</tr>
<tr>
<td>Span. Historical Context</td>
<td>56</td>
<td>30.12%</td>
</tr>
<tr>
<td>Span. Literary Commentary</td>
<td>43</td>
<td>23.12%</td>
</tr>
</tbody>
</table>

As presented in Table 2, English definitions were the only type of resource consulted by more than two-thirds of the participants. With 184 participants having viewed at least one English definition, which constituted 98.92%, only two participants did not consult them at all. The other two types of lexical aids, Spanish definitions and visuals, were consulted by the second and third highest numbers of participants respectively. The data presented in Table 2 show that the three types of lexical aids were consulted by the top three highest numbers of participants, each by over 50%. Thus, the non-lexical aids were each viewed by less than half of the participants.

The computer tracking data are further supported by participants’ responses to question one of the Exit Survey questionnaire. When listed in order by reported use, data from the Exit Survey showed that 97.85% of participants (N = 182) reported consulting English translations, 55.91% (N = 104) consulted visuals, 42.47% (N = 79) consulted the English version of the Historical Context essay, 40.32% (N = 75) consulted the English version of the Literary Commentary essay, 33.87% (N = 63) consulted Spanish definitions, 11.29% (N = 21) consulted the Spanish version of the Historical Context essay, and 5.38% (N = 10) consulted the Spanish version of the Literary Commentary essay.
Discrepancies between the computer tracking data and the exit survey data may be due to the format of the question on the survey. Participants were asked to indicate which of the types of resources they used at least once while reading. On the other hand, the computer tracking data recorded each time a particular page was merely displayed on the computer’s monitor, albeit for one second or less. Thus, the tracking data do not indicate that participants in fact read the aids that they viewed, nor do they represent the aggregate use pattern by participants who may have referred to a specific type of aid multiple times. The most outstanding difference between the two data sets is the ranking of Spanish definitions as the second most viewed according to the computer tracking data, by 137 participants, but only 63 participants self-reported that they had used them, placing them fifth as indicated by the exit survey data. Otherwise, although the numbers of participants vary, the rankings differ only in the relative popularity of the English version of the historical essay over the English version of the literary essay and vice versa. From both sources of data the overall picture is one of English definitions being the sole aid that virtually all participants used at least once.

To further understand how L2 readers use comprehension aids to cope with the task of reading, the second part of the first research question was: Given several comprehension aids as resources, with what frequency will second language readers use them? This second part of the first research question goes beyond asking how many participants used type of aid by seeking to quantify the number of times that each aid was consulted, and therefore to determine a pattern of usage for the various types of resources. Computer tracking data recorded a total of 22,166 hits to links associated with the experimental Internet site. For all analyses of data concerning the number of times that resource materials of specific types were consulted, the original computer tracking data were adjusted to remove clicks to pages that did not contain the resources themselves and multiple clicks made to the same link which were in contiguous succession (i.e., repeatedly viewing the same resource without any intervening access to a different page). After this process, there remained 9,159 unique hits to pages containing comprehension aids. In the following paragraphs the seven types of comprehension aids are discussed, along with them there are two categories of grouped resources, which are defined as follows: Bottom-up = English Translation, Spanish Definition, and Visual; and
Top-down = English and Spanish Historical Context Essays, and English and Spanish Literary Commentary Essays.

Table 3 shows the total number of times that all participants accessed each of the types of comprehension resources in descending order of frequency, which in turn brings to light which of the types of aids were the most utilized. These data relate directly to the second part of the first research question in that through computer tracking we can know the exact number of hits made on each file containing a resource and thus the precise frequency with which each type of comprehension aid was used.

Table 3
Frequency of Access of Comprehension Aids

<table>
<thead>
<tr>
<th>Type of Comprehension Aid</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Definition</td>
<td>7609</td>
<td>83.08</td>
</tr>
<tr>
<td>Visual</td>
<td>689</td>
<td>7.52</td>
</tr>
<tr>
<td>Spanish Definition</td>
<td>578</td>
<td>6.31</td>
</tr>
<tr>
<td>Eng. Literary Commentary</td>
<td>95</td>
<td>1.04</td>
</tr>
<tr>
<td>Eng. Historical Context</td>
<td>83</td>
<td>0.91</td>
</tr>
<tr>
<td>Span. Historical Context</td>
<td>59</td>
<td>0.64</td>
</tr>
<tr>
<td>Span. Literary Commentary</td>
<td>46</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Table 3 demonstrates that the most popular type of aid was English Definition, which received 83.08% of the hits to comprehension resources. The second most popular type of aid, Visuals, falls behind by a wide margin with 7.52% of the hits. The third most popular type of aid was the Spanish Definition, with 6.31% of the hits, placing the three lexical aids as the top three most consulted resources. The most popular non-lexical resource was the English Literary Commentary (1.04%). Table 4 shows the frequency with which participants accessed the comprehension resources when grouped by category.
according to bottom-up or top-down. These data are a first step in elucidating L2 reading strategies based on the bottom-up and top-down reading metaphors.

Table 4
Frequency of Access of Aids Grouped by Category

<table>
<thead>
<tr>
<th>Category of Aids</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom-up</td>
<td>8876</td>
<td>96.91%</td>
</tr>
<tr>
<td>Top-down</td>
<td>283</td>
<td>3.09%</td>
</tr>
</tbody>
</table>

Table 4 illustrates that the lexical resources grouped together, those characterized as “bottom-up,” received 96.91% of the hits to resources even though they made up slightly less than that amount, 94.94%, of all the available links to resources. The non-lexical resources grouped together, those characterized as “top-down,” made up 5.06% of all the available links to resources, and constituted 3.09% of the hits. The first research question looks at the behavior of the participants in the study taken as a whole regardless of their level of proficiency, as a result a strong tendency on the part of all participants to use of lexical helps seems to emerge. This insight into the reading process is made possible only by computer tracking of the readers’ movements as they actually read.

**Amount of the Story Read**

In the text of the story, seventy-five unique words or phrases were linked to lexical comprehension aids. Additionally, six items appeared multiple times: *carraspeaba* two times, *dos rombos* two times, *escacharrar* two times, *recreo* three times, *tazón* six times, and *Sha* three times. Because of these repetitions, a total of eighty-seven links appeared throughout the text of the story. Consequently, those participants who read farther in the text had more lexical aids presented to them. This must considered to be the case with one important caveat. Because participants were not prevented from looking ahead or jumping around the text randomly, in reality all participants had access to all of
the lexical links, even those ahead of the point in the text at which they were reading. For this reason, there is a possibility that participants who were not reading for comprehension, or who gave up on comprehending the story, used a strategy akin to simply clicking randomly on the links in the text without regard to presentational order and may have viewed a number of links beyond the point at which they stopped reading attentively.

This reality could be a confounding factor in data concerning the frequency with which the various types of aids were consulted and preclude an accurate answer to the second part of the first research question and could also call into question all of the computer tracking data used in the study. Therefore, an analysis of the effect that this increasing number of available resources had on participants’ behavior was necessary. Table 5 shows the distribution of linked lexical items throughout the story:

<table>
<thead>
<tr>
<th>Section Number</th>
<th>Frequency of Linked Items</th>
<th>Cumulative Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>36</td>
<td>36</td>
<td>41.38</td>
<td>41.38</td>
</tr>
<tr>
<td>II</td>
<td>11</td>
<td>47</td>
<td>12.64</td>
<td>54.02</td>
</tr>
<tr>
<td>III</td>
<td>8</td>
<td>55</td>
<td>9.20</td>
<td>63.22</td>
</tr>
<tr>
<td>IV</td>
<td>9</td>
<td>64</td>
<td>10.34</td>
<td>73.56</td>
</tr>
<tr>
<td>V</td>
<td>5</td>
<td>69</td>
<td>5.75</td>
<td>79.31</td>
</tr>
<tr>
<td>VI</td>
<td>18</td>
<td>87</td>
<td>20.69</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5 demonstrates that the highest number of lexical resources were available in the first section of the story. It is also shows graphically how participants had progressively more lexical resources presented to them.

On the exit questionnaire, participants were asked to circle a number representing how much of the reading they had completed of sections one through six. The
distribution of the self-reported completion of the six sections of the story is shown in Table 6:

Table 6
Distribution of Sections of the Story Completed

<table>
<thead>
<tr>
<th>Sections Completed</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Frequency</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>5.46</td>
<td>10</td>
<td>5.46</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>5.46</td>
<td>20</td>
<td>10.93</td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>9.84</td>
<td>38</td>
<td>20.77</td>
</tr>
<tr>
<td>3.5</td>
<td>4</td>
<td>2.19</td>
<td>42</td>
<td>22.95</td>
</tr>
<tr>
<td>4</td>
<td>36</td>
<td>19.67</td>
<td>78</td>
<td>42.62</td>
</tr>
<tr>
<td>5</td>
<td>23</td>
<td>12.57</td>
<td>101</td>
<td>55.19</td>
</tr>
<tr>
<td>6</td>
<td>82</td>
<td>44.81</td>
<td>183*</td>
<td>100.00</td>
</tr>
</tbody>
</table>

*Responses missing = 3

As presented in Table 6, approximately 77.05% of participants reported finishing more than half of the story, with 44.81% completing the entire story within the allotted thirty-minute period.

Based on the mean number of bottom-up resources accessed there is indeed a progressive increase in the number of resource items participants consulted given the increased number of items available to those who read more of the story. Table 7 presents the percentage of the available English and Spanish definitions that participants consulted at each point in the reading based on the amount of the story they reported completing.
Table 7
Participants’ Use of the Lexical Aids Presented to Them

<table>
<thead>
<tr>
<th>Sections Completed</th>
<th>Percent of Available English Definitions Consulted</th>
<th>Percent of Available Spanish Definitions Consulted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>71.88</td>
<td>12.19</td>
</tr>
<tr>
<td>2</td>
<td>81.46</td>
<td>3.66</td>
</tr>
<tr>
<td>3</td>
<td>65.87</td>
<td>5.22</td>
</tr>
<tr>
<td>3.5</td>
<td>76.47</td>
<td>5.88</td>
</tr>
<tr>
<td>4</td>
<td>66.00</td>
<td>7.30</td>
</tr>
<tr>
<td>5</td>
<td>69.71</td>
<td>4.64</td>
</tr>
<tr>
<td>6</td>
<td>55.64</td>
<td>3.54</td>
</tr>
</tbody>
</table>

Importantly, as shown in Table 7, when considering the percentage of the English and Spanish definitions that participants actually consulted the data indicate that those approximately 45% of participants who reported finishing the entire story did not do so by pointlessly clicking on every available link, but rather consulted the fewest definitions.

In order to control for this situation, the difference in the amount of the story actually completed was considered a covariate of the number of comprehension resources consulted. An analysis of covariance (ANCOVA) test was employed to adjust the frequency of resource consultation for the amount of the story actually completed. Then, in order to determine the relationship between the frequency of resource consultation and the amount of the story actually completed, the number of links consulted by each participant was divided by the number of sections the participant reported completing reading. The means broken down with reference to the three groups assigned by level of instructed second language experience were the following: Less Experienced Group: 10.68, Moderately Experienced Group: 11.22, Most Experienced Group: 12.64. An analysis of variance (ANOVA) was employed to compare this value across the three language experience levels and showed no statistical significance between the means of each group at the specified 0.05 significance level, $F(2, 180) = 0.99, p = 0.3747$. 

68
Consultation of the English definitions was then brought into consideration by means of a two-way ANOVA using the number of English definitions as the dependent variable and both language experience level and the number of sections completed as independent variables. The results showed significant differences in the overall model for both of the independent variables at the specified 0.05 significance level, $F(8, 174) = 2.82, p = 0.0058$. A $t$ test showed that the differences between certain specific means proved to be significant at the 0.05 level, with a critical value of $t$ of 1.97. For the amount of the story completed the significant differences were between the those who only completed one section ($M = 23$ English definitions consulted) and those who completed three and a half sections ($M = 39$ English definitions consulted), five sections ($M = 41.1$), and all six sections ($M = 41.7$). For language experience level the significant differences were between the Less Experienced Group ($M = 33.45$ English definitions consulted) and the Moderately Experienced Group ($M = 40.83$ English definitions consulted). The Most Experienced Group fell in between having consulted a mean number of 38.42 English definitions. However, in spite of the overall significance of the model and certain significant differences between individual means within the model, there was not a significant interaction between the two independent variables.

**Level of Instructed Second Language Experience**

In order to fully address the issue the strategies that readers with different levels of instructed second language experience employed when using comprehension aids to cope with a reading task, the second research question posed was: What role does level of instructed second language experience play in strategy choice? This question focuses more directly than the other research questions on the interaction between the independent variable of the study, level of instructed second language experience, and the dependent variable, the number of times that participants consulted the comprehension aids in the form of resource materials.

In order to determine if a correlation exists between the number of times that a reader consulted resource materials of specific types and the reader’s level of instructed second language experience, participants were grouped according to their reported
number of semesters of prior study of Spanish. Two semesters of high school Spanish study (i.e., one school year) were counted as equivalent to one semester of post-secondary study. As detailed in the previous chapter, three groups were established based on amount of prior experience: the Less Experienced Group \((N = 58)\), the Moderately Experienced Group \((N = 89)\), and the Most Experienced Group \((N = 39)\).\(^1\)

In order to assess the role of prior language experience in the reading strategies of L2 readers as proposed by the second research question, the data presented in Table 8 show the mean number of times that individual participants consulted one of the seven types of comprehension aids were consulted based on participants’ assigned level of instructed second language experience.

<table>
<thead>
<tr>
<th>Comprehension Aid</th>
<th>Less Experienced Group ((N = 58))</th>
<th>Moderately Experienced Group ((N = 89))</th>
<th>Most Experienced Group ((N = 39))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(M)</td>
<td>(SD)</td>
<td>(M)</td>
</tr>
<tr>
<td>English Definition</td>
<td>33.45</td>
<td>16.24</td>
<td>41.20</td>
</tr>
<tr>
<td>Spanish Definition</td>
<td>2.52</td>
<td>5.29</td>
<td>2.51</td>
</tr>
<tr>
<td>Visual</td>
<td>3.14</td>
<td>4.15</td>
<td>4.25</td>
</tr>
<tr>
<td>Eng. Hist. Context</td>
<td>0.52</td>
<td>0.50</td>
<td>0.42</td>
</tr>
<tr>
<td>Span. Hist. Context</td>
<td>0.31</td>
<td>0.47</td>
<td>0.35</td>
</tr>
<tr>
<td>Eng. Lit. Commentary</td>
<td>0.55</td>
<td>0.50</td>
<td>0.51</td>
</tr>
<tr>
<td>Span. Lit. Commentary</td>
<td>0.22</td>
<td>0.42</td>
<td>0.29</td>
</tr>
</tbody>
</table>

\(^1\) A word count analysis of the written recall protocols that participants wrote immediately after reading appeared to confirm the grouping decisions.
Table 8 illustrates the high number of times that English translations were consulted by the individual participants in each group as compared to all of the other types of resources. It also shows that the English translations were consulted the most by the participants in the Moderately Experienced Group. Similar to Table 8, Table 9 shows the number of times that aids were consulted when grouped according to top-down or bottom-up categories as compared to level of instructed second language experience.

Table 9
Use of Comprehension Aids Grouped by Category According to Level of Experience

<table>
<thead>
<tr>
<th>Category of Aids</th>
<th>Less Experienced Group (N = 58)</th>
<th>Moderately Experienced Group (N = 89)</th>
<th>Most Experienced Group (N = 39)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (M)</td>
<td>SD</td>
<td>Mean (M)</td>
</tr>
<tr>
<td>Bottom-up</td>
<td>39.10</td>
<td>18.98</td>
<td>47.96</td>
</tr>
<tr>
<td>Top-down</td>
<td>1.60</td>
<td>1.34</td>
<td>1.56</td>
</tr>
</tbody>
</table>

Table 9 shows a similar trend to that noted in the case of the types of comprehension resources considered one by one. The trend is that participants in the Moderately Experienced Group consulted the bottom-up type of resources more often than the other groups. Table 9 also demonstrates the same preference for the bottom-up, lexical resources evidenced by each experience level group that was seen earlier with regard to the overall frequency of use of the various types of aids.

In order to determine the nature of the role of instructed L2 experience in the choice of reading strategies, as proposed by the second research question, Table 10 presents the results of the ANOVA for the mean number of times that participants at each of the language experience levels consulted one of the seven types of comprehension aids.
Table 10
ANOVA for Level of Instructed L2 Experience

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Definition</td>
<td>2</td>
<td>2138.19</td>
<td>1069.09</td>
<td>3.71</td>
<td>0.026**</td>
</tr>
<tr>
<td>Spanish Definition</td>
<td>2</td>
<td>99.59</td>
<td>49.80</td>
<td>1.35</td>
<td>0.263</td>
</tr>
<tr>
<td>Eng. Hist. Context</td>
<td>2</td>
<td>2.71</td>
<td>1.36</td>
<td>5.94</td>
<td>0.003**</td>
</tr>
<tr>
<td>Span. Hist. Context</td>
<td>2</td>
<td>0.78</td>
<td>0.39</td>
<td>1.86</td>
<td>0.159</td>
</tr>
<tr>
<td>Eng. Lit. Commentary</td>
<td>2</td>
<td>2.28</td>
<td>1.14</td>
<td>4.74</td>
<td>0.010**</td>
</tr>
<tr>
<td>Span. Lit. Commentary</td>
<td>2</td>
<td>0.98</td>
<td>0.49</td>
<td>2.79</td>
<td>0.064</td>
</tr>
<tr>
<td>Visual</td>
<td>2</td>
<td>120.03</td>
<td>60.02</td>
<td>3.20</td>
<td>0.043**</td>
</tr>
</tbody>
</table>

**p < .05

Table 10 illustrates a statistical significance between the mean number of times that each group consulted four of the seven types of comprehension aids: English definitions, the English essay on historical context, the English literary commentary, and visuals.

First, there was a statistical significance between the average number of times that each group consulted the English definitions at the specified 0.05 significance level, $F(2, 183) = 3.71, p = 0.026$. A $t$ test, the Fisher’s Least Significant Difference (LSD) test, showed that the difference between the means of certain of the groups were significant with regard to consulting English definitions. The differences between means that proved to be significant at the 0.05 level, with a critical value of $t$ of 1.97, were between the Less Experienced Group and the Moderately Experienced Group, -7.754. However, as shown above in Table 8, the means did not line up according to language experience group, Less Experienced Group: 33.45, Moderately Experienced Group: 41.20, Most Experienced Group: 39.08. Thus, those participants in the middle level group consulted a significantly higher number of English definitions than the participants in Less Experienced Group, but those having the most experience in the language fell in between. Since there was no statistical difference between the two higher experience groups, it is only possible to conclude that the behavior of the participants in the Less Experienced Group was the only
one that stands out from the other two. This behavior seems to be consistent with participants in the upper experience groups having found bottom-up processing strategies to be successful.

Second, the results showed a statistical significance between the mean number of times that each group consulted the English version of the Historical Context essay at the specified 0.05 significance level, $F(2, 183) = 5394, p = 0.003$. In this case, the means line up according to language experience group so that the more prior experience the participants had, the less they consulted the Historical Context essay in English, Less Experienced Group: 0.52, Moderately Experienced Group: 0.42, Most Experienced Group: 0.18. An $t$ test showed that differences between means that proved to be significant at the 0.05 level, with a critical value of $t$ of 1.97, were between the Less Experienced Group and the Most Experienced Group, 0.338; and between the Moderately Experienced Group and the Most Experienced Group, 0.236. Consequently, while all three groups were aligned in a tendency to use the resource less often with greater experience in the target language, use by those having the most experience in the language, the Most Experienced Group, was significantly lower than the other two groups. This pattern of behavior was consistent with a lexical, bottom-up reading strategy being sufficient for the most experienced L2 readers, while those with less experience seemed to be accessing the various types of aids more erratically.

Third, there was a statistical significance between the average number of times that each group consulted the English version of the Literary Commentary at the specified 0.05 significance level, $F(2, 183) = 4.74, p = 0.010$. Also in this case again, the means line up according to language experience group so that the more prior experience the participants had, the less they consulted the Literary Commentary essay in English, Less Experienced Group: 0.55, Moderately Experienced Group: 0.51, Most Experienced Group: 0.26. The differences between means that proved to be significant at the 0.05 level, with a critical value of $t$ of 1.97, were between the Less Experienced Group and the Most Experienced Group, 0.295; and between the Moderately Experienced Group and the Most Experienced Group, 0.249. Therefore, again, while all three groups were aligned in a tendency to use the resource less often with greater experience in the target language, use by those having the most experience in the language, the Most Experienced Group,
was significantly lower than the other two groups. In this case there was again a pattern of behavior that seems to be consistent with those in the upper experience groups finding bottom-up processing strategies to be successful, while those with less experience seemed to be using the resources much more erratically.

Fourth, there was a statistical significance between the mean number of times that each group consulted the visual resources at the specified 0.05 significance level, \( F(2, 183) = 3.20, p = 0.043 \). However, the means did not line up according to language experience group, Less Experienced Group: 3.14, Moderately Experienced Group: 4.25, Most Experienced Group: 2.23. The differences between means that proved to be significant at the 0.05 level, with a critical value of \( t \) of 1.97, were between the Moderately Experienced Group and the Most Experienced Group, 2.016. Thus, participants in the Moderately Experienced Group consulted the visuals more often than those in the Less Experienced Group, but not at a significantly higher level. Consultation of visual resources by those having the most experience in the language, the Most Experienced Group, was significantly lower than only the Moderately Experienced Group, not the Less Experienced Group. Since there was no statistical difference between the two lower experience groups, it is only possible to conclude that the behavior of the participants in the Most Experienced Group was the only one that stands out from the other two. This behavior seems to be consistent with participants in the upper experience groups finding bottom-up processing strategies to be successful.

With regard to the second research question, Table 11 presents further results of the ANOVA for the comprehension aids as grouped by category and based on participants’ level of instructed L2 experience.

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom-up</td>
<td>2</td>
<td>2792.31</td>
<td>1396.15</td>
<td>3.83</td>
<td>0.023**</td>
</tr>
<tr>
<td>Top-down</td>
<td>2</td>
<td>22.87</td>
<td>11.44</td>
<td>6.16</td>
<td>0.003**</td>
</tr>
</tbody>
</table>

** \( p < .05 \)
Table 11 demonstrates a statistical significance between the average number of times that each group consulted both of the grouped sets of aids.

There was a statistical significance between the mean number of times that each group consulted the bottom-up resources taken as a group at the specified 0.05 significance level, $F(2, 183) = 3.83$, $p = 0.023$. The differences between means which proved to be significant at the 0.05 level, with a critical value of $t$ of 1.97, were between the Less Experienced Group and the Moderately Experienced Group, -8.852. However, the means did not line up according to language experience group: Less Experienced Group: 39.10, Moderately Experienced Group: 47.96, Most Experienced Group: 45.62. Consequently, participants in the Moderately Experienced Group consulted the bottom-up resources significantly more often than those in the Less Experienced Group, but those in the Most Experienced Group fell in between. I will further discuss possible reading strategies that explain this behavior in the following chapter.

Likewise, the results showed a statistical significance between the average number of times that each group consulted the top-down resources taken as a group at the specified 0.05 significance level, $F(2, 183) = 6.16$, $p = 0.003$. In this case, the means did line up according to language experience group so that the more prior experience the participants had, the less they consulted the top-down resources: Less Experienced Group: 1.60, Moderately Experienced Group: 1.56, Most Experienced Group: 0.72. The differences between means which proved to be significant at the 0.05 level, with a critical value of $t$ of 1.97, were between the Less Experienced Group and the Most Experienced Group, at 0.886; and also between the Moderately Experienced Group and the Most Experienced Group, at 0.844. Thus, while all three groups are aligned in a tendency to use the resource less often with greater experience in the target language, use by those having the most experience in the second language, the Most Experienced Group, was significantly lower than the other two Groups. This is another case in which there was a pattern of behavior that was consistent with a lexical, bottom-up reading strategy being sufficient for the most experienced L2 readers, while those with less experience seemed to be using the resources in a somewhat erratic manner.
Post Hoc Analyses

Moderating Variables

The moderating variables were essentially specific factors in the reading process that I considered in the course of the study in order to determine whether they would significantly influence the findings. They were accounted for by means of information obtained from the language experience survey and the exit questionnaire. The language experience survey solicited information concerning the first moderating variable by means of the two questions Have you lived in a mainly Spanish-speaking country or environment for an extended period of time? If yes, for what period of time? However, these questions were found to be misunderstood by many of the participants and the data from them were not used as a basis for exclusion from the data. Specifically, fourteen participants reported such periods of residence (lengths of time reported ranged from 0.25 to 23 years; with a mean of 8.54 years) in a mainly Spanish-speaking country or environment. An ANOVA test on the responses given by these fourteen as compared to the remainder of the participants found no significant difference, at the $\alpha = 0.05$ decision level, on any measure of resource use behavior. A Chi Squared test of independence revealed no dependence between resource usage and reported residence. For these reasons residence in a Spanish-speaking environment was not deemed to have an effect on these fourteen participants’ resourcing strategies and the computer tracking data obtained from them were included in the study.

Data concerning two other possible moderating variables were analyzed to determine if a correlation exists between participants’ responses concerning them and their use of the comprehension aids. I will now briefly discuss the steps taken to determine if the variables of L1 reading ability and perceived difficulty of the text had an impact on participants’ use of comprehension aids. Further discussion of these analyses may be found in Appendix H.

First Language Reading Skills

The first moderating variable that was fully analyzed was the reading skill of participants in their first language. On the language experience survey participants were
asked to circle a descriptor representing how they would evaluate their reading skills in English. Only two participants rated their own reading ability in English below the level of average on the Likert-type scale provided them. The four descriptors that were chosen by participants were: Less Than Average ($N = 2$), Average ($N = 31$), Better Than Average ($N = 45$), and Strong ($N = 110$).

An ANOVA was used to determine what effect participants’ L1 reading ability might have had on their use of the available comprehension aids. There was a statistical significance between the mean number of times that aids were consulted for only one of the variables, the visuals. Participants who rated their own reading ability in English as average (i.e., those with the lowest self-reported reading ability) consulted a significantly higher number of visual resources than participants who rated their reading abilities in any of the categories above the level of average. However, there were no significant differences between experience level groups with regards to their use of the resources when grouped into top-down and bottom-up categories. Further details pertaining to this analysis are provided in Appendix H. Likewise, when first language reading ability was considered as a second independent variable there was no significant interaction between first language reading ability and the participants’ level of prior study at the at the 0.05 level.

**Text Difficulty**

The second of the moderating variables analyzed was the participants’ perception of how difficult a text the short story posed. As mentioned previously, during the selection process the story was evaluated using the Fry readability graph adapted for use on Spanish-language texts for use with bilingual students. Based on the Fry readability graph, the story falls within the eighth grade reading level. Further data on the perceived difficulty of the text were elicited from the participants themselves. On the exit questionnaire participants were asked to circle a descriptor representing how difficult they would say the story was compared to readings in their current Spanish course. None of the participants rated the text below the level of about the same on the Likert-type scale provided to them. The three descriptors that were used by participants were: About
The Same \( (N = 15) \), Somewhat More Difficult \( (N = 71) \), and Much More Difficult \( (N = 100) \).

An ANOVA was used to determine what effect perceived text difficulty might have had on participants’ use of the available comprehension aids. There was a statistical significance between the mean number of times that that aids were consulted for only two of the variables, Spanish definition, and visual. Of these, there were only significant differences between each of the three difficulty variables for the mean number of consultations to Spanish definitions. Those participants who found the reading the least difficult used a significantly higher number of Spanish definitions than all of the other participants. Yet, there were no significant differences in the use of the resources based on perceived text difficulty when grouped into top-down and bottom-up categories.

Further details pertaining to this analysis are provided in Appendix H. Additionally, when perceived text difficulty was considered as a second independent variable along with participants’ level of prior study, there was no significant interaction at the 0.05 level between perceived text difficulty and the participants’ level of prior study.

**Written Recall Protocol as a Global View of Comprehension**

The issue of global comprehension arises because the findings relating to the second research question present a view of the erratic use of comprehension aids by many participants in the lower and middle levels of language experience. Specifically, I am led to ask, how did the participants in the study at different levels of instructed second language experience vary in their global comprehension of the text? To begin to answer this question I examined the length and content of written recall protocols.

Written recall protocols were obtained from participants after they finished reading the short story, or after the allotted time expired. Protocols were to consist of a retelling of the story in the participants’ own words, in English, with as much detail as possible. To evaluate these protocols the measures used were a simple count of words written. For the purposes of this count, individual words were operationally defined as including contractions, abbreviations, numbers expressed as numerals, and variants separated by a slash. Thus, each of the following examples extracted from participants’
protocols constituted single words: him/her, he/she, 23, T.V., and d’état. Components of hyphenated words were counted separately.

The results of the word count were aligned in ascending order from Less Experienced Group through Most Experienced Group (i.e., Less Experienced Group: 109.88 words, Moderately Experienced Group: 114.34 words, and Most Experienced Group: 126.72 words). The word count means showed a clear trend toward greater comprehension with greater experience in Spanish. Likewise, in spite of the similarly erratic use of resources at all the lower levels, the participants did differ in the amount that they were able to summarize the story, though the differences in the mean number of words written were not statistically significant due to high standard deviations within each group.

Summary

In this chapter I have presented findings concerning the general use of comprehension aids, patterns of resource use associated with level of second language experience, and post hoc analyses. In terms of the frequency of use, lexical aids as a group and English translations in particularly proved to be the most popular resources. With regard to level of second language experience, data showed that participants in the upper experience groups behaved in ways consistent with finding bottom-up processing strategies successful, while those in the lowest experience group behaved in ways consistent with unsuccessful bottom-up strategies and subsequently grasping for any and all resources. The post hoc analyses included the possible effects of participants’ L1 reading ability and their perception of the difficulty of the experimental text. In both cases, and in all measures, these were not found to have a significant impact on resourcing strategies. I will undertake further discussion of the findings presented in this chapter as well as the second and third research questions in the following chapter.
CHAPTER V
DISCUSSION AND IMPLICATIONS

In the previous chapter I presented a description of each of the findings of the study. The purpose of this chapter is to expand on that description through a more fully developed discussion of what the findings tell us with regard to readers’ strategies for using resources in the form of comprehension aids. The use of comprehension aids is the focus of this study because of the intersection of two theoretical constructs. The first construct of importance is the proposition that the act of reading is essentially that of constructing a mental model of the text in the mind of the reader (Hudson, 1998). The second is actually a set of constructs that intersect with the construction of a mental model. They are the top-down, bottom-up and interactive metaphors of language reading. By tracking L2 readers’ use of, and behaviors vis-à-vis, selected types of comprehension aids, we can gain insight into the strategies that those readers employed to help themselves comprehend the text.

The data presented in the previous chapter will be taken up for consideration under similar headings and in an order parallel to the previous chapter. I will first undertake a discussion of results in five categories, starting with the total use of comprehension aids understood from the analysis of two distinct sets of data. The second category will be the role of readers’ level of instructed second language experience, followed by other factors that affect readers’ behavior patterns. Then, I will briefly discuss the post hoc analyses that were presented in the previous chapter and enumerate the benefits obtained through tracking reading behavior. The chapter will close with a consideration of the implications of the study with emphasis on foreign language instruction and recommendations for future research.
Discussion of Results

Use of Comprehension Aids

The use of computer tracking made it possible to count the number of participants who viewed each specific resource and also to count the total number of hits per resource. These two types of data represent two distinct ways to quantify readers’ use of comprehension aids. In one type of data the resources are treated equally regardless of how many of each kind of aid were available or how many times participants might have returned to refer to it. In the other type all hits are treated equally regardless of the number of times any given participant might have consulted the same resource or type of resource. The first part of the first research question (Given several comprehension aids as resources, what resources will second language readers use when reading an authentic text on computer?) addresses the issue of the number of second language learners who would choose particular comprehension aids if these resources were among several available. Data were analyzed in such a way as to count the number of participants who used each type of aid at least once, thereby accounting for the discrepancies quantity between resources such as the English and Spanish definitions, which each consisted of 75 items, and the four essays, which were each single items.

The computer tracking data show that a higher percentage of participants consulted the lexical, bottom-up type resources than they did any of the non-lexical, top-down type resources. The English definitions were the resource that most participants, 98.9%, chose to consult at least once. Spanish definitions were the second most popular type of aid, at approximately 74% of participants. And visuals were consulted by the third highest number of participants, approximately 67%. These rankings are not unexpected based on my predictions, however they will become of more interest when we consider the frequency of consultation for the various types of resources. Likewise, the finding that approximately 99% of participants chose to consult English translations, making it
by far the most popular type of aid, is not unexpected in light of previously published studies.

The high degree of popularity of the lexical aids contrasts sharply with the relatively low number of participants who consulted any of the resources that provided more global, top-down type assistance. Each of the essays, which were intended to provide background information and an overview of the plot, were consulted by less than half of the participants. Furthermore, among the four essays, the English-language versions were each consulted by more participants than the Spanish-language versions. Overall, in answer to the question *What resources will second language readers use when reading an authentic text on computer?*, there was an overwhelming preference for lexical, bottom-up type aids over non-lexical, top-down type aids.

The second part of the first research question (Given several comprehension aids as resources, with what frequency will second language readers use them?) is concerned with the gross number of consultations, or hits, per resource. In order to ascertain how many times each type of resource was consulted, data were analyzed in such a way as to count each viewing without regard to how many times the same individual participant consulted the same type of aid. The purpose was to count the number of times a specific resource was consulted rather than count the number of participants who had consulted it, thus, all non-consecutive hits were treated equally. Computer tracking data are particularly useful with regards to the second part of the first research question because they have the unique ability to ascertain how many times the comprehension aids were consulted. Although data were collected for each aid separately, the components of the 75 lexical glosses were coded as English definitions or left uncoded (i.e., Spanish definitions) in order to count all uses of English definitions together as a composite and all of the Spanish definitions together as a composite.

The finding that approximately 83.1% of consultations, or hits, were to English definitions is very much in conformity with the findings of the only other study to address a question of this kind. Davis and Lyman-Hager (1997) found that 85% of the resources accessed in their study were L1 definitions. However, the finding that visuals were the second most consulted type of resource at 7.52% differs markedly from Davis
and Lyman-Hager’s finding of .59% of consultations being to visuals, a percentage which ranks visuals sixth out of the seven types of resources in their study; likewise, the finding that Spanish definitions ranked as the third most used type of resource differs from Davis and Lyman-Hager’s finding that L2 French definitions consisted of 1.35% of resources consulted, placing it second out of the seven types of resources in their study.

Taken as a group, the lexical resources made up approximately 95% of all the comprehension aids, while the 4 non-lexical resources made up only about 5%. Thus, the finding that the lexical resources received approximately 97% of the hits, while the non-lexical resources received only about 3%, is closely aligned with their relative abundance or lack thereof. These findings do, however, allow for the observation that the lexical resources were more popular, if only slightly, than their actual, statistical representation in the pool of resources (i.e., 97% of the hits were made to links which represented 95% of the resources). Conversely, the non-lexical resources were consulted at a ratio lower than they would have had participants simply clicked on every link available one time each.

These data differ from those discussed under the first part of the first research question in that visuals were found to have actually received more hits than Spanish definitions. This is of interest because Spanish definitions were consulted by more individual participants than were visuals, 73.7% to 67.2%, yet visuals received more total hits. These findings indicate that although more participants viewed a Spanish definition at least once, they did not consult them again as often as those who viewed a visual lexical aid. Perhaps this is best illustrated in terms of the ratio of hits to users, as shown in the previous chapter in Tables 2 and 3, 125 participants viewed the visual aids a total of 689 times, for a mean of 5.51 times each. However, 137 participants viewed the Spanish definitions a total of 578 times, for a mean of only 4.22 times each. This is especially noteworthy when one considers that there were 75 Spanish definitions available as compared to only 20 visuals. Based on their repeated use of them, the participants clearly considered the visuals to be a more helpful type of comprehension aid than the L2 definitions.
In summary, the picture of L2 readers’ resourcing strategies seems to look the same based on both types of data, the number of participants who used each type of aid and the frequency which they used them. Specifically in answer to the question *Given several comprehension aids as resources, with what frequency will second language readers use them?* the tendency of L2 readers to overwhelmingly prefer lexical, bottom-up type resources as a default strategy is confirmed, while bringing an additional detail to light. In reality, the L2 definitions were consulted less frequently than both the English definitions and the visuals. The first research question has identified a lexically based, bottom-up type resourcing strategy as being predominant by a wide margin. I will now go a step further to consider the use of comprehension aids as a function of readers’ level of experience in the L2.

**Level of Instructed Second Language Experience**

The second research question (What role does level of instructed second language experience play in strategy choice?) focuses specifically on the actions taken by learners at differing L2 experience levels during the reading process as a means to develop an understanding of the resourcing strategies that motivate those actions. To this end, computer tracking data provided an excellent tool to examine any correlation between the amount of learners’ previous instructed experience in Spanish and their reading strategies regarding the use of resources in the form of comprehension aids.

Taking as a starting point the theoretical principles outlined in Chapter 2 one of two possible outcomes was anticipated. In the first scenario it was expected that learners with less instructional experience would lack skill in identifying vocabulary which would, in turn, lead them to rely heavily on bottom-up processing strategies such as seeking more aid in the lexical, bottom-up resources (i.e., English definition, Spanish definition, and visual). Furthermore, learners with more instructional experience would possess more completely formed mental lexicons for the L2 and more automatic vocabulary recognition skills, and consequently would rely more on non-lexical, top-down processing strategies. A pattern for such strategies might include seeking less aid in the lexical resources and more aid in the more global, background, and overview resources (i.e., historical context essays and literary commentary essays).
In the second scenario it was expected that precisely because learners with more instructional experience possess more completely formed mental lexicons for the L2 and more automatic vocabulary recognition skills they would find lexical, bottom-up type strategies sufficient for their needs and be able to comprehend the text adequately without the support of the more global, top-down type resources. Learners with less instructional experience, however, might start out with a bottom-up strategy as their initial response to the text but would find it insufficient, not comprehend the text adequately, and as a result abandon their initial strategy in search of another one that served them better. During this process of strategy shifting, readers might appear to be using the various types of resources somewhat randomly or erratically. Moreover, erratic resource use might continue indefinitely if the reader does not settle on a new reading strategy that leads to adequate comprehension.

Analysis of the computer tracking data showed mixed, but informative insights into second language readers’ use of the various comprehension aids. As previously described, the design for this portion of the experimental treatment consisted of the independent variable of the length of time of prior Spanish study, or instructed second language experience. The number of times that resource materials were consulted served as the dependent variable, which was expressed as nine levels of variables. The independent variable was expressed as three levels, defined as the number of semesters of instructed Spanish study, which in turn served as the basis for assigning participants to one of three experience level groups. For purposes of comparison, numbers may be used in the following discussion to refer to the three language experience levels. The numbers should be considered to have the following meaning: Group 1, or simply “1,” refers to the Less Experienced Group, Group 2, or simply “2,” refers to the Moderately Experienced Group, and Group 3, or simply “3,” refers to the Most Experienced Group.

Based on participants’ level of instructed second language experience, significant differences were found to exist between at least two of the language experience groups for the number of times that participants consulted four out of the seven comprehension resources taken individually, and for both of the two grouped sets of resources. However, the results are mixed in that in three cases there was a significant difference only between
the highest and lowest of the three groups’ means (i.e., English definition, visual, and bottom-up resources as a group). In the other three cases, there were significant differences between the lowest mean and each of the other two (English historical context essay, English literary commentary essay, and top-down resources as a group).

In the following paragraphs I will discuss the findings concerning each of the six types of resources or grouped resources for which language experience level showed significant differences. Table 12 illustrates the findings in summary form.

Table 12
Means for Comprehension Aids by Experience Level Group

<table>
<thead>
<tr>
<th>Comprehension Aid</th>
<th>Lowest Mean</th>
<th>Middle Mean</th>
<th>Highest Mean</th>
<th>Significant Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lowest</td>
<td>Middle</td>
<td>Highest</td>
<td>Differences</td>
</tr>
<tr>
<td></td>
<td>Consults</td>
<td>Consults</td>
<td>Consults</td>
<td></td>
</tr>
<tr>
<td>English Definition</td>
<td>G1: 33.45</td>
<td>G3: 39.08</td>
<td>G2: 41.20</td>
<td>G1 ≠ G2*</td>
</tr>
<tr>
<td>Spanish Definition</td>
<td>G2: 2.51</td>
<td>G1: 2.52</td>
<td>G3: 4.31</td>
<td>---</td>
</tr>
<tr>
<td>Visual</td>
<td>G3: 2.23</td>
<td>G1: 3.14</td>
<td>G2: 4.25</td>
<td>G2 ≠ G3*</td>
</tr>
<tr>
<td>Eng. Hist. Context</td>
<td>G3: 0.18</td>
<td>G2: 0.42</td>
<td>G1: 0.52</td>
<td>G1 ≠ G3, G2 ≠ G3</td>
</tr>
<tr>
<td>Span. Hist. Context</td>
<td>G3: 0.18</td>
<td>G1: 0.31</td>
<td>G2: 0.35</td>
<td>--</td>
</tr>
<tr>
<td>Eng. Lit. Commentary</td>
<td>G3: 0.26</td>
<td>G2: 0.51</td>
<td>G1: 0.55</td>
<td>G1 ≠ G3, G2 ≠ G3</td>
</tr>
<tr>
<td>Span. Lit. Commentary</td>
<td>G3: 0.10</td>
<td>G1: 0.22</td>
<td>G2: 0.29</td>
<td>---</td>
</tr>
<tr>
<td>Bottom-up</td>
<td>G1: 39.10</td>
<td>G3: 45.62</td>
<td>G2: 47.96</td>
<td>G1 ≠ G2*</td>
</tr>
<tr>
<td>Top-down</td>
<td>G3: 0.72</td>
<td>G2: 1.56</td>
<td>G1: 1.60</td>
<td>G1 ≠ G3, G2 ≠ G3</td>
</tr>
</tbody>
</table>

Note. *Italics* = sequence of experience groups is in order for the variable. G = language experience group. *significant difference only between lowest and highest

As shown in Table 12, English historical context essay, English literary commentary essay, and top-down resources as a group were also the only three variables for which the means of the three groups lined up in sequence. And, in all three cases the order of the groups’ means, from lowest to highest, was 3, 2, 1. Furthermore, for all three of these
variables, the means for the Most Experienced Group were significantly different from the means of both of the other groups. The lack of significance between the means for the Less Experienced Group and the Moderately Experienced Group indicates that while the Moderately Experienced Group fell between the Less Experienced Group and the Most Experienced Group, they were not dissimilar from the Less Experienced Group by a high enough degree to reach statistical significance. Table 13 presents a more succinct view of the data presented in Table 12 by focusing on the relationship between the means associated with each language experience level.

Table 13
Patterns of Resource Consultation for Each Language Experience Group

<table>
<thead>
<tr>
<th>Language Experience Level</th>
<th>Instances of Lowest Mean Consults</th>
<th>Instances of Middle Mean Consults</th>
<th>Instances of Highest Mean Consults</th>
<th>Instances of Significance From the Means of Both Other Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Experienced</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Moderately Experienced</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Most Experienced</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

The clearest picture of any resourcing strategy on the part of any of the groups emerges at this point concerning the Most Experienced Group. As shown in Table 13, they tended to use resources less than the other groups. The one type of resource that this group consulted more than the others did was the Spanish definitions, though the differences with the other groups were not significant. They consulted the English historical context essay, English literary commentary essay, and top-down resources as a group significantly less than did the members of the Less Experienced Group and the Moderately Experienced Group. Yet, these are precisely the types of aids that learners
like those in the Most Experienced Group, those with the most prior experience in the L2, were predicted to use more often in the first scenario.

Clearly, with regard to the non-lexical, global resources the patterns of behavior on the part of the participants do demonstrate the use of one or more resourcing strategies. First, as noted above, they preferred both of the essays in English to the two essays in Spanish. Second, the participants with the greatest amount of prior experience in Spanish, the Most Experienced Group, consulted them significantly fewer times than either of the other groups. Third, no significant differences emerged with regard to the way the language experience groups consulted any of the Spanish-language resources. However, if the consultation of the non-lexical, global resources, is to be considered to be an indicator that the reader was in the process of constructing a top-down mental model of the story as he or she read, the participants did not behave in a manner consistent with a progressively greater use of top-down processing strategies at progressively higher levels of experience. The data indicate that the opposite occurred. Thus, in terms of the two possible outcomes, the findings argue against the first scenario and for the second scenario. At this point, participants’ behavior seems to have been consistent with those the upper experience groups finding bottom-up processing strategies to be successful. Meanwhile, those in the lower experience group demonstrated somewhat erratic use of the comprehension aids.

Concerning the use of the visual resource, participants in the Moderately Experienced Group consulted visuals the most, followed by those in the Less Experienced Group. Similar to the pattern of use seen for the top-down resources, those in the Most Experienced Group consulted the visuals the least. This resulted in an inversion of the positions of the Less Experienced Group and the Moderately Experienced Group, so that the order of use from least to most resulted in a pattern of: 3, 1, 2. In this case only the means obtained for the Moderately Experienced Group and the Most Experienced Group, the highest and the lowest means, were significantly different. These findings appear to be consistent with participants in the upper experience groups meeting with success in their use of bottom-up processing strategies.
Concerning the use of English definitions and use of the bottom-up resources as a group, in both cases participants in the Moderately Experienced Group consulted the resources the most, followed by those in the Most Experienced Group. Unlike in the other patterns of behavior, those in the Less Experienced Group used these resources the least. This resulted in an inversion of the positions of the Less Experienced Group and the Most Experienced Group with the Less Experienced Group displaced to the low end, so that the order of use from least to most resulted in a pattern of: 1, 3, 2 for both of these variables. Also, in both cases, only the means obtained for the Moderately Experienced Group and the Less Experienced Group, the highest and the lowest, were significantly different. Participants in the Moderately Experienced Group and the Most Experienced Group behaved in a manner consistent with the prediction that learners with more instructional experience would rely more on top-down processing strategies and seek less aid in the lexical resources; an outcome expected by the first predicted scenario. However, it is the behavior of those in the Less Experienced Group, falling below both of the groups of more experienced learners to consult these resources the least, that indicates that the first of the predicted possible scenarios was not what actually happened.

The Less Experienced Group consulted the most popular type of lexical aid, English definition, and the lexical aids taken as a group, less often than the other two groups. Yet, these are precisely the types of aids that learners like those in the Less Experienced Group, those with the least prior experience in the L2, would be expected to use more often based on the first of the possible scenarios. The lack of significance between the means indicates that while the Most Experienced Group fell between the Moderately Experienced Group and the Less Experienced Group, they were not dissimilar from either of the other groups by a high enough degree to reach statistical significance. Consequently, with regard to the use of English definitions and use of the bottom-up resources as a group, the picture is muddled by the fact that only the means of the groups consulting the resources the most and the least were significantly different, because the means obtained for the Most Experienced Group bridge the gap between the means obtained for the other two groups. Thus, in terms of the two predicted possible outcomes, the preponderance of the findings argue for rejecting the first scenario and for
viewing the results of the study in terms of the second scenario. On the whole, all of the findings concerning participants’ resourcing strategies are consistent with participants in the upper experience groups considering bottom-up processing strategies to adequately support their comprehension of the story and staying with them. Those in the lower experience group demonstrated a much more erratic resourcing strategy, as illustrated by such behaviors as their consulting the English definitions significantly less. This erratic use of the comprehension aids is likely an indication that they did not find bottom-up type strategies sufficient to support their comprehension of the story and began a process of strategy shifting.

In summary, the findings related to the second research question lead toward the rejection of the first of the predicted possible scenarios for at least two reasons. First, regarding the consultation of the non-lexical, global resources, the findings showed that the participants behaved in a manner contrary to a progressively greater use of top-down processing strategies at progressively higher levels of experience. Second, regarding the overwhelmingly favored lexical resource of English definitions, and the lexical resources as a group, although the findings are as predicted by the first scenario for two of the three groups. However, the findings concerning the Less Experienced Group are not. Rather, they are as described by the second proposed scenario. Thus, the second scenario has more heuristic power as a likely explanation of the participants’ resourcing strategies.

**Further Explanations of Readers’ Behavior Patterns**

I will now present a rationale for acceptance of the second scenario based on practical and theoretical considerations. Specifically, the primary cause for the more experienced learners to have successfully comprehended the story without the help of the more global, top-down type resources, and the suspected failure of the less experienced learners to successfully apply even a bottom-up resourcing strategy require a more extensive justification. First, it has been acknowledged that a limitation of the study is the relative inability of computer tracking to identify the motivations and intentions behind readers’ choices of which comprehension aids to consult. The computer merely tracks which pages are viewed without offering subjective conclusions as to the value of those pages’ contents or their benefit to the reader. Second, these data should be considered
based on the inclusion of certain other caveats: 1) there was a time limit of 30 minutes imposed on the reading portion of the experimental procedure, 2) participants were not prepared with vocabulary items from the story in advance, and 3) the story was likely longer and more difficult than any L2 reading material that all but the most advanced participants had previously encountered.

Given these caveats, one of the factors contributing to the inability of the less experienced learners to successfully apply bottom-up reading strategies may be a story effect. That is, the story itself may have contributed to a lack of comprehension on the part of the less experienced learners for various reasons. It is likely that an abundance of unknown lexical items and the overall length of the story were contributing factors. Relative unfamiliarity with the topic of the story was another likely factor due to its focus on a specific event in the relatively recent history of Spain and high density of cultural references, both of which are unfamiliar to American students. Also, the time limitation of thirty minutes for the reading portion of the experimental procedure likely contributed to a heightened sense of urgency on the part of less experienced readers. These story factors, along with the length of time factor, may have worked together to cause the participants with less Spanish experience to fail to construct a meaningful mental model of the story starting very early on. Consequently, participants in the Less Experienced Group were forced to abandon the highly popular lexical, bottom-up resources and shift their reading strategy. As a result of this shift many consulted the top-down resources, perhaps in a quest to make sense of the text. This possibility is consistent with the data showing that they consulted the top-down resources more than the other two groups and consulted the bottom-up resources, specifically the English definitions, less than any other group.

The proposal that the participants with less Spanish experience failed to construct a meaningful mental model of the story starting very early on accounts for the significant differences in the mean number of times that they consulted the various types of aids. It is also consistent with Perfetti’s (1994) description of less skilled comprehenders. Perfetti views reading as a structure building process in which the reader lays the foundation for comprehension in response to early segments of a text. The reader then maps subsequent
information onto this foundation, and shifts from a current foundation to begin a new one when the text suggests doing so because a segment is incongruous with the currently active structure. The findings concerning the written recall protocols, although superficial in nature, lend further support to the acceptance of the second predicted scenario. This process seems to have failed in the case of the Less Experienced Group because they were able to summarize the story at less length than those in the Moderately Experienced Group, who in turn wrote shorter summaries than participants in the Most Experienced Group. This failure to construct a meaningful mental model of the story is similar to the Perfetti’s concept that less skilled readers are less effective in laying foundations and mapping new information onto them.

As for the more experienced participants, the inability of the experimental procedure and of the data collected from it to detect the application of a top-down approach may be due to a fundamental mismatch between the way the reader constructs the story model in his or her own mind and what can be viewed externally. They may have indeed been constructing a top-down model of the story while reading and thus did not need to seek out the top-down-type comprehension resources that were external to the text. It may be that the more experienced readers went about constructing their mental models of the story in an interactive manner in which both top-down and bottom-up processes occurred simultaneously (Singhal, 2000). Yet they paused in their reading of the text in order to access the lexical, bottom-up resources more than the global, top-down ones. This is possible because as more experienced learners they had likely passed the lexical capacity that is postulated by the linguistic threshold hypothesis. Thus, because those participants with more Spanish experience met with more success in their use of lexical decoding they did not feel the necessity of moving past that strategy in search of other comprehension aids. This scenario is consistent with the findings that those in the Most Experienced Group consulted the top-down resources significantly less than those in the other two groups, yet the Most Experienced Group remained statistically equal to the Moderately Experienced Group in the use of bottom-up resources, and specifically in their use of the English definitions. The possibility that the more experienced learners may have continued to consult the most popular resources without
looking for extra-textual aid requires the presence of some level of conscious recognition of whether or not one is comprehending during the reading process. Just such conscious attention was found in reading strategies of bilingual Latino/a students. Jiménez, García, and Pearson (1996) found that “the successful Latino/a readers carefully monitored their comprehension by identifying comprehension obstacles” (p. 101).

A final aspect of the findings is the matter of why the more experienced learners would stay with an admittedly less efficient reading strategy such as consulting numerous lexical comprehension aids (Grabe, 1991; Hudson, 1998) to the exclusion of a more efficient one such as summary essays concerning the content of the story, and written in their L1. One answer to this question is provided by Nagy and Herman (1987) in that there is an interconnection between lexical knowledge and global knowledge such that lexical knowledge is both a subset of, and highly correlated with, general world knowledge. They contend that a person who has more words in his or her vocabulary knows more about the world in general. Consequently, there is not a high degree of motivation for the reader who is successfully constructing a mental model of a text using a lexically driven reading strategy to abandon that strategy (even briefly if there is a time constraint placed on the reading activity) in order to seek broader, more generalized knowledge. For example, in the experimental text used in this study, the reader may have felt that he or she was gaining in general knowledge about the underlying environment behind the story as she or he gained additional vocabulary knowledge. Therefore an essay on the background of the situation might have seemed unnecessary even when it promised to relate specifically to the story at hand.

An additional answer to the question of why more experienced learners would stay with an admittedly less efficient, but successful, reading strategy is provided by the principle of least effort. Given the time constraint imposed in the experimental design and the relative success in comprehending as indicated by the length of the summaries written in the recall protocol, the participants with the most prior Spanish experience would not necessarily perceive a savings of present or future work by taking on the additional task of reading an essay which is clearly ancillary to the main text. They may have experienced a type of “Catch 22” effect because they could not adequately determine
whether expending the additional work to read a given ancillary aid would actually save them future work until after reading the aid in question. In other words, the value of a resource as long as an essay remains unknown until the reader expends the work necessary to read it. This is a complication that is not present in the case of the short definitions of lexical items. By merely sampling one of them, the reader can quickly calculate whether accessing more of that type of resource will be a beneficial use of his or her time when the next glossed term appears in the text.

Finally, for these same reasons, the principle of least effort, may provide an explanation for why the visuals were accessed more often by the Less and Moderately Experienced Groups, and significantly more by the Moderately Experienced Group, than by the Most Experienced Group. In articulating the principle of least effort, Zipf (1949) identified three types of effort that a person seeks to minimize: distance, time, and work. Based on the principles of dual coding theory, the visual provided an even faster source of lexical knowledge than the written definitions did, faster even than the definitions in the L1, thereby saving time and work.

**Post Hoc Analyses**

Data on the first of the moderating variables to be considered, the reading skill of participants in their first language, yielded the instructive finding that participants who rated their own L1 reading ability as “average” (i.e., those with the lowest self-reported reading ability) consulted a significantly higher number of visual resources than all of the other participants. Thus, those who were least confident of their own reading skills in their L1 used the lexical, bottom-up helps more than those with more confidence, and made use of visuals to an even higher degree than the other lexical resources. This implies that they reached out to the visual resource for word meaning more because of a lack of confidence in their own L1 reading or lexical skills.

Otherwise, when first language reading ability was considered as a second independent variable there was no significant interaction between first language reading ability and the participants’ level of prior study at the at the 0.05 level with regards to resource use. Likewise, when perceived text difficulty was considered as a second
independent variable there was no significant interaction with participants’ level of prior study with regards to resource use at the 0.05 level.

With regard to the amount of the story that participants completed reading and the percentage of the English and Spanish definitions that participants actually consulted the data indicate that those approximately 45% of participants who reported finishing the entire story did not do so by pointlessly clicking on every available link, but rather the opposite, they consulted the fewest definitions, perhaps indicating a more complete mental model without relying as heavily on the strategy of word by word decoding. A comparison of the amount of the story completed and language experience level did not find any significant differences. This indicates that the participants completed the same amount of the story regardless of their level of instructed Spanish experience. When consultation of the English definitions was brought into consideration by means of a two-way ANOVA using the number of English definitions as the dependent variable and both language experience level and the number of sections completed as independent variables, there were significant differences in the overall model for both of the independent variables. But, in light of the results of the more detailed $t$ test this is not surprising because it is a given that those who read more were exposed to more opportunities to consult English definitions. Likewise, when viewed in terms of the second possible scenario, the significantly higher number of English definitions consulted by the Moderately Experienced Group shows that they employed a strategy of relying heavily on lexical, bottom-up type resources. Likewise the significantly lower number of English definitions consulted by the Less Experienced Group indicates that they abandoned the same strategy early on.

Given that the participants, especially those in the Less Experienced Group, did not use the comprehension aids in a consistent way, the issue became one of whether they understood the story in an equally inconsistent way. The measure employed to examine the matter of global comprehension dealt with the degree to which participants were capable of summarizing the plot of the story in the written recall protocol. The original purpose for asking participants to write the recall protocol was to provide a purpose for reading and to ensure that the participants knew that there would be a comprehension
measure of some kind at the end of the time allotted to reading the text. The rationale for analyzing the protocols at this point was to gain a view of how much of a mental model the participants had developed of the story through an analysis of the amount of the story that they attempted to summarize.

The results of the word count measure are aligned in ascending order from the Less Experienced Group through the Most Experienced Group, and show a clear trend toward greater comprehension with greater experience in Spanish. The range between the means appears impressive with the Less Experienced Group only writing a mean number of 109.88 words as compared to a mean of 126.72 words for the Most Experienced Group. However, the high degree of variability within each group prevented these means from reaching significance. Nonetheless, these data do present one picture of global comprehension in which those with more experience in Spanish were able to recount the story more fully. This evidence of greater comprehension by those in the Most Experienced Group provides even further support for accepting the second predicted possible scenario. However, the superficial nature and lack of validity of the word count measure used, and the individual differences in reading ability among the members of each group make it impossible to adequately determine how much more the members of each group comprehended.

**Tracking Reading Behavior**

There is a growing number of researchers who use computers both as a medium to present L2 materials and as a means of collecting data. The third research question (What advantage(s) does the tracking of reading behavior confer on data analysis in second language text processing?) focuses attention on the methods used to ascertain what is happening during the reading process. The computer is being used by researchers because of a number of benefits that it confers as a tool in data collection.

There are certain advantages to using computers to track users’ movements in and among the pages of a hypertext document. First, computer tracking provides empirical evidence of resource use in real time during reading. Simply stated, data gathered in real
time are superior to data based on a posteriori reportage of usage, but we cannot track student behavior in real time in paper based reading activities. Unlike post-reading reports, questions, or recall protocols, computer tracking has the advantage of collecting the data live as the behaviors take place. Any type of post-event reportage has the inherent disadvantage of a loss of detail due to a reliance on the reader’s memory to reconstruct what took place. Second, computer tracking does not interfere with the reading process in order to collect data. Unlike meta-commentaries such as think-aloud protocols, computer tracking has the advantage of being unobtrusive. The reading process does not have to stop in order to assess what was happening when it was actually taking place. Third, computer tracking allows for a level of detail and specificity that neither the post-reading report, recall protocol, nor think-aloud protocol can even approach.

Although post-reading reports and recall protocols were employed in this study, they could not have provided the quality nor the quantity of information concerning the first and second research questions that the tracking data did. Only the tracking data provided the complete picture of participants’ behavior while reading.

There are also advantages that are inherent to electronic resources such as comprehension aids to accompany a computer-mediated text, whether the intention is to track readers’ movements or not. Some of the principle advantages are that hypertext glosses do not clutter up the reading space and therefore provide a cleaner, less distracting presentation of the text. Computerized aids also provide for much faster access as compared to printed materials. Also, by giving the reader the freedom to choose which aids to consult and in what order to consult them, control of the reader’s behavior is returned to him. Reader-based control in turn permits a desirable individualization of the reading process for each reader. These inherent advantages to computer-mediated texts are not lost or diminished in any way by the addition of a tracking feature to a program.

A strength of the present study is its ecological validity. I presented readers with a universally recognizable format, a Web environment, which provided a familiar template for the presentation of certain kinds of information, such as text containing hyperlinks colored blue and underlined. This means of presenting a text confers validity because it is
similar to reading environments that L2 readers will encounter at on-line literature sites or at sites created for pedagogical purposes. Further ecological validity stems from the use of tracking technology that was already in place on the university’s network server. With no special software to create, or even purchase, any language teaching practitioner, researcher, or graduate student can track reading behaviors in the same way. The only special provision is that they have access to their institution’s network server and the hit logs that it produces.

**Implications**

The fourth research question (What implications do these findings suggest for future studies of text processing and comprehension and for classroom applications?) focuses on the implications of the study in two basic areas, foreign language instruction, specifically classroom applications, and future research into L2 text processing.

**Foreign Language Instruction**

The implications of the present study for foreign language instruction are found in the insights into the L2 reader’s reading strategies that it provides. First, this study shows that challenging authentic texts are not beyond the abilities of language learners even at intermediate levels if they are accompanied by supporting comprehension aids.

From the standpoint of ecological validity to the classroom, learners will face authentic L2 texts in a vast variety of genres, styles, and levels of difficulty. This study presented a group of L2 readers with the kind of reading material that they would encounter in the real world of the target language and most of them completed it in a short period of time. Furthermore, from the standpoint of value for classroom instruction, the use of challenging authentic materials is the only means of preparing learners in advance for what they will encounter in the authentic target language, as it exists in the target culture.

Second, the overwhelmingly favorite strategy is seeking lexical support in the form of definitions of words in the L1. This holds true even if the L1 translations are but one of a menu of comprehension aids available to the reader. This implies that instructors
should provide lexical help in the L1 as much as is feasible given the format of the reading material (i.e., paper or electronic). It further implies that learners may benefit from learning about the value of other types of resources so that they can move beyond the initial impulse to seek L1 translations. As noted by Auerbach and Paxton (1997), teaching about other strategies in advance can help readers overcome problems associated with ambiguity and less than full understanding of a text.

Third, another implication of the present study is the recognition that second language learners do not begin to vary their reading strategies in the L2 enough to be measured until later in their language learning careers. Based on the tracking data obtained in this study, the use of comprehension resources by participants in the two lower groups was often statistically equal while only those in the Most Experienced Group stood out from the rest significantly. Or, alternately, the resourcing strategies of the Less Experienced Group stood out from the other two levels of experience significantly. The implication is that it is not until L2 learners have passed through at least two semesters of instructed study (the maximum for those in the Less Experienced Group) and more likely four semesters of study (the minimum for those in the Most Experienced Group) that a linguistic threshold concerning reading authentic L2 texts is reached. This seems to be the point at which the learner’s L2 lexicon contains enough words so as to allow L2 readers to begin to reap the benefits of bottom-up and / or top-down reading strategies. This is an important step in quantifying when in the language learning process the linguistic threshold is reached.

Fourth, when teachers employ ancillary resources relating to top-down reading strategies, those which purport to provide background information or information on the structure and content of a text, they should be highlighted in instruction to make readers aware of their use and purpose. These types of resources are most likely best presented separately from the text, or there should be a separate period of time that is designated specifically to reading and reflecting on these resources. By separating them from the principle reading task, the instructor can provide the learner with an opportunity to increase background cultural, historical, and literary knowledge of a kind that participants may have overlooked, or considered too time consuming, in the present study.
Fifth, because the critical linguistic threshold necessary to begin to successfully construct mental models of L2 reading material is highly lexical in nature, vocabulary looms large as a key to reading comprehension. This suggests that strategies for rapidly increasing vocabulary knowledge be implemented in language instruction. Teachers can do this through advance organizers, schema activation on the topic, L2 paraphrases, and L2–L1 and L2–L2 dictionaries. Providing lexical resources in advance of reading might reduce L2 readers’ overwhelming dependency on L1 translation as their major strategy.

Finally, teachers should provide both lexical and global resources prior to reading. Doing so should minimize the risk of some very useful resources being overlooked or misunderstood during the actual reading time. It should also reduce the bottom-up processing load on the reader, freeing up more short-term memory for use in top-down, schema-activated processes. In short, supporting these two types of reading strategies equals good teaching.

**Future Research**

Further research should focus on prior language experience as a factor in L2 learning, and especially as a factor in L2 reading success. Another area for future research is the role of visuals as a type of gloss, or comprehension aid. This is of special interest in light of the principle of least effort and dual coding theory. Much can be done to further clarify the results that this study obtained by introducing a measure of reading comprehension. One such avenue is the exploration of a possible correlation between the use of top-down reading strategies and comprehension. Future research should focus on the chronological sequence of the readers’ use of comprehension aids, such as at what point in the text of a story readers begin using lexical aids and at what point they begin using non-lexical aids. It should also address the question of what computer tracking can tell us about the length of time readers spend referring to aids of various types. Future research should also focus on how L2 learners apply reading strategies to expository texts of various lengths and levels of difficulty.

Future research should capitalize on what is perhaps the most important contribution of this study, the method of data collection via computer tracking. Researchers can use this method to quantify a wide range of behaviors related to the
reading process. This type of data collection could also be a tool to gauge the
effectiveness and readability of new materials. With refinement and streamlining,
researchers and language teachers alike could use this type of computer tracking routinely
to ascertain individual learners’ relative strengths and weaknesses when reading in the
target language.
Un día de febrero

I

"Buenos días", saludó la locutora.
"Buenos días", contestó mi abuela.
"¿Cómo se encuentran esta mañana? ¿Llenos de energía?" continuó la locutora en la pantalla, ajena al extraño atuendo que mi abuela presentaba, con su bata acolchada, frente al pelotón de jóvenes gimnastas en mallas aeróbicas que llenaban el plató.
"Yo, ya, hija, a mis años, pues bastante bien me encuentro gracias a Dios".
"Hoy vamos a comenzar con una tanda de ejercicios ligeros, para ir entrando en calor. Así que todos a sus puestos y ...uno ... y dos ... y tres ... y cuatro...
Mi abuela, desanimada por el ritmo frenético de piernas y brazos moviéndose en el aire como tijeras antilípidos, concentró de nuevo su atención en el plato del desayuno, con el vaso de leche caliente y la naranja partida por la mitad, tratando de recordar cuál debía comer antes. Por fin, con aire satisfecho y resuelto, resolvió comenzar por las medias naranjas y nos aleccionó con aplomo: "¡Encima de la leche, nada eche!"
Yo, mientras tanto, iba dejando caer en mi tazón de leche trocitos de pan tostado, para que se fueran ablandando, mientras repasaba una lección de historia antigua que debía aprender de memoria, y que estaba amenizada con fotos a todo color del Coloso de Rodas, del Canon Doríforo, del Discóbolo, y hasta de Laocoonte y sus hijos.
"Alejandro Magno era hijo del rey Filipo de Macedonia".
"Anda, déjate de macedonias y acaba la leche, que vas a llegar tarde al colegio" me decía mi hermano mayor, ajeno por completo a los problemas de la memoria fotográfica, a la insidiosa necesidad de repetir palabra por palabra los resúmenes de historia antigua de los omnipotentes libros de la editorial Anaya, para satisfacer la curiosidad de un profesor avezado en el interrogatorio matutino de niños, aunque suficientemente comprensivo como para dejarnos usar chuletas con los títulos de cada capítulo al recitar la lección de memoria, junto al encerado.
"Yo nunca llego tarde al colegio. Además, estoy harto de llegar pronto, porque el portero no nos deja entrar y hace frío".
Mi hermano mayor fumaba incesantemente, y el aire llevaba su humo intermitentemente hacia mi tazón de leche y hacia las naranjas de mi abuela.
"Tenéis que decirle al portero que os deje entrar, hombre. ¿Quiere que le caliente la leche, abuela?"
"No, hijo, no, hoy no voy a tomar leche".
Mi otro hermano, recién llegado al salón desde la cocina, empuñando su tazón de leche y sus rebanadas de pan tostado, carraspeaba sin cesar, olisqueando el humo de los Ducados...
del mayor, y, sorprendentemente, sin hacer mención explícita del asco que le daba todo aquel humo de tabaco barato y las numerosas colillas esparcidas por los cinco ceniceros del salón y estampadas en las otrora blancas sábanas que mi hermano mayor aún no había recogido de su sofá-cama.

"¿Es que no hay café?"
"Pues no, no hay café, así que tómate la leche, que vais a llegar tarde al colegio".
"Yo no voy al colegio, voy al instituto".
"Lo mismo da".
"No, no da lo mismo porque entramos media hora después".
"Venga, no me toques las narices y bébete el café de una vez, que tu madre ha tenido que ir al médico antes de ir a la tienda y no ha tenido tiempo de comprar café, ¡coño!".
Mi hermano de instituto carraspeaba y carraspeaba, entre sorbo y sorbo de leche, en continua alusión al humo que el mayor echaba por su boca y narices; un increíble desafío a la autoridad del hermano mayor que sólo se podía permitir, al parecer, alguien que estudiara bachillerato. 

"Alejandro Magno expandió el mundo helénico hacia los confines del Asia, tras una serie de sorprendentes victorias militares con las que demostró su extraordinaria capacidad estratégica"

Acabé mi tazón, repleto de migas de pan asquerosamente blandas y dulzonas, y lo llevé a mi cocina antes de salir corriendo hacía el colegio, con un bocadillo de mortadela en mi cartera. Hacía un frío que pelaba y, para colmo, había olvidado mis chapas en casa, por lo que tendría que sufrir la humillación de pedir prestado algún ciclista de segunda fila para poder participar en la vuelta ciclista durante el recreo.

II

[NOTE: You may view definitions for highlighted words by clicking on them; a small window will appear. When you are finished using the small window, close it by clicking on the "X" in its upper-right corner before continuing the story.]

Un suspiro de alivio salió de mi pecho cuando Don Luis eligió a otro para explicar las consecuencias del reparto del imperio alejandrino entre los generales. Era un aspecto de la lección que no había llegado yo a dominar completamente. Por algún motivo, sin embargo, estaba convencido de que me iba a tocar explicarlo. A fin de cuentas, a nadie qué le importaba que el imperio alejandrino se deshiciera, habida cuenta de que había durado menos que un bocadillo de nocilla a la puerta de un colegio. ¿En qué consistía el problema? Seguro que los súbditos de Alejandro lo pasaron en grande el día que todo se vino abajo, como esos iraníes enloquecidos que se dieron el gusto de escacharrar todos los automóviles de Teherán ante las cámaras de televisión para celebrar la caída del Sha un par de años atrás. Un gran día para los vendedores de automóviles.

"José Luis, ¿estás de acuerdo con lo que acaba de decir Andrés sobre el capítulo 4 de la lección de hoy?..."
"Lo siento, no estaba atendiendo," respondí aturdido.
"¿Y en qué estabas pensando, en las musarañas?"
"Lo siento, anoche no pude dormir bien".
"Bueno, pues a ver si mañana duermes mejor, porque el miércoles me tienes que explicar
dos capítulos de la lección IV".
¡Puaj! Pensé que todo eso era por culpa de mis hermanos, que siempre me distraían. Eché un vistazo a la lección IV, sobre el imperio romano, y decidí que en el fondo era mejor saber cuándo le iban a preguntar a uno. Así, además, podría estar seguro de que no me iba a tocar otra vez al menos en dos semanas. Me distraje otra vez de la clase y sumergí mis pensamientos en la desgarradora estatua del pobre Laocoonte, cuyos hijos, por algún motivo incomprensible, tenían las piernas abiertas en una pose provocativa y erótica, que ciertamente cautivaba mi atención más que la sudorosa calva de aquel presentador de concursos metido a profesor.
"No te preocupes", me dijo Mariano al salir al recreo, "Don Luis sabe que tú eres uno de los estudiantes más serios".
"Sí", sentenció Tejero, "no te preocupes".
"¡Alguien me puede prestar un ciclista, aunque no sea muy bueno? Se me han olvidado los míos en casa" dije aprovechando la coyuntura, e intentando no sonar demasiado quejumbroso.
"¡Bah! No importa, hace mucho frío para jugar a las chapas, yo creo que deberíamos jugar a la cadena o a civiles y ladrones".
Y, en efecto, la opinión de Mariano, el más alto, se impuso, como de costumbre, y acabamos jugando a civiles y ladrones, lo cual era una buena opción teniendo en cuenta el frío, aunque por otra parte mi falta de velocidad hacía el juego indeseable para mí. Finalmente, y habida cuenta de que en el sorteo fui elegido como ladrón, me pasé la mayor parte del recreo en la cárcel, lamentando mi infortunio y esperando a que algún ladrón rápido se decidiera a intentar un rescate, en vez de calentarse las manos en el bidón de basura y hojas que el portero estaba quemando junto a la puerta.

**III**
[NOTE: You may view definitions for highlighted words by clicking on them; a small window will appear. When you are finished using the small window, close it by clicking on the "X" in its upper-right corner before continuing the story.]

"Vamos a ver, no me ha dado tiempo a preparar otra cosa, así que hoy toca otra vez macarrones y albóndigas" anunció mi madre, poniendo las dos viejas cazuelas de aluminio sobre la mesa del salón. Acto seguido, guardó en su enorme bolso negro los volantes del médico y el número de mi hermano para el otorrino, y se fue a peinar y hacer una coleta mientras mi padre partía el pan y mi abuela se colocaba su dentadura.
"Señor," dijo mi padre, "te damos gracias por los alimentos que vamos a tomar. Amén". Entonces, nos abalanzamos sobre nuestros platos soperos repletos de macarrones con tomate y carne picada, y dimos buena cuenta de tres barras de pan, que apenas duraron para mojar en la deliciosa salsa con sabor a ajo que bañaba las grandiosas albóndigas salpicadas de perejil. Todo estaba riquísimo, aunque nadie lo comentó, ya que no era domingo, día en que tocaba alabar lo sabroso y bien hecho del pollo asado, o enfrentarse a las recriminaciones de nuestra madre en caso contrario. Entre semana se podía comer sin dar opiniones, aunque jamás estaba permitido llevar nada de vuelta a la cocina, y la comida restante se repartía equitativamente entre los varones sentados a la mesa;
supuesto el caso, claro está, que hubiera quedado algo, lo cual no ocurrió ese día. Y después de la comida, vuelta al colegio corriendo con la cartera repleta de libros de religión, de matemáticas, de ciencias naturales, y el estómago repleto de carne picada por los cuatro costados. Y, al llegar, el hipo. ¡Hip! ¡Hip! ¡Hip!

**IV**

Recuerdo con claridad los deberes que estaba haciendo esa tarde, de nuevo ante mi tazón, ahora sabrosamente repleto de café con leche. Entre tostada y tostada, resolvía problemas de caída libre, tomando como ejemplo un dibujo de un viejo lunático renacentista que lanzaba desde la torre de Pisa una serie de objetos de distinto peso y explicaba a los lectores la fórmula para calcular el tiempo que tardarían en estrellarse contra el suelo. Tuve la certeza de que el tal individuo habría aprovechado también la caída del Sha para escacharrar unas cuantas furgonetas en público, haciendo bueno el refrán en el que nuestros profesores insistían más a menudo en aquellos días: "No hay bien ni mal que mil años dure... excepto, claro, la dinastía del Sha del Irán, recientemente derrocada por el imán Jomeini y su revolución socialista islámica". La verdad es que era divertido calcular lo que tardarían en caer las cosas, mucho mejor que calcular la fuerza con que habría que tirar de una polea para levantar una pesa de acero de cien kilos, por ejemplo. El instinto de los niños coincide casi siempre, al parecer, con esa ley de la termodinámica según la cual el universo tiende hacia su autodestrucción. De repente, entre estas cavilaciones, vi que mis hermanos tenían la boca abierta y los ojos fijos en la pantalla del televisor. Tan sólo mi abuela parecía ahora desinteresada de la programación, con la mirada perdida en el plato de la merienda.

"Señoras y señores, interrumpimos la programación para darles una noticia importante. Hace escasos minutos, efectivos de la Guardia Civil entraron en el congreso de los diputados e interrumpieron la sesión parlamentaria..."

**V**

Era difícil conciliar el sueño esa noche, muy a pesar de la insistencia con que mi madre dejó perfecta y absolutamente claro que "un golpe de estado no es motivo para que los niños no se vayan a dormir a la cama a su hora". En mi cabeza se barajaban incansablemente las rotundas frases con las que mi familia había comentado la entrada del teniente coronel Tejero en el congreso. "No os preocupéis, hombre, que una compañía de soldados son sólo doscientos y no sé cuantos y bla bla bla, bla bla bla" nos había tranquilizado mi hermano mayor, haciendo alarde de su reciente paso por el ejército.
"Nada, nada, si todo lo que sale por la televisión son películas, todo es mentira, no hay que creerse nada", había dicho mi abuela con una sonrisa inocente, desde detrás de sus gafas que triplicaban el tamaño de sus ojos. "Bueno, sea lo que sea," había dictaminado mi madre, "ya se verá mañana por la mañana, que es hora de dormir ... y ¡pasa!"). Creo recordar que en algún momento mi padre entró en nuestra habitación para decírnos que aun no se sabía nada y que nos durmiéramos. No es que hiciéramos ruido, pero de sobra sabían que estábamos despiertos. Sin embargo, mis extrasensoriales intentos de escuchar la radio que mi padre y mi hermano mayor tenían encendida en el salón, con un volumen tan bajo que no me hacía llegar más que un leve cuchicheo ininteligible, no impidieron que en algún momento me quedase frito.

VI

[NOTE: You may view definitions for highlighted words by clicking on them; a small window will appear. When you are finished using the small window, close it by clicking on the "X" in its upper-right corner before continuing the story.]

Sólo a la mañana siguiente me enteré de aquella frase tan buena para dormir que el rey le había susurrado al presidente de Cataluña por la noche: "Tranquilo, Jordi, tranquilo". ¡Qué buena hubiera sido aquella frase para haberme dormido más tranquilito y en paz! Era asquerosamente injusto que los niños tuvieran que irse a la cama sin saber si vivían en un país democrático. Incluso mi hermano de instituto había tenido que esperar hasta el día siguiente para averiguar que el rey salió por televisión y que los tanques que andaban sueltos por Valencia volvieron al cuartel después de haber estropeado unos cuantos bordillos. ¡Puaj! Era difícil distinguir lo que pasaba en el congreso de lo que pasaba en mi casa y en la escuela. El profesor de lengua, sin embargo, nos dejó escuchar un rato la radio, y así pudimos seguir en directo el momento en que numerosos guardias civiles se tiraron por una ventana del congreso, aunque nos costó comprender que no se estaban suicidando -si me hubieran dejado verlo por la tele hubiera sabido inmediatamente que la ventana estaba en un entresuelo. Igualmente confuso era que en mi clase hubiese un niño que también se apellidaba Tejero, aunque él juraba (¿quizá perjuraba?) que no tenía nada que ver con el otro. Pensaban lo que pensaran los mayores, sin embargo, yo no tenía ninguna confusión con respecto a mis ideales democráticos. Sabía lo que había en juego. En caso de haber ganado Tejero, yo hubiera pasado el resto de mi vida sin poder ver aquellos programas de dos rombos que tanto habían proliferado en la televisión desde que Franco murió. En tal caso, hubieran sido inútiles todas aquellas noches de lucha intensa contra la autoridad materna, todas aquellas galletas que partía en trocitos infinitesimales pequeños y luego mojaba ligerisimamente en mí nescafé, para gastar la menor cantidad posible de líquido, y que mi taza durara, durara, durara, fría o caliente, los treinta, cuarenta, cincuenta minutos necesarios para acabar de ver, antes de irme a la cama, el episodio de la serie "La Fundación", una serie con dos rombos como dos castillos en la cual, no sólo el difunto marido de la protagonista había tenido relaciones con una prostituta que quería quedarse con parte de la herencia familiar, sino que la mismísima Davinia Prince, aparte de sus tejes y manejes en el consejo de administración de la fundación, tenía el atrevimiento de permitir a su hijo de catorce años empapelar su
cuarto con fotos de mujeres desnudas. ¡Esa era la edad de mi hermano, quien nunca se atrevió a sustituir su póster del Barcelona F. C. por los de las chicas del Interviú! Por ver aquello había que hacerlo todo, todo por no irse a la cama tan de prisa, aunque con el suficiente disimulo como para no acabar castigado en la cocina, bebiendo a la carrera mi tazón porque ya no había por qué demorarse y me iba a perder el programa de todos modos.

¡No, no iba a ceder ni un sólo paso! Una vez paladeada la libertad no se podía retroceder, ni aun teniendo en cuenta que todas aquellas galletas, veinte, treinta, cuarenta por noche, sabiamente bañadas todas ellas en nescafé, eran probablemente una de las mayores causas de mi incipiente obesidad. Algún día, sin lugar a dudas, sería adulto y podría ver todos los episodios perdidos de "La Fundación", de "Poldark", de "Claudio y yo" (incluso el de Calígula). Algún día, sí, algún día, vería lo que me diera la real gana. Algún día, lejos, muy lejos, de aquel nefasto 23 de febrero.

José Luis Martín, España, US © 1996. Used by permission.
APPENDIX B

LANGUAGE EXPERIENCE SURVEY
Language Experience Survey

The purpose of this survey is for information and information only. Your response to all questions is appreciated, however, you are under no obligation to answer every question. Thank you.

I. Background in Instructional Setting:

1. How many semester-length Spanish classes have you had before this one?

   High School: __________

   Post High School: __________ (including community college, FSU, language institute, etc.)

II. Background in Natural Language Setting:

2. Did you grow up speaking Spanish at home?    Yes       No

3. Have you lived in a mainly Spanish-speaking country or environment for an extended period of time?    Yes       No

   If yes, for what period of time? ________________

III. Reading Background:

4. How would you evaluate your reading skills in English? Please circle one:

   Weak       Less Than Average       Average       Better Than Average       Strong

5. Do you have a diagnosed reading disability?    Yes       No
APPENDIX C

EXIT QUESTIONNAIRE
“Un día de febrero” Exit Survey

(For Experimenter’s Use Only: Subject Number:___________)

NAME:__________________________________________ DATE:_____________
INSTRUCTOR:___________________________________SECTION:__________

In the space below, please retell the story with as much detail as possible.

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

112
Please answer the following questions concerning your experiences with reading a Spanish short story on the computer. Thank you for your assistance with this project.

1. Please check off any of the following resources and strategies that you used at least once while reading the story:

___ English Definition
___ Spanish Definition
___ Historical Context (in English)
___ Contexto Histórico (in Spanish)
___ Literary Commentary (in English)
___ Comentario Literario (in Spanish)
___ Pictures
___ use prior knowledge to make predictions about the information in the text
___ focus primarily on word identification

2. How difficult would you say the story was compared to readings in your current Spanish course (circle one item)?

Much More Difficult
Somewhat More Difficult
About The Same
Somewhat Less Difficult
Much Less Difficult

3. How would you rate your enjoyment of the story?

Did Not Enjoy The Story
Did Not Enjoy The Story Much
About Average For A Spanish Text
Enjoyed The Story Some What
Enjoyed The Story Very Much

4. How much of the reading did you complete? Through section: 1   2   3   4   5   6

5. Any other comments?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
**Experiment Script**

“Internet Technologies and the Reading of Authentic Materials in a Second Language —Second Study” Summer, 2000

**Day 1: (In the classes’ regular classrooms.)**

Step 1: Say:
A colleague of mine is conducting an experiment this semester. I would like for you, as a class to participate. Today, I have two brief forms for you to fill out. First, there is a Consent Form giving your consent to participate in the experiment. Second, there is a Survey about your language background. The experiment involves reading and it will take about 50 minutes to conduct. You will go as a class to the computer lab in 129 Diffenbaugh on another day to do the actual experiment. Participation in this experiment is totally voluntary and if you sign the consent form now, but do not wish to participate on the day of the experiment, you will be free to use the computer lab facilities of the Modern Language Department on your own.

Step 2: Pass out the Consent Form. Make sure that students fill in all the blanks. Another student can sign the “Witness” line for them.

Step 3: Pass out the Survey and say:
Please notice the statement near the top of the “Language Experience Survey”: “The purpose of this survey is for information and information only. Your response to all questions is appreciated, however, you are under no obligation to answer every question. Thank you.” Now, please fill these out and you can pass them back to me with the Consent Forms when everyone is done.

Step 4: If students are still working after eight (8) minutes, say:
Let’s try to finish in about two minutes.

Step 5: When all students have finished, say:
Please pass your papers up to me and my colleague thanks you for your participation.
Day 2: In the Computer Lab (129 Diffenbaugh Building)

Step 1: As students enter the computer lab have a prepared list of participants, ask each person his/her name and assign them a computer sequentially starting with number one. Record number of the computer they will be working at on the list.

Step 2: After everyone is seated at a computer, say:
On the computer in front of you, you will find a short story written in Spanish. Along with the text are several other resources which might help you as you read the story. You may access the other helps by clicking on terms which are highlighted in blue and underlined. Please read the story and any of the other materials that you wish to yourself as many times as you like. Then, when you are confident of your understanding, raise your hand and I will give you a comprehension follow-up activity. You will not be graded on the reading or comprehension activity, but we would like your individual responses and would appreciate your not sharing with your neighbor.

You may read the materials as often as you like in 30 minutes. If you have any questions about the use of the computer raise your hand and I will be happy to help you. Now, click the left mouse button once where you see the words “Un día de febrero” and begin reading.

Step 3: If students are still reading after thirty (30) minutes, say:
It is time to complete the questionnaires. Raise your hand when you are ready. — When a student raises his/her hand, give that person the questionnaire.

Step 4: If students are still working after forty-three (43) minutes, say:
Let’s try to finish in about two minutes.

Step 5: When all students have finished say:
Thank you for your participation. You may contact me in about three weeks to find out the results of the experiment.
APPENDIX E

INFORMED CONSENT FORM
Informed Consent Form

I am eighteen (18) years of age, or older, and I freely, voluntarily and without element of force or coercion, consent to be a participant in the research project entitled “Internet Technologies and the Reading of Authentic Materials in a Second Language.”

This research is being conducted by Fleming L. Bell, M.A., who is a doctoral candidate in the Department of Modern Languages and Linguistics at the Florida State University. The purpose of his research project is to better understand students’ learning, comprehension and behavior when reading a text which is written in a language other than the students’ native language. I understand that if I participate in the project I will be reading a text on a computer, which is written in Spanish and will answer brief comprehension questions concerning the reading passage on paper and asked survey-type questions about the experience. I will be monitored and observed during the reading process and scored on the comprehension test. I will also be asked to fill out a pencil and paper questionnaire. I will be asked questions about my past and present study of languages, my grades in language classes, other contact which I may have had with the Spanish language, my academic Grade Point Average, final grade in the Spanish courses I have been enrolled in, and about my own perceptions about my reading ability and my attitude toward computers. The total time commitment will be about one (1) hour. Any compensation for my time, such as bonus participation points, will be at the discretion of my current Spanish instructor, and not given by the researchers or research project.

I understand that my participation is totally voluntary and I may stop participation at any time without penalty. All information obtained during the course of the study will remain confidential, to the extent allowed by law, and will be identified only by a subject code number. My name will not appear on any of the results. No individual scores will be reported. Only group scores, findings, and/or anonymous survey comments will be reported.

I understand there are benefits to participating in this research project. First, I will be providing language teaching professionals with valuable insights into second language reading. This knowledge can assist them in providing better materials and programs for the teaching of languages. Second, I may receive some benefit from my instructor. However, the type and quantity of any such benefit is solely at my individual instructor’s discretion. Third, group results will be sent to me upon my request. My questions at this time, if any, have been answered to my satisfaction.

There are no foreseeable risks or discomforts if I agree to participate in this study. If I have any questions about my rights as a subject/participant in this research, or if I feel I have been placed at risk, I can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Vice President for the Office of Research at (850) 644-8633. Also, I understand that I may contact Fleming Bell, Florida State University, Department of Modern Languages and Linguistics, 362 Diffenbaugh,
(850) 644-3728, or via e-mail at: fbell@mailer.fsu.edu, for answers to questions about this research or my rights.

I am eighteen (18) years of age, or older, and I have read and give my consent to participate in the above study.

____________________________________
(Subject’s Name) _____________________

____________________________________
____________________________________
(Date) ______________________________

____________________________________
(Witness)
APPENDIX F

ESSAY ON HISTORICAL CONTEXT
“Un día de febrero” Historical Context

After the death of its dictator, General Francisco Franco, in November 1975, Spain entered into a stage of rapid political and social transformation which was expressed in the restoration of the Bourbon monarchy, legalization of political parties, freedom of the press, holding of elections, and the proclamation of a new, democratic constitution, which was finally ratified by the people in the referendum of December 6, 1978.

The government of Adolfo Suárez, chosen by King Juan Carlos I to direct the complicated process of transition to democracy, found itself in continuous instability, subjected to simultaneous pressures from all sides, from the preservationist right, and the center, to the revolutionary left. It was anchored to the old political formulas of the civil war (1936-39), such as the nationalist forces which reclaimed the autonomy, or the independence, of the peripheral regions which are not Castilian speaking (Catalonia, the Basque Country, and Galicia).

This contradictory climate combined democratic enthusiasm with continual disillusionment over the slow rate of political reforms. At the same time, a severe economic crisis followed the increase in oil prices in 1973 and 1979; all the western nations were shaken, and Spain especially hard.

The younger generations, eager for novelty and disposed to break with anything traditional and conservative that could be found in the social reality of Spain, loudly celebrated the end of censorship. They easily identified with the ideas of the vanguard and anarchist movements in Madrid society, in whose musical and cinematographic creations the Spaniards appeared to throw off the repression suffered during the dictatorship. It was the era of liberality, in which actors, actresses, and the public competed to rapidly remove their clothes in front of the camera.

As 1981 approached, the escalation of terrorist attacks carried out by the Basque independence organization ETA and the worsening of the economic crisis put the government in an extremely weak situation and foreshadowed the imminent triumph of the parliamentary left. A group of the military high command, taking advantage of the resignation of the president of the government, which they had apparently forced themselves, arranged to take power and seize the parliament during the investiture ceremony of the new president of the centrist government, Leopoldo Calvo Sotelo, on the afternoon of February 23, 1981.

After several hours of confusion and a vacuum of power, the appearance of the king on television deauthorizing the insurrectionists, isolated the Civil Guard troops, who had taken over the Congress of Deputies under the command of lieutenant colonel Antonio Tejero. The rebels surrendered at noon on the next day, liberating the government and the members of parliament. The masses thronged into the streets of the large cities to celebrate the triumph of the democratic system.
APPENDIX G

LITERARY COMMENTARY
“Un día de febrero” Literary Commentary

In “Un día de febrero” the voice of a boy recounts a day in his life to us, the routine of family life, the elementary school, and the children’s games. However, an event in the world of grown ups, a coup d’état, interrupts the continuity of this day which seemed to be going to end as just one more of the ordinary days of childhood which the passage of time piles up without embellishment in the memory.

We do not know in which city of Spain the story takes place, although by the description of the school yard, in which “it is very cold to play with bottle caps,” we can imagine it to be a city on the plateau or in the north of the peninsula. The date, on the other hand, we know exactly: the 23rd of February, 1981, the day of the failed coup attempt against the young Spanish democracy. The action of the story develops in the usual settings of the life of a child: the dining room of the home, the classrooms of the school, the playground, the family room in front of the television, the bedroom. The characters are also from a child’s world: members of the family, schoolmates, and teachers. Nevertheless, into this closed universe peep elements of other, distant realities. The textbooks speak to him of Alexander the Great and his empire of two thousand years ago, of Greek statues, of a wise man of the renaissance who dropped objects from towers. This other reality, in which the cyclists are real and not mere images on bottle caps, filters into his daily life through the family television, the great window on the world beyond the family and school. The television brings him images of young gymnasts wearing few clothes that contrast with his grandmother in her housecoat, who drinks her cup of milk each morning. Before going to bed, the television brings him images full of intrigue, adventure, sex, and everything that is not present in his daily life as a boy. But the television also brings contradictory and threatening images which endanger the other, exciting world that freedom represents to him.

“Un día de febrero” succeeds in nostalgically capturing the small childhood world in which the little, everyday things, a glass of milk, snack of cocoa cream, bottle caps, still have an aura of the fantastic that they will lose when childhood is finished. The innocent gaze of the main character sees things with interest, the same things that an adult has seen a thousand times and no longer notices.

The story ends on the morning following the failed coup d’état. The main character, finally fed up with the limitations of a child’s life and determined at the same time to take the illusions of childhood with him, desires with all of his might to become an adult in order to make his dreams of freedom, from the other side of the screen, real. From this side, we, the readers, wake up from the dream of childhood that the author has had us relive in his story.

By: Enrique Fernández and José Luis Martín
[http://home.cc.umanitoba.ca/~fernand4/undia/undialit.html]
Translation: FLB
APPENDIX H

POST HOC ANALYSES
First Language Reading Skills

In order to determine if L1 reading skill had an effect on the L2 readers’ choice of strategies the data in Table 14 show the means and standard deviations for the seven comprehension aids based on participants’ self-reported level of first language reading ability for those responding average and above.

Table 14
Level of L1 Reading Ability

<table>
<thead>
<tr>
<th>Comprehension Aid</th>
<th>Response = Average (N = 31)</th>
<th>Response = Better Than Average (N = 45)</th>
<th>Response = Strong (N = 110)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>English Definition</td>
<td>40.06</td>
<td>18.33</td>
<td>35.40</td>
</tr>
<tr>
<td>Spanish Definition</td>
<td>3.48</td>
<td>7.18</td>
<td>2.93</td>
</tr>
<tr>
<td>Eng. Hist. Context</td>
<td>0.42</td>
<td>0.50</td>
<td>0.42</td>
</tr>
<tr>
<td>Span. Hist. Context</td>
<td>0.39</td>
<td>0.50</td>
<td>0.31</td>
</tr>
<tr>
<td>Eng. Lit. Commentary</td>
<td>0.48</td>
<td>0.51</td>
<td>0.47</td>
</tr>
<tr>
<td>Span. Lit. Commentary</td>
<td>0.26</td>
<td>0.44</td>
<td>0.24</td>
</tr>
<tr>
<td>Visual</td>
<td>6.19</td>
<td>5.99</td>
<td>3.58</td>
</tr>
</tbody>
</table>

Table 15 presents the summary of the means if comprehension aids are grouped into categories based on participants’ first language reading ability for those responding average and above.
Table 15
Level of L1 Reading Ability: Aids Grouped by Category

<table>
<thead>
<tr>
<th>Category of Aids</th>
<th>Response = Average (N = 31)</th>
<th>Response = Better Than Average (N = 45)</th>
<th>Response = Strong (N = 110)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Bottom-up</td>
<td>49.74</td>
<td>21.03</td>
<td>41.91</td>
</tr>
<tr>
<td>Top-down</td>
<td>1.55</td>
<td>1.55</td>
<td>1.44</td>
</tr>
</tbody>
</table>

Table 16 presents the results of an ANOVA for the seven types of comprehension aids based on participants’ self-reported reading ability in English.

Table 16
ANOVA for L1 Reading Ability

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Definition</td>
<td>2</td>
<td>537.32</td>
<td>268.66</td>
<td>0.90</td>
<td>0.41</td>
</tr>
<tr>
<td>Spanish Definition</td>
<td>2</td>
<td>14.99</td>
<td>7.49</td>
<td>0.20</td>
<td>0.82</td>
</tr>
<tr>
<td>Eng. Hist. Context</td>
<td>2</td>
<td>0.07</td>
<td>0.03</td>
<td>0.14</td>
<td>0.87</td>
</tr>
<tr>
<td>Span. Hist. Context</td>
<td>2</td>
<td>0.32</td>
<td>0.16</td>
<td>0.76</td>
<td>0.47</td>
</tr>
<tr>
<td>Eng. Lit. Commentary</td>
<td>2</td>
<td>0.01</td>
<td>0.005</td>
<td>0.02</td>
<td>0.98</td>
</tr>
<tr>
<td>Span. Lit. Commentary</td>
<td>2</td>
<td>0.05</td>
<td>0.02</td>
<td>0.14</td>
<td>0.87</td>
</tr>
<tr>
<td>Visual</td>
<td>2</td>
<td>300.38</td>
<td>150.19</td>
<td>8.45</td>
<td>0.0003**</td>
</tr>
</tbody>
</table>

** p < .05

Table 16 demonstrates a statistical significance between the mean number of times that each group consulted visuals at the specified 0.05 significance level, $F(2, 183) = 8.45,$
A t test, the LSD, showed that the difference between certain of the means were significant with regard to consulting visuals. The differences between means which proved to be significant at the 0.05 level, with a critical value of t of 1.97, were between those who rated their own reading ability in English as average and those who rated it as better than average, 2.616; and between those who rated their own reading ability in English as average and those who rated it as strong, 3.521. Consequently, participants who rated their own reading ability in English as average (i.e., those with the lowest self-reported reading ability) consulted a significantly higher number of visual resources than participants who rated their reading abilities in any of the categories above the level of average. Table 17 presents the summary of the means if comprehension aids are grouped into categories.

Table 17
ANOVA for L1 Reading Ability: Aids Grouped by Category

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom-up</td>
<td>2</td>
<td>1146.24</td>
<td>573.12</td>
<td>1.54</td>
<td>0.22</td>
</tr>
<tr>
<td>Top-down</td>
<td>2</td>
<td>1.22</td>
<td>0.61</td>
<td>0.31</td>
<td>0.74</td>
</tr>
</tbody>
</table>

$p < .05$

Table 17 illustrates that there were no significant differences between experience level groups with regards to their use of the resources when grouped into categories.

Text Difficulty

As a tool in the assessment of how the participants’ perceived of the text’s level of difficulty the data in Table 18 show the means and standard deviations for the seven types of comprehension aids based on participants’ perceptions of the difficulty of the experimental text as compared to readings to which they were exposed in their current Spanish courses.
Table 18
Perceived Difficulty of the Text

<table>
<thead>
<tr>
<th>Comprehension Aid</th>
<th>Response = About The Same [(N = 15)]</th>
<th>Response = Somewhat More Difficult [(N = 71)]</th>
<th>Response = Much More Difficult [(N = 100)]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>M</strong></td>
<td><strong>SD</strong></td>
<td><strong>M</strong></td>
</tr>
<tr>
<td>English Definition</td>
<td>30.87</td>
<td>13.43</td>
<td>41.07</td>
</tr>
<tr>
<td>Spanish Definition</td>
<td>7.67</td>
<td>12.30</td>
<td>3.21</td>
</tr>
<tr>
<td>Eng. Hist. Context</td>
<td>0.13</td>
<td>0.35</td>
<td>0.41</td>
</tr>
<tr>
<td>Span. Hist. Context</td>
<td>0.27</td>
<td>0.46</td>
<td>0.25</td>
</tr>
<tr>
<td>Eng. Lit. Commentary</td>
<td>0.27</td>
<td>0.46</td>
<td>0.48</td>
</tr>
<tr>
<td>Span. Lit. Commentary</td>
<td>0.20</td>
<td>0.41</td>
<td>0.24</td>
</tr>
<tr>
<td>Visual</td>
<td>2.47</td>
<td>3.02</td>
<td>4.52</td>
</tr>
</tbody>
</table>

Table 19 shows the summary of the means if comprehension aids are grouped into categories based on participants’ perception of the difficulty of the text.

Table 19
Perceived Difficulty of the Text: Aids Grouped by Category

<table>
<thead>
<tr>
<th>Category of Aids</th>
<th>Response = About The Same [(N = 15)]</th>
<th>Response = Somewhat More Difficult [(N = 71)]</th>
<th>Response = Much More Difficult [(N = 100)]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>M</strong></td>
<td><strong>SD</strong></td>
<td><strong>M</strong></td>
</tr>
<tr>
<td>Bottom-up</td>
<td>41.00</td>
<td>16.19</td>
<td>48.80</td>
</tr>
<tr>
<td>Top-down</td>
<td>0.87</td>
<td>1.36</td>
<td>1.38</td>
</tr>
</tbody>
</table>
Table 19 shows that participants who perceived the text to be of about the same level of difficulty as those in their current language class consulted all types of aids the least when the various aids are grouped together.

Table 20 presents the results for mean number of consultations to each of the seven types of comprehension aids based on participants' perception of the difficulty of the experimental text.

Table 20
ANOVA for Perceived Difficulty of the Text

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Definition</td>
<td>2</td>
<td>1434.32</td>
<td>717.16</td>
<td>2.46</td>
<td>0.09</td>
</tr>
<tr>
<td>Spanish Definition</td>
<td>2</td>
<td>439.82</td>
<td>219.91</td>
<td>6.27</td>
<td>0.002**</td>
</tr>
<tr>
<td>Eng. Hist. Context</td>
<td>2</td>
<td>1.16</td>
<td>0.58</td>
<td>2.45</td>
<td>0.09</td>
</tr>
<tr>
<td>Span. Hist. Context</td>
<td>2</td>
<td>0.33</td>
<td>0.16</td>
<td>0.78</td>
<td>0.46</td>
</tr>
<tr>
<td>Eng. Lit. Commentary</td>
<td>2</td>
<td>0.66</td>
<td>0.33</td>
<td>1.33</td>
<td>0.27</td>
</tr>
<tr>
<td>Span. Lit. Commentary</td>
<td>2</td>
<td>0.02</td>
<td>0.01</td>
<td>0.05</td>
<td>0.95</td>
</tr>
<tr>
<td>Visual</td>
<td>2</td>
<td>127.17</td>
<td>63.59</td>
<td>3.40</td>
<td>0.04**</td>
</tr>
</tbody>
</table>

**p < .05

Table 20 illustrates that there was a statistical significance between the mean number of times that aids were consulted for only two of the variables, Spanish definition and visual. There was a statistical significance between the mean number of times that each group consulted Spanish definitions at the specified 0.05 significance level, $F(2, 183) = 6.27, p = 0.002$. The means lined up according to perceived difficulty with those responding about the same consulting the Spanish definitions the most ($M = 7.67$), followed by somewhat more difficult ($M = 3.21$), and much more difficult ($M = 1.94$). The differences between the means that proved to be significant at the 0.05 level, with a critical value of $t$ of 1.97, were between those who responded about the same and those
who responded *somewhat more difficult*, 4.455; and between those who responded *about the same* and those who responded *much more difficult*, 5.727. Consequently, those participants finding the reading the least difficult consulted a significantly higher number of Spanish definitions than all of the other participants. Based on the second proposed scenario, this greater use of Spanish definitions is likely the result of a successful experience with the use of English definitions. Perhaps the participants’ level of confidence in their own mental model of the text was sufficiently high to allow them to move away from the L1 helps and begin to rely on L2 helps to a higher degree.

In addition, there was a statistical significance between the mean number of times that each group consulted visuals at the specified 0.05 significance level, $F(2, 183) = 3.40, p = 0.04$. The difference between certain of the means which proved to be significant at the 0.05 level with a critical value of $t$ of 1.97 were only those between participants who responded *somewhat more difficult* and those who responded *much more difficult*, 1.631. However, the means did not line up according to experience level, with those responding *about the same* consulting the visuals the least ($M = 2.47$), followed by *much more difficult* ($M = 2.89$), and with those rating the difficulty in the middle (i.e., *somewhat more difficult*) consulting the visuals the most ($M = 4.52$).

Table 21 presents the results for the comprehension aids grouped together into categories.

<table>
<thead>
<tr>
<th>Source</th>
<th>$df$</th>
<th>$SS$</th>
<th>$MS$</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom-up</td>
<td>2</td>
<td>1952.75</td>
<td>976.37</td>
<td>2.65</td>
<td>0.07</td>
</tr>
<tr>
<td>Top-down</td>
<td>2</td>
<td>5.10</td>
<td>2.55</td>
<td>1.31</td>
<td>0.27</td>
</tr>
</tbody>
</table>

$p < .05$

Table 21 demonstrates that there were no significant differences in the use of the resources when grouped into categories based on perceived text difficulty.
Written Recall Protocol as a Global View of Comprehension

The 186 participants wrote a total of 21,491 words summarizing the story in English. These do not include meta-commentary external to the narrative itself (e.g., “That’s all I got from it,” “That’s all I read,” “I would have written more but I ran out of time,” etc.). Table 22 shows the totals and means for the word count for the three language experience groups:

Table 22
Recall Protocol Word Count by Level of Instructed L2 Experience

<table>
<thead>
<tr>
<th>Comprehension Measure</th>
<th>Less Experienced Group $(N = 58)$</th>
<th>Moderately Experienced Group $(N = 89)$</th>
<th>Most Experienced Group $(N = 39)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Count</td>
<td>6373</td>
<td>10176</td>
<td>4942</td>
</tr>
<tr>
<td>$M$</td>
<td>109.88</td>
<td>114.34</td>
<td>126.72</td>
</tr>
</tbody>
</table>

Table 22 demonstrates that the mean number of words is lowest for participants with the least amount of previous instructed second language experience in Spanish (Less Experienced Group) at 109.88, those participants with the middle amount of previous experience (Moderately Experienced Group) fell in the middle, at 114.34 words, while those participants with the highest amount of previous experience (Most Experienced Group) wrote the most, at 126.72 words. Since these results were aligned in ascending order from Less Experienced Group through Most Experienced Group, they show a clear trend toward greater comprehension with greater experience in Spanish. However, an ANOVA showed no statistical significance between the mean number of words written in the recall protocol by each group at the specified 0.05 significance level, $F(2, 180) = 1.03, p = 0.3597$. This is due to high standard deviations: Less Experienced Group:
109.88, Moderately Experienced Group: 114.34, Most Experienced Group: 129.90, which are evidence of a high degree of variability in the number of words written within each language experience group and perhaps of the relatively superficial measure of word count.
APPENDIX I

HUMAN SUBJECTS COMMITTEE APPROVAL
APPROVAL MEMORANDUM
from the Human Subjects Committee

Date: June 22, 2000
From: David Quadagno, Chair
To: Fleming L. Bell
1605-A Sauls Street
Tallahassee, FL 32308
Dept: Modern Languages and Linguistics
Re: Use of Human subjects in Research
Project entitled: Internet Technologies and the Reading of Authentic Materials in a Second Language - Second Study

The forms that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and two members of the Human Subjects Committee. Your project is determined to be exempt per 45 CFR § 46.101(b)2 and has been approved by an accelerated review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals which may be required.

If the project has not been completed by June 22, 2001 you must request renewed approval for continuation of the project.

You are advised that any change in protocol in this project must be approved by resubmission of the project to the Committee for approval. Also, the principal investigator must promptly report, in writing, any unexpected problems causing risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols of such investigations as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Protection from Research Risks. The Assurance Number is M1339.

cc: L. Ulman
APPLICATION NO. 00.237
Informed Consent Form

I am eighteen (18) years of age, or older, and I freely, voluntarily and without element of force or coercion, consent to be a participant in the research project entitled "Internet Technologies and the Reading of Authentic Materials in a Second Language."

This research is being conducted by Fleming L. Bell, M.A., who is a doctoral candidate in the Department of Modern Languages and Linguistics at the Florida State University. The purpose of his research project is to better understand students' learning, comprehension and behavior when reading a text which is written in a language other than the students' native language. I understand that if I participate in the project I will be reading a text on a computer, which is written in Spanish and will answer brief comprehension questions concerning the reading passage on paper and asked survey-type questions about the experience. I will be monitored and observed during the reading process and scored on the comprehension test. I will also be asked to fill out a pencil and paper questionnaire. I will be asked questions about my past and present study of languages, my grades in language classes, other contact which I may have had with the Spanish language, my academic Grade Point Average, final grade in the Spanish courses I have been enrolled in, and about my own perceptions about my reading ability and my attitude toward computers. The total time commitment will be about one (1) hour. Any compensation for my time, such as bonus participation points, will be at the discretion of my current Spanish instructor, and not given by the researchers or research project.

I understand that my participation is totally voluntary and I may stop participation at any time without penalty. All information obtained during the course of the study will remain confidential, to the extent allowed by law, and will be identified only by a subject code number. My name will not appear on any of the results. No individual scores will be reported. Only group scores, findings, and/or anonymous survey comments will be reported.

I understand there are benefits to participating in this research project. First, I will be providing language teaching professionals with valuable insights into second language reading. This knowledge can assist them in providing better materials and programs for the teaching of languages. Second, I may receive some benefit from my instructor. However, the type and quantity of any such benefit is solely at my individual instructor's discretion. Third, group results will be sent to me upon my request. My
questions at this time, if any, have been answered to my satisfaction.

There are no foreseeable risks or discomforts if I agree to participate in this study. If I have any questions about my rights as a subject/participant in this research, or if I feel I have been placed at risk, I can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Vice President for the Office of Research at (850) 644-8633. Also, I understand that I may contact Fleming Bell, Florida State University, Department of Modern Languages and Linguistics, 362 Diffenbaugh, (850) 644-3728, or via e-mail at: fbell@mailer.fsu.edu, for answers to questions about this research or my rights.

I am eighteen (18) years of age, or older, and I have read and give my consent to participate in the above study.

(Subject's Name)  (Date)

(Witness)
APPENDIX J

COPYRIGHT PERMISSIONS
Fleming L. Bell  
408 Audley Bolton Drive  
Searcy, Arkansas 72143  
(501) 368-0784  

March 6, 2002

Dear Professor Martín,

I am completing a dissertation at Florida State University entitled “Comprehension Aids, Internet Technologies and the Reading of Authentic Materials in a Second Language.” I would like your permission to reprint in my dissertation excerpts from the Proyecto Sherezade web site [http://home.cc.umanitoba.ca/~femand4] including the following:

1) The text of the short story “Un día de febrero” and the accompanying Spanish-language glosses as published on the Proyecto Sherezade web site at: http://home.cc.umanitoba.ca/~femand4/undia/access.html


The requested permission extends to any future revisions and editions of my dissertation, including non-exclusive world rights in all languages. These rights will in no way restrict republication of the material in any other form by you or by others authorized by you. This authorization is extended to University Microfilms International, Ann Arbor, Michigan, for the purpose of reproducing and distributing copies of this dissertation. Your signing of this letter will also confirm that you own the copyright to the above-described material.

If these arrangements meet with your approval, please sign this letter where indicated below and return it to me in the enclosed return envelope. Thank you very much.

Sincerely,

Fleming L. Bell

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

José Luis Martín  
Department of Spanish and Portuguese  
Ohio State University  
Columbus, Ohio 43210  
Date: 3/11/2002
Dear Professor Fernández,

I am completing a dissertation at Florida State University entitled “Comprehension Aids, Internet Technologies and the Reading of Authentic Materials in a Second Language.” I would like your permission to reprint in my dissertation excerpts from the Proyecto Sherezade web site [http://home.cc.umanitoba.ca/~fernand4] including the following:

1) The text of the short story “Un dia de febrero” and the accompanying Spanish-language glosses as published on the Proyecto Sherezade web site at:
http://home.cc.umanitoba.ca/~fernand4/undia/access.html

2) The text of the “Contexto Histórico” as published on the Proyecto Sherezade web site at:
http://home.cc.umanitoba.ca/~fernand4/undiahis.html

3) The text of the “Comentario Literario” as published on the Proyecto Sherezade web site at:
http://home.cc.umanitoba.ca/~fernand4/undialit.html

The requested permission extends to any future revisions and editions of my dissertation, including non-exclusive world rights in all languages. These rights will in no way restrict republication of the material in any other form by you or by others authorized by you. This authorization is extended to University Microfilms International, Ann Arbor, Michigan, for the purpose of reproducing and distributing copies of this dissertation. Your signing of this letter will also confirm that you own the copyright to the above-described material.

I have received a signed permission letter from Professor José Luis Martín. I would like to have your approval as well because you are the owner of the web site. Also, I understand that the two of you co-authored certain of the above items, but am unaware of the roles each played.

If these arrangements meet with your approval, please sign this letter where indicated below and return it to me in the enclosed return envelope. Thank you very much.

Sincerely,

Fleming L. Bell

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

Enrique Fernández
Department of French, Spanish, and Italian
University of Manitoba
Winnipeg, Manitoba R3T2N2
Canada

Date: June 20, 2002


142


computers and the humanities  (pp. 469-473). Rockville, MD: Computer Science Press.


Young, D. J. (1997, November). *Simplifying authentic passages: Facilitating or debilitating SL reading comprehension?* Paper presented at the meeting of the American Association of University Supervisors and Coordinatorss, Nashville, TN.


BIOGRAPHICAL SKETCH

Fleming Louis Bell is an assistant professor of Spanish at Harding University. Dr. Bell was born in Chattanooga, Tennessee. He is married to Penny Sue Davis and they have one daughter, Elizabeth. He received his B.A. in Bible and Speech Communication at Lipscomb University and his M.A. in Spanish at Florida State University. He has also studied Spanish language and literature at the University of Tennessee at Chattanooga and the Centro Venezolano Americano in Caracas, Venezuela.

Dr. Bell received the Terrell Tatum Award for the outstanding graduating student in Spanish at the University of Tennessee at Chattanooga (1994). He was honored as the Outstanding Graduate Student in Spanish at Florida State University (1998-99), and received a StudyWeb Excellence Award for his Web page entitled “Top 10 Grammar Pitfalls in Spanish” (1999).

Dr. Bell has made several presentations and conducted workshops at professional conferences. He was a member of the composition team for the Web-based activities published on the website to accompany the Dímelo Tú textbook (1998) and co-authored the article The Language of Glosses in L2 Reading on Computer: Learners' Preferences (2000).