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ADULT READERS' EYE MOVEMENTS
DURING THE PRODUCTION OF ORAL MISCUES

by

Eric John Paulson

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A Dissertation Submitted to the Faculty of the
DEPARTMENT OF LANGUAGE, READING, AND CULTURE
In Partial Fulfillment of the Requirements
for the Degree of
DOCTOR OF PHILOSOPHY
In the Graduate College
THE UNIVERSITY OF ARIZONA

2000
As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Eric John Paulson entitled Adult Readers' Eye Movements During the Production of Oral Miscues and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

\[\text{Yetta M. Goodman} \quad 11/9/99\]
\[\text{Kenneth S. Goodman} \quad 11/9/99\]
\[\text{Alan D. Flurkey} \quad 11/9/99\]

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

\[\text{Yetta M. Goodman} \quad 11/9/99\]
\[\text{Kenneth S. Goodman} \quad 11/9/99\]
STATEMENT BY AUTHOR

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DEDICATION

This dissertation is dedicated to the memory of my grandfather, Peter C. Paulson, who taught me that when you fall off one of his Arabian thoroughbreds, you get right back on.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF FIGURES</td>
<td>12</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>17</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>18</td>
</tr>
<tr>
<td>I. MOVING TOWARD A MORE COMPLETE ANALYSIS OF THE READING PROCESS</td>
<td>20</td>
</tr>
<tr>
<td>Reading Research Methodologies</td>
<td>20</td>
</tr>
<tr>
<td>Ecological Validity in Research Methodology</td>
<td>23</td>
</tr>
<tr>
<td>Research Questions</td>
<td>25</td>
</tr>
<tr>
<td>Research Question</td>
<td>25</td>
</tr>
<tr>
<td>Subquestion</td>
<td>26</td>
</tr>
<tr>
<td>Procedures</td>
<td>26</td>
</tr>
<tr>
<td>Participants (Readers)</td>
<td>26</td>
</tr>
<tr>
<td>Number of Participants</td>
<td>27</td>
</tr>
<tr>
<td>Equipment and Materials</td>
<td>29</td>
</tr>
<tr>
<td>Equipment</td>
<td>29</td>
</tr>
<tr>
<td>Materials</td>
<td>29</td>
</tr>
<tr>
<td>Data Collection</td>
<td>30</td>
</tr>
<tr>
<td>Selection of Readings</td>
<td>30</td>
</tr>
<tr>
<td>Procedure of Sessions</td>
<td>32</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>34</td>
</tr>
<tr>
<td>Miscue Analysis</td>
<td>34</td>
</tr>
<tr>
<td>Eye Movement Analysis</td>
<td>34</td>
</tr>
<tr>
<td>Eye Movement and Miscue Analysis</td>
<td>34</td>
</tr>
<tr>
<td>Types of Analysis</td>
<td>35</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS—Continued

Macro Analysis .......................... 35
Micro Analysis .......................... 35
Organization of Dissertation ............... 37
Significance ............................ 38
Limitations ............................. 38
Glossary ................................ 39
Eye Movement Terminology ................ 39
Miscue Analysis Terminology .............. 40

II. MISCUE ANALYSIS: A WINDOW ON THE READING PROCESS .......... 42

Miscue Analysis .......................... 42
Theoretical Underpinnings of Transaction 42
The Transactional Sociopsycholinguistic Model of Reading .............. 52
Miscue Analysis Procedures and Contributions ......................... 57
Miscue Analysis Criticism: Silent vs. Oral Reading ................. 62
Miscue Analysis of the 9 Readings ........ 64
How Miscues Inform Readers’ Assessment .......................... 64
What Miscue Analysis of the Nine Readings Reveal about the Reading Process .... 71
Miscue Types ................................ 74
Substitutions ............................. 74
Omissions ................................ 75
Insertions ................................ 75
TABLE OF CONTENTS—Continued

Punctuation ........................................... 76
Partials .............................................. 77
Repetitions ........................................... 78

Elements of the Transactional Socio-
psycholinguistic Model: Cue Systems ...... 79

Graphophonic ........................................ 79
Syntactic ........................................... 80
Semantic ............................................ 81

Elements of the Transactional Socio-
psycholinguistic Model: Cognitive
Strategies ........................................... 82

Sample/Select ........................................ 82
Predict ............................................... 83
Infer ............................................... 84
Disconfirm ......................................... 85
Confirm ........................................... 86
Correct ............................................ 87

Summary .............................................. 88

III. EYE MOVEMENT RESEARCH: READING AS A
PERCEPTUAL PROCESS .......................... 89

Historical Background ............................. 89
Early Studies ....................................... 89
The Physiology of the Eye ....................... 95

Eye Movement Measures of the Reading Process 97
Words Fixated ..................................... 98

What Is the Linguistic Nature of Words
That Are Skipped? .............................. 110
**TABLE OF CONTENTS--Continued**

- Fixation Duration ........................................... 113
- The Cuing Systems .......................................... 118
- The Graphophonc Cuc System .............................. 119
- The Lexico-Grammatical (Syntactic) Cuc System ........... 122
- The Semantic-Pragmatic Cue System .......................... 123
- Reading "Flow" ............................................. 126
- Regressions ................................................ 129
- Summary .................................................... 138

**IV. INTRODUCING EMMA** ...................................... 139
- Miscue Analysis and Eye-Movement Analysis ................. 140
  - Argument Against Combining the Methodologies ............. 141
  - Argument For Combining the Methodologies .................. 145
    - Lexicon as Metaphor .................................... 145
    - Fairbank's Research ................................... 149

**V. WHAT EMMA REVEALS ABOUT THE READING PROCESS** .... 153
- Overall Patterns .......................................... 154
- Regressions ............................................... 157
  - Regressions to Refixate a Word ......................... 160
  - Regressions and Refixation of a Phrase .................. 161
  - Inter-line Regressions ................................ 163
  - Within Word Regressions ................................ 165
  - Between Word Regressions ................................. 166
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Miscues</td>
<td>168</td>
</tr>
<tr>
<td>Substitutions</td>
<td>169</td>
</tr>
<tr>
<td>Fixations</td>
<td>169</td>
</tr>
<tr>
<td>Fixation Duration</td>
<td>172</td>
</tr>
<tr>
<td>Regressions and Corrections</td>
<td>173</td>
</tr>
<tr>
<td>Substituted Words Are Thoroughly Examined</td>
<td>174</td>
</tr>
<tr>
<td>Omissions</td>
<td>179</td>
</tr>
<tr>
<td>Fixations</td>
<td>180</td>
</tr>
<tr>
<td>Fixation Duration</td>
<td>181</td>
</tr>
<tr>
<td>Regressions and Corrections</td>
<td>183</td>
</tr>
<tr>
<td>Non-deliberate Omissions</td>
<td>184</td>
</tr>
<tr>
<td>Insertions</td>
<td>188</td>
</tr>
<tr>
<td>Fixations</td>
<td>190</td>
</tr>
<tr>
<td>Fixation Duration</td>
<td>191</td>
</tr>
<tr>
<td>Regressions and Corrections</td>
<td>193</td>
</tr>
<tr>
<td>Insertions: &quot;Blue Sky&quot; Miscues</td>
<td>194</td>
</tr>
<tr>
<td>Repetitions</td>
<td>196</td>
</tr>
<tr>
<td>Fixations and Fixation Duration</td>
<td>198</td>
</tr>
<tr>
<td>Regressions</td>
<td>198</td>
</tr>
<tr>
<td>Repetitions: a Regression Sandwich</td>
<td>199</td>
</tr>
<tr>
<td>Partial</td>
<td>204</td>
</tr>
<tr>
<td>Fixations</td>
<td>205</td>
</tr>
<tr>
<td>Fixation Duration</td>
<td>205</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS—Continued

Regressions and Corrections ............ 207
The Three Sides of a Partial ............ 208
Overview of Types of Miscues ............ 211
VI. READERS’ AUTHORITY TO COMPOSE ............. 216
   Perception ........................................ 219
   Schema ........................................ 223
   The Perceptual Process ..................... 227
   Perception in Reading ..................... 230
Miscues: Evidence of the Perceptual Cycle in Reading ..................... 233
   Substitutions ................................. 241
   Omissions and Insertions ................... 243
Examined Miscues ............................. 251
VII. READING IS WHAT YOU THINK YOU SEE ............ 256
   Judy’s Exemplar .............................. 256
   Summary of Major Points ................. 263
   Areas In Need of Further Exploration .... 269
   Conclusion .................................. 276
APPENDIX A: Waterford Ghost’s Revenge ....... 280
APPENDIX B: Frugal Gourmets ................. 283
APPENDIX C: Eye-Miscue Coding Form ........... 286
APPENDIX D: Interview Form .................. 287
APPENDIX E: ASL 4000SU Eye-Tracker Schematic .... 289

REFERENCES ....................................... 290
LIST OF FIGURES

2.1 Readers' Miscues Per Hundred Words for All Readers 65
2.2 Miscue Quality Scores for All Readers 67
2.3 Miscue Procedure III Scores for All Readers 70
2.4 Miscue Quality Scores for SamW and Jack 72
2.5 Miscue Quality Scores for Enzo and Judy 73
2.6 Mike's Substitution of unusable 74
2.7 Enzo's Omission of a 75
2.8 Vera's Insertion of the 75
2.9 Barry's Substitution of a Period for a Comma 76
2.10 Jack's Partial of 1- 77
2.11 SamW's Repetition of for 78
2.12 SamF's Substitution of po-devin in The Frugal Gourmets 80
2.13 Judy's Substitutions of cook, comes, and dump 80
2.14 Judy's Substitution of checkered 81
2.15 Astor's Substitutions of the 82
2.16 Astor's Substitution of steal 83
2.17 SamF's Substitutions of From, gastorofic, and slamming 85
2.18 SamW's Insertions of Then and they, and Substitution of looked 86
2.19 Astor's Repetitions of good and from the 87
LIST OF FIGURES--Continued

2.20 Barry's Omission of did ........................................ 87

3.1 Readers' and Overall Percentages of Words Fixated .................. 98

3.2 Mean Percentage of Words Fixated by All Readers for Waterford Ghost's Revenge, by Sentence .... 107

3.3 Mean Percentage of Words Fixated by SamW for Waterford Ghost's Revenge, by Sentence .......... 108

3.4 Sam's Fixations in Sentences 11 and 12 of Waterford Ghost's Revenge .......................... 108

3.5 Average Percentage of Content and Function Words Fixated ......................... 111

3.6 Barry's Eye-Movements: Content Vs. Function Words ........................... 112

3.7 Readers' Average Total Time Word Fixation Durations ....................... 114

3.8 Readers' Average Total Time Word Fixation Durations for Each Sentence in Waterford Ghost's Revenge ........................................ 117

3.9 Enzo's Average Word Gaze Durations for Each Sentence in Frugal Gourmets .................... 127

3.10 Enzo's Average Duration of All Fixations for Each Sentence in Frugal Gourmets ............... 128

3.11 Astor's Percentage of Regressions for Each Sentence in Waterford Ghost's Revenge .......... 130

3.12 Regressions Compared to Words Fixated in Astor's Reading of Waterford Ghost's Revenge .. 131

3.13 Mike's Regression to Refixate a Word ............... 133

3.14 Judy's Regression and Refixation of a Phrase .. 133
LIST OF FIGURES—Continued

3.15 Barry's Inter-line Regression .......................... 135
3.16 Enzo's Within Word Regression ........................ 136
3.17 Enzo's Between-word Regression ....................... 137
4.1 Combination of Eye Movement Recording and Miscue Analysis ................................................. 140
4.2 SamF's Substitutions of checking, checkered, and pleasant .................................................... 148
5.1 Relationship of Number of Miscues, Procedure III Scores, and Regressions for SamW .............. 156
5.2 Regressions Relative to Oral Miscues ................. 158
5.3 Corrections Involving Regressions ..................... 159
5.4 Mike's Regression to Refixate a Word ............... 160
5.5 Judy's Regression and Refixation of a Phrase ...... 162
5.6 Barry's Inter-Line Regression ......................... 164
5.7 Enzo's Within Word Regressions ........................ 165
5.8 Enzo's Between-word Regression ........................ 167
5.9 Mike's Substitution of unusable ....................... 169
5.10 Substituted Words in Foveal Focus .................. 171
5.11 Fixation Durations Relative to Substitutions ...... 172
5.12 Substituted Words: Corrections and Regressions. 174
5.13 SamW's Substitution of looked ........................ 178
5.14 Enzo's Omission of a .................................. 179
5.15 Omitted Words in Foveal Focus ........................ 181
5.16 Fixation Durations Relative to Omissions ...... 182
5.17 Omitted Words: Corrections and Regressions .... 183
5.18 Sam's Omission of that ............................ 186
5.19 Mike's Omission of with ............................ 187
5.20 Vera's Insertion of the ............................ 189
5.21 The Percentage of Words Fixated in Sentences With and Without Insertions ...................... 191
5.22 Fixation Durations Relative to Insertions ...... 193
5.23 Regression Percentages of Sentences With and Without Insertions ............................. 194
5.24 SamW's Repetition of for .......................... 196
5.25 Regressions Made Between Oral Repetitions ...... 199
5.26 Mike's Repetition of barge ....................... 200
5.27 Vera's Repetition of right ....................... 201
5.28 Astor's Repetitions of good and from the ...... 202
5.29 Jack's Partial of 1- ............................... 204
5.30 Fixation Durations Relative to Partials ........ 206
5.31 Percentage of Regressions Made After Partial .. 207
5.32 Enzo's Partial of P ............................... 208
5.33 Mike's Partial of ha- ............................. 209
5.34 Astor's Partial of un- ............................. 210
5.35 Percentage of Direct or Foveal Fixations on Miscues, Before Production of Miscue ............. 212
LIST OF FIGURES--Continued

5.36  Words Receiving Direct Fixations: Miscued Words (before production of miscue) Vs. All Words ... 213
5.37  Average Duration of Fixations: Miscued Words (before production of miscue) Vs. All Words ... 214
6.1   Sam: Complex Miscue in Waterford Ghost's Revenge ................................................. 216
6.2   Necker Cube ................................................................. 220
6.3   Neisser's Perceptual Cycle .............................................. 228
6.4   The Perceptual Cycle: Reading ................................. 231
6.5   Vera's Substitution of will for will .................... 235
6.6   Vera's Order of Fixations ............................................. 237
6.7   Mike's Substitution of unusable ......................... 241
6.8   Mike's Omission of with ............................................. 243
6.9   SamW's Insertions of Then and they ..................... 245
6.10  The Cycles Element of the Transactional Sociopsycholinguistic Model of Reading ........ 248
6.11  Refiguring the Cycles Element of the Transactional Sociopsycholinguistic Model of Reading ................................................................. 250
7.1   Judy's Substitutions of cook, comes, and dumps. 257
7.2   Judy: Order of Fixations ............................................. 260
7.3   Barry's eye movements in a sentence with no miscues ........................................... 269
7.4   Barry's Inter-Line Regression ................................. 271
7.5   Mike: Implicit Correction ............................... 273
7.6   Vertical Fixation Measurements: SamF .............. 275
LIST OF TABLES

1.1 Readers and Texts Read ............................................. 32

2.1 Elements of the Transactional
Sociopsycholinguistic Model of Reading ............ 54

2.2 Readers and Texts Read .............................. 64

4.1 Frequency of Different Types of Errors, Good and Poor Readers .................. 150

4.2 Eye-movement Measures of First Fixations on
Error Words .................................................. 151

5.1 Measures of EMMA for Vera and Jack ................. 154

5.2 Measures of EMMA for Vera, Jack, and Barry ...... 155
ABSTRACT

Miscue analysis and eye-movement recording technology are combined in this dissertation to explore the reading processes of adult, skilled readers. The combination of approaches forms a new reading research methodology termed Eye Movement Miscue Analysis, or EMMA, that provides a powerful view of the reading process.

Miscue analysis, the psycholinguistic analysis of unexpected responses in a reader's oral text, provides a verbal dimension of data for reading research. Similarly, eye-movement recording, which shows precisely where in a text a reader looks, provides a visual dimension of data. When these two research approaches are combined, both verbal and visual data are analyzed, resulting in a powerful, multi-dimensional view of the reading process.

This dissertation focuses on adult readers' eye movements made during the production of miscues and other oral reading phenomena. Patterns of eye movements relative to substitutions, omissions, insertions, partials, and repetitions are described, analyzed, and compared. Results of the analysis are discussed in terms of whether current causal explanations of miscues are augmented or refuted. Original conceptions about the reading process formed as a
result of this research are developed and placed in existing theoretical frameworks.

Major findings include that the eye movements relative to different types of miscues and other oral reading phenomena exhibit different patterns, and both eye movements and miscues, and the relationship between them, are functions of comprehension. Also, contrary to conventional wisdom, most miscued words are examined, and examined thoroughly, before the miscue is produced; miscues are not caused by careless or reckless reading, or visually skipping words.

Implications for theories and models of the reading process are discussed, and areas of needed research are described.
CHAPTER 1

MOVING TOWARD A MORE COMPLETE ANALYSIS OF THE READING PROCESS

"To know what one book says you must read others?"
"At times this can be so."
--Umberto Eco, The Name of the Rose

This chapter presents a brief introduction to ecologically valid research methods that form the core of the research presented here and introduces the research questions. In addition, the research procedures are described.

Reading Research Methodologies

Edmund Burke Huey (1908), perhaps the father of modern psychological inquiry into the reading process, considered reading "...a psycho-physiological process...almost as good as a miracle" (p. 5). To Huey, the exegesis of that miracle would be no small feat: "And so to completely analyze what we do when we read would almost be the acme of a psychologist's achievements..." (p. 6). Almost a century later, psychologists, linguists, psycholinguists, and reading researchers have contributed significantly to an increase in understanding how readers read. While the researchers' data and analyses have led to unprecedented levels of understanding of the reading process, Huey's
"complete analysis" remains an elusive goal. The research this dissertation presents is designed to advance one step further toward that goal by juxtaposing miscue analysis and eye-movement analysis. The integration of these highly informative and ecologically valid methodologies promises insight into the reading process and a new perspective on both eye-movements and the production of oral miscues.

Because of the impossibility of depositing a homunculus in the reader's brain to report every detail of the reading process, researchers are forced to infer perceptual mechanisms based on readers' observed reactions to reading tasks. While scores of different research tasks have been used to investigate the reading process, the most influential and popular--locating prespecified targets in a text, word identification, altered text, miscue analysis, and eye-movement analysis--bear review.

In tasks such as proofreading and letter cancellation, readers are asked to locate prespecified targets in a text. For example, Daneman & Stainton (1991) embedded several different types of anomalies in a text and asked readers to find and circle as many anomalies as they could. The researchers would then make assumptions about the reading process based on which types of anomalies the readers were able to locate.
In a word identification task, readers are asked to make decisions about words tachistoscopically presented to them, usually either to decide if the word is real or a pseudoword (the lexical decision task), or to say the word they see as quickly as they can (the naming task). In their exploration of lexical search processes, Forster & Chambers (1973) provide prototypical examples of both types of tasks. In both procedures, subjects were presented with letter sequences on a screen; in the lexical decision task the subjects were to say "yes" if the sequence was a word, and "no" if it was not, while in the naming task the subjects' reaction times were measured as they pronounced the letter sequence as quickly as they could. Inferences about the reading process were made dependent upon accuracy of the subjects' lexical decision scores, reaction times during the naming task, and other factors.

Another popular method of researching the reading process is to alter a text and note readers' reactions, or measure their comprehension through post-reading assessments. Kolers' (1970) seminal research with "tortured text" involved geometrically transformed text. Readers were exposed to text, for example, that had been written upside down, and readers named the letter sequences as quickly as they could. Differences in the ease or difficulty of
reading the different types of text were compared and used to illuminate different aspects of the readers' "visual operations" level of reading performance.

Ecological Validity in Research Methodology

Without arguing the relative effectiveness of each of the research paradigms above in drawing inferences about the reading process, certain obvious problems present themselves, as Just & Carpenter (1987) point out. These problems include the quality of graphic information, the absence of linguistic context, the question of a lack of an intrinsic reading goal or purpose on the part of the subject, and the possibility that additional, non-reading-related processes will assert themselves as a consequence of the idiosyncratic task faced by the subjects (55-56). The main problem would appear to be the lack of an authentic task coupled with the presence of an inauthentic text. In other words, subjects doing things they don't normally do while reading texts they wouldn't normally read. The obvious solution would be to utilize a research method that allowed the subjects to read as naturally and authentically as they usually read—that is, if you want to study normal reading, study normal reading. With these constraints in mind, two promising research methods present themselves: miscue analysis, the analysis of readers' oral observed responses,
and eye-movement analysis, the recording of readers' eye
movements and fixations, both of which are discussed in
detail in Chapters 2 and 3.

Both miscue analysis and eye-movement research
methodologies utilize whole, authentic texts, with the only
task being to read (aloud, in the case of miscue analysis);
they retain their legitimacy as reading acts. Goodman
(1996) states,

Reductionist research in reading has inevitably
focused on recognition of bits and pieces of
language rather than on comprehension of real
texts. But we can't assume that perception of
letters and words in the process of making sense
of real meaningful texts is the same as
recognizing letters or words in isolation or in
highly reduced contexts. And we can't assume that
comprehension follows successful recognition of
words (p. 5).

The solution, then, is to "...observe real readers reading
real texts" (p. 4), one of the fundamental precepts of
miscue analysis research. Similarly, much eye-movement
research does not rely on non-reading tasks to study
reading, as Underwood & Batt (1996) point out: "The
technique of monitoring eye movements is considered by many
to be more ecologically valid than the other traditional
methods (i.e. LDT [lexical decision task], tachistoscopic
identification) used to tap into the reading process. Subjects can read 'normally' in preparation for some questions about the meaning of the text, rather than having to press response buttons or name words under time pressure" (145). Rayner & Pollatsek (1989) concur: "...the technique also has a great deal of ecological validity in that subjects in eye-movement experiments are actually engaged in the task that we wish to study, namely reading" (p. 24).

**Research Questions**

This dissertation explores the reading process through the combination of miscue analysis and eye-movement analysis methodologies. This study combines the two research methods with a view toward creating a more complete and powerful "window on the reading process" (Goodman & Goodman, 1994). The data collection goals and procedures include recording readers' eye-movements while they read whole texts aloud, and juxtaposing miscue analysis with eye-movement analysis, as explicated below, following an introduction to the research question and subquestion.

**Research Question**

What does the combination of miscue analysis and eye-movement analysis reveal about the reading process, and what conclusions about the reading process are reached?
Subquestion

What are the demonstrable and explicable relationships between readers’ eye-movements and their oral miscues?

While eye-movements have been combined with a record of oral reading, usually to study the eye-voice span (Levin, 1979, Buswell, 1920), no attempt has been made to explore the relationship of miscues to eye-movements. One notable exception that will be discussed in detail in Chapter 4 is Grant Fairbanks’ 1937 study that examined some characteristics of eye-movements as they relate to oral reading errors (miscues). This was obviously before miscue analysis as a research method was formalized, and Fairbanks concentrated more on statistical descriptions of the “accuracy” of eye-movements relevant to errors than to the psycholinguistic nature of the errors and how reading is informed by juxtaposing the methodologies.

Procedures

In this section I outline the procedures used in the study, including selection and number of participants, materials used, equipment, data collection, and data analysis.

Participants (Readers)

The participants in this study are University of
Arizona students with no connection to the Department of Language, Reading, and Culture. Besides volunteering (for which they earned extra credit in a statistics class taught by the professor who owns the eye-tracking equipment), English being the native language, and generally being able to read at a college level (self-reported) there is no specific criteria sought after in participants.

Number of Participants

Eight readers were used in this study, a number consistent with both miscue analysis and eye movement studies. Miscue analysis typically utilizes small numbers of readers, due to the large amount of data even a single reading can produce. Allen, in his introduction to Findings of Research in Miscue Analysis (1976) states of the research reviewed that "a limited number of subjects were studied by each researcher. These are depth studies, analyzing hundreds of miscues" (p. 7). He points out that the miscues his readers produced generated, on average, more than 27 raw units of data each, and the three readers in William Page's miscue dissertation generated 32,000 units of data (p. 7). Similarly, eye-movement research does not typically use huge numbers of readers. For example, while 30 or more is possible (Rayner & Frazier, 1989, used 32 readers), many studies use less than half that amount; Just & Carpenter
(1980) utilized 14 college students, Underwood, Clews, & Everatt (1990) used 12 students, Hyona, Niemi, and Underwood (1989) used the results from 11 readers, and McConkie & Zola (1979) employed 8 readers. Thus, in both research traditions the focus is on large amounts of data from few participants.

Due to the lack of previous research involving a combination of these two research methodologies, the completion of this study will involve the setting of certain research precedents. One of the most important precedents is the level of depth of research necessary to obtain qualitative data that supplements the more obvious, surface quantitative data. Miscue analysis, eye-movement analysis, and the combination of miscue and eye-movement analyses is performed on each participant's reading, which produces hundreds of bits of data. While the data is quantifiable, it is first interpreted as qualitative data. It is this interpretation of the qualitative data that is expected to inform the reading process, while descriptive statistics are used to illustrate general patterns. This research is thus heavily dependent on depth analysis for its data analysis. The number of readers were therefore limited to 8, producing a total of 9 readings (one subject, "Sam," contributes two readings of different stories).
Equipment and Materials

In this section I provide descriptions of the eye tracking equipment and texts used in the study.

Equipment

An Applied Science Laboratories 4000SU Eye-Tracker\(^1\) is used to record eye-movements (Appendix E for a schematic). The 4000SU records pupil and corneal reflections with an infrared reflection source and is accurate to within 1°. In addition, a head tracker is used, which negates the need for a chin rest or bite bar; the readers are free to move as they are accustomed to while reading. The eye-movement data is captured and produced as a series of x, y coordinates. A video camera simultaneously records a cursor that reflects eye-position superimposed on the text and the readers' oral reading.

Materials

The participants read two stories, in addition to practice materials designed to alleviate any trepidation or nervousness the readers had. The two stories are Waterford Ghost's Revenge (Appendix A) (Colby, 1973), a 471 word "true" ghost story, and Frugal Gourmets (Appendix B) (Foglino, 1998), a 475 word factual article about food from

\(^1\) With the permission and invaluable help and advice of Dr. Elizabeth Krupinski, in the University of Arizona Radiology Department.
Civilization magazine. I chose these texts because they are authentic, represent two commonly found styles of writing (fictional narrative and factual essay) and short enough so they may both be read, retold, and discussed in a short (1/2 hour) period of time. There are no other requirements for the texts to be used in this exploratory study; suggestions for further study will certainly include comparing the effects of different genre and writing styles on readers’ eye-movements and miscues. The texts were printed on white paper and mounted on a black background, placed upright directly in front of the reader, who sat in a comfortable chair. The texts were printed in a font large enough to be seen easily from the readers’ sitting position.

Data Collection

I present the data collection procedures below, including selection of readings and the procedure of the sessions.

Selection of readings

Twice as many readers as were needed were recorded, and eight were chosen based on factors such as clean audio and eye-movement recording\(^2\), and a basic understanding of the texts. Participants read two texts aloud while their eye-

\(^2\)For example, one reader’s data was unable to be used because of a “droopy” eye lid that prevented proper eye movement recording.
movements were recorded, then retold the texts in any way they wished. From the two texts each participant read, one was chosen for analysis. The text to be analyzed was selected based upon accuracy of calibration, or the degree to which the eye-tracker is accurate in recording where the participant is actually looking. This comparison is in part determined by having each participant look at the first letter of the title of the story and say that letter before beginning each story. Note that this is not the procedure by which readers are calibrated; that takes place at the beginning of the session. This is a check to make sure the calibration is still accurate, and provides a means of choosing between the two texts each participants read. In the event each reading was equally calibrated, the reading with the most miscues was chosen as a tie-breaker (more miscues equals more data). The following chart illustrates the nine readings and the texts analyzed:

3 The order that readers are presented within each story grouping is arbitrary in this table and all other tables and figures unless otherwise designated.

4 Sam's readings for both texts were used because of his rich miscues. In figures and tables where there may be confusion between his two readings, SamW indicates his reading of Waterford Ghost's Revenge and SamF indicates his reading of Frugal Gourmets.
<table>
<thead>
<tr>
<th>Reader</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sam</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Vera</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Astor</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Jack</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Barry</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Mike</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Sam</td>
<td>Frugal Gourmets</td>
</tr>
<tr>
<td>Enzo</td>
<td>Frugal Gourmets</td>
</tr>
<tr>
<td>Judy</td>
<td>Frugal Gourmets</td>
</tr>
</tbody>
</table>

**Procedure of Sessions**

Each reader participated in the study individually, and required one session with the researcher. A typical session follows:

1. The reader enters the lab and has the equipment explained to him/her.

2. The reader has a discussion about his/her own definitions of reading, guided by an interview sheet (Appendix D).

3. The system is calibrated to the reader (3-5 minutes).

4. The purpose of the study and the reader’s task are explained.

5. The reader reads the directions sheet as a warm-up and to make sure s/he is comfortable reading with the eye-
tracking equipment, not nervous, etc. The text of the
directions follows:

These are the directions for your part
of the project we are doing. First, get
as comfortable as you can, and relax--
there is no scoring or points or
pass/fail in this project. We are just
watching the behavior of people reading.

We want you to read a couple
stories aloud. It's important that you
try to read as you normally do, not
memorize the texts, and not rush
yourself.

After you finish each story we will
ask you to "retell" it any way you like.
Again, this is not a test, we just want
to encourage you to pay attention to
comprehending the story, above all else.

Thanks for helping us out, and we
hope you enjoy the stories!

6. The reader then reads the texts.
7. After reading each story, the reader retells the text
   any way s/he wanted to.
8. After each reader's retelling, the data collection
   session is complete. Readers are asked if they have
   any questions or comments about the session, and are
   free to leave.
Data Analysis

Several different levels of analysis were performed on the data after the data collection, as described below.

Miscue Analysis

A Procedure I miscue analysis was performed on each reading, following the procedures described in Goodman, Watson, & Burke, 1987. Each reading and retelling is analyzed according to current miscue analysis theory.

Eye-Movement Analysis

The order and duration of the reader's eye-fixations were overlaid on the text. An analysis of each reading was made using procedures suggested by Rayner & Pollatsek, 1989, Just & Carpenter, 1987, Buswell, 1937 and current eye-movement theory. First-pass fixation duration, total time gaze duration, percent of fixations, percent of regressions, number of words fixated, number of words regressed to, linguistic nature of words fixated, etc., are examined.

Eye Movement and Miscue Analysis

The miscue analysis and eye-fixation map were juxtaposed. A video camera simultaneously recorded a cursor that reflects eye-position superimposed on the text and the readers' oral reading, providing an easily
interpretable estimate of when eye-movements take place relative to miscues. In addition, the data produced by the Eyenal software that provides the position and duration of each eye-fixation also provides the exact time of each fixation, easily allowing the exact chronological relationship of eye-fixation to miscue. The macro and micro analyses of the nine readings are outlined below.

Types of Analysis

For each miscue, a minimum of 20 units of data are generated. In addition, each reading generates several hundred fixations on words that are not miscued, as well as a retelling and other features of miscue macroanalysis and eye-movement macroanalysis, all of which are used to construct a picture of the reading process.

Macro Analysis.

The following questions are focused on:

What is the correlation between MPHW (miscues per hundred words) and:

1. number of words fixated?
2. number of raw fixations?
3. number of regressions?
4. mean fixation duration?
5. where fixations occur?

Micro Analysis.

Each miscue is examined in terms of the eye-movements made relative to that miscue. Specifically, the following types
of miscues
  a. substitution
  b. omission
  c. partial
  d. insertion
and the following oral reading phenomenon\(^5\)
  e. repetition
are analyzed according to whether the eye-movements relative to them display any of the following characteristics:
  a. regression
  b. longer than average duration
  c. shorter than average duration
  d. denser than average fixation rate
  e. fixation vs. no fixation ("skipping words")
  f. atypical placement of fixation

The analysis includes whether each miscue is syntactically acceptable/not acceptable, semantically acceptable/not acceptable, corrected/not-corrected, meaning change/no

\(^5\)Repetitions are usually considered oral reading strategies instead of miscues but are included here as they fit the definition of a miscue as "...an observed response (the OR) that does not match what the person listening to the reading expects to hear (the ER)" (Goodman, Watson, and Burke, 1987, p. 37), and repetitions are not usually expected by the listener. However, to avoid confusion they will be included under the category "oral reading phenomenon" instead of "miscues."
meaning change, and whether the sentence or clause it appears in is syntactically acceptable/not acceptable, semantically acceptable/not acceptable, corrected/not-corrected, meaning change/no meaning change.

Organization of Dissertation

In addition to this introduction, there are six other chapters that make up the body of this work. Chapter 2, *Miscue Analysis: A Window on the Reading Process*, discusses the roots of the Transactional Socio-psycholinguistic model of reading and the contributions of miscue analysis to reading theory. The discussion then centers on what miscue analysis can explain about the nine readings of this study. Chapter 3, *Eye Movement Analysis: Reading as a Perceptual Process*, provides a review of a century of eye movement research, illustrated with examples from an eye movement analysis of the nine readings. The readings are looked at from an eye-movement analysis perspective. Chapter 4, *Introducing EMMA*, outlines the reasoning behind and methodology of combining the two types of analyses, which becomes *Eye Movement Miscue Analysis*. Chapter 5, *What EMMA Reveals about the Reading Process*, presents macro and micro analyses of the nine readings using a combination of eye movement and miscue analysis. Chapter 6, *Readers' Authority to Compose*, is an interpretation and extension of findings
reported in Chapter 5. Chapter 7, *Reading is What You Think You See*, summarizes the dissertation, presents important findings, discusses the implications of the findings, and suggests further research.

**Significance**

Eye Movement Miscue Analysis (EMMA) presents a unique way to interpret a reading. By adding information about the movement and duration of eye movements to the analysis of oral reading miscues, we gain a more thorough understanding of how readers construct meaning. EMMA informs miscue analysis theory as it explicates readers' confirming and disconfirming strategies by examining eye movements relative to miscues. In the same way, the analysis of miscues explains eye movement sequences that would otherwise have to be inferred by the eye movement researcher. Its explanatory power has the potential to not only inform "traditional" explanations for oral reading miscues, but also resolve arguments that exist in the field today. And, perhaps most importantly, it provides teachers and students with information that helps them understand the reading process - understanding that has implications for instruction.

**Limitations**

The ability to generalize from this study is limited in several ways. First, only two texts of less than 500 words
each are used. Although they are complete and the content unaltered, they represent only two types of writing, a newsessay and short fiction. A more complete set of studies should include texts of varying lengths and genres. In addition, while producing ample data, only 8 readers (a total of 9 readings analyzed) are used. This is a sufficient number for this exploratory study, but a wider breadth of readers would be informative. Diverse ethnic and linguistic backgrounds, second language learners, and various age groups would all add to the significance of the findings.

Glossary

Eye Movement Terminology

**duration measures: word**

*gaze duration*: the sum of the total fixation time on a word the first time it is encountered

*first fixation duration*: the duration of the first (or only) fixation on a word

*total time duration*: the sum total of all fixations at any time on a given word, including regressions, multiple fixations, and refixations

**duration measures: fixation**

*duration of fixation*: the length of a fixation, not necessarily in relation to a word
**fixation**: pauses the eye makes between saccades (movements). It is during fixations that the eyes deliver useful information to the brain.

**multiple fixations**: several fixations on a word

**refixation**: fixating a word after it has already been fixated, either by a regression or another forward fixation

**regression**: a saccadic movement backwards - for English texts, a movement from right to left. This is not to be confused with **repetition**, which is orally reproducing a section of text

**saccade**: the ballistic movements of the eyes from one place in the text to another. No useful visual information is acquired during a saccade

---

**Miscue Analysis Terminology**

**correction**: the reader’s spontaneous self-correction of a miscue

**insertion**: the oral addition of an item not found in the written text

**miscue**: in oral reading, an observed response (OR) that is different than the expected response (ER)

**omission**: the absence of an item in the reader's oral text

**partial**: the oral production of part of a word
repetition: orally repeating a section of text. This is not to be confused with regression (sometimes considered a synonym) which in this dissertation refers to a backwards eye movement only.

substitution: the oral replacing of one text item for another.

tentativity: caution shown about predictions and inferences which makes the reader alert to contradictory perceptions.

unsuccessful correction: the reader's attempted correction of a miscue that results in the same miscue or a different miscue, but not the expected response.
CHAPTER 2

MISCUE ANALYSIS: A WINDOW ON THE READING PROCESS

The print does not always have the same shape as the body that impressed it, and it doesn't always derive from the pressure of a body. At times it reproduces the impression a body has left in our mind: it is the print of an idea. The idea is sign of things, and the image is sign of the idea, sign of a sign. But from the image I reconstruct, if not the body, the idea that others had of it.

--Umberto Eco, The Name of the Rose

The philosophies, methodologies, procedures, and contributions of miscue analysis will be reviewed in this section, followed by a miscue analysis of the 9 readings done for this study.

Miscue Analysis

Miscue analysis is a powerful research tool that has contributed significantly to our understanding of the reading process. It informs, and is informed by, the Transactional-Sociopsycholinguistic Model of reading, which has it's philosophical and epistemological roots in Kantian philosophy.

Theoretical Underpinnings of Transaction

Miscues are unexpected responses to the text that readers produce when reading an unfamiliar text aloud. The term "miscue" is used to avoid the negative connotations of "error" or "mistake" and reflects the methodology’s
underlying assumption that miscues are the result of the same language cue systems that produce expected responses in oral reading—they are not simply random errors. The term was first used in print by Ken Goodman in 1965, and a taxonomy of miscues was soon developed (Goodman, 1969). Soon after, the process of miscue analysis was adapted by Yetta Goodman and Carolyn Burke (1973) and there have been hundreds of miscue analysis studies published since (Brown, Goodman, & Marek, 1996).

Before discussing the assumptions and contributions of any research method, it is useful to examine its theoretical underpinnings. This is particularly true with miscue analysis, as miscues are valuable as data only if the researcher understands that miscues are not simply random errors, but produced by the same processes that produce expected responses (Goodman & Goodman, 1994). Perhaps the single most important idea to understand before analyzing miscues is that reading is a process of constructing meaning via the written text. Goodman, Watson, & Burke (1987) explain:

To understand a holistic view of reading, we need to consider that both the reader and the author are equally active in constructing or building meaning. The text or the written material is the medium through which the reader and the author transact. The concept of transaction in the
reading process, as elaborated by Rosenblatt, suggests that when a reader and an author, by way of the written text, transact, significant changes take place (p. 20).

It is these "significant changes" that become miscues and offer a view of the reading process. Because of the importance of the concept, the philosophical and epistemological foundations of the idea of transaction will be reviewed en route to an explication of the model most closely associated with miscue analysis, the Transactional Sociopsycholinguistic Model.

The idea of a transaction between what is known and s/he who would know it is not new; Immanuel Kant's unification of rationalist and empiricist ideas of knowledge may be a distant precursor of transactional theory, especially if we couch his very general dialogue in terms of reading.

[Kant] concluded that our mind is no merely passive receiver of information obtained by our eyes, ears and other senses. Knowledge is only possible because our mind plays an active role, organizing and systematizing what we experience (Scruton, p. 117).

The reader does not have information delivered unto him from the text, but plays a necessary part in constructing that information. Kant writes that only when we use our
background knowledge and what our senses perceive (a priori and a posteriori knowledge, respectively) simultaneously can we “know:”

*Understanding and sensibility, with us, can determine objects only in conjunction. If we separate them, we have intuitions without conceptions, or conceptions without intuitions; in both cases, representations, which we cannot apply to any determinate object (Kant, 1781, p.250).*

In the same way a reader uses his or her background knowledge of the topic, genre, and text type in conjunction with the physical text to read. Kant views background knowledge as, though a priori, having its origin in sensory experience. His usage of the term ‘schema’ for this background knowledge is remarkably compatible with the modern definition:

*This formal and pure condition of sensibility, to which the conception of the understanding is restricted in its employment, we shall name the schema of the conception of the understanding....In truth, it is not images of objects, but schemata, which lie at the foundation of our pure sensuous conceptions (p. 160).*

Here he begins to express the notion that one’s background knowledge has a great deal to do with what one perceives. An idea that is closely related is that of expectations; that is, one sees what one expects to see. Kant makes it
clear, however, that while one's schemata may predispose him or her to anticipate and perceive things a certain way, a priori knowledge cannot predict specific sensations:

All cognition, by means of which I am enabled to cognize and determine a priori what belongs to empirical cognition, may be called an Anticipation....But...sensation is just that element in cognition which cannot be at all anticipated (p. 180).

That is, schemata based expectations cannot predispose one to experience specific a posteriori input. From a reading standpoint we can interpret Kant's ideas to mean that although we may approach a text with a particular stance, our background knowledge cannot allow us to predict exactly what we will find in that text. We may perceive and interpret what we transact with the text in a certain way, but the text is still a necessary part of the transaction--no amount of background knowledge, schemata, or prediction can completely replace the text.

Much as Kant showed us that knowledge is neither found in the a priori or the a posteriori but in the unity of the two, Dewey and Bentley (1949) describe knowing in terms of a transaction:

What we call "transaction" ...is, therefore, in technical expression, neither to be understood as if it "existed" apart from any observation, nor as
if it were a manner of observing "existing in a man's head" in presumed independence of what is observed (p. 104).

In terms of reading, then, the reading event is found in the transaction between the reader and the text. The relevant text is not something to be interpreted, but the interpretation itself; as with knowledge, reading is neither wholly in the reader's mind or in the author's product.

The "transaction," as an object among and along with other objects, is to be understood as unfractured observation--just as it stands, at this era of the world's history, with respect to the observer, the observing, and the observed—and as it is affected by whatever merits or defects it may prove to have when it is judged, as it surely will be in later times, by later manners (p. 104).

Dewey and Bentley here assert that knowledge changes over time and situations, even if the observer and the observed are the same. In the same way, a reader may transact differently with a text every time s/he encounters it. The actual physical text stays the same, but the reader's approach, or stance, changes--s/he may be studying the text instead of reading for enjoyment, or finding metaphors in innocuous phrases that s/he did not during the first reading, and so on. Reading events are not immutable and not only differ each time the same text is read, but also
during and after a single reading. Introspection, for example, can further develop the transaction.

Transaction is inquiry of a type in which existing descriptions of events are accepted only as tentative and preliminary, so that new descriptions of the aspects and phases of events, whether in widened or narrowed form, may freely be made at any and all stages of the inquiry (p. 122).

Dewey and Bentley define "widened" and "narrowed" (above) as "social" and "individual," respectively (p. 142), thus asserting that transaction may have a social dimension outside of the observer and observed. Their theory of knowing, then, is firmly placed in a social context, where knowing is influenced not only by the observed and the observer's stance, but also by the societal interaction of the observer. The implications for a reading event are obvious, as discussion with others about the text may play a valid role in a reader's transaction.

Rosenblatt (1978) extends Kant's, and Dewey and Bentley's argument of how "knowing" occurs when she emphasizes the importance of stance, either aesthetic or efferent, that the reader chooses. Even the act of choosing a stance is a transaction, as the reader decides what kind of text s/he is about to read upon the initial encounter. This transaction does not have to be a deliberate action, as
certain texts may trigger certain stances in readers that are not consciously decided upon.

James’s concept of selective attention may help us to see that choice does not necessarily involve a conscious pondering of alternatives. The reader is simply responding to cues set forth in the text, and because he has developed the habit of such response to such cues seemingly automatically adopts a particular stance (Rosenblatt, 1978, p. 77).

Thus, a telephone book, a newspaper article, and a chapter from a novel may all evoke different stances along the efferent-aesthetic continuum without the reader having to make a conscious choice about "how" to read each text. These cues (or clues, she uses the terms synonymously), then, signify efferent/aesthetic reading, or genre (1978, p. 55-56). According to Rosenblatt, the initial transaction, that of deciding upon a stance, is based on textual cues:

"Cues" or "clues" have been used as the most general terms for designating the textual signs to which the reader responds. If we try to sort out the various types of cues, we usually start with language. The reader, we have said, must possess competence in the phonemic and syntactic systems of the language, as well as the system of visual symbols. What the words stand for—the semantic "code" ... obviously is also involved (p. 55-56).

The textual cues from which a reader transacts meaning thus
include syntax, orthographic information, phonological information, and semantics.

Rosenblatt drew heavily from William James when formulating her concept of reader's stance:

One of the major characteristics that James postulates for the stream of thought is a continuing process of bestowing interest on particular thoughts or elements of consciousness, which then seem to be independent of the general stream of consciousness. 'It is interested in some parts of these objects to the exclusion of others, and welcomes or rejects--chooses from among them, in a word--all the while.' This is the sense in which I speak of the efferent reader screening out all but the needed end result or residue. Similarly, the aesthetic reader bestows his attention on a fuller arc of his response to the verbal symbols, selecting out what can be woven into the relevant structure of idea, feeling, and attitude. He feels this to be independent of the general diffuse stream of consciousness. (p. 43).

Depending on readers' stance toward a text, they focus on different aspects of the transaction between text and reader-- "...the eyes... are devices for collecting information for the brain...(but)...it is the brain that determines what we see and how we see it" (Smith, 1994, p. 65). The readers' stance thus, in part, determines which
aspects of the information available from a text readers will focus on. As it is the cuing systems that provide the information, the reader's stance specifies what combination of cuing systems will be "selected" for "attention." Thus although all three cue systems are utilized during reading, the reader is able to increase or decrease the relative attention given one or more of the cue systems depending on how the reader approaches the text. For example, Smith (1994) writes that "a poem may evoke a much more intense experience, especially emotionally, involving a particular mental attitude and a sensitivity to the sound as well as to the meanings of words, akin in many ways to listening to music" (p. 168). Rosenblatt (1994 p. 1067) agrees that for certain texts a reader's "attention may include the sounds and rhythms of the words themselves, heard in 'the inner ear' as the signs are perceived."

Rosenblatt's theory has found support in the work of schema theorists, who suggest that individuals may have sets of expectations for generic structures in texts (Whaley, 1981), and these expectations may differ from genre to genre. Empirical evidence also exists for the idea of 'stance' in reading; Zwaan (1994) studied whether expectations about genre influences the process and products of text comprehension and concluded that the subjects read
the passages differently depending on their genre expectations.

The Transactional Sociopsycholinguistic Model of Reading

Thus the idea of a "transaction" between the knower and the known has philosophical and epistemological roots with Kant, and Dewey and Bentley, and reading theory roots with Rosenblatt, who in turn relates her ideas philosophically to James. As was discussed above, Goodman's Transactional Sociopsycholinguistic Model of reading depends heavily on the idea of transaction, and Goodman (1994, p. 1100) acknowledges these roots: "Rosenblatt has drawn on Dewey's view that both the knower and the known are changed in the course of knowing. I've built on Rosenblatt's insight."

Goodman's use of Rosenblatt's ideas provides his model with a solid epistemological foundation, while, in turn, providing Rosenblatt with research that supports her ideas: "These studies in 'miscues,' though mainly concerned with efferent reading, have brought welcome reinforcement to my view of the reading process" (Rosenblatt, 1978, p. 63).

Findings from miscue analysis have also resulted in one of the most influential reading models of the modern era, as Ken Goodman (1994, pp. 1097-1098) explains: "The transactional sociopsycholinguistic theory and model of reading...that I have built is grounded in the scientific
analysis of the reading miscues of hundreds of readers of wide ranges of abilities and cultural and linguistic backgrounds." Because of its links to miscue analysis, the model is presented here as one of the products of miscue analysis research findings.

The overriding theme of Goodman's (1994) model of reading is that reading is a process of meaning making--both the deliberate and subconscious choices readers make, and both the overt and subtle behavior readers exhibit, support this notion. Although there are no distinct separations between many of the aspects of the model, for explanatory purposes it can be divided into three sections, as the following chart (p. 1120) illustrates:
Table 2.1
Elements of the Transactional Sociopsycholinguistic Model of Reading

<table>
<thead>
<tr>
<th>Language ( Cue) Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>graphophonic (symbolic)</td>
</tr>
<tr>
<td>orthography</td>
</tr>
<tr>
<td>phonology</td>
</tr>
<tr>
<td>phonics (relationships between semiotic systems)</td>
</tr>
<tr>
<td>lexico-grammatical (structural)</td>
</tr>
<tr>
<td>syntax/grammar morphology</td>
</tr>
<tr>
<td>order of functions wording</td>
</tr>
<tr>
<td>inflections</td>
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<td>function words</td>
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</tr>
<tr>
<td>ideational</td>
</tr>
<tr>
<td>interpersonal</td>
</tr>
<tr>
<td>textual</td>
</tr>
</tbody>
</table>

Cognitive Strategies
initiate/recognize (act of reading)
sample/select
predict
infer
confirm/disconfirm
correct
terminate (act of reading)

Cycles
visual
scan
fix

perceptual
image formation
narrow window
schema use

syntactic
assign surface structure
apply transformations
assign deep structure

semantic
assimilation
accommodation

The language cue systems are aspects of the text that prompt readers to construct and comprehend their own
personal, parallel texts, and are based on Halliday's systemic-functional view of language:

In constructing their texts and comprehending, readers take information, in the form of cues, from the three levels of language Halliday describes. Learning to read is at least partly gaining control over these systems and their interactions in the context of literacy events. (Goodman, 1994, p. 1119).

The graphophonic system is concerned with the patterns of alphabetic symbols on the page and their relationship with the patterns of phonological symbols of speech. The lexico-grammatical (structural) system is the grammar of written language, and the semantic-pragmatic system is concerned with meaning in a social context. As Goodman points out, the use of these cue systems is simultaneous and integrated (p. 1119).

Cognitive strategies are those actions, either deliberate or non-deliberate, taken by readers to make sense of a text. Readers sample from the text the most efficient and useful information available, based on their continuous predictions, inferences, and need to confirm or disconfirm their perceptions, as Goodman (1996, p. 112-113) explains:

Sample/selection is one of the key strategies we [readers] use. We choose from the display only the most useful information, by drawing on
everything we know about the writing system of our language, everything we know about the language, and everything we know about the text and the meaning created up to the point of our visual fixation on the print. In other words, we choose what is most useful on the basis of what we already know. ...We are constantly anticipating where a text is going, what will come next, what we will see, what structures we will encounter, and we make inferences from what we think we've seen and predicted. Our predictions are based on the information we've selected and sample from the text, but they also guide the process of selecting and sampling.

The cycles aspect of the model illustrates the cyclical nature of the reading process: the eye delivers information to the brain, which forms perceptions and allows the cue systems to be used. Based on this perceptual information the brain directs the eye where to fixate next, and the cycle continues. Each part of the process informs the next and is, in turn, informed by other parts of the process.

The model focuses, justly, on the perceptual aspects of reading. Goodman's (1996) assertion that "we read with our brain, not with our eyes" (p. 38) is supported by Smith's (1997) argument that "reading depends more on what is behind the eyes...than on the visual information in front of them" (p. 30) and Kolers (1969) conclusion that "reading is only
incidentally visual" (p. 8). Perhaps because assertions such as these have been taken out of context, Goodman's model has sometimes been mischaracterized as "top-down" (see Gough, 1984, Carrell, Devine & Eskey, 1988). In fact, there is a very clear, cyclical, and substantial interaction—a transaction—between the reader and the text. As has been discussed, the transactional aspect of the model is central to understanding how miscue analysis is a window on the reading process (Goodman 1970): that miscues are not errors, but evidence of the parallel text being constructed by the reader, a parallel text that is the product of the words on the page and the mind of the reader.

Thus, the theoretical foundations of a key aspect of Goodman's model have been explored, and Goodman's model has been presented as having a symbiotic relationship with miscue analysis. Below, miscue analysis is explained, and some important contributions to our understanding of the reading process are presented.

**Miscue Analysis Procedures and Contributions**

As with most valid and reliable research methodologies, there are two basic, but very important aspects of miscue analysis necessary to the methodology: the method of data collection and the perspective of data analysis.

Data collection procedures are important as they are
designed to mimic, as much as possible, an authentic reading experience for the reader. An entire story that is new to the reader and at a challenging level is chosen to read aloud, which is tape recorded. While the researcher uses a typescript for following the reading and marking miscues, the reader reads from the original text. The reading takes place in a comfortable environment with adequate lighting, and other physical necessities. The reading is unaided and not stopped unless the reader is either making so few miscues that another, more challenging text is in order, or the reader is unable to continue independently. After finishing the reading, the reader retells the story to the researcher which, while beginning as an unaided retelling, may also include open-ended questions by the researcher. At a subsequent time, the researcher marks the reader’s miscues on the typescript, using notes made during the reading and the tape recording of the reading. The oral retelling is also transcribed.

After completing the transcription of the retelling and miscue marking, the analysis, or coding, begins. Goodman, Watson, & Burke (1987) explain:

At the heart of miscue analysis are questions that are asked about each miscue and about patterns of miscues in relationship to each other. These questions evaluate the relationship between
miscues and:

Linguistic systems of the text and of the reader
Language of the reader and the author
Concepts of the reader and the author
Reader's use of sampling, predicting, and confirming strategies (p. 60).

Each miscue is examined in terms of the relationship between itself and the sentence in which it is embedded, as well as itself and the entire text. Areas of examination include syntactic acceptability, semantic acceptability, meaning change, correction, graphic similarity, and sound similarity. This information is recorded on a coding form (Appendix C) from which descriptive statistics can be produced to supplement the rich qualitative data produced by miscue analysis. Details of the four miscue analysis procedures can be found in Goodman, Watson, & Burke, 1987.

Miscue analysis has thus been demonstrated to be an effective tool for the exploration of reading processes, and has been the basis for many insights into the reading process. Some important findings are presented here:

Menosky's 1971 dissertation investigated the reading habits of 18 2nd, 4th 6th, and 8th grade readers and demonstrated that the quality of miscues changes after the first 200 words in the text; after readers gain familiarity
with the author’s style and content, their miscues tend to improve in quality. This underscores the importance of utilizing complete texts, not short excerpts, in reading research and assessment.

In 1972, Goodman illustrated the pitfalls of error counting as a form of reading evaluation and described the type of in-depth understanding of a reader’s proficiency that becomes possible if their miscues are analyzed instead of merely counted. This article would become influential during the reexamination of informal reading inventories (IRI’s) that based evaluations on gross number of errors made.

Goodman and Burke’s 1973 work, Theoretically based studies of patterns of miscues in oral reading performance, is responsible for a number of important findings. They collected data from 94 readers with proficiency levels ranging from low second grade to high tenth grade. First, they demonstrated that non-word substitutions retain elements of the original word; they are not simply wild guesses. In addition, word substitutions retain the same grammatical pattern of the word they are replacing much of the time, indicating the readers’ strong awareness and knowledge of the grammar of the text. They also provided evidence that the least proficient readers use graphic
information more than the most proficient; the most proficient readers attend more to context and meaning than letters and words.

Allen and Watson (referenced in Goodman, et al., 1987) demonstrated that the more personally involved readers are in their reading, the more proficiently they read. The classroom implications were obvious—students should be able to choose texts to read that make a connection to their lives.

In their thorough 1978 study Goodman and Goodman looked at 96 readers who were either English Second Language students or speakers of a stable, rural dialect. The study provided evidence that non-word substitution miscues like palow or plew for plow do not necessarily hinder readers' understanding of the concept; unacceptable pronunciation does not signal inability to construct meaning from the text. They also emphasized that dialect differences between the reader and the text do not constrain proficiency in reading.

Using the miscue data base that included second, fourth, and sixth grade students who were Navajo, Hawaiian Samoan, Arab, and Texas Spanish second language speakers, as well as downeast Maine, Appalachian white, Mississippi rural black, and Hawaiian-pidgin dialect speakers, Bess Altwerger
and Ken Goodman's 1981 study looked at text difficulty through miscues. Sentences that generated the highest rates of miscues per word per reader were analyzed for contributory factors. Their findings include the conclusion that the interaction between text and reader must be examined when exploring text difficulty, but also aptly demonstrated that miscue analysis has potential for examining texts as well as readers.

Miscue analysis is an ecologically valid research method with solid epistemological and research support, and has contributed to our understanding of the reading process for over 30 years. However, miscue analysis enjoys its share of criticism, which is addressed in the following section.

Miscue Analysis Criticism: Silent vs. Oral Reading

Findings from miscue analysis have been questioned on the basis of the differences between oral and silent reading (Leu, 1982). While the two types of reading are not exactly the same, their similarities outweigh their differences. Goodman & Goodman (in Gollasch, 1982) state: "...a single process underlies all reading. The cycles, phases, and strategies of oral and silent reading are essentially the same" (160). In addition, Beebe's (1980) research found that "[the data] lead to the conclusion that analysis of
oral reading miscues is an effective way of inferring what kinds of miscues may occur during silent reading." (335). Levin (1979) constructs a persuasive argument for the similarities of oral and silent reading that includes evidence that

those who read well in one mode do so in the other. Comprehension is similar as is the development of the skills. Anderson and Dearborn conclude that silent and oral reading may be implicit and overt expressions, respectively, of the same underlying processes (20).

In 1920 Buswell found that the eye-movements relative to ambiguous words were the same, which "...shows that eye movements in both oral and silent reading are largely controlled by the recognition of meaning" (in Levin, 1979, p. 31). In addition, Anderson & Swanson (1937) compared the eye-movements of readers reading orally and silently and found that the difference in eye-movements between oral and silent reading is one of degree, not kind: "Correlations between each measure of eye-movements in silent reading and the same measure in oral reading were uniformly positive and rather high for all groups" (68). For these reasons, I consider oral reading, while superficially different than silent reading, as proceeding from the same central reading process and able to generate reliable inferences about
silent reading.

Miscue Analysis of the 9 Readings

This section uses miscue analysis to evaluate and explore the nine readings in this study, as outlined in Chapter 1. The following chart¹ illustrates the nine readings² and the texts analyzed:

<table>
<thead>
<tr>
<th>Reader</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sam</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Vera</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Astor</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Jack</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Barry</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Mika</td>
<td>Waterford Ghost’s Revenge</td>
</tr>
<tr>
<td>Sam</td>
<td>Frugal Gourmets</td>
</tr>
<tr>
<td>Enzo</td>
<td>Frugal Gourmets</td>
</tr>
<tr>
<td>Judy</td>
<td>Frugal Gourmets</td>
</tr>
</tbody>
</table>

How Miscues Inform Readers’ Assessment

Miscue analysis allows rich qualitative description of readers’ proficiency, but also provides descriptive

¹The order that readers are presented within each story grouping is arbitrary in this table and all other tables and figures unless otherwise designated.

²Sam’s readings for both texts were used because of his rich miscues. In figures and tables where there may be confusion between his two readings, SamW indicates his reading of Waterford Ghost’s Revenge and SamF indicates his reading of Frugal Gourmets.
statistics that allow a snapshot of a reading. I provide analyses of data on readers' miscues per hundred words, proficiency scores, and Procedure III scores.

Overall, these 9 readings produced 204 miscues. The number of miscues per hundred words (MPHW) ranged from 1.9 to 9.9, as Figure 2.1 demonstrates:

Figure 2.1
Readers' Miscues Per Hundred Words for All Readers

As tempting as it may be to conclude that the readers with more miscues had a worse reading than those with fewer miscues, the relationship is not that simple; it is the quality of miscues that is informative, not the raw number (Y. Goodman, 1972). That is, a high number of syntactically and semantically acceptable miscues may indicate a more
proficient reading than a lower number of miscues that are not syntactically and semantically acceptable. Goodman & Marek (1996) explain that the quality of miscues can demonstrate readers' degrees of efficiency and effectiveness:

Readers whose patterns of miscues result in sentences that are semantically and syntactically acceptable, or if unacceptable are corrected, we consider to be effective readers. In addition to being effective, if readers also show that they make non-deliberate substitutions, omissions, and insertions of function words, have high-quality substitution miscues, shift grammatical units of text without disruption to meaning, and have a good percent of substitution miscues that show only some or no graphic and sound similarity, we consider these readers to be efficient. We have defined readers as proficient if they show both effective and efficient reading strategies. We use retellings to corroborate the proficiency of the readers as revealed through miscue analysis (p. 103).

To help express effectiveness and efficiency, the RMI includes a scoring system which delves further into the reading, but can still be represented numerically for comparative purposes. Two important measures of the proficiency of a reading are the areas of meaning construction and grammatical relationships. Each miscue is
judged by its' effect on the text—in the meaning construction category a miscue can be considered to have no loss of meaning, a partial loss of meaning, or a loss of meaning for the reader. Similarly, the grammatical relationships category is divided into four possible outcomes: strength, partial strength, overcorrection, and weakness. Figure 2.2 provides the percentages of each readers' miscues that appear in the meaning construction and grammatical relationships categories:

Figure 2.2
Miscue Quality Scores for All Readers

Overall, the average of these scores show the readings to be
effective, with only a relatively small percentage of the scores indicating a loss of meaning construction and weakness in grammatical relationships (20% and 17%, respectively). These scores, coupled with the readers’ retellings, provide an assessment of the proficiency of the reading.

The readers’ retellings support the appraisal that these readers comprehended the texts well. All the retellings are complete and accurate, with only one detail being misunderstood by one reader: Mike named the protagonist from Waterford Ghost’s Revenge “Mr. Waterford,” when in the text he is not given a name (Waterford is the name of the town in which the story is set). This misrepresentation is minor and does not alter the events in the story, nor does it mar Mike’s otherwise complete and accurate retelling.

In addition to the Procedure I miscue analysis and the retelling analysis, a Procedure III was applied to each reading. Procedure III is useful for assessment reasons as it goes beyond each specific miscue and looks at sentence level acceptability for each sentence. Scores for this procedure include a percentage of sentences that were semantically and syntactically acceptable when produced by the reader, even if no miscues were produced. This
procedure thus gives a picture of how readers deal with the text as a whole, instead of focusing on individual miscues. For example, Barry's Procedure I statistics show that 78% of his miscues resulted in no loss of meaning, and the same number were coded as exhibiting strong grammatical relationships--while not a low number, it is not a terribly high number either. However, a Procedure III analysis of Barry's reading shows that 100% of his sentences, as he finally produced them, were syntactically acceptable, semantically acceptable, and did not result in any meaning change. Barry made so few miscues, 2.5 per hundred words, that a few miscues in the "loss" category of meaning construction can lower his "no loss" percentage considerably. So it is important to look at the whole text, not just the portions containing miscues. Below, the salient Procedure III scores are shown for each reader, as the percentage of sentences that are completely syntactically acceptable, semantically acceptable, and free of meaning change:
While Procedure I and III clearly illustrate different levels of efficient and effective reading across readers, the procedures and the retellings indicate that the readers were able to read these texts and comprehend them—an important point, as we will assume a basic understanding of the overall text when we examine the readers' eye movements in chapter 3. I should emphasize that these are not "troubled" readers, but undergraduate students in a respected university who volunteered for the project. Only one of the readers - Sam - expressed a lack of confidence in his reading ability before beginning the project. However, when I asked him to talk about himself as a reader, he said...
that in addition to academic reading for his studies he enjoys reading John Grisham and Joseph Conrad novels, among others. His confidence is not high, but he is a "reader."

What Miscue Analysis of the Nine Readings Reveal about the Reading Process

We turn now from miscue analysis-as-assessment to an exploration of what miscues reveal about these readers' reading processes, and about reading processes in general. First, it is important to point out that no one set of numbers tells the whole story of a reading, as mentioned above. To illustrate the fact that it is the quality, not quantity, of miscues that reveals a reader's proficiency, the above scores are shown for the reader with the highest number of MPHW, SamW, and the reader with the lowest number of MPHW, Jack, for their readings of Waterford Ghost's Revenge, in Figure 2.4:
These two readers with very different MPHWs (8.7 and 1.9, respectively) have very similar meaning construction and grammatical relationships scores. The converse can also be true; note the difference between Enzo's relatively non-proficient reading of *Frugal Gourmets* and Judy's proficient reading of the same story in Figure 2.5.
Enzo and Judy have almost the same number of MPHWs (4.4 and 4.2, respectively), yet their readings are qualitatively different. So while the descriptive statistics that enable RMI's to be compared are useful, they also serve as a reminder that in order to fully exploit the explanatory power of miscue analysis it is necessary to analyze individual miscues. To do this, we examine two sets of miscues: first, as an introduction to the variety of different types of miscues that exist and the information
they provide, an example of each type of miscue made during the course of this project will be illustrated. Second, miscues that illustrate important aspects of the reading process will be selected and explained.

**Miscue Types**

Examples of miscues include substitutions, omissions, insertions, and partials. Repetitions are usually considered a type of oral reading strategy and are included here for the sake of expediency.

**Substitutions.**

**Figure 2.6**
Mike's Substitution of unusable

<table>
<thead>
<tr>
<th>line</th>
<th>unusable</th>
</tr>
</thead>
<tbody>
<tr>
<td>205</td>
<td>The house was run down, but usable, and they hoped to rent</td>
</tr>
<tr>
<td>206</td>
<td>it rather quickly.</td>
</tr>
</tbody>
</table>

Substitutions are signified by the reader's word appearing in italics above the text item it replaces. Mike substitutes unusable for usable, probably predicting a continuation of the idea of a "run down house" presented at the beginning of the sentence. He does not correct it, despite producing the contrastive but as found in the text.
**Omissions.**

Figure 2.7
Enzo's Omission of a

<table>
<thead>
<tr>
<th>line</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>303</td>
<td>You taste it</td>
<td></td>
</tr>
<tr>
<td>304</td>
<td>and then instantly wish you were at a red-and-white-checked</td>
<td></td>
</tr>
<tr>
<td>305</td>
<td>table in Italy, with a big peasant family in the background.</td>
<td></td>
</tr>
</tbody>
</table>

Here Enzo omits the indefinite article *a*, probably en route to constructing a plural object of the preposition--*tables* instead of the singular *table*. Like Mike, above, Enzo doesn’t correct the miscue even though he receives disconfirming information subsequent to the miscue.

**Insertions.**

Figure 2.8
Vera's Insertion of the

<table>
<thead>
<tr>
<th>line</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>211</td>
<td>\textcopyright the \textbackslash At \textamp</td>
<td></td>
</tr>
<tr>
<td>212</td>
<td>first they thought that perhaps the wife had come back and</td>
<td></td>
</tr>
<tr>
<td>213</td>
<td>was secretly living there.</td>
<td></td>
</tr>
</tbody>
</table>

Insertions are designated by the inserted word appearing above a caret at the place of insertion. Vera inserts the after producing *At*. Here she is apparently predicting an object of the preposition like *house* (which was the location addressed in the previous sentence) to follow the
preposition At. She corrects the miscue by repeating At and finishing the sentence with no further miscues.

**Punctuation.**

Figure 2.9
Barry’s Substitution of a Period for a Comma

<table>
<thead>
<tr>
<th>line</th>
<th>Unfortunately, his own parents were particularly selfish.</th>
</tr>
</thead>
<tbody>
<tr>
<td>109</td>
<td>cruel and mercenary and demanded that he will them his</td>
</tr>
<tr>
<td>110</td>
<td>house and property, which in case of his death would have</td>
</tr>
<tr>
<td>111</td>
<td>gone to his wife.</td>
</tr>
<tr>
<td>112</td>
<td></td>
</tr>
</tbody>
</table>

Punctuation miscues are indicated in a manner similar to insertions, with the implied punctuation mark added above a caret at the point of insertion. Barry predicted a short sentence describing the parents, and by his intonation we can tell he ended the sentence after selfish. When he realized the sentence continued on the subsequent line, with more descriptors and action, he repeated selfish with intonation used for the first item in a list.
Partials.

Figure 2.10
Jack's Partial of l-

| line | The lights contin-
|------|------------------|
| 307  | ued showing right up until the day when, with a muffled © l-
| 308  | crash and a \textit{cloud} of dry dust, the sagging roof finally fell in
| 309  | and the tottering walls collapsed into the cellar hole.
| 310  | 

Partials are marked exactly like substitutions, with the exception of a hyphen at the end of the utterance to designate an incomplete attempt. In this example, the line under \textit{cloud} attached to the symbol © indicates that the miscue was corrected. Jack produces the partial 1 before correcting the miscue and producing \textit{cloud}. Although it is difficult to surmise what word he may have been about to say from just one phoneme, it was probably \textit{loud} as that would fit semantically (\textit{crash} immediately precedes the word), syntactically (as an adjective to further describe the action surrounding the crash) and graphophonically (\textit{loud} shares a high degree of similarity both graphically and phonically).
Repetitions.

Figure 2.11
SamW's Repetition of for

<table>
<thead>
<tr>
<th>line</th>
<th>®</th>
</tr>
</thead>
<tbody>
<tr>
<td>207</td>
<td>But no tenant ever rented it, (\text{for}) presently discouraging things began to happen.</td>
</tr>
<tr>
<td>208</td>
<td></td>
</tr>
</tbody>
</table>

Repetitions are indicated by a line under the repeated items, connected to the symbol ® at the point where the repetition begins. Sam repeats the preposition for once before continuing the sentence. As mentioned below, this may be an observable part of Sam's process of confirmation.

Repetitions and partials are not usually coded as miscues. Repetitions are sometimes considered strategies that can "...provide interesting information about the reader" and partials do not "...provide enough information to answer the miscue analysis questions" (Goodman, Watson, and Burke, 1987, p. 70 & p. 76). The definition of a miscue, however, is "...an observed response (the OR) that does not match what the person listening to the reading expects to hear (the ER)" (Goodman, Watson, and Burke, 1987, p. 37), and neither repetitions nor partials are usually expected by the listener. Moreover, these unexpected responses comprise 28.9% of all miscues; 1.5 MPHW across readers consisted
solely of partials and repetitions, a number large enough to warrant investigation. However, to avoid confusion repetitions will be termed "oral reading phenomena" to distinguish them from true miscues. Exceptions to this rule in this dissertation include table and chart headings where an economy of space dictates the use of the term "miscues" to refer to the oral reading phenomena focused on in this dissertation: substitutions, omissions, insertions, partials, and repetitions.

Elements of the Transactional Socio-psycholinguistic Model:

Cue Systems

While "readers select from [the] language cue systems interchangeably and their use is simultaneous and integrated," (Goodman, 1994, p. 1119) it is possible to identify miscues in which the reader attends to one of the cue systems with more alacrity than others. This section will outline each cue system.

Graphophonic.

In Figure 2.12, Sam F. utilizes the graphophonlic cue system to come up with a pronunciation for the unfamiliar last name of a restaurant chef:
Figure 2.12
SamF's Substitution of po-devin in The Frugal Gourmets

<table>
<thead>
<tr>
<th>line</th>
<th>For</th>
</tr>
</thead>
<tbody>
<tr>
<td>201</td>
<td>(\text{po-devin})</td>
</tr>
<tr>
<td>202</td>
<td>Le Cirque 2000 chef Marc Poidevin, it all makes sense:</td>
</tr>
<tr>
<td>203</td>
<td>&quot;When the wealthy have tried everything else, they start</td>
</tr>
<tr>
<td>204</td>
<td>expanding to the foods of the poor.</td>
</tr>
</tbody>
</table>

He works out a pronunciation, then repeats it to solidify the pronunciation should the name reappear in the text. The syntactic and semantic information in this sentence does not provide any information for Sam to inform his choice of pronunciation.

Syntactic.

In Figure 2.13, Judy appears to be concerned less with the graphophonetic cue system than she is with the syntactic:

Figure 2.13
Judy's Substitutions of cook, comes, and dumps

<table>
<thead>
<tr>
<th>line</th>
<th>“You sit there holding on to this</th>
</tr>
</thead>
<tbody>
<tr>
<td>301</td>
<td>extremely ornate silver spoon,” says one recent diner, “and</td>
</tr>
<tr>
<td>302</td>
<td>(\text{cook comes}) (\text{dumps})</td>
</tr>
<tr>
<td>303</td>
<td>the (\text{cooks come} \text{and dump}) gruel on your table.</td>
</tr>
</tbody>
</table>

On the third line Judy begins to construct a situation in which there is one cook dumping gruel on the diners' table--it is easy to see how she could predict a singular subject,
after all, how many cooks usually come at one time to a diner's table? Once she chose the singular cook over the plural cooks she then continued to construct the rest of the sentence in a way that was syntactically compatible with the singular subject. That is, come and dump, two third-person plural verbs, must become comes and dumps, two third-person singular verbs, to agree with the singular subject the cook. Even though the sentence works as she constructed it, she notices the miscue, and repeats the word and before regressing and correcting the entire phrase. Her attention to the syntactic cuing system produced miscues that were syntactically compatible with her perception of the singular cook. Note that semantically there is very little variability—only the difference between one cook coming to the table and two or more cooks coming.

**Semantic.**

In Figure 2.14, Judy produces a substitution miscue that is a synonym of the word in the text:

<table>
<thead>
<tr>
<th>line</th>
<th>Judy’s Substitution of checkered</th>
</tr>
</thead>
<tbody>
<tr>
<td>303</td>
<td>You taste it checkered</td>
</tr>
<tr>
<td>304</td>
<td>and then instantly wish you were at a red-and-white-checked table in Italy, with a big peasant family in the background.</td>
</tr>
<tr>
<td>305</td>
<td></td>
</tr>
</tbody>
</table>

By producing checkered for the text item checkered, Judy is
responding to the meaning of the author’s message. It is not a letter-by-letter rendering of the symbols on the page that Judy is concerned with, but constructing meaning. Her attention to the semantic nature of the text word checked overrides the information she gets from the graphophonic cue system.

Elements of the Transactional Socio-psycholinguistic Model: Cognitive Strategies

Several of the cognitive strategies crucial to the Transactional Sociopsycholinguistic Model are demonstrated by the miscues readers make. These strategies are illustrated in this section.

Sample/Select.

Below, Astor’s miscues show how he samples information from the text and selects what he needs to make sense of the text—not just from the graphophonic cuing system, but from the syntactic and semantic systems as well:

<table>
<thead>
<tr>
<th>line</th>
<th>the</th>
<th>the</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>At that time, near the end of a barge canal, there lived a carpenter.</td>
<td></td>
</tr>
</tbody>
</table>

First, Astor substitutes the for that, two words that have similar initial graphic and phonic configurations. He
sampled the first two letters of that and produced a phrase that is probably more familiar to him - At the time - which is parallel in meaning and syntax to the phrase in the text. The next miscue again involves the determiner the, but this time it is substituted for a word that has no graphic similarities. Astor has sampled enough of the text, including the article the three words previous to his miscue, to enable him to decide that the article after of will be definite, just as the rest of the articles in the beginning of the sentence are. He illustrates here the nature of sampling and selecting: it is not a random process, but one driven by the predictions and inferences of the brain.

Predict.

In Figure 2.16, Astor provides a demonstration of the strength of prediction in reading:

Figure 2.16
Astor's Substitution of steal

| line | The greedy parents nevertheless kept trying to rent \or sell
|      | the place. |

The context leading up to this sentence, and indeed the beginning of this sentence, build upon the idea of the protagonist's parents as being cruel, stop-at-nothing coveters of ownership of a specific house. Astor's
prediction of steal is based on his past knowledge of their character and expectations about what they are capable of. The graphically similar beginning, middle, and ending of the word sell to his substitution steal are enough to confirm his prediction, so he produces or steal the place. However, while steal is syntactically acceptable, it does not match with the available graphophonic information or the local semantic information (of "trying to rent") so he notices the discrepancy, backs up, and corrects the miscue while repeating the end of the sentence.

Infer.

An inference is similar to a prediction, but is more general, and involved in providing information that is needed but not known. For example, when the dialogue in a story is between two people and it is clear who is talking and when, the author will sometimes omit dialogue carriers (he said, she replied) altogether, and let the reader infer who is talking without explicitly referring to the speaker. Readers make other inferences about text construction as well, as Sam demonstrates in Figure 2.17, the first sentence of a paragraph:
In the preceding paragraphs of this essay, the author talks about foods "from staple to delicacy" and ends by discussing inexpensive food. Sam is utilizing his knowledge about how texts are constructed to infer the pattern of the text—first the text addresses expensive food, then inexpensive food, then—and this is his inference—it would talk about both inexpensive and expensive foods together. When he produces From those to expensive food he is setting up a construction in which inexpensive food (those, from the previous paragraph) is joined with expensive food for some text organization reason. The miscues on the second line represent points of semantic tentativeness, but do not disconfirm his basic inference about the way the text is organized.

**Disconfirm.**

Reading is a tentative process, and miscues can provide evidence of readers' ongoing confirmation and disconfirmation of their predictions. Below, Sam illustrates a sequence in which he encounters text features that
disconfirm his predictions:

**Figure 2.18**
SamW's Insertions of Then and they, and Substitution of looked

<table>
<thead>
<tr>
<th>line</th>
<th>Then</th>
<th>looked</th>
<th>they</th>
</tr>
</thead>
<tbody>
<tr>
<td>213</td>
<td>\</td>
<td>\</td>
<td>\</td>
</tr>
</tbody>
</table>
| 214  | did not investigate too carefully.

In portions of the text immediately preceding this sentence, some of the protagonist's neighbors noticed lights coming from his empty house and wondered if the wife had moved back in. Sam predicts a situation in which the neighbors would investigate after seeing the lights, saying: Then they had looked the wife - liked the - They had liked the wife. His miscue of looked, graphically similar to the beginning, middle, and end of the text item liked, reflects that prediction. However, syntactically a preposition or particle is expected after the intransitive verb looked: looked at the wife, looked in (the house), looked behind (the house), etc. Sam encounters no such preposition and so disconfirms his prediction and corrects looked the to liked the. He then disconfirms his time clause marker Then and corrects the entire independent clause.

**Confirm.**

Instances of disconfirmation are more obvious than confirmation, but Astor provides us with two repetitions that may be evidence of confirming:
Both *good* and *from the* are produced tentatively, and repeated when Astor confirms their acceptability within the sentence.

**Correct**

We have already encountered several instances of correction, suggesting confirming strategies, in the examples above, and Barry provides another "clean" example below:

**Figure 2.20**

**Barry's Omission of *did***

| line | Shortly before *he died*, he warned his parents that if
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
<td>they did anything to harm his family after he was gone, he</td>
</tr>
<tr>
<td>114</td>
<td>would come back and haunt them as long as they themselves</td>
</tr>
<tr>
<td>115</td>
<td>lived.</td>
</tr>
</tbody>
</table>

Barry produced *Shortly before he die*, probably predicting a simple past construction of *die* instead of one which used a modal. When he discovers that the text does not contain *died*, he realizes that he has an unacceptable structure and
repeats and corrects the phrase he did die.

Summary

In this chapter the philosophical and epistemological roots of Goodman's Transactional Sociopsycholinguistic Model of reading were explored. Miscue analysis was introduced as a research methodology that both informs and is informed by Goodman's model, and the methodology's contribution to reading research was discussed. Lastly, the chapter ends with a discussion about what miscue analysis reveals about the nine readings of the participants in this study.
CHAPTER 3

EYE MOVEMENT RESEARCH: READING AS A PERCEPTUAL PROCESS

The good of a book lies in its being read. A book is made up of signs that speak of other signs, which in their turn speak of things. Without an eye to read them, a book contains signs that produce no concepts; therefore it is dumb.
--Umberto Eco, The Name of the Rose

For nearly 100 years, the observation and analysis of readers' eye-movements has been recognized as a direct indication of how the eye operates in reading and, by inference, how the brain uses the eye and the visual input it provides in comprehending written texts. In other words, eye-movement research has provided a view of the reading process.

Historical Background

The review of important concepts in the eye movement research of reading is presented throughout the chapter and intertwined with results from the eye movement analysis of the nine readings, and this first section introduces information necessary to understanding how eye movements can inform our understanding of the reading process.

Early Studies

In 1879, University of Paris Professor Emile Javal observed that a reader's eyes do not sweep smoothly across
print but make a series of short pauses, or saccades, at different places until reaching the end of a line, when they move to the beginning of the next in a smooth, unbroken fashion (reported in Huey, 1908). Although perhaps obvious now, this observation set in motion eye-movement research remarkably similar to what is being undertaken today. Before Javal, it was assumed that the eye glided unceasingly across text—such a movement could offer no real insight into the reading process. With the acknowledgment that the eyes do indeed stop at certain places along a line of print came the basis for exploring the role of eye movement in reading. Numerous questions arose to become obvious points of departure for explorations into the reading process: Where do the eyes stop? For how long? Why do they stop there? Why do they regress at times?

Perhaps the first concrete insight into the reading process made possible by eye-movement analysis was provided in 1891 by one of Javal’s colleagues at the University of Paris, Professor Landolt. Landolt observed subjects’ eye movements while reading different types and genre of text to see if their eye movements differed or stayed static. Huey reports Landolt’s findings: “Reading of a foreign language required more pauses, as did also the reading of detached words, numbers, and lists of proper names” (1908, p. 19).
Landolt thus provided the first evidence that the eyes do not proceed on a regular, predetermined path, regardless of the type of reading being done. Rather, the eyes are directed by the brain and study of their movements provides a window to perception and comprehension processes taking place while reading.

Dodge (1900) constructed an experiment to explore the type of information the eye picks up while it moves. Two pieces of cardboard were positioned one behind the other, and a slit measuring 4 mm wide was cut into the center of the piece in front. Subjects, who sat before the cardboard pieces, were to fixate first on a point to the left of the slit and then to make a single eye-movement to a point to the right of the slit. The slit itself was not visible from either fixation point. Six different colors were placed on the rear screen five times each to determine whether the subjects saw the color through the slit as they executed the required eye movement. Dodge reported that "when the eye movement was unbroken, the observer was unable to tell what had been exposed or even that anything at all had broken the black of the perimeter" (p. 461). His results indicated that since no useful information is received during the movement of the eyes, research should concentrate on the pauses the eye makes.
Huey (1908), himself, provided what is possibly the first physical record of readers' eye movements. In a procedure that sounds more than a bit uncomfortable for the subjects, a plaster of Paris cup with a hole in the center was attached to the cornea of one eye, much as a contact lens is today. The cup was attached to an aluminum pointer which responded to the slightest movement of the eye and traced on a piece of paper a record of the subjects' eye movements as they read. In addition to demonstrating that the eye regresses a small percentage of the time, he also showed that the first fixation in a line is many times not the first word, but the second or even the third. Likewise, the last fixation in a line was usually not the last word. Huey's data also demonstrated that readers fixated anywhere from 20 percent to 70 percent of the words in a line.

Huey's remarkable research, undertaken more than 90 years ago, shows evidence that reading is not a passive process of word-by-word identification, but that the reader makes choices about where and when to fixate while reading.

Buswell and Judd (Judd & Buswell, 1922; Buswell, 1920, 1922, 1937) photographed the eye movements of readers in a relatively (for their time) non-intrusive manner. The apparatus consisted of photographing a beam of light reflected first to the cornea of the eye from silvered glass
mirrors, and then from the cornea through a camera lens to moving kinetoscope film. While the subject read, the changing positions of the beam of light would be recorded on the film, which provided an "...accurate record showing the position and duration of each fixation of the eye while the subject reads (Buswell, 1922, pp. 12)."

Judd and Buswell also deserve credit for the sheer amount of data they assimilated, analyzed, and disseminated. In addition to providing their audience with an idea of what the data look like through copious illustrations (90 plates in Judd & Buswell, 1922, alone), they support their conclusions quite well. Their findings include evidence that not only do different readers read differently, but individual readers read differently in different circumstances and, ever mindful of pedagogical implications, they assert that readers "...need to be made aware of the fact that reading habits should be flexible and properly adapted to the purpose and the type of material which is read" (Buswell, 1937, p. 143). Their contributions to our understanding of the reading process are significant. Through their eye-movement findings they conclude that reading is a perceptual process that involves interpretations on the reader's part, not a process of word by word identification. On the subject of word
identification, of great current dispute, they argue for the primacy of context in determining the meaning of a word:

...in real life the word will always turn up as a part of a sentence and that it will have a peculiar shade of meaning through its contrast with other words or through its special relation in the total idea conveyed by the sentence. The notion that a word and its meaning are two fixed pieces of experience that can be tied together is a purely mechanical theory and not adequate... (Judd & Buswell, 1922, p. 4).

Tinker's landmark 1936 study investigated the reliability and validity of eye-movement analysis as it applies to reading. One of his primary concerns was whether the artificial laboratory situation that necessarily accompanied eye-movement studies caused subjects to significantly alter their reading strategies and processes. He had 57 college students individually read one version of a reading test at a table away from the eye-movement apparatus and then read another version of the reading test while under typical eye-movement recording conditions. The results were encouraging for eye-movement researchers; "Although some subjects did better and some poorer before the camera, the group as a whole gave an entirely typical performance in the photographic situation" (Tinker, 1936, p. 742). Tinker's conclusion that eye-movement reading records
can be indicative of authentic reading behavior has allowed researchers to extend their findings to situations outside of the laboratory.

The Physiology of the Eye

Despite the exciting forays into the reading process that eye-movement research introduced in the beginning of the 20th century, very little was done from the time of the studies presented above until the late 1960's, a hiatus that some blame on the behaviorist doctrine that held sway (Rayner & Pollatsek, 1989). By the late 1960's eye-movement recording apparatuses, while operating on the same basic principles as earlier equipment, became more sophisticated than that used by previous researchers. Micro-analyses of the eyes' behavior now became possible, and, accordingly, contemporary eye-movement research is characterized not by broad generalizations, but smaller scaled, significant contributions to overall knowledge about the role of the eye in reading.

A central question since the inception of eye-movement research has surrounded the amount of information the eye can process with each fixation. This question became even more important as Dodge's (1900) conclusion that we see nothing while the eye is actually in motion began to be empirically replicated (e.g., Wolverton & Zola, 1983); the
only text information available is presented during the fixations.

From physiological studies of the eye we know several basic facts about how the eye is able to process information. There are three regions of viewing information the eye has access to during a fixation: the foveal, parafoveal, and peripheral regions. The foveal region is the area that we think of as being in focus, and includes 2 degrees of visual angle around the point of fixation, where 1 degree is equal to about 3-4 letters (6-8 letters are thus in focus). The parafoveal region extends about 15-20 letters, and the peripheral region includes everything in the visual field beyond the parafoveal region. The fovea is concerned with processing detail, with anything beyond the fovea producing a marked drop in acuity; words presented to locations further from the fovea are more difficult to identify (Rayner & Sereno, 1994). These are, of course, physical limitations of the eyes' ability to present visual information to the brain; of interest to reading researchers and theorists is the perceptual process of what the brain makes of the visual information from the eyes. For example, evidence from eye-movement studies in the early part of the century demonstrated that many words in a text are not fixated. Fisher & Shebilske (1985) report that "...in the
17 records published by Judd and Buswell (1922) we have found that less than two-thirds of the words were fixated in eight of the records and no more than three-fourths in any of those remaining" (149). However, the skipped words are still perceived - that is, even though they are not fixated, readers believe they have read them, a concept that is discussed below. The next section is concerned with eye-movement research that has been influential in increasing our knowledge of how the eye is involved in reading as a perceptual process.

Eye Movement Measures of the Reading Process

Four general measures of eye movements are discussed frequently in eye movement literature (see Just & Carpenter, 1987, Rayner & Pollatsek, 1989):

• the percentage of word fixations
• type of words fixated (usually such categories as content and function)
• fixation duration
• regressions

In this section each of these measures will be reported for the nine readings. In addition, I explore the significance of these eye movement measures and what they reveal about reading, including an explanation of how they relate to the Transactional Socio-psycholinguistic model of reading.
Words Fixated

The mean percentage of words fixated across all readers in this study is 64%, with a range of 59% to 70%. Figure 3.1 illustrates each readers' word fixation percentage and the mean percentage for each story.

Figure 3.1
Readers' and Overall Percentages of Words Fixated

While the range of words fixated spans Barry's 59.47% to Jack's 70.37%, the averages for the all readers on the two stories were remarkably similar: 64.15% for Waterford Ghost's Revenge and 64.23% for Frugal Gourmets. This figure of about 64% means that well over 1/3 of the words in the readings are not fixated, a finding that does not support
syntheses of eye movement research by several noteworthy reading theorists:

Do skilled readers skip over any significant number of words in meaningful text? Not really. Normal adult readers fixate most words of a text, regardless of its difficulty (Adams, 1990, p. 100).

This research is consistent in indicating that the vast majority of content words in text receive a direct visual fixation (Stanovich, 1992, p. 7).

The elegant studies of eye movements during reading by Rayner and his associates have shown conclusively that good readers read every word" (Liberman & Liberman, 1992, p. 352).

However, the above statements are not supported by the eye movement research from which the statements' authors draw their syntheses:

... at least 20% to 30% of the words in text are skipped altogether (i.e. do not receive a fixation) .... (Rayner, 1997 p. 319).

...in the 17 records published by Judd and Buswell (1922) we have found that less than two-thirds of the words were fixated in eight of the records and no more than three-fourths in any of those remaining (Fisher & Shebilske, 1985, p. 149).
...about 68% of the words [in the study] are fixated" (Just & Carpenter, 1987, p. 37).

In fact, in the present study about 40% of the words were skipped... (Hogaboam, 1983, p. 315)

While the discrepancy between some theorists' syntheses and the research they are synthesizing is puzzling, the important fact is that the percentage of words fixated in this study is consistent with the same measure found in early and contemporary eye movement studies.

On average, 36% of the words in the texts in this study were not fixated, yet the readers reported no comprehension problems and were all able to give complete and relatively inclusive retellings of the readings, nor did any report that they felt like they skipped over a third of the words. But if a word does not receive a fixation, and is not in foveal focus, it is not physiologically possible to process its individual letters. How then, can readers not fixate words and still feel as if they are reading?

In Goodman's view of reading (Goodman, 1994) the reader engages in a process of meaning making and constructs a personal text parallel to the published text. Having successfully constructed meaning, the reader has the perception that every word has been read. That is, while not physiologically focusing on every word, the reader
believes that every word has been seen. Just & Carpenter (1987) explain that readers perceive the words that eye movement studies show are not fixated:

Some of the words that are not fixated directly are still processed to some extent. The evidence for this claim is that certain words are more likely to be skipped than others. If readers did not process the skipped words, then all words would be equally likely to be skipped.... Readers were more likely to skip three letter function words (such as the, and) than three letter content words (such as ant, run).... This selectivity implies that readers had more information about those words than just their length, even though the words were not fixated (p. 39).

Readers are thus able to receive some text-level information from the parafoveal region. But how, since the parafovea is not in focus? Predictions and inference play a part in how well these words that are not fixated are processed, as the following studies demonstrate.

McClelland & O’Regan (1981) explored whether the usefulness of information in the parafovea was dependent on readers’ expectations about what the next word in a text would be. One of their experiments examined target word naming reaction time facilitation from the use of preview information in an experimental paradigm that simulated eye movements. Subjects read an incomplete sentence (the last
word was left out) displayed on a computer screen. When they reached the last word, they pressed a button that initiated a 100 ms preview, followed by a 100 ms blank space, then finally the target word. Subjects were to name the target word as soon as they read it. Preview items were of three types: a series of x’s (the X condition), an item similar to the target word except that the second and penultimate letters were replaced by other letters of the same shape (the shape-end-letter condition), or the same word as the target word (the word condition). In addition, the sentences the subjects read were of two types: those that enabled a series of judges (that did not take part in the experiment) to accurately predict the last word, and those that the judges felt did not allow them to predict the last word. The former condition was termed “Constraining Context,” the latter, “Neutral Context.” McClelland & O’Regan’s results demonstrate that the speed and ease with which readers could name a target word from a parafoveal preview is dependent upon the reader’s expectations: “...a priori expectations and context greatly increase the benefit subjects gain from a preview of a word in parafoveal vision” (634). They assert that “...our experiments have clarified one point: The ability to derive benefit from the preview we receive of upcoming words in parafoveal vision depends on a
prepared mind" (643). That is, readers are able to make use of text information that they have not fixated on but which they have predicted. Fuzzy input is enough to confirm a prediction.

To support the idea that unfixated words are, nevertheless, perceived and processed, Fisher & Shebilske (1985) performed an experiment that made use of a yoked-control group. Half of the 60 undergraduate participants had their eye movements monitored while reading sentences (as well as short essays) such as the following:

Pets have funny names such as my favorite dog, Jingles.

If those subjects failed to fixate, for example, the words funny and dog, the other half of the subjects (the yoked-controls) would see the sentence as:

Pets have ____ names such as my favorite ____ , Jingles.

The researchers then examined the percentage of words that were skipped that subjects could report vs. the percent of words that were not skipped that subjects could report. The reasoning is that if words that are not fixated are not perceived, the first group of subjects would recall as many of the "skipped" words as the second group of subjects. In fact, this was not the case: the ratios of reporting non-fixated words to fixated words in the first group of subjects were 1.0 (sentences) and .97 (essays), while the
ratios for the group of subjects that received the yoked control materials were .40 (sentences) and .45 (essays) (that the yoked-control subjects were able to "recall" a word at all is a function of their ability to infer the words from the context). The indication is that even though a word is not directly fixated it is still perceived. Fisher and Shebilske conclude,

More specifically, the present results support the generality of the hypothesis that expectations based on contextual constraints can interact with parafoveal information to determine the guidance of fixations (p. 154).

In other words, predictions from context are used by the brain to direct the eye where and whether to fixate or not. To further confirm the effects of contextual constraint, or predictability, of text, Rayner & Well (1996) asked readers to read sentences that contained a target word that was either classified as high-, medium-, or low-constraint. Their method of determining the predictability of the target words is similar to that of Fisher and Shebilske, above; judges who did not participate in the study were given a cloze task with the sentence or paragraph presented up to the target word and asked to fill in the blank. Target words that were produced by the judges over 60% of the time were considered highly constrained, or
predictable, and target words that were produced less than 10% of the time were considered unconstrained. Eighteen adult participants' eye movements were recorded reading a range of sentences, from highly constrained to relatively unconstrained, with word length and word frequency controlled. The study's results indicate that the low-constraint words yielded longer fixation times than the medium and high constraint words and readers were more likely to not fixate on the high-constraint target word than the medium- or low-constraint target word. The researchers effectively confirm findings of other eye movement studies that show that

... highly constrained target words are skipped (i.e., not directly fixated) more frequently than unconstrained words....(and) when target words are fixated, fixation time is shorter on constrained than unconstrained words (504).

Rayner and Well (1996) conclude that "predictability of a word (or the amount of contextual constraint for that word)...will affect both fixation time and word skipping" (507). That is, readers' predictions allow them to skip (to not fixate) certain upcoming words. In doing so they use some parafoveal information about the words. Not all researchers agree with this conclusion; studies by Zola (in McConkie & Zola, 1981) and Hyona (1993) both questioned the
usefulness of context in parafoveal processing. However, both Zola and Ryona's studies have been criticized as being flawed; see Ehrlich & Rayner, 1981, Rayner & Pollatsek, 1989, pg. 223-224, and Rayner & Well, 1996, for a critique of the studies.

So the readers in this study look at, on average, 64% of the words in the texts; a proportion consistent with every eye-movement study published. The range of word fixation percentages between readers in this study, 59%-70%, is also consistent with the ranges published in other eye movement studies. What is not usually pointed out, however, is the percentage of words fixated within-reader, and within-text. The chart below shows the average percentage of words fixated by the six readers of Waterford Ghost's Revenge by sentence:
Figure 3.2
Mean Percentage of Words Fixated by All Readers for Waterford Ghost's Revenge, by Sentence

Note that by no means is the average, 64.15%, of the words fixated in each sentence; the range is from 57% to 73%. Sentences with more fixations indicate readers need more text information to construct meaning. Note the uneven nature of the graph, demonstrating that readers are economical with fixations when they can be, and produce more when they need more. This word fixation percentage, which finds parallels to Flurkey's (1997) time course flow of reading (discussed subsequent to the Fixation Duration section, below), is even more obvious in the profile of an individual reader:
Figure 3.3
Mean Percentage of Words Fixated by SamW for Waterford Ghost’s Revenge, by Sentence

Sam fixates between 47% and 86% of the words in a given sentence. Sam’s sentences 11 and 12 are presented below:

Figure 3.4
SamW’s Fixations in Sentences 11 and 12 of Waterford Ghost’s Revenge

<table>
<thead>
<tr>
<th>line</th>
<th>So they closed the blinds and waited for a tenant. But no tenant ever rented it, for presently discouraging things began to happen.</th>
</tr>
</thead>
<tbody>
<tr>
<td>206</td>
<td>350 200 383 483 433 317 133 633 367 367 300 367 233 283 450 283 300 150 217</td>
</tr>
<tr>
<td>207</td>
<td>1 2 3 4 5 6 7 11 16 8 13 10 14 9 15</td>
</tr>
<tr>
<td>208</td>
<td>200 250 517</td>
</tr>
</tbody>
</table>

In this and all eye movement overlays, the top number signifies the position of the fixation on the word directly
above it (these numbers start over at 1 on each line subsequent line. In the event a letter is used, that indicates an inter-line regression sequence). The bottom, three-digit number indicates the duration of the fixation in milliseconds (ms.). Thus, in the first line, the "b" of BLINDS is the third fixation on that line, and was fixated for 383 ms. In sentence 11 Sam fixated 50% of the words and in sentence 12 he fixated 77%. It is not only the number of words fixated in the latter which indicates Sam’s tentativeness, though; several words have multiple fixations and there are many regressions, concepts that are discussed in subsequent parts of this chapter. It is not the entire sentence that gives sentence 12 a high percentage of fixations, but the middle section that is densely sampled - the beginning and end of the sentence have similar fixation patterns to sentence 11.

The point here is that readers do not skip every third word, but sample from the text at points where they need more information. Sam fixated only half the words in a sentence that was highly predictable and easily confirmed, but had substantially more fixations in a sentence where his predictions were disconfirmed and he needed more text information before becoming satisfied with that portion of the text. Below, we look at the reasons why certain
linguistic types of words are more likely to be skipped than others.

**What is the Linguistic Nature of Words That Are Skipped?**

In many eye movement research studies it appeared that the shorter the word was, the more it was likely to be skipped. In order to ascertain whether it was word length or a syntactic feature of the word that was responsible for the likelihood of its being skipped, O'Regan (1979) recorded the eye movements of subjects who read pairs of sentences that began the same, but ended differently (each subject read one of each pair):

*The dog that growled the most was friendly.* / *The dog that growled ate many biscuits.*

*He claimed the ladies the maid knew lived in New York.* / *He claimed the ladies met many times to discuss.*

In these sentences readers skipped the substantially more than they skipped three letter verbs. So in the first example given, *the* was more likely to be skipped in the first sentence than *ate* in the second sentence, and in the second example, the second *the* in the first sentence was more likely to be skipped than *met* in the second sentence.

O'Regan summarizes:

> The conclusions to be drawn from this experiment are first, that local eye movement parameters (saccade size, regression probability, number of
fixations, and perhaps fixation duration), are controlled sufficiently rapidly to be influenced from moment to moment by information concerning the lexical category of a word in peripheral vision. ...it is clear that some systematic influence of sentence structure exists (p. 59).

This trend was echoed in the 9 readings in this study; readers fixated 79% of the content words and 46% of the function words, as Figure 3.5 shows:

**Figure 3.5**
Average Percentage of Content and Function Words Fixated

In Figure 3.6, a sentence from *Waterford Ghost's Revenge* illustrates how Barry fixated content words instead of function words (in this and all figures with eye movements
overlaid on the text, the top number signifies the position of the fixation on the word directly above it. The bottom, three-digit number indicates the duration of the fixation in milliseconds [ms.]):

**Figure 3.6**

**Barry’s Eye-Movements: Content Vs. Function Words**

<table>
<thead>
<tr>
<th>line</th>
<th>The greedy parents nevertheless kept trying to rent or sell</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>306</td>
<td>733 483 250 400 300</td>
<td>2</td>
</tr>
<tr>
<td>307</td>
<td>the place.</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>450</td>
<td>4</td>
</tr>
</tbody>
</table>

In this sentence there are four function words--**THE, TO, OR, and THE**--and eight content words. Barry fixates the words that give him the most information--**PARENTS, NEVERTHELESS, TRYING, RENT, SELL, PLACE**--and, not coincidentally, they are content words. His assigned sentence pattern facilitates his prediction and confirmation of determiners, infinitives, and conjunctions, so he does not need fixate them. Overall, the ratio in this study is reflective of Just and Carpenter’s 1980 study that found that readers fixated an average of 67.8 percent of the words, with content words being fixated 83 percent of the time and function words being fixated 38 percent of the time (Carpenter & Just, 1983). Function words in English set up the grammatical patterns and represent fewer alternatives than content words. When readers do not fixate function words it shows
that they have already assigned a syntactic pattern for the sentence.

Thus, not only is every word in a text not fixated, but the syntactic and semantic components of each word play a role in whether or not the word is fixated. When readers utilize their implicit knowledge of the structure of language along with their constant predictions about upcoming text, they are able to read more efficiently—to skip words that have been confirmed parafoveally.

**Fixation Duration**

The amount of time a reader spends looking at a given word can be measured in several ways (Rayner & Sereno, 1994): first fixation duration, the duration of the first (or only) fixation on a word, gaze duration, the sum of the total fixation time on a word the first time it is encountered (all fixations before moving off the word), and total fixation time, the sum total of all fixations, including regressions and refixations, at any time on a given word. The amount of time readers spend on individual words is an important measure as moment-to-moment processing of the text influences when readers move their eyes (Rayner & Well, 1996); the time readers spend on a word is a measure of the ease or difficulty they experience with that portion of the text. Figure 3.7 displays the mean total time word gaze
duration for each reader:

Figure 3.7
Readers’ Average Total Time Word Fixation Durations

Note that Figure 3.7 measures the average total time readers spent on each word, a measure that includes all multiple fixations and regressions on words. The average duration of each fixation is a different measure, concerned not with words, but with the length of each fixation, and is smaller (the readers’ average duration of each fixation is 335.89 ms.). As is obvious, readers do not spend the same amount of time on words, as the range is from Jack’s 352 ms. per word to SamF’s 807 ms. per word. This is a large difference, and prompts the question of whether they are
each relatively consistent within the text, or there is a large variation between total time gaze durations within each reader as well. If there was as large a variation within-text, that would indicate that readers spend less time on predictable parts of the text, and more time on portions that are not predictable. Several reading theorists deny that readers spend less time on predictable text, which implies that word fixation times must be stable. For example, Adams (1990) asks,

> Even if skilled readers look at every word, they might not process every word in equal detail. Do skilled readers sample the visual features of predictable text less thoroughly? No. Regardless of semantic, syntactic, or orthographic predictability, the eye seems to process individual letters (p. 101).

Similarly, Stanovich (1992) states:

> Furthermore, the study of the processing of visual information within a fixation has indicated that the visual array is rather completely processed during each fixation. It appears that visual features are not minimally sampled in order to confirm ‘hypotheses,’ but instead are rather exhaustively processed, even when the word is highly predictable (p. 7).

However, the assertions about eye movement fixation durations made in the Adams and Stanovich’s syntheses above
are not supported by eye movement studies. For example, in their 1996 study described above, Rayner & Well demonstrated that "...as far as fixation times of words are concerned, words that are unconstrained by context are fixated longer than words that are moderately to highly constrained" (507). Similarly, in 1998 Reichle et al. stated that

reading is a more interactive process, and there may be many situations in which a word will not be predictable in the absence of any information but quite predictable given minimal information such as approximate word length and the first letter (p. 153).

As explained by eye movement researchers such as Keith Rayner, the variability in the fixation durations of different words in the nine readings makes sense. Figure 3.8 shows readers' total time fixation duration of words in each sentence of Waterford Ghost's Revenge:
Figure 3.8 shows that readers spend more time on some words than others, explained by eye movement research as a function of how predictable the text is. In short, readers constantly make predictions about upcoming text. Eye movement studies show that when readers encounter words that they expect, they do not fixate or only do so for a brief time. That finding is supported by the data from the nine readings.

The reason readers look at words for different lengths of time is based on efficiency—if they fixate a word they predicted, they are able to move off of that word faster.
then if they fixate on a word that disconfirms their prediction. In the view of reading as meaning construction, when readers confirm their expectations by briefly fixating on a word they expected to be there, they are sampling the text. Smith (1994) points out that "the secret of reading efficiently is not to read indiscriminately but to sample the text. The brain must be parsimonious, making maximum use of what is already known and analyzing the minimum of visual information required to verify or modify what can be predicted about the text" (p. 81).

When readers use the least amount of text information necessary to create meaning, they are sampling from the three text-based levels of cuing systems (Goodman 1994): the graphophonic, lexico-grammatical (structural), and semantic-pragmatic systems. Eye movement research has demonstrated that readers use the three cuing systems during the parafoveal preview to be able to skip upcoming words or to facilitate their identification. The following section explains how eye movement research supports readers' use of cue systems.

**The Cuing Systems**

While Goodman (1994) stresses that "readers select from [the] language cue systems interchangeably and their use is simultaneous and integrated" (p. 1119), other reading
theorists disagree. For example, Grossen (1997) draws from uncited "recent eye movement research" to claim that:

Of the three cuing systems frequently mentioned in reading (semantic, syntactic, and graphophonemic [sic] cues), the semantic and syntactic cuing systems seem to play a minor role. Recent eye movement research indicates that good readers do not sample the text and predict to recognize words efficiently, but rather see every single letter on the page (paragraph 35).

Her last supposition, that readers see every letter on the page, has been refuted by eye movement research earlier in this chapter. Below I provide examples of eye movement studies that support the use of each of the cuing systems.

The Graphophonic Cue System.

The graphophonic cue system consists of phonological and orthographic details and information about how the two systems relate to each other. To demonstrate the importance of phonological information, Pollatsek, Lesch, Morris, and Rayner (1992) undertook a project designed to determine whether homophones provide a better parafoveal preview than do visually matched controls. Of interest was fixation duration on the target word in a sentence. Each target word had one of four corresponding preview words, either a homophone, a visually similar word, a completely different word, or an identical word to the target. The text was
displayed on a computer screen. When the subjects began reading the sentence, one of the preview words would be in the target word’s position until their eyes crossed the boundary point (the parafoveal preview), at which time the preview word would be replaced with the target word. In other words, the preview word would be in the sentence until the readers began the saccade that would take them to that word, at which time the computer would change the preview word to the target word (remember that the eye picks up no information during a saccade, so the reader was not aware that there was a change). The dependent variable was processing time of the target word once it was reached, with the processing time (i.e. a shorter eye fixation duration) being attributed to the usefulness of the parafoveal preview. The results indicate that the readers fixated for less time after a homophone preview than with a visually similar preview that was not a homophone. The authors summarize:

The central finding of this study is that when a parafoveal preview word was a homophone of a target word, there was a greater preview benefit than when the preview was a non-homophonic control word that was as visually similar to the target word as was the homophone (p. 158).

A similar technique was used by Balota and his
colleagues (1985) to explore the orthographic portion of the graphophonic cuing system. Utilizing a boundary technique, they explored the influence of context and parafoveal information that was either visually similar or visually dissimilar to a target word that the reader would subsequently fixate. For example, in the following sentence cake would have as a parafoveal preview either cake, cahc, pies, picz, or bomb that would be changed to cakm during the reader's saccade immediately preceding the word:

Since the wedding was today, the baker rushed the wedding cake to the reception.

They found that readers were significantly more likely to skip the visually identical or visually similar parafoveal previews (cake, cahc) than when shown the semantically related, visually dissimilar, or anomalous parafoveal previews (pies, picz, bomb). They conclude that the data imply that when the word is skipped, only the beginning two or three letters of the parafoveal word were actually identified. Thus, on these occasions, a strong context helps readers to fill in information that is not totally available in their parafovea (p. 374).

Readers are able to sample phonological and orthographic information in the parafoveal field of vision in conjunction with their expectations of the upcoming text to either skip
upcoming text or fixate on it for a shorter than average period of time. In the meaning construction view this sampling from the text—not thoroughly processing the letters—makes possible efficiently utilizing the least amount of information necessary to make sense of the text and move on.

The Lexico-Grammatical (Syntactic) Cue System.

In a study in which the eye movements of 14 college students reading 15 different short (about 135 words) passages from news magazines were recorded, Just and Carpenter (1987) demonstrated that readers make use of syntactic information in the parafovea. Specifically, readers were more likely to skip three letter function words such as and and the than three letter content words like act and two. While they caution that it is not certain which aspect of a function word a parafoveal preview utilizes, Carpenter and Just (1983) describe function words as "semantically impoverished" and that, along with word length and shape, "it is possible to recognize a great proportion of the three-letter function words on the basis of the prior syntactic context...." (p. 283-4). Similarly, in the study described earlier, O’Regan (1979) found that readers skipped the substantially more than they skipped three letter verbs.
When readers utilize their implicit knowledge of the structure of language along with their constant predictions about upcoming text, they sample from the syntactic cuing system to confirm the syntactic pattern they have assigned. This enables them to read more efficiently—to skip or spend less time on words that are already predicted and confirmed parafoveally.

**The Semantic-Pragmatic Cue System.**

One aspect of semantic information that the semantic cuing system conveys is morphemic; that is, different parts of words carry different types of semantic information, some of which is more useful than other parts during reading. Underwood, Clews, and Everatt (1990) examined the process whereby a fixation location is informed by the information distribution of the word in the parafoveal preview. For example, underneath is the only word of its length ending in neath, which makes the end of the word a “zone of high information.” The end of engagement, however, is “redundant,” as ment can attach to a great number of words. Underwood et al. selected target words that fit several categories of words with zones of high information at the beginning or end of the word, and embedded them in short stories. The location of readers’ fixations on the target words were recorded. The researchers proceeded with the
expectation that if readers consistently fixated on the zones of high information then they must be processing morphological information parafoveally. This is indeed what happened, as the researchers summarize:

The target words used in our sentences varied in their distribution of information. Being given the first few letters of some words would not be sufficient to identify them, and likewise, the final few letters of some words did not provide a unique suggestion as to the identity of the word. The distribution of the information had its effect upon the location of the first fixation upon the target. A redundant beginning induced a first fixation further from the word’s beginning. This variation in the initial landing position is evidence of parafoveal processing of the distribution of information in the word, because until that fixation had been made only parafoveal processing could deliver the information necessary to guide the eyes to one location or another (p. 58).

However, Rayner and Morris (1992) replicated the above study and, based on their findings, argue that Underwood et al.’s (1990) claim that the eye initially fixates on the most informative part of a word is too strong a claim:

Although the results of the present study are consistent with data reported previously...with regard to the amount of time that readers look at words as a function of where the information for
uniquely identifying the word is located, our data are not consistent with the more controversial claim advocated by Underwood and colleagues....Our data definitely do not support such a model. Of course, as we acknowledged earlier, semantic processing of parafoveal words does occur. What we are arguing against is a semantic preprocessing model in which the meanings of parafoveal words are unconsciously analyzed, and the information is used to determine where to look next (pp. 169-170).

Thus, while the research is in agreement that readers are able to sample semantic information from the parafoveal field, researchers' beliefs about the reading process influence how they interpret their data. Yet in either view semantic information is shown to enable readers to use as textual cues the most informative part of a word—a good example of one of the numerous ways readers make efficient use of the text.

This section has demonstrated that there is strong experimental eye movement evidence for readers using all cuing systems in a text in order to maintain the most efficient reading process possible. Specifically, readers utilize graphophonic, syntactic, and semantic information in conjunction with their predictions and inferences to more efficiently process upcoming text. This efficiency is demonstrated by readers' ability to skip one out of every
three or four words, yet still perceive them as being "read." When readers fixate for a short amount of time on a word that they expected to be there, they are confirming their predictions—a process that can be completed by sampling from the most useful cuing systems available.

Reading "Flow"

Flurkey's (1998) concept of "flow" in reading helps us to conceptualize the variability in word fixation duration as a "...dynamic acceleration and slowing of reading rate....[which ebbs] and flows as readers continually respond to text" (p. 21-22). To illustrate the eye movement equivalent of this concept, Enzo provides an example of the variation in total time word fixation duration in an individual reader in Figure 3.9:
It may be tempting to suppose that readers fixate for a static, set time period and simply fixate more times on those words with a higher total fixation duration times, causing the variation evident in Figure 3.9. This is not the cause, however, as the following figure demonstrates. In Figure 3.10, Enzo's mean fixation durations (the duration of an average fixation, as opposed to the duration of time spent on a word) for each sentence are shown:
Where Figure 3.9 showed how much time Enzo spent on each word, Figure 3.10 shows the average length of each of his fixations - regardless of which word it is attributed to. I show Figure 3.10 to demonstrate that the variation in word fixation duration in Figure 3.9 is not merely a function of some words being fixated many times, by fixations that are all equal. Rather, the actual length of the fixations themselves are highly variable. Thus the duration, not simply the number, of readers' fixations change as they negotiate a text, a concept reflected in reading flow theory:
Readers who display mature control over use of the reading process when transacting with a particular text are able to efficiently and flexibly control their use of the cognitive reading strategies of sampling, predicting, inferring, and confirming. When readers produce proficient readings, they display greater facility in speeding up when they can and slowing down when they need to. Their control over process and text enables them to do whatever they deem necessary to identify and solve "problems" as they construct meaning (Flurkey, 1998, p. 29).

Readers are able to sample syntactic, semantic, and graphophonic information in the parafoveal field of vision in conjunction with their expectations of the upcoming text to either skip upcoming text or fixate on it for a shorter than average period of time. It is this sampling from the text— as opposed to thoroughly processing each and every letter— that makes possible efficiently utilizing the least amount of information necessary to make sense of the text and move on.

Regressions
In other studies, about 10-15% of readers' saccades move backwards and are called regressions (Rayner & Pollatsek, 1989, p. 114). The average for the 9 readings in this study was 17.3%, although there was considerable variation between readers, from Barry's 7.9% to Jack's 25.57%. Similar to
measures such as the percentage of words fixated, the percentage of regressions is not a stable number within a reading but varies widely from sentence to sentence, depending on readers' tentativeness or difficulty with portions of the text. Figure 3.11 shows Astor's regression percentages (percentage of fixations that are regressions) for each sentence:

Figure 3.11
Astor's Percentage of Regressions for Each Sentence in Waterford Ghost's Revenge

Overall, 11.68% of Astor's fixations were regressions. Only sentence 14 comes close to this percentage, however. Astor, like all the readers in this study, regressed not on a regular basis, but when it was needed. Sentences 6, 8, 12, and 23 had no regressions, while almost half of the
fixations in sentence 21 were regressions. This varying percentage of regressions is not simply a function of "more words being fixated, therefore more regressions occur," as the figure below that juxtaposes the percentage of regressions and the percentage of words fixated in each sentence of Astor's reading shows:

Figure 3.12
Regressions Compared to Words Fixated in Astor's Reading of Waterford Ghost's Revenge

Figure 3.12 shows that at times the percentage of regressive fixations decreases as the percentage of words fixated increases, and vice-versa. Sentences 2 and 3 show the percentage of regressions staying the same while the amount of words fixated decreases, while sentences 19 and 20 show the opposite happening. So other factors--not the
percentage of words fixated—must cause regressions.

Regressions are interesting because they are direct and instant indications of cognitive and comprehending processes at work. While readers cannot change the direction of a saccade once it has been initiated (Underwood & Batt, 1996, p. 145), saccades are under cognitive control (Rayner & Pollatsek, 1989), so there is no delay between the desire to reexamine parts of the text and the ability to do so. Regressions are, therefore, responses to the text, probably usually for confirmation or disconfirmation purposes:

"Regressive fixations usually are launched to areas of the text that have caused linguistic confusion, or contain particularly complicated words" (p. 146, Underwood & Batt, 1996). In addition, "Ambiguous, unexpected, complex, or important information, be it semantic or syntactic, can cause regressions" (Taylor & Taylor, 1983, p. 134). These, however, are all general notions of the causes of regressions. In order to understand where, when, and why they happen we will look at several examples from the nine readings.

In Figure 3.13, Mike demonstrates how he regresses to refixate a trouble area for him:
At that time, near the end of a barge canal, there lived a carpenter.

*Barge* is a potential trouble area here as it is not a common word outside of port cities and is usually used as a noun, not a noun modifier. For these reasons Mike is not expecting to find such a word in the text and his eye movements show he is working to fit the concept into his schema. He fixates *or*, then *barge*, then to the punctuation between *canal* and *there* before regressing to *barge* and fixating it for more than twice his average word fixation duration. He then fixates *there* and makes only forward fixations for the remainder of the sentence.

In Figure 3.14 Judy regresses and refixates an entire phrase:

She executes two series of forward fixation sequences, joined by a single regression: she fixates *is, not, the, first,*
FOODS, have, followed, American, then regresses to refixate foods, followed, and American. She fixates 75% of the words in this sentence, a high rate for her (her overall rate is 60.75%), which indicates tentativeness. She refixates three words in the same order that she first fixated them, giving the impression of a confirmation strategy, or perhaps of changing the emphasis she gave portions of the sentence during the first pass.

The next example involves an interline regression. I have been numbering fixations by numbering the first fixation of each line "1" regardless of whether it's a new sentence or not. This allows me to avoid large, potentially cumbersome numbers when describing the time order of fixations. However, in order to represent interline regressions it is necessary to utilize a code to represent fixations that go from line 1 to line 2, back to line 1, then again to line 2. This is done by using letters, instead of numbers, to describe an interline sequence of fixations. So the first fixation on a line that is also the first fixation in an interline regressive sequence is labeled "a", and all fixations in that sequence are labeled with letters, in alphabetical order: a, b, c, etc. The first fixation on line 2 that begins a sequence in which there are no interline regressions then starts the usual
labeling procedure of using numbers. In short, numbers are used when the fixations do not jump between lines, letters are used after leaving one line and before settling finally on the next. Barry makes a regression from one line to another in Figure 3.15:

Figure 3.15
Barry's Inter-line Regression

<table>
<thead>
<tr>
<th>line</th>
<th>As no one wanted to rent the place</th>
</tr>
</thead>
<tbody>
<tr>
<td>302</td>
<td>1 2 1</td>
</tr>
<tr>
<td>303</td>
<td>133 200 167 267 650</td>
</tr>
</tbody>
</table>

Barry's only regression in this sentence is to a previous line. He fixates FELL and the second MORE, then refrxitates THE in the previous line, probably to confirm or disconfirm a previous prediction. Note that when he moves back to the second line he picks up where he left off by fixating the second MORE, then RUIN, to finish the sentence.

In Figure 3.16 Enzo makes several within-word regressions:
Eager diners at Manhattan's Le Cirque 2000 eschewed the restaurant's famous paupiette of black sea bass in Barolo....

Enzo makes several interesting regressive sequences here, including a regression from a long fixation on MANHATTAN'S to DINERS (fixations 3 and 4, respectively), which probably indicates confirmation or disconfirmation of his perception of diners. Of note here, however, is his intra-word regressions on eschewed. The word is not a common one, nor is it particularly predictable in this context (ate, enjoyed, or chose are perhaps more predictable). He fixates several times on the word, gaining as much textual information as he can before moving on. Note a similar sequence on the word paupiette in the second line. Here, however, Enzo fixates PAUPIETTE, regresses to FAMOUS for contextual information to help him with the meaning of this unknown word, then refixates PAUPIETTE three times to gather as much print information as he can to help him make a decision about the word.

Below, Enzo makes a regression to an area between words:
Fixations do not always fall on words, and some researchers make a conscious decision to attribute the fixation to the word on the right of the fixation, as the perceptual span of readers of English tends to the right of the point of regard (Just & Carpenter, 1980). However, this “solution” ignores the possibility of readers gaining information from the space between words. In this case, there is a clear fixation on the punctuation mark that ends the sentence with the word distinctions. After the reader fixates on class on the penultimate line, he then fixates on the first word of the following sentence, then immediately regresses to the punctuation mark, then follows with another regression to distinctions. This may indicate a prediction by Enzo that class was the last word of the sentence, probably because of the space available to the right of the word—it looks as though it is not only the end of a sentence, but also a paragraph. When Enzo then fixates on the first word of the
next sentence, he discovers a word to the left in his parafovea, fixates on the punctuation mark to disconfirm his prediction, then fixates on DISTINCTIONS as a way of ending the previous sentence.

Summary

In this chapter I first explored the 100 year old science of eye movement research. In addition to a review of the literature, I presented major eye movement findings from this study, including fixations, fixation durations, and regressions. Early, contemporary, and my current eye movement research support a view of reading as a transaction between reader and text which is concerned with meaning construction.
CHAPTER 4
INTRODUCING EMMA

The language of gems is multiform; each expresses several truths, according to the sense of the selected interpretation, according to the context in which they appear. And who decides what is the level of interpretation, and what is the proper context?
--Umberto Eco, The Name of the Rose

As chapter 3 demonstrated, eye movement analysis is a powerful reading research tool. It does not, however, provide a complete picture of the reading process, as Just & Carpenter (1984) point out:

A conceptual limitation, shared with all chronometric approaches, is that eye fixation behavior does not directly indicate the end product of the comprehension process, what the reader has learned from the text. It is usually worthwhile to supplement eye fixation monitoring with another measure like recall, question-answering, or retrospective protocols that indicate more about what has been comprehended (154).

Partly for this reason I have incorporated miscue analysis with eye-movement analysis. This chapter introduces the combination of Eye Movement Miscue Analysis (EMMA) to set the stage for the following chapter that presents EMMA's
findings.

**Miscue Analysis and Eye-Movement Analysis**

The purpose of this dissertation is to combine two of the most ecologically valid reading research methodologies, miscue analysis and eye-movement analysis, to further explore the reading process. Figure 4.1 provides a graphic that illustrates the combination:

**Figure 4.1**
Combination of Eye Movement Recording and Miscue Analysis

- **Miscue Analysis**
  - Analysis of unexpected responses during oral reading; places where the reader's oral text does not match the written text.

- **Eye Movement Recording**
  - An infra-red beam of light is bounced off the eye; this enables spatial signals to be fed back to a computer that records exactly where the reader looks on a text.

**Verbal Data**

**Visual Data**

Eye Movement Miscue Analysis (EMMA)

The combination of miscue analysis and eye movement recording: Analysis of readers' eye movements made relative to oral miscues

Verbal and Visual Data that inform the Reading Process

In this section I defend the combination of methods and introduce the analysis procedure.
Argument Against Combining the Methodologies

Arguments against the juxtaposition of miscue analysis and eye-movement analysis would conceivably sound similar to arguments against miscue analysis that focus on the time course of processing letters and words. This perspective is, generally, that since it takes longer to say a word than to see or understand it, anything that comes out of the reader’s mouth is a product not of word identification, but of post-lexical processes, and has nothing to do with comprehension. Rayner & Pollatsek (1989) explain:

That is, from what we know about the speed of lexical access, it is entirely likely that the words produced by the speech mechanism in oral reading are strongly influenced by processes occurring after the lexicon has been accessed, and thus the resulting data may say little about how the lexicon is initially contacted to arrive at the meaning of a given word....most oral reading errors are the result of processes occurring after the lexicon has been accessed (181).

One of the foundations of this perspective is the concept of the eye-voice span (EVS), that the eyes are usually ahead of the voice by one or several words (Buswell, 1920). Readers’ EVSs have been measured in a variety of ways, from the researcher covering up the readers’ text by surprise and asking them to report the words that they had seen but not
had a chance to say, to the more accurate synchronic eye movement and oral reading records. EVS span has a long history of research, mainly revealing things about the EVS. Levin & Kaplan (1970) give some examples:

One consistent finding has been that EVS tends to increase with age. Moreover, the EVS is readily affected by the difficulty of the reading material. The more difficult the reading material, the shorter the EVS. Similarly, reading rate and EVS increase with more structured or constrained materials. Thus, the EVS would be shorter for a word list than for sentential material or, in other words, the greater redundancy of the material the longer the EVS (p. 120).

The length of the EVS appears to be a measure of how confident and proficient a given reader feels with a given text - shorter when they have a great deal of tentativeness and longer depending on the degree of predictability. EVS research has the effect of replicating eye movement research, then: fewer and shorter fixations and regressions during a confident and predictable reading, more and longer fixations and regressions during a difficult reading.

But like eye movement averages, we cannot assume that the EVS is a stable measure, as Levin (1979) points out:
Almost from the first it was recognized that most readers' EVSs varied from task to task. A reader does not carry around an EVS of fixed size as characteristic as the color of his eyes. Rather, the EVS operates like an accordion, bellowing in or out for different parts of the same text (p. 3).

So the EVS is not a fixed measure during which the brain dumps a predetermined amount of words in short term memory and moves the eye forward; this cannot be the case because when a reader encounters an unfamiliar or ambiguous word, the eye-voice span goes down almost to zero (Taylor & Taylor, 1983). If the eye and the voice become simultaneous while the reader searches for meaning from the text, the voice cannot be an entity completely separate from the comprehension process. The research presented in this dissertation demonstrates that the voice is linked to comprehension processes.

Why, then, is the eye ahead of the voice at all when reading? First, Taylor & Taylor (1983) point out that it makes an excellent tool for demonstrating that reading doesn't proceed on a word by word basis. Smith (1994) explains how the EVS demonstrates this:

(The eye-voice span (is) a term that is rather misleading because it might suggest that we need more than a second to organize in speech the
sounds of the particular word that we are looking at. But this is incorrect. We do not need a second to identify a word; the difference in time is not so much a reflection of how far thought lags behind the eye as of how far thought is ahead of the voice. We use our eyes to scout ahead so that we can make decisions about meaning, and thus about individual words, in advance.... The span, in fact, reflects rather precisely the sense that we make of text, because it tends to extend to the end of a meaningful phrase (p. 33).

Second, we must remember that it takes time for physiological processes to work — mental processes are so much faster — the actual voicing of words takes time. Rayner & Pollatsek (1989) provide an outline of what must happen before a word can be verbalized:

(a) the subject must decide what response is called for [in this case the response is uttering the word]; (b) the subject must retrieve the motor program for executing the response; (c) the command must be sent down nerve pathways to the mouth; (d) the muscles of the mouth and throat must execute the command (p. 63).

This all takes time, of course; it would be uneconomical for the eyes to wait for the verbal translation of the mental construct to be actualized before moving off the word. So the EVS is also partially the product of the time difference between deciding to say a word and the word being produced.
The eye voice span thus exists because (1) readers make sense of text, not words, so there's no reason for each word to be uttered while the eye examines it, and (2) it is a construct of a mental perception using physiological means to produce an observable product (oral speech), which takes time, and there's no reason for the eye to wait for the cycle to be completed before moving to another word (even if the eye fixated every word, which we have seen that it does not even come close to doing).

However, as Rayner & Pollatsek (1989) express, the chief concern is not the EVS per se, but whether or not miscues are generated before or after the lexicon is accessed. The following section addresses that concern en route to constructing an argument for juxtaposing miscue analysis and eye movements.

**Argument For Combining the Methodologies**

The arguments against oral reading miscues as a justifiable correlate to eye-movement records are inadequate and are refuted below.

**Lexicon as Metaphor.**

Richards, Platt & Platt (1992) define a lexicon as "a mental system which contains all the information a person knows about words....The total set of words a speaker knows
forms his or her mental lexicon" (pp. 212-213). Theories regarding the exact make up of the lexicon are varied (see Forster, 1990 for a review of the word-detector circuit, activation, and lexical search families of lexicon models), but rarely is the existence of the lexicon questioned. While hundreds of studies over the last century have been undertaken to ascertain how the lexicon is accessed (see McCusker, Hillinger, & Bias, 1981 for a thorough review), few studies made a case either for or against the existence of a mental lexicon. It is assumed to exist, as Smith (1994) points out: "...the notion that such a lexicon actually exists is often taken for granted and not even debated" (276). Part of the reason for its seeming universal acceptance is that, as Smith explains, the concept of a lexicon is a metaphor (p. 276). What the lexicon metaphor represents is clear—knowledge of words—and therefore when researchers speak of "accessing the lexicon" in terms of reading they must mean comprehension—the end result of comprehending a word. Comprehension, in turn, is measurable only in terms of what the reader understood from the text—one would not charge that a reader could understand without comprehending. This is why a central tenet of miscue analysis is that a reader's miscue is not a random error, but actually the meaning the reader
Comprehension is, therefore, a perceptual measure: readers comprehend what they perceive; what readers think they see has more bearing on comprehension than what they "actually" see (after Goodman, 1996).

Therefore, in reading, "accessing the lexicon" is a metaphor that indicates "comprehending," and comprehension necessarily relies on readers' perceptions. In this light, Rayner & Pollatsek's (1989) criticism of miscue analysis is illogical:

...when reading aloud, readers often give synonyms or paraphrases. However, it is by no means clear that they really encoded the text that way...and thus the resulting data may say little about how the lexicon is initially contacted to arrive at the meaning of a given word (p. 181) (italics added).

Here the authors would separate readers' comprehension from how they "really" encoded the text, and "initially" contacted the lexicon. Even if the lexicon were not considered a metaphor, their argument gives primacy to what the reader should have understood instead of what the reader actually understood. Figure 4.2 illustrates the problems of this perspective:
Sam orally produces: "You taste it and then instantly wish you were at a red-and-white checkered table in Italy, with a big pleasant family in the background." Sam first reads checking for checked, then abandons that word and produces checkered. He then produces pleasant for peasant. The perspective that readers can access the lexicon with one word yet understand and comprehend a different word would argue that Sam "read" checked but then somehow ended up "saying" checking. This doesn't account for Sam's attempt at correcting checking after he realized it didn't fit the rest of the text--if he had "accessed" checked than there would be no need to correct his oral output, since in this view it plays no part of the meaning construction process. But Sam comprehended and understood checking, which is why he had to look at the word again and correct it when it didn't make sense with subsequent parts of the text. Note also that Sam's correction is to checkered - during a deliberate attempt to correct his miscue to match
the text, Sam produces the word that he perceives, not the word that was delivered by his eyes to his brain. Comprehension is dependent upon perception.

Sam also comprehends and understands pleasant instead of peasant, but doesn’t need to correct it because it makes sense—totally different meanings, yet since the word Sam perceives is acceptable within the sentence and not disconfirmed elsewhere, he doesn’t even pause. It is an illogical argument that defends a process that allows for Sam to access peasant in his mental lexicon but then comprehend and understand pleasant. Hence, the lexicon is a metaphor for comprehension and can not be used as a refutation of miscue analysis methodology.

**Fairbank’s Research.**

Many studies have been undertaken that record oral reading and eye-movements simultaneously (e.g., Buswell, 1920, Levin 1979), usually to research the eye-voice span. These studies do not consider miscues to be of interest and do not analyze them or discuss eye-movements relative to them, although Buswell did include his readers’ observed responses in his monographs. A notable exception is Grant Fairbanks’ 1937 article in *Psychological Monographs* in which one of his purposes was to “...determine the type of eye-movement behavior which accompanies oral reading errors...”
To that end, he simultaneously recorded readers' eye-movements and their oral reading, and compared the two records. He focused on five different types of errors, the type, number, and percentage of which are shown in Table 4.1, below (p. 94):

<table>
<thead>
<tr>
<th>Type</th>
<th>Good</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omissions</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Insertions</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Mispronunciations</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Substitutions</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Repetitions</td>
<td>16</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>42</td>
</tr>
</tbody>
</table>

Fairbanks was interested in whether it was inaccurate or "faulty" eye-movements that caused errors:

It was thought that if faulty eye-movements caused errors, the characteristics of the first fixation on a given error would be different from those of an analogous fixation when no error is made, that the duration, for example, might be abnormally short, the preceding or following forward shift too long, the eye-voice lead too great, or the fixation placed at the very limit of the reading span (p. 96).

In order to analyze the eye-movements made relative to the readers' miscues, Fairbanks compared them to eye-movements

1 I use Fairbanks terminology here of "error" instead of "miscue."
made relative to the same place in the text by another
reader who did not miscue at that place, thus setting up an
experimental and control group. Table 4.2 presents the
results of that comparison (adapted from page 96):

Table 4.2
Eye-movement Measures of First Fixations
on Error Words.

<table>
<thead>
<tr>
<th>Measures</th>
<th>All readers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Error</td>
<td>Control</td>
</tr>
<tr>
<td>Mean distance from midpoint of error</td>
<td>2.37</td>
<td>2.61</td>
</tr>
<tr>
<td>Mean duration</td>
<td>.29</td>
<td>.29</td>
</tr>
<tr>
<td>Mean forward shift preceding</td>
<td>12.14</td>
<td>11.31</td>
</tr>
<tr>
<td>Mean forward shift following</td>
<td>8.38</td>
<td>8.75</td>
</tr>
<tr>
<td>Mean eye-voice lead at error</td>
<td>21.81</td>
<td>21.57</td>
</tr>
<tr>
<td>Mean eye-voice lead preceding</td>
<td>18.6</td>
<td>17.88</td>
</tr>
<tr>
<td>Mean number fixations within span</td>
<td>1.47</td>
<td>1.39</td>
</tr>
<tr>
<td>Mean number regressions within span</td>
<td>.79</td>
<td>.53</td>
</tr>
<tr>
<td>Percent preceded by regressions</td>
<td>10</td>
<td>22.5</td>
</tr>
<tr>
<td>Percent followed by regressions</td>
<td>35.5</td>
<td>23.5</td>
</tr>
</tbody>
</table>

Time in seconds, space in percent of the line, matched controls

He concludes that "inspection of [the table] reveals no
differences of any magnitude between the error and control
groups. Fixation is equally precise when an error is made
as when it is not" (p. 96). Fairbanks also included
details of the nature of the eye-movements relative to each
specific type of miscue, creating an invaluable baseline and
reference for future studies of this kind.

Unfortunately, Fairbanks was more interested in the
simple existence of errors than in what the nature of the
errors were. While he does briefly discuss corrections, he
does not analyze the errors in terms of semantic or
syntactic acceptability, graphophonic similarity to the
expected response, or other aspects of the analysis that is
now associated strongly with miscue analysis. Thus, the
need still exists to analyze readers' miscues, analyze
readers' eye-movements, and to thoroughly juxtapose both
analyses for a more complete window on the reading process.
This analysis is undertaken in Chapter 5, What EMMA Reveals
about the Reading Process.

Interestingly, Fairbanks' 1937 demonstration that
reading errors are not caused by faulty eye-movements did
not help stem the tide of instructional materials in the
1950's and 1960's that recommended eye-movement training to
help poor readers read better (e.g., Judson, 1972, Flesch,
1955).
CHAPTER 5

WHAT EMMA REVEALS ABOUT THE READING PROCESS

"We say it isn't there because we didn't find it. But perhaps we didn't find it because we haven't seen it where it was."

"But we looked everywhere!"

"We looked, but did not see. Or else saw, but did not recognize...."

--Umberto Eco, The Name of the Rose

This chapter explores the process of meaning making by focusing on analyses of the conjunction of Eye Movement and Miscue Analyses - EMMA - of the nine readings used in this study. While chapters 2 and 3 dealt with the individual contributions of eye movement research and miscue analysis research, the focus of this chapter is to look at reading processes through the combination of these two types of analysis. This chapter thus introduces findings that are at the crux of what I set out to explore with this study, as the title of the dissertation implies: Eye Movements Made During the Production of Oral Miscues. I approach these EMMA explorations by first focusing on overall patterns of Miscues Per Hundred Words (MPHW), percentage of words fixated, percentage of regressions, fixation duration, miscue quality, and corrections. I then look at eye movement characteristics across readers in terms of types of miscues.
Overall Patterns

A "bird's eye view" of the readings provides a perspective on the patterns and relationships between eye movements and miscues. However, like miscue analysis, EMMA provides descriptive statistics that illustrate the need to look at individual miscues and their related eye movements for real insight into their relationships. To illustrate, the following chart presents a summary of several crucial measures that miscue analysis and eye movement analysis can provide.

<table>
<thead>
<tr>
<th>Table 5.1</th>
<th>Measures of EMMA for Vera and Jack</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MPHW</td>
</tr>
<tr>
<td>Vera</td>
<td>2.3</td>
</tr>
<tr>
<td>Jack</td>
<td>1.9</td>
</tr>
</tbody>
</table>

There is no causal relationship between the numbers, despite an intuitive feeling that there must be. For example, Vera and Jack have similar MPHW (2.3 and 1.9), no loss of meaning (86% and 83%) and strength in grammatical relationships (71% and 67%) scores, which would lead one to believe that their eye movement measures might also be similar. And, indeed, their percentage of words fixated (62.17% and 70.37%) are
not greatly different. However, there is a slightly larger difference in their respective percentages of regressions (17.91% and 25.57%), and more than a 3 standard deviation difference between both their total time word fixation durations and their duration of all fixations averages. The extent to which these numbers resist superficial patterns is even more obvious if Barry's scores are added to the above example; while he made a similar number of miscues as Vera and Jack, he fixated the fewest number of words out of all the readers and made less than a third of the regressions that Jack did.

**Table 5.2**

<table>
<thead>
<tr>
<th></th>
<th>MPHW</th>
<th>meaning: no loss</th>
<th>grammar: strength</th>
<th>% words fixed</th>
<th>% regressions</th>
<th>mean total time fixation duration of words</th>
<th>mean duration of all fixations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vera</td>
<td>2.3</td>
<td>86</td>
<td>71</td>
<td>62.17</td>
<td>17.91</td>
<td>672</td>
<td>480</td>
</tr>
<tr>
<td>Jack</td>
<td>1.9</td>
<td>83</td>
<td>67</td>
<td>70.37</td>
<td>25.57</td>
<td>352</td>
<td>225</td>
</tr>
<tr>
<td>Barry</td>
<td>2.5</td>
<td>78</td>
<td>78</td>
<td>59.47</td>
<td>7.87</td>
<td>461</td>
<td>393</td>
</tr>
</tbody>
</table>

Similarly, if we proceed from these numbers that summarize the whole text to a chart that enumerates some of the relationships between miscues and eye movements, a pattern is still wanting. For example, the chart on the following page combines Sam's regressions and percentage of words fixated with the number of miscues in each sentence and the
The result is unimpressive; sometimes there are fewer regressions on sentences that were syntactically and semantically unacceptable (NN-) sentences, and sometimes there are fewer regressions on syntactically and semantically acceptable (YYN) sentences. Sometimes sentences with several miscues have fewer regressions than sentences

The symbols signify the syntactic and semantic acceptability rating and whether there was any meaning change in the sentence as it was finally produced. Thus YYN would read as "syntactically acceptable, semantically acceptable, no meaning change"
with no miscues and vice-versa. In addition, there is no relationship between the number of fixations and the Procedure III score. The chart does illustrate the "flow" of the reading nicely; but there is still not enough information to understand why it flows.

The point here is similar to the argument in chapter two about numbers in miscue analysis not telling the whole story; these descriptive statistics give us information about the characteristics of different readings but provide no correlative insight. In order to understand the relationship between readers' miscues and their eye movements we must look closely at the text. Before that, however, the relationship between regressions and miscues needs to be explored.

Regressions

One interesting aspect of SamW's chart is that when he produces a sentence with no miscues he also makes no regressions (regressions are left-branching eye movements, repetitions refer to orally repeating a section of the text; see Definitions in chapter 1). This phenomenon raises the issue of the relationship between regressions and miscues. As we saw in chapter 3, regressions appear to be an immediate response to the text for confirmation or disconfirmation purposes—obviously, regressing to correct a
miscue is an instance of observable disconfirmation. 34.3% of all regressions made in the nine readings were made relative to miscues, as Figure 5.2 shows:

Figure 5.2
Regressions Relative to Oral Miscues

Of course, this leaves 65.7% of the regressions made for reasons that are not oral-miscue-related, and not overt. This group of regressions is out of the scope of this dissertation, which is concerned with the eye movements made relative to miscue, and is not discussed here.

Of the 34.3% of regressions that were made relative to miscues, some result in corrections, and some do not. The overall trends in the nine readings for corrections that involve a regression are shown in Figure 5.3:
The chart makes clear that one of the main purposes of a regression is for correcting miscues. When miscues were corrected, 42.7% of them received a direct regressive fixation and 18% had no regression associated with them. The numbers are nearly reversed when considering miscues that were not corrected: 21.2% of uncorrected miscues received a direct regressive fixation, and 47.5 had no regression sequences. Clearly, one important function of regressions is to aid in correction cycles. Other functions are made evident below as I examine what happens during the regressions relative to miscues.

In chapter 3 I introduced five structurally different
types of regressions: regression to refixate a word, regression and refixation of a phrase, inter-line regression, within-word regression, and between-word regression. Below, each of these types is explained from an EMMA perspective.

**Regression to Refixate a Word.**

In Figure 5.4 Mike orally repeats barge:

**Figure 5.4**  
Mike's Regression to Refixate a Word

<table>
<thead>
<tr>
<th>line</th>
<th>At that time, near the end of a barge canal, there lived a carpenter.</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>2 1 3 4 5 6 7 9 10</td>
</tr>
<tr>
<td></td>
<td>467 350 317 567 1,000 933 750 250 417 267</td>
</tr>
<tr>
<td>106</td>
<td>1 2</td>
</tr>
<tr>
<td></td>
<td>433 167</td>
</tr>
</tbody>
</table>

Barge presents a potential trouble area here as it is not a common word outside of port cities and is usually used as a noun, not a noun modifier. For these reasons Mike is not expecting to find such a word in the text and his eye movements show he is working to fit the concept into his schema. As we saw in chapter 3, Mike fixates of, and then BARGE. After he fixates BARGE, he orally produces it, then fixates the punctuation between CANAL and THERE before

---

\(^2\)To avoid potential confusion, when discussing words in terms of eye movements I use small caps and when discussing words in terms of oral speech and/or miscues I use italics. E.g., the reader fixated on BARGE and said barge.
regressing to BARGE and fixating it for more than twice his average word fixation duration. After this regression to BARGE he then orally repeats the word. He then fixates there and makes only forward fixations for the remainder of the sentence. The EMMA sequence of this miscue is: 1. oral production of barge, 2. eye movement forward off of BARGE, 3. eye movement regressing back to BARGE, 4. oral repetition of barge. As we will discuss later, oral repetitions may not always signal processing time on the word being repeated. However, here it is quite clear that barge is the concept in question. In addition to the pattern of eye-oral production-regression-repetition explicated above, there is only one movement off of the word before returning to it—not several fixations before or after the word as one could expect if it were other parts of the sentence being attended to. Also, the fixation durations surrounding barge are substantially longer than others in the sentence, signaling additional processing time. This combination of eye movements and oral repetition, then, reveals Mike's strategies for dealing with an unfamiliar concept.

Regression and Refixation of a Phrase.

In Figure 5.5 Judy produces a partial, then corrects it, similar to Mike's repetition above in that the miscue involves only one word. However, the eye movements are
substantively different:

Figure 5.5
Judy’s Regression and Refixation of a Phrase

<table>
<thead>
<tr>
<th>line</th>
<th>This is not the first time foods have followed the American</th>
</tr>
</thead>
<tbody>
<tr>
<td>206</td>
<td>1 2 3 4 5 6 10 7 8 11 12 9</td>
</tr>
<tr>
<td></td>
<td>517 183 133 183 150 267 650 267 517 150 183 367</td>
</tr>
<tr>
<td>207</td>
<td>dream from staple to delicacy.</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td></td>
<td>100 283 550 217 383 117</td>
</tr>
</tbody>
</table>

She executes two series of forward fixation sequences, joined by a single regression: she fixates IS, NOT, THE, FIRST, FOODS, HAVE, FOLLOWED, AMERICAN, then regresses to refixate FOODS, FOLLOWED, and AMERICAN. Between the time she produced Amer- and then corrected it, she regressed and retraced her steps to the partial. When she refixates American, it is for a very short time, about 90 ms. shorter than her average fixation duration. It is probably not the miscued word that Judy is confirming, but the entire phrase. Indeed, she fixates 75% of the words in this sentence, a high rate for her (her overall rate is 60.75%), which indicates tentativeness. She refixates three words in the same order that she first fixated them, giving the impression of a confirmation strategy, or perhaps of changing the emphasis she gave portions of the sentence during the first pass. In this instance, her correction of the miscue Amer- as foods have followed the American dream allows her to recheck the entire phrase. She then goes on—and in the second line she
makes no regressions.

**Inter-Line Regression.**

As I pointed out in Chapter 3, I have been numbering fixations by numbering the first fixation of each line "1" regardless of whether it's a new sentence or not. This allows me to avoid large, potentially cumbersome numbers when describing the time order of fixations. However, in order to represent interline regressions it is necessary to utilize a code to represent fixations that go from line 1 to line 2, back to line 1, then again to line 2. This is done by using letters, instead of numbers, to describe an interline sequence of fixations. So the first fixation on a line that is also the first fixation in an interline regressive sequence is labeled "a", and all fixations in that sequence are labeled with letters, in alphabetical order: a, b, c, etc. The first fixation on line 2 that begins a sequence in which there are no interline regressions then starts the usual labeling procedure of using numbers. In short, numbers are used when the fixations do not jump between lines, letters are used after leaving one line and before settling finally on the next.

In Figure 5.6 Barry regresses from the second work to the in the previous line:
When dealing only with eye movement records, we know that Barry makes a regression to the previous line; fixating FELL and MORE, then refixating THE in the previous line. However, when we add miscue analysis, we gain information about why Barry makes this regression. He substitutes that for the in the first line, then makes a partial in the second line. Before correcting the partial, he regresses to his miscue, repeats the word it, corrects fell, then completes the sentence. In this case, the regression was directly back to the point of miscue--a disconfirmation strategy. And although he regresses to the miscued section of the text, Barry does not overtly correct it, as the miscue is syntactically and semantically acceptable, with no meaning change. His regression with no subsequent correction of the miscue suggests an awareness of a perceptual mismatch but an uncertainty of what is causing that mismatch. His oral production of f- seems to function as a placeholder during his regression.
Within Word Regressions.

Enzo makes several interesting regressive sequences in Figure 5.7, including a regression from a long fixation on MANHATTAN's to DINERS (fixations 3 and 4, respectively):

Figure 5.7
Enzo’s Within Word Regressions

<table>
<thead>
<tr>
<th>line</th>
<th>dinners</th>
<th>Eschewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>107</td>
<td>Eager diners at Manhattan’s Le Cirque 2000 eschewed the restaurant’s famous paupiette of black sea bass in Barolo....</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 2 4 3 5 6 7 9 8 10 11 14 16 13 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>667 183 217 933 267 400 217 183 283 200 167 100 583 317 283 233</td>
<td></td>
</tr>
<tr>
<td>108</td>
<td>restaurant’s famous paupiette of black sea bass in Barolo....</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 3 2 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>150 233 183 467 317 583 683 317 600</td>
<td></td>
</tr>
</tbody>
</table>

The addition of miscue analysis helps us understand that his regression to DINERS is part of his strategy for disconfirming his miscue dinners. While he regresses to his fixation, he doesn’t correct it even though it is partially semantically unacceptable. An argument may be made here, however, that his regression directly to the miscue signals an implicit correction. This will be discussed in the “suggestions for further research” section of chapter 7. Of note here, however, is his intra-word regressions on ESCHEWED. The word is not a common one, nor is it particularly predictable in this context (ate, enjoyed, or chose are perhaps more predictable). He fixates several times on the word, gaining as much textual information as he can before moving on. He doesn’t move off of ESCHEWED to
search for contextual clues that might give him information about the meaning, and when he finally makes a verbal attempt at the word, he produces a non-word, different only in stress (on the penultimate instead of ultimate syllable). Note a similar sequence on the word paupiette in the second line. Here, however, Enzo fixates PAUPIETTE, regresses to FAMOUS for contextual information to help him with the meaning of this unknown word, then refixates PAUPIETTE three times to gather as much print information as he can to help him make a decision about the word. Multiple intra-word fixations thus appear to be geared toward gaining enough graphophononic information with which to pronounce the word, in oral reading. In silent reading this may be a strategy of relying on the word's sound in order to assign it a meaning—a selective attention focus on the graphophononic cue system.

**Between-word Regression.**

In Figure 5.8 Enzo makes a regression to a space between words that holds a punctuation mark:
Some theorists point to heightened health consciousness to explain the trend, but Betty Fussell, food historian and author of *I Hear America Cooking*, sees it as a perfect illustration of the irrational nature of distinctions. "They're often totally arbitrary, and never more..."

From his intonation we know that Enzo initially ends the sentence after class, probably because of the space available to the right of the word—it looks as though it is not only the end of a sentence, but also a paragraph. He then makes an implicit correction by intoning distinctions as though it were the actual end of the sentence (which it is). Enzo's regressions reveal his process of negotiating the end of the sentence: When he fixates on the first word of the next sentence, he discovers a word to the left in his parafovea, fixates on the punctuation mark to disconfirm his prediction, then fixates on distinctions for a final check that it is the last word of the sentence. At that point he verbalizes distinctions and moves on to the next sentence.

As was mentioned in chapter 3, some eye movement researchers attribute inter-word fixations to the word to the right of the fixation; this is done so that every fixation has a word to call its own. However, as is obvious from this example,
this "solution" ignores the possibility of readers gaining information from the space between words—in this case, the punctuation mark that helped Enzo disconfirm his prediction that the sentence had ended on the previous line.

Types of Miscues

In this section, the eye movements relevant to the most prevalent types of miscues produced in the nine readings will be explored: substitutions, omissions, insertions, and partials, and the oral reading phenomena of repetitions3. Each is prefaced by EMMX measures—miscues, eye fixations and durations—overlaid on the miscue example that was used to introduce different types of miscues in chapter 2.

Note that in addition to standard eye movement measures of direct fixation percentages and word durations, I have consistently included measures of fixations that were not directly on a miscued word but in foveal focus. I included

3As explained in chapter 2, repetitions are usually not coded as miscues but are included here as they fit the definition of a miscue as "...an observed response (the OR) that does not match what the person listening to the reading expects to hear (the ER)" (Goodman, Watson, and Burke, 1987, p. 37), and repetitions are usually not expected by the listener. However, where appropriate, repetitions have been categorized as "oral reading phenomena" to distinguish them from proper miscues.
these measures because I am interested in the area of the text in which a miscue takes place, not just the miscued word itself. For that reason I have measured durations not only in terms of the average amount of time a word is fixated, but also the average duration of fixations relative to areas of the text I'm interested in. That way the focus is not on the word, but on the portion of the text the word appears in. The measurement has the same assumption as word duration measurements, that longer fixations equals longer processing times, and no loss of reliability—it is still the average durations of fixations that are being compared.

Substitutions

In the miscue example used in chapter 2, we saw that Mike substituted unusable for usable, probably predicting a continuation of the idea of a “run down house” presented at the beginning of the sentence.

Figure 5.9
Mike’s Substitution of unusable

<table>
<thead>
<tr>
<th>line</th>
<th>unusable</th>
</tr>
</thead>
<tbody>
<tr>
<td>205</td>
<td>The house was run down, but usable, and they hoped to rent</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 6 5 7 8 9</td>
</tr>
<tr>
<td></td>
<td>267 133 467 500 1257 400 367 250 783</td>
</tr>
</tbody>
</table>

| 206  | it rather quickly. |
|      | 1 2 |
|      | 917 133 |

Fixations.

With the addition of his eye movements added to the
text, we see that he fixated 60% of the words in the sentence, slightly lower than his average for the whole text. Little is remarkable about his eye movements before and after his miscue—there are no regressions, and aside from fixations 9 and 10, the fixation durations are near his average. The word usable, however, gets three fixations, including an intra-word regression, and a gaze duration of 2,257 ms. In this instance Mike hesitates very briefly after reading aloud down, makes the three fixations on usable, then says but unusable. It is tempting to think of the intraword regression as an implicit, non-verbal correction of the miscue, but Mike made all the fixations on the word before verbalizing it—it can’t be a correction when there’s nothing yet to correct. So on the substituted word, Mike actually fixated, and fixated for a long time. It seems counter-intuitive that Mike would look at substituted words for a longer period than other words—what about the other substitutions made by Mike and the other readers?

There were a total of 92 substitutions made in the nine readings. Of those, 63 of the expected words were directly fixated and 23 were in foveal focus (as we discussed in chapter 3, 6-8 letters around the point of fixation are in foveal, or sharp, focus)—almost 94% of words receiving
substitutions were in sharp focus, as Figure 5.10 illustrates:

**Figure 5.10**
**Substituted Words in Foveal Focus**

In other words, most words that are substituted for are looked at before the oral substitution is produced (this graph does not include substituted words that were looked at after the miscue was produced). Note that these fixations on substituted words refer to the first time the miscued words are encountered—not to regressions or any other fixations that take place subsequent to a fixation after the word. Thus when I speak of a substituted word being fixated, I am referring to a fixation that happens before the oral substitution is made, not a fixation that could be part of a correction strategy. So most words that are
substituted are actually looked at by the reader. But are all the substituted words looked at for as long a period of time as Mike spends on usable, above?

**Fixation Duration.**

The mean duration of the fixations associated with substitutions—either directly on the substituted word or in foveal focus—was 430.5 ms. In contrast, the mean duration of all the fixations throughout the readings was 335.89 ms.:

![Figure 5.11](image)

**Figure 5.11**
Fixation Durations Relative to Substitutions

The durations of fixations associated with substituted words is almost 24% longer than the durations of all fixations.

[footnote: In addition, the first pass fixation duration of}
substituted words—the time spent on a substituted word when it is first encountered, which doesn’t include regressions or refixations after moving off of the word—is longer than the mean fixation duration—including regressions, refixations, etc.—for all words in the texts: 462.64 ms. and 350.5 ms., respectively.] Not only does this demonstrate that substituted words are not caused by a too-brief glance, but that they are actually looked at for a longer period of time than other words.

Regressions and Corrections.

Substituted words are either regressed to or immediately followed by a regressive sequence most of the time (67.39%); if we also consider regressive sequences that immediately precede the substituted word the percentage is even higher (80.43%). Clearly regressions are related to the substitution phenomenon. Chapter 3 pointed out that regressions many times signal a correction strategy, and as 2/3 of substituted words are accompanied by a regression directly on the substituted word or immediately after the miscue, it is important to look at the relationship between those regressions and substitutions that are corrected.

Of the 36 substitutions that were corrected, 32 involved a regressive sequence: there were 15 examples of regressions that directly fixated the substituted word and
26 examples of regressions that immediately followed the miscue but did not directly fixate the substituted word (9 of the miscues had both types and are counted in both categories). Only 12 of the 56 non-corrected substitutions had no regressive sequence associated with them. Figure 5.12 illustrates the relationship between substitution corrections and regressions:

Figure 5.12
Substituted Words: Corrections and Regressions

Regressions seem to be an integral part of the substitution phenomena, whether the miscue is corrected or not.

Substituted Words Are Thoroughly Examined.

Miscue analysis holds that there is a reason for every
miscue; they are not mistakes, but windows into the reader's parallel text that is being constructed. The reasons given for the production of substitutions are thus usually idiosyncratic to a specific text and reader. Miscue researchers are reluctant to make sweeping generalizations about substitutions because they are aware of the myriad of different possible reasons, graphophonic, syntactic, and semantic, for the production of any single miscue. However, there are other, "common sense" views of substitution that EMMA may be able to inform. Most of these views center around substitutions being caused by carelessness, as Ekwall (1981) asserts: "The child who substitutes one word for another is probably either a careless reader or a reader who has not developed adequate word recognition skills" (p. 26). Similarly, Dechant (1981) includes carelessness and reading too rapidly as causes of substitutions, as well as "failure of pupil to scan the word thoroughly enough to identify the order of the letters and to be certain that the word is a particular word and not another" (p. 333). In addition, entire studies have been constructed around the premise that substituted words are not seen "correctly." For example, Nicholson, Pearson, & Dykstra's (1979) study was designed to emulate certain miscues that assumes that when readers make oral substitutions they have not seen the correct word, and
failed to see at all words that they omit. The researchers explain:

It was assumed that in trying to understand a story, the unskilled reader is not only faced with insufficient text data (caused by failing to respond at all to certain words) but anomalous data as well (caused by responding with certain semantically inappropriate substitutions) (341).

Frank Smith (1994) explains away miscues in general as the byproducts of a focus on meaning that allows the surface level of language a certain amount of carelessness:

The prior use of meaning ensures that when individual words must be identified, for example, in order to read aloud, a minimum of visual information will be used. And as a consequence, mistakes will occur (p. 154).

In general, the common-sense explanation for the generic causes of substitutions are carelessness, reading too rapidly, and not using enough visual information. But as we saw above, the readers directly fixated 68.5% of substituted words—a higher number than the average percentage of words fixated overall (64.2%)—and had an overwhelming amount of substituted words in sharp focus (93.5%). In addition, the average duration of fixations relative to substitutions was 430 ms., well above the average duration of all fixations (335.89 ms.). Contrary to “common sense” explanations, substituted words are examined, and examined for plenty of
time—in fact, physiologically they are examined more thoroughly than other words. I say "physiologically" to stress that while the readers’ perceptions of substituted words were that they were different, it is not because of a lack of visual acuity or visual attention.

There are strong indications that the substitutions made in the nine readings were made for meaning, rather than structural, reasons. More than two thirds (71.74%) of substituted words were content words, which, unlike function words, carry meaning. Also, almost all (90.22%) of the substitutions kept the original part of speech as the substituted word, so it was not the grammatical structure of the sentence the readers were altering. It was also the semantic acceptability that was affected the most; 45.7% of substituted words were semantically unacceptable, more than twice the amount that were syntactically unacceptable (21.7%). Because all the cue systems work integratively (Goodman & Goodman, 1994) it is too simplistic to say that readers are concerned only with semantics when they make substitutions. Meaning, not structure, however, seems to be the focus. Readers make predictions about what comes next in the text based on prior textual information and their expectations. If they encounter an area of the text that does not fit their predictions, they either adjust their
predictions to meet the disconfirming text evidence, or involve a different response in their parallel, constructed text. In the case of substitutions, readers have subconsciously chosen to include a different word in their parallel text—usually after thoroughly examining the word that will be substituted and finding it unsatisfactory with the sentence the reader had predicted. In the example of disconfirmation used in chapter 2, Sam produces a substitution after looking directly at the substituted word, saying: Then they had looked the - liked the - They had like the wife and so they did not investigate too carefully.

Figure 5.13 shows the EMMA sequence:

| line | © Then \ They had \ liked the wife, and so
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>213</td>
<td>6 14 7 5 2 9 3 10 8 11 367 333 200 183 550 233 133 900 150</td>
</tr>
<tr>
<td>214</td>
<td>did not investigate too carefully.</td>
</tr>
<tr>
<td></td>
<td>233 233 150 267 233</td>
</tr>
</tbody>
</table>

In portions of the text immediately preceding this sentence, some of the protagonist’s neighbors had noticed lights coming from his empty house and wondered if the wife had moved back in. Sam so strongly predicts a situation in which the neighbors would investigate after seeing the lights that when he fixates liked he finds that word unsatisfactory and instead perceives and produces looked.
Noticing the absence of a particle or preposition that would confirm his choice of looked (looked at, looked in), he regresses and fixates they and had twice, then wife, and back to liked before correcting the phrase.

Readers progress through the text, predicting, sampling, confirming, and disconfirming. When readers make predictions that are not satisfied with the disconfirming evidence they encounter when fixating on the substituted word, they perceive instead a word that has a meaning closer to the predicted meaning.

Omissions

In Enzo’s example from chapter two, we saw that he omitted the article a, possibly because he was predicting a plural object of the preposition at.

Figure 5.14
Enzo’s Omission of a

<table>
<thead>
<tr>
<th>line</th>
<th>You taste it and then instantly wish you were at a red-and-white-checked table in Italy, with a big peasant family in the background.</th>
</tr>
</thead>
<tbody>
<tr>
<td>303</td>
<td>304</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>350</td>
<td>160</td>
</tr>
<tr>
<td>317</td>
<td>367</td>
</tr>
</tbody>
</table>

Throughout the sentence Enzo makes several regressions and multiple fixations on words, signaling a high degree of tentativity. He fixates at and red, on either side of the omitted word. After saying red he regresses to a, but
doesn't correct the miscue. Two things are of particular interest here. One, on two separate fixations, 10 and 11, he had the omitted word well in foveal focus, so he could see and read the word. Why would he omit it? And two, he regresses to the omitted word for a fairly long time--467 ms.--but still doesn't correct it. In other words, why would he not correct an omitted word that he "saw" in the first place? This is further evidence of the power of the idea of the reader's parallel, constructed text. It is reasonable to infer that Enzo predicted a plural object of the preposition, and having parsed the sentence that way, resisted the disconfirming information that the article a provided--remember that the singular table is on the next line, not even in Enzo's parafovea. When he gets to the next line, he regresses to table and spends a longer than average fixation on it--perhaps indicating an implicit correction.

Fixations.

Enzo's fixations brought the omitted word into foveal focus (not a direct fixation until the regression). Figure 5.15 shows the proportion of omitted words that either received a direct fixation or were in foveal focus:
Out of the 32 omissions across readers and texts, 17 were fixated directly (53.13%) and 10 were in foveal focus, but not fixated directly (31.3%). As with the figures given for substitutions in foveal focus, these fixations on omitted words refer to the first time the miscued words are encountered—not to regressions or any other fixations that take place subsequent to a fixation after the word. Again, as with substitution-type miscues, most of the omitted words are looked at before they are omitted—84.43%, in this case.

**Fixation Duration.**

Fixating an omitted word might not be very interesting if those fixations were substantially shorter than the average fixation—it might seem as though it were only a
fleeting glimpse. However, that is not the case. As Figure 5.8 illustrates, the fixations relative to omitted words were actually longer than the average fixation duration:

Figure 5.16
Fixation Durations Relative to Omissions

Readers spend an average of 372.58 ms. on the fixations relevant to omitted words, and an average of 335.89 ms. on all fixations. The mean first pass fixation duration was also higher than the mean fixation duration of all words (384.15 ms. and 350.5 ms., respectively). As with substituted words, omitted words are looked at for longer than average.
Regressions and Corrections.

Only 8 of the 32 omissions were corrected, and 5 of those involved either a direct regression to the omitted word or a regressive sequence directly after the miscue that didn't directly fixate the omission. Interestingly, a higher percentage of non-corrected omissions received either direct regressions or involved a regression after the miscue, as Figure 5.17 shows:

Figure 5.17
Omitted Words: Corrections and Regressions

About one quarter of omissions involve a regression without subsequent correction, which implies that regressions are either not always for correction of miscues, or result in implicit correction that only the reader is privy to. Regressions are used to get more visual input, but not always for overtly corrective purposes on a word level.
However, it is not always necessary to fixate the word itself to correct the miscue; that only 1 of the 8 corrected omissions received a direct fixation suggests that readers can use implicit syntactic/semantic knowledge and knowledge about the text from surrounding text to correct miscues.

**Non-deliberate Omissions.**

The omissions that these adult readers make are not made deliberately, in an effort to avoid a difficult or unknown word; rather they are non-deliberate omissions that reveal the reader's parallel, constructed text to not use that word in that specific place. The evidence for this is the fact that most of the omitted words were function words or short verbs, like do, to, the, a, and, that, and of; few would suggest that these adults, none of whom omitted lower frequency and "harder" words like gastronomic and paupiette, were unable to read the. Goodman & Gollasch (1980) report some patterns of non-deliberate omissions:

The patterns of extended pauses are not present in non-deliberate omissions. Often such omissions involve words read correctly without hesitation at other places in the text. The reader's intonation usually shows no sign of a disrupted pattern inappropriate to the syntax of the text being read (p.17).

What, then, is the cause of non-deliberate omissions? The "common-sense" explanation is similar to that of
substitution-type miscues, that readers are careless or reading too fast. For example, Spache (1964, p. 255) states that "Omissions of whole words, particularly among intermediate grade and older pupils, may indicate either excessive speed or a tendency to skip over unknown words." Harris & Sipay (1980, p. 216) argue that "Omissions usually are caused by carelessness or inattention." However, over half of omitted words are directly looked at. In the case of omissions, it is especially useful to look at not only direct fixations, but also omitted words that were only in foveal focus. The reason is that common sense explanations suggest that omitted words aren't seen at all; remember that Nicholson, Pearson, & Dykstra's (1979) study viewed omissions as "insufficient text data" that were "caused by failing to respond at all to certain words" (p. 341) (emphasis added). But if the omitted word was in foveal focus, than it was physiologically seen, and 84.38% of omissions were in foveal focus (all others were in the parafovea). The response that the reader makes is to omit it, it is not a default inaction that omits the word.

In order to understand why readers omit words, we need to look at the nature of the words that are omitted. In contrast to substituted words, omissions were mostly function words (75%), which carry little meaning and serve
grammatical structure in the sentence. While substitutions seem geared toward semantic changes, omissions seem to be evidence of readers altering syntactic aspects of their parallel, constructed texts. While the ratio of no syntactic acceptability to no semantic acceptability for substitutions was 1:2.1, for omissions it was less than half of that, 1:1; the semantic acceptability is affected only so far as the syntax is altered. But more illustrative of omissions being a syntactic alteration are the sentences in which optional syntactic units are omitted. For example, in Figure 5.18 Sam omits the conjunction that:

Figure 5.18
SamW’s Omission of that

<table>
<thead>
<tr>
<th>line</th>
<th>312</th>
<th>313</th>
<th>314</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No one could explain the mysterious lights, but many neighbors felt sure that the Waterford ghost had had its revenge....</td>
<td></td>
<td></td>
</tr>
<tr>
<td>312</td>
<td>1 3</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>313</td>
<td>1.100 283 200 333 317 233 417 233 183 250 233 217 117 100 633 533 283 450</td>
<td></td>
<td></td>
</tr>
<tr>
<td>314</td>
<td>1</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

The word that does not function as a necessary semantic or syntactic unit in this sentence. Sam fixated THAT, then, not satisfied with the syntactic construction, omits the word in his parallel text and continues the rest of the sentence verbatim. Note also that the word the is not fixated, but it is verbalized.
Perhaps even more interesting than readers' non-deliberate omissions of optional text elements are readers' omissions that change the syntactic structure of the sentence. Mike provides an example in Figure 5.19 of an omission of a preposition that demonstrates his prediction of the syntax:

**Figure 5.19**
Mike's Omission of with

<table>
<thead>
<tr>
<th>line</th>
<th>The lights continued showing right up until the day when a muffled crash and a cloud of dry dust, the sagging roof finally fell in and the tottering walls collapsed into the cellar hole.</th>
</tr>
</thead>
<tbody>
<tr>
<td>307</td>
<td>1</td>
</tr>
<tr>
<td>308</td>
<td>650</td>
</tr>
<tr>
<td>309</td>
<td>617</td>
</tr>
<tr>
<td>310</td>
<td>717</td>
</tr>
</tbody>
</table>

A lengthy prepositional phrase has been moved by the author from the verb fell to the beginning of the subordinate clause after when. Assignment of syntax predicts the verb but not this unexpected interruption of the syntactic flow. The sentence might have been more predictable if the prepositional phrase followed fell. Note that Mike fixates on WITH for 450 ms., then on A for 567 ms. and MUFFLED for 167 ms, at which time he has subconsciously rejected the
information he found in the text in favor of the independent clause + subordinate WH-clause syntax, beginning with a noun phrase (a muffled crash) he had predicted. When he reaches the end of the noun phrase, he repeats THE, which, as we will see in the "Repetitions" discussion (below), indicates processing of text around the repeated word. Thus he has probably disconfirmed his prediction, but makes no explicit correction of his omission of with.

The point of these examples is that, like substitutions, omitted words are thoroughly examined before being omitted in the readers parallel, constructed text. The omissions seem to be evidence of readers' dissatisfaction with the syntactic structure of the sentence. As they read, readers predict a grammatical structure that they confirm or disconfirm as they move through the sentence. When they encounter, through a fixation, a syntactic text element that disconfirms their predictions of the structure of the sentence, they can either change their idea of the sentence's structure, or omit the disconfirming element in their parallel text.

Insertions

In this example of an insertion from chapter 2, Vera probably predicts a location such as the house as the object of the preposition At as continuation of the preceding
sentence that described mysterious lights aglow in the house. Instead, the object is temporal, and she corrects her insertion by repeating the word previous to it and continuing to the next word in the text:

Figure 5.20
Vera's Insertion of the

<table>
<thead>
<tr>
<th>line</th>
<th>© the</th>
</tr>
</thead>
<tbody>
<tr>
<td>211</td>
<td>\At</td>
</tr>
<tr>
<td>212</td>
<td>\A</td>
</tr>
<tr>
<td>213</td>
<td>\l</td>
</tr>
</tbody>
</table>

\[ \frac{1}{100} \]

<table>
<thead>
<tr>
<th>2</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>5</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>450</td>
<td>367</td>
<td>417</td>
<td>183</td>
<td>317</td>
<td>267</td>
<td>317</td>
<td>450</td>
<td>500</td>
</tr>
</tbody>
</table>

first they thought that perhaps the wife had come back and was secretly living there.

She fixates within foveal focus of \At, then says \At the, fixates they, then first on the next line, then repeats \At and continues. While she regresses from they to first, she does not regress to the previous line to gain more textual information, but is able to repeat \At by regressing through her mental, constructed text. The miscues in this sentence are not qualitatively different than her miscues overall—the percentage of words fixated and the percentage of regressions in this sentence are well within one standard deviation of her overall average. Her first pass duration of the fixation near where the insertion takes place (in foveal focus of where the word was inserted), however, is 79.17% shorter than her average. There are only 11 more
examples of insertions among the nine readings, but there is a consistent pattern even within that small amount.

**Fixations.**

Sam was responsible for 9 of the 12 insertion miscues in the nine readings, so the average of his fixations are slightly more reliable than Mike’s, Astor’s, and Vera’s data, each of whom only made one insertion. Sam fixated 66.89% of the words in sentences with insertion miscues compared to 65.91% of words in all other sentences. This ratio is similar to Mike’s, who fixated 68.75% of the words in the sentence containing his lone instance of insertion, to 66.85% of the words overall. As we saw above, Vera’s is close as well: 68.75% in her example to 62.17% overall. Astor’s sentence with his insertion miscue departs from this trend, however; he fixated 83.3% of the words in his insertion miscue sentence to 60.51% overall. Figure 5.21 illustrates these scores:
In addition, 9 of the 12 insertion miscues received fixations near enough to the place of insertion that, had the insertion actually been in the text, it would have been in foveal focus. While the relative paucity of insertion miscues makes it difficult to suggest patterns, that 75% of the miscues are within foveal, sharp focus continues the trend found with substitution and omission miscues; specifically, that they don’t take place in a part of the text that is unexamined.

**Fixation Duration.**

Fixation durations for insertions were measured by first pass foveal durations of fixations to either side of
where the insertion would be in the text: like foveal durations for other miscue types, I measured the gaze durations of foveal fixations as the average of all fixations in foveal range until a fixation moved away from foveal position (four letter spaces in either direction). If the insertion was between the end word of one line and the beginning word of the subsequent line, the foveal fixation duration included both the end of the first line and the beginning of the second, since it’s impossible to say at which line the word was inserted. This doesn’t inflate the duration measure, however, as it is the mean of the number of fixations that is being measured. The average duration of fixations in foveal view of where the insertion would be in the text was low, as Figure 5.22 demonstrates:
Figure 5.22
Fixation Durations Relative to Insertions

While the duration is lower than average, it is still well within accepted average fixation durations for normal reading (Rayner, 1997). In other words, these seem to be areas of the text which the readers approached with confidence.

Regressions and Corrections

Four of the insertions were corrected, all of which involved a regressive sequence, and there were a further 3 regressions relative to the 12 insertion miscues. The regressive sequences in each sentence had a similar relationship to the regressive sequences across the entire texts as did the fixation percentages, above, as shown in
Except in Astor's case, the percentages of regressions relative to insertions were near equal or less than the percentages of regressions in the texts overall. This is further support for the idea that the sentences with insertions were not approached tentatively by the readers. This notion will be developed in the discussion that follows.

*Insertions: "Blue Sky" Miscues.*

All of the instances of insertions are at least
partially semantically and syntactically acceptable, and there is no meaning change in any of the sentences. As with omissions, most inserted words are function words (66.67%), and are primarily used to modify the syntactic structure of the sentence. Like both omissions and substitutions, insertions take place in areas of the text that are examined. Unlike omissions and substitutions, however, the duration of the fixations in the foveal area around insertions is substantially less than the average fixation duration, and only just over half of the average fixation duration relative to a substituted word. Since readers spend more time on parts of text that are semantically or syntactically difficult (Just & Carpenter, 1987), we can assume that places where readers sampled the text for less than two thirds of their average fixation durations were not troublesome. The miscue data bear this notion out; the readers had 100% partial or full syntactic and semantic acceptability with no meaning change in any of the sentences. In addition, only 33.33% of the miscues were corrected, and of those, all but one were only partially syntactically and semantically acceptable. This type of correction behavior "...shows that readers have predicted appropriately and, while confirming, decide there is no reason to self-correct because the language and meaning are
acceptable and meaningful. In fact, readers are often unaware of making these types of high-quality miscues" (Goodman, Watson, & Burke, 1987, p. 69). The point to be made here is that by both eye movement and miscue analysis accounts, readers approached the areas of the text with insertion miscues with confidence, and a low degree of tentativeness.

As with omissions, readers use insertions to alter the syntactic structure of their parallel text. The eye movement difference between the two types of miscues centers around the 72% longer gaze duration spent on fixations relative to omissions. So insertions, in sentences with the overall close to average percentage of words fixated, lower than average percentage of regressions, and lower than average fixation durations, are made in "clear, blue skies"—areas of high confidence and low tentativeness.

Repetitions

In this sentence Sam repeats the word for:

Figure 5.24
SamW's Repetition of for

<table>
<thead>
<tr>
<th>line</th>
<th>tenant. But no tenant ever rented it, for presently discourag-</th>
</tr>
</thead>
<tbody>
<tr>
<td>207</td>
<td>2 1 3 4 7 12 5 14 10 14 9 15 433 317 133 633 367 367 300 667 233 283 450 283 300 150 217</td>
</tr>
<tr>
<td>208</td>
<td>ing things began to happen. 1 2 3 200 250 517</td>
</tr>
</tbody>
</table>

The miscue itself doesn't tell us much; in fact, repetitions
are usually not even considered proper miscues (Goodman, Watson, & Burke, 1987, p. 76). However, as they are "unexpected responses" (Goodman & Goodman, 1994) to the text, they may signal processing activity as do other miscues. The EMMA time course of the repetition is: Sam fixates for, then says for for the first time. He then regresses to RENTED, fixates forward to PRESENTLY, and forward to DISCOURAG-, regresses to refixate PRESENTLY, regresses again to refixate for, and regresses once more to RENTED. Sam then repeats for. So between oral utterances of for, Sam produced a series of regressions and refixations. In this way, the repetition served as a place marker for Sam as he samples the text heavily. After his repetition of for, Sam’s eye movements are all forward-moving and he makes no miscues during the remainder of the sentence. His relatively dense sampling of the text between repetitions of for seems to have been for confirmation/ disconfirmation purposes. Apparently he was troubled by the use of for as a conjunction (meaning "because") as he checked the expected syntax of the sentence; after the repetition it’s smooth sailing. In this example he fixates the repeated word and makes an interesting regressive sequence between repetitions; let’s examine the oral repetitions across readings for all readers.
Fixations and Fixation Durations.

There were 25 instances of repetition across all readings, 10 of which were multiple word repetitions. Eighteen instances involved at least one of the repeated words being directly fixated, and the remaining 7 had at least one word in foveal focus. Repetitions have a high percentage of direct fixations, 64.86%, similar to eye movements relative to the other miscues we’ve looked at. However, if we add repeated words that did not receive a direct fixation but were in foveal focus, the rate climbs to 100%. In addition, the mean duration of fixations relative to repetitions is high: 427.11 ms. to the average fixation duration across texts of 335.89 ms. If Sam’s example is any indication, the high percentage of repeated words in foveal focus and their higher-than-average fixation durations may in part be due to a high degree of tentativeness with that section of the text in general. This idea is supported by the unique EMMA relationship of repetitions to regressions, as detailed below.

Regressions.

Of the 25 instances of repetition in the nine readings, 24 of them involve a regressive sequence that takes place between oral utterances of the repeated word. This relationship is shown in figure 5.25:
The consistent phenomenon of a regression between oral utterances of the same word indicates that repetitions are used for a specific purpose. Instead of a type of miscue that provides a window onto the reader’s parallel text being constructed, repetitions are a type of cognitive strategy for dealing with a difficult or unexpected portion of text. In the discussion section that follows, I develop the notion of repetitions as an indication of comprehension processes at work.

Repetitions: a Regression Sandwich.

Miscue research reveals that "the position, extent, and frequency of repetitions reflect the reader's lack of efficiency and confidence. Examining points in the text
where the reader's repetitions diminish or increase may indicate the predictability and complexity of the passage" (Goodman, Watson, & Burke, 1987, p. 151). What is less clear is whether the complexity lies in the word or phrase that is being repeated or in the text surrounding the repetition.

The answer may be both. Some repeated words and phrases receive direct regressions and multiple fixations, which indicates it is the repeated portion of the text that is being given attention. For example, Mike fixates *barge* for 750 ms., says *barge*, fixates the space between *canal* and *there* for 250 ms., refixates *barge* for 933 ms., repeats *barge*, and finishes the sentence without any more regressions:

**Figure 5.26**
Mike's Repetition of *barge*

| line |  
| 105 | At that time, near the end of a *barge* canal, there lived a  
| 106 | carpenter. |

Clearly, Mike's repetition of the unusual type of canal is part of his strategy for processing the repeated word itself. He verbally produces *barge*, fixates forward for a short period, regresses and directly refixates *barge*. After he finishes his regressive sequence he repeats *barge* and moves on. This type of repetition, where the only
regressions refixate the repeated word, seems to be a confirmation of ownership of the repeated word, although it may also show he confirmed that what he thought he saw was right and decides to go on even though "barge canal" makes little sense. Among instances of repetition in this study this type of repetition was in the minority (12%), although it shares the characteristic "regressions between oral repetitions" sequence of the other type of repetition, which is discussed below.

In contrast to confirmation-type repetitions exemplified by Mike's example, above, other repeated words and phrases are never fixated, even on regression. This is further evidence that repetitions are not necessarily signs of processing the miscued word, as not fixating a word is not traditionally considered evidence of processing that word; the opposite is true. Vera provides an example of a repeated word that does not receive a fixation in Figure 5.27:

Figure 5.27
Vera's Repetition of right

<table>
<thead>
<tr>
<th>line</th>
<th>The lights continued</th>
</tr>
</thead>
<tbody>
<tr>
<td>307</td>
<td>1 2 467 367</td>
</tr>
<tr>
<td>308</td>
<td>1 2 3 4 5 6 7 8</td>
</tr>
<tr>
<td></td>
<td>467 233 1.367 350 367 350 1.383</td>
</tr>
</tbody>
</table>

Here Vera verbalizes right, fixates up, until, and day,
regresses to the, then verbalizes right again. She is not spending time processing the word right, but is processing the text after it—the long fixation durations and regression indicate a high level of tentativeness, as if a prediction had been disconfirmed. Repeating the word allows Vera to return to a known area of the text before continuing to construct her parallel text. The pattern of first utterance → regressive fixation sequence → second utterance → forward fixation sequence is an overwhelmingly prevalent pattern, existing in 96% of the repetition miscues. In Figure 5.28, Astor provides another example:

**Figure 5.28**

Astor’s Repetitions of good and from the

<table>
<thead>
<tr>
<th>line</th>
<th>Rumor spread that the son had indeed come back to</th>
<th>make good his promise to keep the parents from making any</th>
<th>money from the cottage. As no....</th>
</tr>
</thead>
<tbody>
<tr>
<td>218</td>
<td>1 3 2 4 5 6 7 8 750 117 417 200 383 200 317 633</td>
<td>1 4 2 3 7 5 6 8 10 9 11 717 267 267 283 450 267 150 100 250 417</td>
<td>1 2 4 3 367 483 583 183</td>
</tr>
</tbody>
</table>

The EMMA time course of these two repetitions are exactly like Vera’s, above: Astor fixates good, verbalizes good, fixates promise and keep, regresses to his, then repeats good. On the third line, he fixates money, and from, verbalizes from the, fixates the first word in the following sentence,
regresses to cottage, then repeats from the (note that he never fixates the although he verbally produces it twice). In both of these repetitions, Astor produces the "regression sandwich" combination of fixations and speech found in almost all instances of repetition: first utterance → regressive fixation sequence → second utterance → forward fixation sequence. In this sequence, all regressive eye movements are produced before the repeated word is uttered for the final time, so the very tentative sampling of the text takes place between oral repetitions. As we saw with Astor's examples, the regressive sequence can take place to the right of the repeated word—-one or two forward fixations, then a regression or series of regressions. The repeated word thus acts as an anchor for the reader.

After probing an area of the text that doesn't match their predictions, the oral repetition allows readers to attempt that area of difficulty from a "springboard" of confidence—the repeated word—before diving into that portion of the text. It is similar to the idea of a "running start" that has been discussed in miscue analysis, in which readers, after encountering an area of the text that gives them problems, return to the beginning of a phrase or sentence that did not present them with difficulty in order to try the problematic area "from the top."
Partials

Like repetitions, partials are not coded as miscues, although they are marked on the transcript as an unexpected response. By definition, a partial is an incomplete response. Below, it appears as though Jack is about to produce loud—although it is difficult to be certain what word he may have been about to say from just one phoneme, loud would fit semantically (crash precedes the word), syntactically (as an adjective to further describe the action surrounding the crash) and graphophonically (loud shares a high degree of similarity with cloud both graphically and phonically):

Figure 5.29
Jack's Partial of 1-

| line | The lights contin-
| 307 | ued showing right up until the day when, with a muffled |
| 308 | 1 2 3 267 433 150 |
| 309 | © l-
| 310 | crash and a \cloud of dry dust, the sagging roof finally fell in |
| 307 | 1 3 2 4 5 6 7 8 10 9 11 150 233 267 2000 200 |
| 308 | 268 150 317 217 267 117 267 150 500 233 200 |
| 309 | 267 150 233 267 300 150 233 200 100 450 217 150 100 300 |
| 310 | 267 150 233 267 300 150 233 200 100 450 217 150 100 300 |

Jack fixates on cloud, says 1-, fixates on dry, regresses to cloud, verbally corrects his miscue by saying cloud, then moves on. We can see that he did not merely sample the word that he miscued, but also looked to surrounding words to
disconfirm his original choice.

**Fixations.**

Of 34 partials produced, every one received a fixation that was within foveal focus, including 25 direct fixations. This continues the trend we have seen with substitutions, omissions, insertions, and repetitions of miscued words (or areas, in the case of insertions) being examined. Partialis are not caused by a lack of visual information being transmitted to the brain, but by what the brain does with that information.

**Fixation Duration.**

Continuing the trend of lengthy durations of fixations surrounding all the miscues discussed except insertions, partials received an average of 456 ms. per fixation:
Like substitutions, omissions, and repetitions, not only are the durations of fixations relative to partials longer than the average length of all the fixations across the readings, but the first pass fixation duration of partials is longer than all other word durations—by any measure, partials are looked at longer than non-miscued words. Note again that these measures are of the first time the miscues are encountered; regressions were not added as they are usually part of a correction procedure and do not affect the reader’s perception of the word the first time it is encountered.
Regressions and Corrections.

All partials presented in this study are corrected; an uncorrected partial is treated as an omission (Goodman, Watson, & Burke, 1987, p.70). Twenty-five of the corrections utilized a regression after the partial was produced:

Figure 5.31
Percentage of Regressions Made After Partial

This sets up a situation opposite that of substitutions and omissions, where there are sometimes regressions without corrections. When readers are able to correct partials without regressing or refixating the word (or fixating it at all, in some cases), it demonstrates that readers maintain the semantic and syntactic structure of the sentence in their memory and do not always need more textual information
to disconfirm choices.

The Three Sides of a Partial.

Who knows what a partial would have become? One phoneme does not provide enough information for analysis (Goodman, Watson, & Burke, 1987), but we can still divide them into three distinct categories. These are partials that appear to be: 1) the beginning of the current word (word that the partial momentarily replaces), 2) the beginning of the word before or after the current word, and 3) the beginning of an unknown word (not represented in the surrounding text).

Category 1 type partials, comprising 64.71% of the total number of partials, appeared to be the beginning of the current word. About half of these appear to be attempts to gain more information about the word the partial replaces. Enzo provides an example below:

Figure 5.32
Enzo's Partial of P

<table>
<thead>
<tr>
<th>line</th>
<th>201</th>
<th>For</th>
</tr>
</thead>
<tbody>
<tr>
<td>202</td>
<td>Le Cirque 2000 chef Marc © P. Poidevin. It all makes sense:</td>
<td></td>
</tr>
</tbody>
</table>

| 1 4 3 | 9 11 15 17 18 |
| 25   | 19 20        |
| 6 14 7 13 8 16 9 12 | 11 10 17 18 |
| 150 300 167 283 150 183 150 133 267 367 200 767 | 700 117 300 117 600 |
| 19 20 | 250 167       |

Enzo fixates POIDEVIN 5 times for a total time fixation duration of 1.834 ms. Although he regresses back to MARC
and chef between multiple fixations on POIDEVIN, he does not proceed forward until he has corrected the miscue. It is an unfamiliar French name, and Enzo struggles to identify it—notice that he also provides the chef's first name with multiple fixations.

Mike's miscue is an example of a partial that appears to be the beginning of the word subsequent to the miscued word:

**Figure 5.33**
*Mike's Partial of ha-

| line | ...tenant. But no tenant ever rented it, for presently discourag-
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>207</td>
<td>2 1 3 4 5 6 7 9 11 8 10 13 12 14</td>
</tr>
<tr>
<td></td>
<td>417 133 717 217 350 250 733 167 200 150 233 283 417 167</td>
</tr>
</tbody>
</table>
|      | © ha-
| 208  | ing things \began to happen. |
|      | 1 2 4 3 |
|      | 633 300 250 417 |

The word that is miscued is never fixated, although it is corrected. Instead, the word that has the same initial phonemes and letters as the partial is fixated, and regressed to, an eye movement pattern shared by half of the examples of this type of partial. Note that if Mike were indeed going to say happen, it would be an omission of began to--and because, as we have seen, omissions often serve to make structural changes, he might have actually said happened. If this is the case, his eye movement to the end of HAPPEN and regression back to the beginning of the word
would have been enough to disconfirm the simple past tense (finding no ed on the end of the word) and realize that the text uses a verb-infinitive-verb configuration.

Astor's miscue is representative of partials that appear to be the beginning of a word not represented in the immediate text.

Figure 5.34
Astor's Partial of un-

<table>
<thead>
<tr>
<th>line</th>
<th>The house was run down, but usable, and they hoped to rent</th>
</tr>
</thead>
<tbody>
<tr>
<td>205</td>
<td>1 2 3 64 5 7 8 9</td>
</tr>
<tr>
<td></td>
<td>350 967 167 300 417 183 900 1,317 133</td>
</tr>
<tr>
<td>206</td>
<td>it rather quickly.</td>
</tr>
<tr>
<td></td>
<td>1 2</td>
</tr>
<tr>
<td></td>
<td>383 183</td>
</tr>
</tbody>
</table>

Astor fixates usable, and, then regresses back to the u in usable. He then says but un- but usable. So in this case Astor regressed before making the miscue, and didn't regress again. This sequence shows how strongly he predicted that the house would be described as unusable, for the same reasons that Mike produced the substitution unusable in the same place (discussed in the Substitutions section of this chapter). In this type of partial, readers' predictions seem to be disconfirmed quickly. In all cases, the reader moves off the word to another word either to the right or left, thenrefixates the word.

Fifty percent of partials have eye movement patterns similar to those of repetitions: partial→all regressions
completed → correction. This indicates they may be used as place holders, as repetitions are, while some aspect of the surrounding text is processed. Other partials may be the initial stages of an omission or substitution, as Mike and Astor’s examples demonstrate.

Overview of Types of Miscues

We saw that, contrary to conventional wisdom, most miscued words are examined, and examined thoroughly, before the miscue is produced. Below, the 5 types of miscues examined in this chapter are combined for a comparison of miscues against portions of the text not miscued.

Miscued words and the area in foveal focus around miscued words are heavily sampled. Figure 5.35 shows the percentage of miscued words fixated, in addition to the percentage of miscued words in foveal focus if not directly fixated (like insertions):
I have consistently included measures of fixations that were not directly on a miscued word but in foveal focus because I am interested in the area of the text in which a miscue takes place. However, it is also important to compare only direct fixation percentages as that is a conventional measurement (and a useful one, as we saw in chapter 3). For comparison to the overall percentage of words directly fixated, the percentage of directly fixated miscued words is averaged and shown in figure 5.36 (excluding insertions because they allow only foveal fixations; there's no word to fixate in the text):
Miscued words are more likely to receive a fixation on the first pass than all non-miscued words, although the 2.6% difference between the amount of directly fixated miscued words and all words would not be found statistically significant by any statistics test. However, that is what makes this comparison significant—that miscued words are not skipped over or otherwise visually not processed. Fairbanks' (1937) data are similar; across all subjects, 79.5% of the errors Fairbanks recorded were "accompanied by fixations falling within distances from the midpoints of the errors of one-half the mean size of fixation (the
reading span [6-8 letters])" (p. 95). In other words, 79.5% of the errors were either fixated or well within foveal focus.

Not only are miscued words fixated more often than all the words in the text, they are also fixated for a longer period of time. Figure 5.37 compares the duration of all the fixations in the text to the duration of fixations relative to miscues.

Figure 5.37
Average Duration of Fixations: Miscued Words (before production of miscue) Vs. All Words

In order to include insertions, I have averaged in durations of fixations in foveal focus if the miscued word didn’t receive a direct fixation. Note that this actually lowers
the average fixation duration for miscued words, as places of insertions had the smallest fixation durations. Regardless of how the data are divided, it is clear that the fixations on and around miscues are thoroughly examined.

Different types of miscues are associated with different types of eye movements. This is not a causal relationship, however—miscues do not cause eye movements and eye movements do not cause miscues. Rather, they are both observable aspects of the brain's process of making sense of print. In the next chapter these findings are discussed in terms of what they demonstrate about the reading process.
CHAPTER 6
READERS' AUTHORITY TO COMPOSE

Books are not made to be believed, but to be subjected to inquiry. When we consider a book, we mustn't ask ourselves what it says but what it means....
--Umberto Eco, *The Name of the Rose*

This chapter is an interpretation of findings reported in chapter 5; specifically, a response to the finding that before the oral miscue takes place, miscued words are fixated more often and for a longer period of time than other words in the text. The focus of this chapter is the role of perception in reading. After the introductory example, below, I will discuss general notions of visual perception before relating them to the findings of this study and perception in reading.

Figure 6.1 shows a sentence from *Waterford Ghost’s Revenge* in which Sam produces five miscues:

---

**Figure 6.1**
Sam: Complex Miscue in *Waterford Ghost’s Revenge*

| line | 218 | ©and (uc) sons came
Rumor spread what the son had indeed come back to
4 1 7 3 8 23 6 9 10 11 12 13 14
250 633 450 150 217 283 200 517 100 150 133 133 250 183
© money
\make good his promise to keep the parents from making any
36 2 5 4 1 7 8 9 11 10 12
350 233 350 217 133 283 383 367 333 300 350 117
money from the cottage.
34 1 2 6 5
183 167 383 317 150 1.017
Sam orally produces *Rumor spread and the sons—that the sons indeed came back to make money—make good his promise to keep the parents from making any money from the cottage.* He makes five miscues in this sentence, which can be considered in three groups. The first group includes the corrected substitution of and for that and the uncorrected (the miscue was repeated) substitution of *sons* for *son.* I grouped these two miscues only because the correction attempt covered both miscues. The second group of miscues includes the omission of had and the substitution of *came* for *come.* The omission of had is in response to Sam’s prediction of the syntax of the sentence containing simple past construction (as with the verb *spread*), instead of perfect tenses. This expectation and omission then drives his perception of the text item *come* as the simple past tense *came.* This second group of miscues is not corrected, probably because Sam’s miscues were consistent, each involving perceptions of a simple past construction that worked. The third group is actually one miscue, the substitution of *money* for *good,* which Sam corrected. What is interesting about this miscue is that the word *money* is on the line below the miscued area, within the reader’s parafovea. The substitution of words in the parafovea or periphery is not uncommon, and are almost always at least partially syntactically and
semantically acceptable (Goodman, 1975).

Even though Sam makes 32 fixations on the 25 words in this sentence, six of the words are not fixated. Since there are 6 words not fixated and 5 words that were miscued, common sense would predict that the miscues took place on those unexamined words. However, as we saw in chapter 5, that's not how reading works. Sam did not miscue at all on any of the unexamined words, and in fact he fixated directly on each of the miscued text items before orally miscuing. That miscued words are examined was shown in chapter 5; remember that miscued words were shown to be more likely to receive a direct fixation than all other words in the text. In addition, fixations relative to miscued words are longer than other fixations in the text. This is significant as the readers are changing, adding, or omitting words in the text that they can physiologically see, in perfect focus, are not there - physiologically in the sense that the eye transmitted data to the brain; it is not for a lack of data that readers miscue. I pointed out in chapter 5 that miscues can no longer be assumed to be caused by careless or too rapid reading.

So readers are receiving perfect, in focus, visual data from the text, but are perceiving something different. Most words not fixated in a text are not miscued, while most
miscued words are fixated. Why are thoroughly examined portions of text changed during the course of constructing a parallel text? To begin to answer this question we must first examine the role of perception in general, and the role of visual perception in reading.

Perception

Our eyes do not deliver concepts to our brain, but provide a "...diffuse and continual bombardment of electromagnetic radiation, minute waves of light energy that vary only in frequency, amplitude, and spatial and temporal patterning" (Smith 1994, p. 69). Another, less technical way to describe the data our eyes deliver to us is to say that "we are given tiny distorted upside-down images in the eyes...." (Gregory, 1966, p. 7). We obviously don't perceive the world upside-down, much less in terms of electromagnetic radons, but if that is what the eyes "see," why not? The reason is that it is the brain, not the eyes, that constructs our visual world. The eyes merely deliver raw data to the brain, while the brain decides what to attend to. This, then, is perception - not what the eyes look at, but what the brain does with the visual information it receives. Thus when the brain constructs perceptions it has to decide what to see, a process that the familiar Necker
cube\textsuperscript{i} illustrates in Figure 6.2:

Figure 6.2
Necker Cube

Is the face on the cube marked with an "o" on the outside or inside of the cube? As you look at the cube, both seem possible, and the "o" seems to alternate from the front to the back face, and vice-versa. But the figure itself has not been altered, nor has the information the eye transmits to the brain. This alternating - "it's the front face! No, it's the back face! wait...." - is evidence of the brain constructing different perceptions of the same visual input. This example is a microcosm of what the brain is engaged in on a continuous basis: what may be called "hypothesis checking." As Gregory (1966) argues, "...the senses do not give us a picture of the world directly; rather they provide evidence for checking hypotheses about what lies before us. Indeed, we may say that a perceived object is a

\textsuperscript{1This example is after Gregory, 1966, p. 12.}
hypothesis, suggested and tested by sensory data." (pp. 11-12). This idea is echoed by other perceptual psychologists as well (Bruner, 1973; Neisser, 1976).

The concept of our perceptions, through which we know the world, being tied in with hypotheses we continually make may not have intuitive appeal; after all, do we really sit around hypothesizing about what we will see if we turn to the left, if we glance up, if we look across the room? Certainly we don’t make conscious hypotheses of the sort we might see displayed in a booth at a science fair, but our implicit hypotheses about the world are made very much on a continual basis. These implicit hypotheses are often thought of as expectations, and become obvious when we encounter situations which we did not expect, which were not hypothesized. For example, a friend of mine recently traveled to Canyon de Chelly, a national park in northern Arizona. While browsing in the gift shop, she felt a tap on her shoulder and heard a “hello!” When she turned around to see who was greeting her, it took her several seconds to realize who it was - a colleague of hers that she sees every day at work, hundreds of miles away. Because her hypotheses of the “greeter” included salespeople from the gift shop, fellow travelers, or simply a stranger about to ask the time, it took her longer to recognize her colleague, who is
usually encountered in a totally different context. Of course when her colleague taps her on the shoulder and says "hello!" at her place of employment she recognizes her immediately - in the context of her workplace, her hypotheses include those people that work with her, and her perceptions are constructed that much faster.

The Necker cube provides no clues as to which hypothesis, i.e., "A. the circle is on the front face, or B. the circle is on the back face," is more acceptable, which is why we don't perceive one hypothesis as being better than the other. For the most part, however, our brains construct hypotheses about the world that allow us to settle on a perception that has meaning. For example, the task of describing the amount of water in a drinking glass as half full or half empty is traditionally a popular parlor game question. Some people perceive the glass as half full, and some perceive it as half empty. Thus, like the world around us, the same object is perceived differently by different people. But what predisposes us to make certain perceptual choices?

The general agreement that an optimist will say "half full" and the pessimist "half empty" has almost become cliched. But the cliche comes from sound reasoning: it is our personal knowledge, backgrounds, experiences, moods,
social beliefs and other individualisms that create our perspectives. Our experiences feed our expectations, drive our hypotheses, create our perceptions, and interpret the world around us. In chapter 2 I pointed out that Kant's (1781) term for these background experiences is still used today: schema.

**Schema**

Schemata are generally understood to be internalized, organized cognitive structures of related knowledge that guide a person's response to experience (Goodman & Goodman, 1994, p. 116). A schema has been described as "that portion of the entire perceptual cycle which is internal to the perceiver, modifiable by experience, and somehow specific to what is being perceived" (Neisser, 1976, p. 54). Mental activities, including reading, do not take place in a vacuum or in a neutral, decontextualized setting. Rather, we activate a schema to give meaning to situations we encounter. For example, in an adult reading class I teach, we read *My Papa's Waltz*, individually jotting down notes about our interpretation of each line and the poem as a whole. I include the poem and readings of several of my students below:
MY PAPA'S WALTZ

The whiskey on your breath
Could make a small boy dizzy;
But I held on like death:
Such waltzing was not easy.

We romped until the pans
Slid from the kitchen shelf;
My mother's countenance
Could not unfrown itself

The hand that held my wrist
Was battered on one knuckle;
At every step I missed
My right ear scraped a buckle.

You beat time on my head
With a palm caked hard by dirt,
Then waltzed me off to bed
Still clinging to your shirt.

After we all finished with our notes about "what was happening" in the poem we shared them, and the interpretations differed. Dan, a 40 year old ex-marine, wrote for his overall interpretation that it was about "alcoholism and abusement" (and he highlighted those two words):

To me, the poem sounds like a man was unable to control his drinking at any special occasions, and needs lots of help, because it is affecting his marriage life.

---

2 by Theodore Roethke. The method of interpreting this poem line by line and as a whole is adapted from Brown and Harrison (1992).
Tom (late teens/early 20s), however, saw the drinking not as a problem but as an aftereffect of having a good time. His line-by-line interpretations include:

- #5: having a good time.
- #7: wondering what his mom would think./having one hell of a party.
- #13: having already gotten a buzz before his friends.

And his overall interpretation:

Partying like crazy, got too wasted or drunk.

Dan's experience may have taught him that even a potentially innocuous line like "the whiskey on your breath" may be indicative of a larger problem, while for Tom the greatest danger whiskey holds is that your mother may find out. In contrast, Sally, who just returned to school after five years and is currently working on getting her GED, wrote:

- This (is) someone trying to do something on their own but yet needs a push now and then. This is like a young man or woman trying to prove to their mother they can do it but in the process they mess up and they're frustrated but in the end they do it.

Terri, who just graduated from high school, responded to the poem this way:

- It is about a girl that has trouble at home and finds herself someone who sweeps her off her feet. Also shows comfort to her and gives her what she needs.
Each student responded to the same letters, words, sentences, and stanzas, but constructed different meanings based on their background experiences and knowledge; their schemata. I don't mean to imply that schema comes into play only when interpreting esoteric poetry - on the contrary, schema directs our understandings of all types of texts. Anders & Guzzetti, (1996, p. 11) provide an example with the following passage:

On our long trek through the loop area, we finally found a spot to get our much desired huckleberries. Our sacks were bulging as we left, ready for the long drive home. We were satisfied when we imagined our end result.

Depending on readers background experiences, their construction of this text will differ, as the authors' questions demonstrate:

Who did you picture? Did you see yourself in this passage? What is the loop area? Did you picture downtown Chicago, a freeway system, or a path through the woods? What are huckleberries? What color are they? What kind of sacks did you picture? Did you see grocery sacks, burlap bags, or backpacks? Where is home? Did you picture the city or the suburbs? What is the end result? Did you think of making jam or baking a pie? Whatever you pictured as you read the above passage was probably the closest interpretation to your own
Anders and Guzzetti's questions emphasize the number of different contexts their passage can be put into, contexts that are generated by the reader's background knowledge and experiences, which in turn generate expectations. Schemata thus drive the perceptual process.

Schema is a broad term but can be generally divided into two types: content and formal (Carrell & Eisterhold, 1988). Content schemata are the kinds of background knowledge that I've focused on above - knowledge of the content area of the text. Formal schemata are the types of background knowledge about how a text is constructed - grammatical and rhetorical organizational structures.

The Perceptual Process

I've pointed out that the eyes are responsible only for transmitting raw data to the brain, while it is the brain's task to perceive. These perceptions are described as hypotheses that are constantly generated and checked. My descriptions of different aspects of perception have yet to
address the process whereby perceptions are created; this is undertaken in the current section.

What then, is the process that results in our perceiving something? While I have described aspects of the perceptual process sequentially, I don't mean to imply that the process has a distinct beginning or ending. In fact, each part of the process informs another part, which Neisser (1976, p. 21) illustrates in Figure 6.3:

Figure 6.3
Neisser's Perceptual Cycle

Object
(available information)

\[
\begin{align*}
\text{modifies} & \quad \text{samples} \\
\text{Schema} & \quad \text{directs} \\
\text{Exploration}
\end{align*}
\]
Our schemata direct our need to explore our environment for more visual data, which is done by sampling the object. The information gained from sampling modifies our schema, which directs the eyes to explore the object more, and so on. In this model the percept is neither the object itself, nor our a priori representation of it, but an informed combination of the two. Neisser explains:

...perception is directed by expectations but not controlled by them; it involves the pickup of real information. Schemata exert their effects by selecting some kinds of information rather than others, not by manufacturing false percepts or illusions....The interplay between schema and situation means that neither determines the course of perception alone (pp. 43-44).

And the brain never ceases to be engaged in creating meaning, in perceiving. The last sentence in the above passage echo's Kant's (1781) argument that knowing is a combination of information the senses provide the brain and background knowledge, not simply one or the other. As I discussed in chapter 2, this idea is furthered by Dewey and Bently (1949) who describe knowing in terms of a transaction, and by Rosenblatt (1978) who terms reading as a transaction between text and reader. This, then, brings us to the role of perception in reading.
Perception in Reading

While I used examples of texts to demonstrate how schemata helps form hypotheses about the world, for the most part I dealt with visual perception in general. In this section I use that discussion of perception to inform a more specific issue, that of perception in reading.

One of the foci of this dissertation is the information about the reading process gained by the analysis of oral reading miscues. As such, the model of reading that fully takes into account miscue analysis - the Transactional Sociopsycholinguistic Model - is used as a framework for much of the analysis found within. The model's epistemological foundation extends general models of perception, such as those described above, to reading.

Goodman (1996) describes the cyclical nature of reading:

We are constantly anticipating where a text is going, what will come next, what we will see, what structures we will encounter, and we make inferences from what we think we've seen and predicted. Our predictions are based on the information we've selected and sampled from the text, but they also guide the process of selecting and sampling (pp. 112-113).

So what readers find when they read depends on what they think they will find, which is informed by what they actually find - I envision this relationship by casting
Neisser's Perceptual Cycle (Figure 6.3, above) in terms of reading. See Figure 6.4, below:

Figure 6.4
The Perceptual Cycle: Reading

![Diagram of the Perceptual Cycle: Reading](image)

The compatibility of general perceptual cycles and those of reading is exactly the point I make here. This conception of the perceptual process supports the Transactional Sociopsycholinguistic model of reading; in the latter part of this chapter I will discuss how the perceptual aspects of the model can be extended.

Expectations, predictions, and hypotheses are crucial
to perceptions, both of the world in general and of text. The idea of readers forming hypotheses about upcoming text, however, has become a frequent point of confusion regarding the Transactional Psychosociolinguistic Model of reading. Stanovich and Stanovich (1995), for example, review research that argues a reader's probability of predicting the following word in a passage is usually between .20 and .35. They state that "...it is often incorrectly assumed that predicting upcoming words in sentences is a relatively easy and highly accurate activity" (p. 90). The interpretation of "prediction" to mean anticipation of a specific word is the locus of the problem. As Neisser (1976) says, "this 'anticipation' is not a deliberate and conscious hypothesis, of course, but a general readiness for information of a particular kind" (p. 40)." Similarly, Smith (1994, p. 161) states that "the way readers look for meaning is not to consider all possibilities nor to make reckless guesses about just one, but rather to predict within the most likely range of alternatives." Goodman (1999) also rejects the notion that readers predict specific words, characterizing prediction instead as an expectation of a range of probable meanings.

A further example of the compatibility of general theories of visual perception and theories of perception in
reading is provided by Neisser (1976), who argues that "perception itself depends on the skill and experience of the perceiver - on what he knows in advance" (p. 13). Readers know this to be true - the more familiar a reader is with the topic of the text, the more efficiently she or he can read. And Neisser does in fact include texts in his discussion when he explains that "the same principle applies to briefer experiences: What you learn from the second half of this very sentence will depend on what you have already picked up from the first" (p. 13). Reading is a perceptual process, and is informed by theories of visual perception. The following section deals with how miscues are observable instances of the perceptual cycle in reading.

Miscues: Evidence of the Perceptual Cycle in Reading

In the same way that we know the world around us through our perceptions, we understand print through a perceptual cycle. Rosenblatt (1978) calls this a transaction with the text, and Goodman (1994) views the perceived print as part of a parallel, constructed text. Without miscues it can be difficult to conceive of readers as constructing a parallel text that is not exactly the same as the written text; after all, readers reading the same text all receive the same visual data, so why would they
have different interpretations? The discussion on schema theory, above, can answer that question sufficiently on a more global (comprehension of whole text) scale. Indeed, it’s not necessary to think in terms of miscues to see the perceptual cycle at work. Let’s look at Chomsky’s classic example:

*Flying airplanes can be dangerous.*

Someone perceiving *flying* as a gerund constructs a text that is different than someone perceiving *flying* as a noun modifier. The first reader gains from his constructed text that piloting airplanes is definitely not for him, while the second reader gains from her constructed text that it would be wise to stay indoors when there are planes flying overhead. These understandings, these perceptions, make up the constructed text. It is this parallel, constructed text that readers comprehend, not the printed text.

While Chomsky’s *flying airplanes*-type examples (others include *Visiting relatives can be a nuisance*) provide insight into where constructed texts may differ from the written text, miscues give us insight into where specific, local differences between the written text and constructed text lie. A clear example was given in chapter 4, where Sam substitutes *pleasant* for *peasant* in the phrase with a big *peasant family in the background*. Sam’s constructed text,
his perceived text, includes the family being pleasant instead of peasant.

Some aspects of constructed texts are orally less obvious than others. Readers can and do miscue without producing an expected response that has a different orthographic configuration than the expected response. For example, in Figure 6.5 Vera substitutes the word will for the word will:

![Figure 6.5](image)

<table>
<thead>
<tr>
<th>line</th>
<th>Unfortunately, his parents were particularly selfish,</th>
<th>Cruel and mercenary and demanded that he will them his house and property, which in case of his death would have gone to his wife.</th>
</tr>
</thead>
</table>
| 109  | 1 2 3 4 5 6 8 7 9 500 600 117 267 333 500.500 | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 |}

* Vera said “oh” here
Letters indicate inter-line fixations (for example, from PROPERTY back to WILL)

Her substitution was of the auxiliary verb will for the base verb will (as in “last will and testament”). She orally produced: Unfortunately, his parents were particularly selfish, cruel and mercenary and demanded that he will that he will them his house and property – oh! – that he
will them his house and property, which in case of his death would have gone to his wife. Her intonation changed when she produced will the third time, from that of an unstressed helping verb to a stressed main verb. A more obvious piece of evidence that her perceptual cycle changed her perception of the word will is that she exclaimed oh! just before producing the phrase in a way that preserved the expected syntactic structure of the sentence. This is a fine example in which to see the perceptual cycle at work: Vera's anticipation of one syntactic structure was disconfirmed by the information available, and she directed her eyes to sample the text again. In the area surrounding will, this is what she looked at:
Figure 6.6
Vera’s Order of Fixations

<table>
<thead>
<tr>
<th>house and property, which in demanded that he will them his</th>
<th>as found in the text</th>
</tr>
</thead>
<tbody>
<tr>
<td>house house property in he them will them demanded them</td>
<td>10 — 1 words</td>
</tr>
<tr>
<td>house property in he them will them demanded them</td>
<td>11 Vera fixated,</td>
</tr>
<tr>
<td>and which in</td>
<td>12 and fixation</td>
</tr>
<tr>
<td>which in</td>
<td>13 number</td>
</tr>
<tr>
<td>demanded that will</td>
<td>14</td>
</tr>
<tr>
<td>that will</td>
<td>15</td>
</tr>
<tr>
<td>his</td>
<td></td>
</tr>
</tbody>
</table>

Although the words in the text are presented sequentially, the reader does not sample them that way. She directs her eyes back to portions of the text that she believes holds the key to comprehending this section. Her sampling modifies her schema and enables her to construct a new perception, one that makes sense, and she continues reading. Note that Vera’s having predicted a certain structure did not mean that structure was all she could imagine. Neisser
(1976) explains:

The assertion that perception involves anticipation is easily misunderstood. It does not imply that I can see only what I expect to see. If someone had substituted [one object for another] without telling me about it, I would probably notice the change. My first glance would provide information that changed the schema and would direct further exploration of the new object. When a perceptual cycle is carried out normally, schemata quickly tune themselves to the information actually available (pp. 42-43).

As in the world in general, readers' perceptual cycles are always in motion.

Some miscues, like Vera's substitution of will for will, are obvious only through the reader's intonation changes. Other perceptions result in changes that we would describe with different orthographic representations, and are what are usually thought of as miscues - changes that include substitutions, omissions, and insertions. These miscues are obvious places where readers constructed texts part from the written text, where their predictions don't mesh exactly with the written text. However, it should be pointed out that every miscue meshes well with at least one of the cue systems. That is, a miscue is at least partially acceptable syntactically, partially acceptable semantically, or has some graphophonic similarity. This meshing with at
least one cue system allows readers to perceive the word they predicted. The miscue data in this dissertation indicate that a prediction that is neither semantically acceptable, syntactically acceptable, graphically similar nor phonologically similar would produce no miscue: since perceptions are, as we have seen, predictions plus input readers would hit the proverbial brick wall, and would not perceive what they predicted*. A metaphor can be a useful heuristic; this need for at least one of the cue systems to match readers expectations if a miscue is to develop can be likened to that of a relay race in a track and field event. In the mile relay, there are four runners, each of whom runs a quarter mile, then hands off a baton to next runner, who repeats the cycle. During the handing off of the baton, the runner receiving the baton starts running slowly, facing forward, with his hand outstretched behind him. The first runner completing his quarter mile hands the second runner the baton; when the second runner feels the baton in his hand he grabs it and takes off. The second runner expects a sturdy, smooth, cylindrical object of a specific weight to be placed in his hands. If he feels such an object in his

*Further miscue research, not necessarily in combination with eye movement analysis, is needed to ascertain whether this is an accurate depiction across all readers in addition to those used in this dissertation.
hand he grabs it and runs—there's no reason to inspect it to make sure it is what he thinks it is. Now imagine what would happen if the first runner, as an April Fool's joke, handed the second runner a feather, instead of the baton. The second runner would probably stop, bewildered, and look at what he was holding—although it might be the right length, the feather would not be smooth, cylindrical, or of the appropriate weight. The race would grind to a halt. But what if the prank-playing first runner handed the second runner a small branch he had broken off of a tree, a branch that was similar to the baton in weight and length, but a bit narrower and not as smooth. The second runner might not even notice—his hand closes around an object that meets a sufficient amount of his expectations to enable him to continue running. After all, he is concentrating on a race, not examining each baton he comes in contact with. Think of the first runner as the text, the second runner the readers, and the baton a lexical item with its features equal to cue systems. If readers encounter a lexical item in the text that satisfies a sufficient combination of cue systems to allow them to continue making meaning, they will continue reading. Like the runner focusing on the race instead of the baton, so the reader focuses on meaning, not the words. The "fake baton" is a miscue, but one that is perceived as
having veridicality, and the meaning making process
continues. Thus are miscues still, in every way, the
perceptions that create the constructed text that readers
respond to and comprehend.

With the example of the substitution of will for will in
Figure 6.5 I discussed readers' changes to the text that
keep the same orthographic configuration and phonology
(although the suprasegmental phonology changes as the
sentence's stress patterns differ). Continuing en route to
a discussion of why miscued sections of text are examined by
the reader and then non-deliberately orally changed, the
next sections are concerned with miscues that result in
overt changes to the written text: substitutions, omissions,
and insertions.

Substitutions

In Figure 6.7 we see an example of a not-atypical
substitution:

Figure 6.7
Mike's Substitution of unusable

<table>
<thead>
<tr>
<th>line</th>
<th>unusable</th>
</tr>
</thead>
<tbody>
<tr>
<td>205</td>
<td>The house was run down, but usable, and they hoped to rent</td>
</tr>
<tr>
<td></td>
<td>1 2 3 4 6 5 7 8 9</td>
</tr>
<tr>
<td>206</td>
<td>267 133 467 500 1,357 400 367 250 783</td>
</tr>
<tr>
<td></td>
<td>it rather quickly.</td>
</tr>
<tr>
<td></td>
<td>10 11</td>
</tr>
<tr>
<td></td>
<td>917 133</td>
</tr>
</tbody>
</table>

Mike fixates usable for 500 ms., fixates it again for 400
ms., then makes a within-word regression to fixate usable a
third time, for 1.397 ms. He says unusable before moving off the word. Note that this is the only word to receive multiple fixations in this sentence, and 60% of the words are fixated, with only 1 of the 11 fixations being a regression. These numbers are all below the average for Mike's overall reading, indicating that he did not find this sentence relatively troublesome.

As I pointed out in chapter 5, most substitutions were content words and remained the same part of speech as the substituted word. The grammatical structure is not altered in these cases, but the meaning can be. In Figure 6.7, Mike substitutes unusable for usable, an adjective for an adjective that does not change the syntax of the sentence. It does, however, change the meaning, as unusable is the opposite of usable. We have seen how readers' schemata drive their perceptions; in this case the relevant type of schema is content, instead of formal, schema. Mike's formal schema did not drive this miscue, for the grammar remains the same. His prediction of the house as being unusable is attributable to schema of a run down, dilapidated house—knowledge of the content of the text. Substitutions, then,

---

To avoid potential confusion, when discussing words in terms of eye movements I use small caps and when discussing words in terms of miscues I use italics. E.g., the reader fixated on usable and said unusable.
tend to effect semantic properties of the sentence.

Omissions and Insertions

Mike's omission of with in Figure 6.8 is representative of most omissions:

Figure 6.8
Mike's Omission of with

<table>
<thead>
<tr>
<th>line</th>
<th>The lights continued</th>
</tr>
</thead>
<tbody>
<tr>
<td>307</td>
<td></td>
</tr>
<tr>
<td>308</td>
<td>days</td>
</tr>
<tr>
<td>309</td>
<td></td>
</tr>
<tr>
<td>310</td>
<td></td>
</tr>
</tbody>
</table>

Mike fixates with for 450 ms. and then fixates the word a before omitting with and verbalizing the rest of the phrase. Mike's parsing of the sentence up until the end of the second line does not include a prepositional phrase imbedded in the subordinate WH-clause. Rather, he predicts a syntax in which there are no prepositions. Note that he fixates on with for 450 ms., then on a for 567 ms. and muffled for 167 ms, at which time he rejects the information he found in the text in favor of the independent clause + subordinate WH-clause syntax he had predicted. In contrast to Mike's...
example in Figure 6.7, above, this miscue affects the syntax of the sentence but does not directly affect the meaning. A caveat here: because language is an interrelated, complex process it is not easy (or even desirable) to segment it into clearly defined pieces. I speak of a miscue affecting the syntax but not affecting the meaning directly when it is apparent that the meaning of a sentence is altered only because an illegal syntactic structure has reduced the sentence to syntactic nonsense. In Figure 6.8, the omission of with is primarily a structural change, even if the meaning is altered when the syntax is later shown to be unacceptable. This is true of most omissions - three quarters of the omissions in this study were function words that carried no semantic meaning and served structural purposes. This is not to say that the grammar of the sentences were always adversely affected; as we saw in chapter 5, many omitted words were optional text elements anyway. Omitting optional syntactic units changes the syntax of a sentence but not its acceptability.

Insertions seem to play a role similar to that of omissions, in that they tend to affect the syntactic structure of a sentence instead of its meaning. Sam makes two insertions in Figure 6.9:
Figure 6.9
SamW's Insertions of Then and they

<table>
<thead>
<tr>
<th>line</th>
<th>Then</th>
<th>looked</th>
<th>they</th>
</tr>
</thead>
<tbody>
<tr>
<td>213</td>
<td>They had liked the wife, and so</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 1 4 7 5 2 9 3 1 0 8 1 1 7 3 6 7 3 3 3 2 0 0 1 4 3 5 5 0 2 3 3 1 3 3 9 0 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>214</td>
<td>did not investigate too carefully.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1 2 5 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>233</td>
<td>233 150 267 233</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sam says, Then they had looked the - liked the - They had liked the wife, and so they did not investigate too carefully. In addition to his substitution miscue of looked for liked, which was discussed in chapter 5, Sam makes two insertion miscues here, then and they. He makes short fixations within foveal focus of where the insertions would be if they were included in the published text. While there is no text item to fixate in the case of insertions, the reader had the area in which he inserted words in sharp, foveal focus. That is, he could "see" there was nothing there, but still inserted a word. The insertion of Then as a time order marker is partially acceptable, especially with the additional miscue of looked for liked. After he corrects looked, the reader corrects the entire initial clause. The insertion they, however, is totally acceptable and is not corrected. They is able to be omitted by the author because the two clauses are parallel and have the same subject. The insertion does not change the underlying grammatical structure, nor does it alter its acceptability.
The reader exercised an option the author also could have used.

Like omissions, the majority of insertions are function words which affect the syntax of the sentence, not the meaning. In contrast to substitutions, it seems to be readers' formal schemata that are involved in the omission and insertion changes made to the written text.

As we saw with miscues such as a substitution of will for will (Figure 6.5), readers can miscue without uttering an overt difference between the written text and their constructed text (there is no difference in will and will graphically, but the intonation is different for a modal than for a main verb). While readers' perceptions of parts of a text can differ from other readers' perceptions of the same parts of the text, it is not always obvious that the perceptions are different. It is difficult, if not impossible, to tell at any given time what a reader's constructed text really is or what he or she has comprehended or is comprehending. Figures 6.7, 6.8 and 6.9 demonstrate times that we can infer what the readers' constructed text is like, what their perceptions of the written text are. In the same way that Figure 6.5, the substitution of will for will, shows a perception of text that is different while sharing the same spelling and
phonology (in general), Figures 6.7, 6.8, and 6.9 are examples of how perceptions can have a different orthographic configuration than that of a written text. Regardless of the graphic form of the perception, it is important not to forget that readers' perceptions are how they know the text - the perceived text is the "read" text.

As chapter 5 made clear, and the examples in this chapter reiterate, miscued text items are generally fixated before they are miscued. That is, miscued words are not skipped but are examined before and during the production of the miscue. While these findings support the Transactional Sociopsycholinguistic model of reading introduced in chapter 2, they also extend parts of the model. Specifically, the finding that miscued words are more likely to be fixated than non-miscued words extends the aspects of the model that deal with perception. Perception is part of the Cycles aspect of the figure presented in chapter 2; this section is represented in figure 6.10 below:
In chapter 2, I explained that the section of the Transactional Sociopsycholinguistic model depicted in Figure 6.10 illustrates the cyclical nature of the reading process - the eye delivers information to the brain, which forms perceptions and allows the cue systems to be used. However, in contrast to these cycles in which perception is a part, the current discussion shapes perception as a cycle itself that subsumes the visual, syntactic, and semantic cycles, as was shown in Figure 6.4. Conceptualizing the perceptual cycle this way (and as in Figure 6.11, below) makes it unlikely that syntactic and semantic assignments would follow a reader’s perception of a text item as in Figure 6.10; instead, the syntactic and semantic nature of that text item help form the perception itself. If, instead of
perceptual cycle, image formation cycle were to be used in Figure 6.10, than syntactic and semantic assignments could follow that cycle - if, of course, the image were thought of as a simple physiological imprint, like a photograph. As soon as the discussion turns to how readers interpret the image of graphic data the eye has captured during a fixation, however, perception must be introduced.

Goodman describes the interplay between these cycles as sequential: "Perceptual processing depends on optical input, syntactic processing operates on perceptual input, and semantic processing depends on syntactic input" (1994, p. 1124). Of course, the cycles have no distinct stopping and starting points, but resemble a merry-go-round (p. 1124). Goodman provides a partial explanation for how miscues can occur in the proficient reader by explaining that readers do not have to partake of every cycle:

...we make leaps. Since our goal in reading is always the construction of meaning, and since we supply much of the information necessary to make our own sense of the text, we can and do leap ahead of the cyclical process. We're such good guessers that we've barely formed a perceptual image before we've decided what the meaning is (1996, p. 92-93).

However, while "leaping" is useful as a metaphor (see below), the findings of this study suggest that aspects of
the perceptual cycle are not leaped over, but are completely cycled through. Evidence of this is found in the fact that the very places in texts where one would expect a cycle of the reading process to be skipped - miscued words - are thoroughly examined by readers. Since the perceptual cycle is essentially a negotiation of meaning between the knower and the known, skipping an aspect of the cycle would cease perceptual processes (not abstract thinking or remembering, but the perceptual process involved with active reading). A refiguring of the Cycles element of the Transactional Sociopsycholinguistic model based on the arguments in this chapter is found in figure 6.11:

Figure 6.11
Refiguring the Cycles Element of the Transactional Sociopsycholinguistic Model of Reading

<table>
<thead>
<tr>
<th>Perceptual Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>visual exploration</td>
</tr>
<tr>
<td>scan</td>
</tr>
<tr>
<td>fix</td>
</tr>
<tr>
<td>schema expectations</td>
</tr>
<tr>
<td>structural/syntactic</td>
</tr>
<tr>
<td>assign surface structure</td>
</tr>
<tr>
<td>apply transformations</td>
</tr>
<tr>
<td>assign deep structure</td>
</tr>
<tr>
<td>content/semantic</td>
</tr>
<tr>
<td>assimilation</td>
</tr>
<tr>
<td>accommodation</td>
</tr>
</tbody>
</table>

I think of this reconfiguration as an extension of the current Transactional Sociopsycholinguistic model, especially because the concept of leaping ahead in the
original configuration of the cyclical process used as a metaphor is a powerful way to describe reading as being an efficient utilization of the fewest aspects of all cue systems possible en route to meaning. I have made the case in this chapter that readers do not require all cue systems to fit their predictions in order to create meaning (remember the baton in the relay race metaphor). In this sense, readers can attend to different aspects of the perceptual cycle with each cycle - a leaping "within" the cycle instead of leaping "over." Note that conceptualizing the perceptual cycle as being completely cycled through even for miscues provides further support for the notion that observed responses (miscues) are produced by the same processes that produce expected responses. Such support is key to evidence from miscue analysis being generalizeable to areas of the text where no miscues are made.

Examined Miscues

The question that was asked in the first part of this chapter can now be restated: Why are thoroughly examined portions of text changed during the course of constructing a parallel text?

The answer lies in the very nature of the reading process. Readers have the task of deciding, subconsciously, what aspects of the written text are to be used and what
aspects are to be disregarded. This we saw with the *flying airplanes* example; is it parsed as gerund-object noun or adjective-subject noun? When readers “change” the written text in the course of constructing a parallel text, like with Sam’s change of *pleasant families* for *peasant families*, they are exercising their authority to alter the written text. Readers will change the written text if it does not fit their meaning-centered predictions.

In this chapter I discussed several elements of the reading process crucial to understanding the notion that readers will change the written text if it does not fit their predictions. In brief, these are: 1) our perceptions of the world are hypotheses, 2) our background experiences, or schemata, direct and drive our hypotheses, 3) information our senses deliver to the brain modifies our schemata and informs further seeking of information, 4) the perceptual cycle inherent in #s 1-3 is the same for reading and can be stated as: what we find when we read depends on what we think we will find, which is informed by what we find, 5) miscues are evidence of readers’ perceptual changes to the written text - the construction of a parallel text, 6) miscues are examples of perceptual processes that engage the readers’ a priori expectations and a posteriori evidence - predictions plus convergence (as measured by acceptability
in the miscue analysis paradigm) with at least one cue system found in the written text, 7) different types of miscues are evidence of different types of changes to the written text; specifically, syntactic or semantic. Using these understandings of the reading process it becomes possible to understand why, in the case of miscues, readers change the input to fit their expectations instead of changing their expectations to fit the input.

Readers non-deliberately add, delete, or change text items that they have fixated and thoroughly examined. This seems counter-intuitive because if a prediction does not mesh with the input, it’s usually easier to change the prediction than to “change” the input. Yet most miscued text items are visually examined and then perceived differently. “Perceived” because the change is not a conscious one. Readers believe the non-deliberate miscue is the item in the text; that what they said is what they read.

When readers make miscues they are exercising their authority to change the text. The Necker cube (Figure 6.2) can be used as a metaphor here. As with the Necker cube, readers have the ability to change the structure of the graphic information the eye sends the brain. And like readers try to understand the Necker cube they also try to understand text. As they disregard a version of the Necker
cube, so readers disregard an element of the text. But while the Necker cube flits back and forth from one perception to another, readers' perception of the text item makes sense, satisfies their expectations, and they can move on.

That readers look at the word shows that the perceptual cycle is not being short-circuited, and shows that readers sample the text and search for meaning. Readers change the text instead of changing their minds because they can - reading is not passive, but active, and constructive. Reading is not conforming to the text, but constructing a parallel one. Readers want to follow the text, of course; they want to find out what it says and what it means. But the route to meaning is not in information transfer from text to reader but in a transactive construction of meaning between text and reader. It is to be expected that in the process of constructing a text there will be changes in the written text and in the reader; Dewey & Bently (1949) write that both the knower (the reader) and the known (the text) are changed in the course of knowing (reading). Portions of the text where observable changes - oral miscues - take place are fixated and examined, then changed because readers' predictions are confirmed by at least one cue system represented in the text item. In making changes to
the written text readers exercise their implicit authority to disregard text items that don't make sense for text items that do make sense - they allow themselves to construct a meaningful text even if it is not graphically similar to the published text.
CHAPTER 7

READING IS WHAT YOU THINK YOU SEE

"Therefore you don't have a single answer to your questions?"
"Adso, if I did I would teach theology in Paris."
"In Paris do they always have the true answer?"
"Never," William said, "but they are very sure of their errors."
"And you," I said with childish impertinence, "never commit errors?"
"Often," he answered. "But instead of conceiving only one, I imagine many, so I become the slave of none."

--Umberto Eco, The Name of the Rose

This chapter summarizes findings, presents instructional implications, and outlines areas where further research using this methodology is needed. I first present and explicate an example that I use as a microcosm of many of the findings of this dissertation.

Judy's Exemplar

In Chapter 2 I introduced Judy's complex substitutions of cook, comes, and dumps to illustrate a point about syntax. Here her example includes a map of the eye movements she made when producing the sentence with the miscues. To the full description of how the miscues in each example support aspects of the model are added a full description of how the eye movements support those same aspects, and how the miscues and eye movements intertwine.
The reader’s miscues are presented in figure 7.1:

Figure 7.1
Judy's Substitutions of *cook*, *comes*, and *dumps*

<table>
<thead>
<tr>
<th>line</th>
<th>“You sit there holding on to this</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>301</td>
<td></td>
<td>217</td>
<td>167</td>
<td>300</td>
</tr>
<tr>
<td>302</td>
<td>extremely ornate silver spoon,”</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>says one recent diner, “and</td>
<td>400</td>
<td>533</td>
<td>467</td>
</tr>
<tr>
<td>303</td>
<td>©<em>cook</em> comes® <em>dumps</em> the <em>cooks</em> come\ and dump gruel on your table.</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>166</td>
<td>283</td>
<td>290</td>
<td>317</td>
</tr>
</tbody>
</table>

What Judy read aloud was: “You sit there holding on to this extremely ornate silver spoon,“ says one recent diner, “and the *cook* comes and dumps...and...*cooks* come and dump gruel on your table.” As we have seen before, the numbers under the words indicate which word is being fixated and the order of the readers eye fixations, while the three-digit numbers under those numbers indicate the amount of time, in milliseconds, that Judy spent on each fixation.

Judy’s miscues allow us insight into her process of meaning making. On the third line she begins to construct a situation in which there is one *cook* dumping gruel on the diners table. Once she chose the singular *cook* over the
plural cooks she then continued to construct the rest of the sentence in a way that was syntactically compatible with the singular subject. The third-person plural verbs come and dump must become comes and dumps, two third-person singular verbs, to agree with the singular subject the cook. Even though the sentence works as she constructed it, she is still tentative, repeating the word and before regressing and correcting the entire phrase.

Miscue analysis provides a view of the meaning making process at work, but the only evidence available is the explicit verbal oral reading and comments the reader makes. Eye movement analysis allows the exploration of how the reader deals with the text she is correcting. Before examining her eye movements relative to her miscues, however, Judy’s eye movements for the first part of the text, where there are no miscues, are addressed.

On the first line, she fixates You, holding, and to. Although only 3 of the 7 words on this line are fixated, there are no oral omissions, substitutions, or other miscues on the 4 words that are not fixated—how is that possible? Well, through Judy’s knowledge of the text’s setting and
content, as well as her implicit predictions and expectations of what could come next in the text, she is able to sample this first line efficiently; that is, fixating directly on the minimum amount of words necessary to construct a meaning parallel to the text. The words she did not fixate are not in clear focus, but with predictable text she is able to confirm even fuzzy information to the right and left of the words that were directly fixated, as I discussed in chapter 3. The second line is similarly fixated in a straightforward way, with no regressions. It’s important to be aware of Judy’s pattern of eye movements in sections of text where she experiences no problems so we can contrast that with portions of the text where, when her oral text doesn’t match the written text, she encounters some difficulty.

As I mentioned above, the third line presents a problem for Judy. She predicts a singular subject, cook, and then deals with the consequences of that choice until she finally corrects the miscue. Below, I provide a closer look at the eye movements Judy made while dealing with that third line. Figure 7.2 presents the words Judy fixated in the third line, in the exact order she fixated them:
Figure 7.2
Judy: Order of Fixations

<table>
<thead>
<tr>
<th>the cooks come and dump gruel on your table.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. the</td>
</tr>
<tr>
<td>2. the</td>
</tr>
<tr>
<td>3. cooks</td>
</tr>
<tr>
<td>4. come</td>
</tr>
<tr>
<td>5. (between words)</td>
</tr>
<tr>
<td>6. come</td>
</tr>
<tr>
<td>7. and</td>
</tr>
<tr>
<td>8. gruel</td>
</tr>
<tr>
<td>9. gruel</td>
</tr>
<tr>
<td>10. dump</td>
</tr>
<tr>
<td>11. dump</td>
</tr>
<tr>
<td>12. gruel (between words)</td>
</tr>
<tr>
<td>13. cooks</td>
</tr>
<tr>
<td>14. cooks</td>
</tr>
<tr>
<td>15. come</td>
</tr>
<tr>
<td>16. dump</td>
</tr>
<tr>
<td>17. and</td>
</tr>
<tr>
<td>18. gruel</td>
</tr>
<tr>
<td>19. your</td>
</tr>
<tr>
<td>20. table</td>
</tr>
<tr>
<td>21. line 3 as found in the text</td>
</tr>
<tr>
<td>1. words Judy fixated and</td>
</tr>
<tr>
<td>fixation number</td>
</tr>
</tbody>
</table>

The eye movements allow insight into that correction process. Judy first two fixations on this line are on THE. The is the definite article in English and marks the noun phrase it introduces as "old information" usually already present in the text. That her first and second fixations are on THE perhaps indicates that she is bothered by what old information the article reintroduces. She then fixates on COOKS, COME, DUMP
after which she orally produces

**cook comes**

She appears to experience disconfirmation, perhaps relating to her tentative fixations on the earlier. She regresses and refixates

**come**

in order to gain more text information—remember, Judy's oral text is a combination of the print on the page and her background, expectations, and predictions. She then continues, however, with the singular subject syntactic construction she has assigned by finishing the verb phrase:

**and dumps**

As she is saying that, however, her eyes are scanning for further information, to confirm that she has created a different syntactic construction. She thus fixates on

**AND, GUEL, DUMP**

and then employs a strategy to give herself time to correct her miscues: she chooses the one word in the phrase that is immutable and thus is correct in either syntactic construction and repeats it, with a short pause following:

**and**

During her oral repetition of and and the short pause, she regresses backwards through the text, fixating key words in the phrase:
GRUEL, COME, COOKS

She then corrects the subject by uttering

cooks

and, because she is still tentative about the syntactic construction, refixates

COME, DUMP, AND, GRUEL

before finally finishing her correction by saying

come and dump gruel

Notice that after she corrects her miscues, the eye-movements relative to the end of the sentence are similar to those before the miscues: 2 of the 3 words are fixated, and there are no regressions—why? Because at this point, Judy is confident of her predictions, traveling smoothly across the text again, and there is no need for refixations, regressions, or anything else that would reduce the efficiency of meaning construction.

With miscue analysis alone, we would know that Judy corrected her miscues. But we could only infer how, and we wouldn’t have any idea how she dealt with parts of the text that she didn’t make any miscues on. By the same token, with eye movement analysis alone, we wouldn’t know why there were so many regressions and refixations in the part of the sentence discussed above. The conjunction of miscue analysis and eye movement analysis makes clear that reading is a
process of meaning making - and that miscues and eye movements are functions of comprehending.

This discussion of Judy's EMMA transcription, supported by data analyzed and explicated in chapters 3, 4, and 5, lead to five major points, summarized below.

Summary of Major Points

1. **Readers sample the text.** In contrast to claims made by some theories of reading (e.g., Adams, 1990, and Grossen, 1997), readers do not fixate on every letter or every word in a text. On the contrary, readers fixate between one half and three quarters of the words in the text. In figure 7.1, Judy fixates 68% of the words in that sentence.

2. **Both eye movements and miscues, and the relationship between them, are functions of comprehension.** The eyes do not plod along regularly through the text, but go where the brain directs them in order to gain more text information. The irregular nature of eye movements can at first glance appear haphazard until a closer look reveals that the pattern is to be found not in uniform saccades but in the readers' quest for meaning. Miscues are also not random errors but are windows into text construction and the perceptions readers form as they read. The relationship between eye movements and miscues is not casual, but is an
observable aspect of the brain's making sense of print.

3. **The eye movements relative to different types of miscues and other oral reading phenomena exhibit different patterns.**

For example, the eye movements relative to repetitions\(^1\) are characterized by the consistent phenomenon of an eye movement regression between the oral repetitions, where the final utterance of the repeated word or phrase is made only after all eye movement regressions in that area have been completed. Insertions, on the other hand, are characterized by a lower than average percentage of regressions and lower than average fixation duration in the area in which the insertion took place. That different patterns of eye movements accompany different types of miscues is an indication of readers producing different types of miscues for different reasons (such as syntactic or semantic modifications) is discussed in chapters 5 and 6.

4. **Contrary to conventional wisdom, most miscued words are examined, and examined thoroughly, before the miscue is produced.** Miscues are not caused by careless or reckless reading, or visually skipping words as some theorists maintain (e.g., Spache 1964, Harris & Sipay 1980, Dechant

\(^1\)Repetitions are usually not coded as miscues but are included here as oral reading phenomena that signal processing activity. Where appropriate repetitions have been categorized as "oral reading phenomena" to distinguish them from proper miscues.
1981, Smith 1994). Miscued words are instead usually fixated, and fixated for a slightly longer period of time on average than the other words in the text. The implication here is that miscues represent parts of the text where readers exercise their authority to modify text elements in constructing their texts, as discussed in chapter 6. As evidence from the eye movements made relative to miscues demonstrate, readers look at the text but read not what they physiologically fixate on, but what they perceive. Readers read what they think they see. Reading is a perceptual act, not simply the direct input of graphic data.

5. The findings demonstrate support for models of reading that view reading as an interactive or transactive process of meaning making. One of the reasons it is important to identify the model of reading that this research supports is that different models lend themselves toward different teaching methods and perspectives. Specifically, support for the Transactional Sociopsycholinguistic Model of reading demonstrates, by extension, support for the whole language perspective of teaching reading. And, since the research participants in this study are all college age adults, I focus on the use of the whole language perspective as it relates to adult literacy below.

Whole language is a theoretical perspective that
embodies a set of applied beliefs about learning and teaching, language development, curriculum, and the social community (Strickland, 1995). It has long been associated with the teaching of children, but is whole language a viable teaching perspective for adult learners? Its oft-contrasted counterpart - explicit phonics instruction - hardly seems an appropriate instructional strategy for the great number of adult literacy students that can read aloud quite capably but have severe comprehension problems. Yet, “like reading instruction for children, adult reading instruction engenders many controversies. In both fields the same debates rage about the whole language approach versus the word recognition, decoding, or phonics approach” (Sticht & McDonald, 1992, p. 315).

In addition to actually teaching adult learners according to whole language principles there are two main ways to measure the appropriateness of the approach. One is by juxtaposing adult learning theory with one or both of the approaches to see how much convergence there is. Lewis (1995) does this by comparing the basic tenets of whole language and andragogy, the influential theory of adult learning developed by Malcolm Knowles. The two approaches share so many parallel themes that he states “the two universes of discourse are one” (p. 4). Lewis quotes others
that have come to the same conclusion; David Kring said "as the discussion turns to WL [whole language]...I almost feel as though it is a discussion of Adult Ed foundations...." (Lewis, 1995, p. 3). These assertions of the common goals, methods, and philosophies of whole language and adult learning theory are echoed in Brockman (1994), Harns (1992), Wartenberg (1994), and Keefe & Meyer (1991).

One way, then, to judge the appropriateness of using a whole language approach in adult literacy instruction is to compare the philosophies of whole language and adult education. Another way is to provide support for the model that undergirds the instructional perspective. This study has supported and extended the Transactional Sociopsycholinguistic Model of reading. In fact, miscue analysis and eye movement research have, in their respective chapters, been shown to support the transactional sociopsycholinguistic model of reading. It stands to reason that a reading event looked at from a combination of the two research methodologies would also support the model, and indeed it does.

In figure 7.1 and the subsequent explanation, it is clear that Judy uses syntactic, semantic, and graphophonic cues to construct meaning, sampling the text more densely when she is tentative and less densely when she is
confident. She constructs a grammar to fit her expectations, self-correcting when her predictions are disconfirmed. Throughout her predicting, sampling, confirming, disconfirming, and other strategies of negotiating the text, the overriding goal as well as the end product is comprehension. Judy does not achieve comprehension by looking at each letter sequentially and allowing each word to penetrate her brain, which only then assigns meaning. Instead, she actively transacts with the text, showing that, as Goodman & Goodman (1994) explain, "...the brain is the organ of human information processing...not a prisoner of the senses, but controls the sensory organs and selectively uses their input..." (p. 107).

The explanation of Judy's miscues in figure 7.1 using EMMA methodology and the research findings reported and interpreted in chapters 2-6 shows support for the Transactional Sociopsycholinguistic Model of reading. By demonstrating support for the model that is expressed pedagogically through whole language, this study supports an instructional implication: the whole language perspective of literacy instruction is wholly appropriate for adult students.
Areas In Need of Further Exploration

In this section I discuss findings that, either due to their tangential nature regarding the focus of this dissertation or the lack of high instances of observation in nine readings used here, were not focused on. These areas appear promising, however, and deserve further attention in a subsequent study.

1. Although texts are not read aloud or, conceivably, perceived as an incoherent, non-grammatical hodgepodge of words, eye movement records nevertheless show definitively that texts are sampled non-sequentially. Figure 7.3 shows an example of this:

Figure 7.3
Barry’s Eye Movements in a Sentence with No Miscues

<table>
<thead>
<tr>
<th>line</th>
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<tbody>
<tr>
<td>211</td>
<td></td>
</tr>
<tr>
<td>212</td>
<td>first they thought that perhaps the wife had come back and</td>
</tr>
<tr>
<td>183</td>
<td>2</td>
</tr>
<tr>
<td>217</td>
<td>1</td>
</tr>
<tr>
<td>150</td>
<td>3</td>
</tr>
<tr>
<td>167</td>
<td>4</td>
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<td>400</td>
<td>5</td>
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<td>9</td>
<td>6</td>
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<tr>
<td>610</td>
<td>10</td>
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<td>7</td>
<td>8</td>
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<td>11</td>
<td>12</td>
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<td>217</td>
<td>217</td>
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<td>250</td>
<td>250</td>
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<td>150</td>
<td>150</td>
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<td>300</td>
<td>300</td>
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<tr>
<td>133</td>
<td>133</td>
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<td>333</td>
<td>333</td>
</tr>
<tr>
<td>267</td>
<td>267</td>
</tr>
<tr>
<td>213</td>
<td>was secretly living there.</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>350</td>
<td>350</td>
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<tr>
<td>750</td>
<td>750</td>
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<tr>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>217</td>
<td>217</td>
</tr>
</tbody>
</table>

Barry produced no miscues in this sentence, reading
At first they thought that perhaps the wife had come back and was secretly living there.

His eyes, in contrast, fixated this sentence like this:
At they first thought thought that wife had come the wife come and
SECRETLY LIVING SECRETLY THERE.

The reader's eyes fixated the sentence in a way that seems to produce syntactic nonsense, but he nonetheless read the sentence aloud as it was written in the text. This is further evidence that reading is not a process of word-by-word recognition but is a process of meaning making. Of interest in examining EMMA records of text where there are no miscues would be an exploration of patterns of eye movements and how they relate to different syntactic and semantic patterns inherent in the text. While this first suggested area is actually very important to the understanding of how texts are sampled by the eyes, it was not dwelled on in the body of this dissertation because the most interesting aspect of this phenomenon does not include miscues, the stated focus of this study.

2. The total time duration is the sum total of all fixations at any time on a given word, including regressions, multiple fixations, and refixations. As Rayner and Pollatsek (1989) point out, "This measure assumes that the regression [which enabled the word to be refixated] was made in order to continue processing the word in some way" (p. 116). One problem with measuring processing time by total time duration is that an inflated time may not be an
On line 303, he fixates *fell* and the second *more*, then refixates *the* in the previous line. His substitution of *that* for *the* in line 302 is probably the reason he regresses to *the*. After the regression, he refixates the same *more* he fixated before his regressive sequence, giving *more* a total time duration of 634 ms. It is doubtful that this extra time reflects continued processing of the word *more*, especially as the reader did not need even a single fixation to process the first *more*. Rather, refixating *more* reflects Barry's use of the word as a place holder - a portion of the text that he is familiar with and can revisit as a springboard to continuing the rest of the sentence once his regressive sequence is complete. The focus should not be on
the word level, then, because looking at a word twice may not signal processing difficulty of that word at all, but of another portion of text altogether. Reading is not as simple as identifying the words in the text, and eye movements should not be interpreted as signifying word identification only.

3. Barry's example in Figure 7.4 brings up a number of issues that show promise for further research. For example, his regression to the syntactically and semantically acceptable miscue of that for the was followed by a pattern of fixations and regressions that reflects his pattern on the text as a whole; 46.6% of the words are fixated with 11.11% of fixations being regressions (overall, Barry fixated 59.47% of the words in the text and regressed 7.87% of the time). However, in another sentence, Barry makes and corrects a miscue that is syntactically and semantically unacceptable and in that sentence fixates more words 65.71% and makes more than twice as many regressions (20%) than his average for the text as a whole. This is only one example, but it raises the questions: After a regression to a miscue, are there more subsequent fixations and regressions on the rest of the sentence if the miscue was syntactically/semantically unacceptable than if the miscue
was syntactically/semantically acceptable? and does it matter if the miscue was corrected? Such examinations would further inform the idea that when readers sense trouble or disequilibrium, they sample from the text more, and make more tentative regressions; that when readers have less non-visual understanding they need more visual information as a supplement to find equilibrium (after Smith, 1994).

4. In Figure 7.4, Barry explicitly corrects the miscue that he regressed to. But what if he had not orally corrected the miscue - would it be obvious that he was cognizant of the departure from the published text? For example, in Figure 7.5, Mike omits As and does not correct it:

(As explained in chapter 3, the letters indicate an intra-line regression; on the second line Mike fixated FELL, IT, and MORE, then refixated RENT, ONE, and AS on the previous line.) So although he does not verbally correct his miscue,
Mike regresses and refixates the omitted word. This raises the question of whether the reader implicitly corrected the miscue. By the time Mike reaches the second line and fixated FELL, IT, and MORE, he realizes that his parsing of the sentence will not work, and he backtracks to find the point of his departure from the written text, fixating FIRE, ONE, and AS. Is this an implicit correction? Probably, but without explicit verbalization on the reader's part there is no way to be sure. One avenue of investigation would be to combine EMMA with a retrospective technique so the reader's thoughts would inform the debate.

5. In eye movement literature it is rarely pointed out that eye movements vary not only horizontally within a word, but also vertically. The assumption is that whether a fixation is on the top of a letter or on the bottom of a letter does not alter the fact that that word was fixated. In Figure 7.6 the vertical as well as horizontal location of Sam's fixation points for the sentence The same thing is happening with blue corn tortillas are represented:
Notice that just as the fixations are not squarely on the center of each word horizontally, neither are they on the center of each word vertically. An interesting study would be an examination of whether readers place fixations on the top half of letters when that area is more helpful for disambiguation than the lower half. For example, the tops of the letters t and r are more informative than the top halves of the letters b and q.

The vertical variability of fixations helps explain certain types of miscues. In his 1975 article, Goodman pointed out that many observed responses can be found in the text, within foveal, parafoveal, and peripheral view of the miscued word. In Figure 7.6 this is the case - Sam’s insertion of the takes place on the line directly above an area where the text item the is located. And notice that the reader’s fourth fixation is approximately equidistant
both horizontally and vertically from the area of his miscue and the area of the identical text item on the subsequent line. Sam could see the the on the line below the line he was reading and used that information to make a syntactic change to his constructed text.

Conclusion

Eye Movement Miscue Analysis (EMMA) methodology provides a more in depth and complete picture of the reading process than either eye movement analysis or miscue analysis alone. This study has resulted in findings that resolve some misconceptions about the reading process, provide insight into how readers comprehend text, and provide educational implications. However, this study has only begun to scratch the surface of research possibilities that utilize EMMA methodology. For example, younger readers need to be studied; how do their miscue/eye movements relationships differ from adult readers? What do the eye movements of younger readers demonstrate about how they negotiate text that is interwoven with illustrations? Also, the relationship of second language learners' eye movements to their miscues should inform second language reading theory and education. The possibilities are vast; Eye Movement Miscue Analysis methodology presents research and learning possibilities for scholars from a myriad of
perspectives, including pedagogical, andragogical, linguistic, psycholinguistic, second language acquisition, and, of course, reading education.
APPENDIX A: Waterford Ghost’s Revenge .......... 280
APPENDIX B: Frugal Gourmets ...................... 283
APPENDIX C: Eye-Miscue Coding Form ................ 286
APPENDIX D: Interview Form .......................... 287
APPENDIX E: ASL 4000SU Eye-Tracker Schematic .... 289
APPENDIX A: Waterford Ghost's Revenge

APPENDIX B: Frugal Gourmets

Appendices A and B are the texts the participants in this study read. In order to fit prescribed margin formatting requirements of this bound dissertation the texts' point size has been reduced from 22 to 16. However, the font and line and page breaks are intact.
Waterford Ghost’s Revenge

It’s not often that a ghost has a chance to get back at people still alive, but near Waterford, New York, there was supposed to have been one which did just that. The ghost’s revenge took place about 1900.

At that time, near the end of a barge canal, there lived a carpenter. He was poor and sick with tuberculosis, but he still worked hard to support his wife and two children with earnings from odd jobs about the village.

Unfortunately, his own parents were particularly selfish, cruel and mercenary and demanded that he will them his house and property, which in case of his death would have gone to his wife. This, of course, the carpenter refused to do. Shortly before he did die, he warned his parents that if they did anything to harm his family after he was gone, he would come back and haunt them as long as they themselves lived. He would see to it, he said, that they would never make any profit from his house even if they did get it away
from his wife.

As soon as their son had passed away, the parents undertook legal proceedings and did obtain possession of the property, evicting the impoverished wife and youngsters. The house was run down, but usable, and they hoped to rent it rather quickly. So they closed the blinds and waited for a tenant. But no tenant ever rented it, for presently discouraging things began to happen.

Some of the neighbors, passing the empty house late at night, soon noticed lights shining between the shuttered windows and from between loose boards along the sides. At first they thought that perhaps the wife had come back and was secretly living there. They had liked the wife, and so did not investigate too carefully.

However, the lights continued to wave about and flicker from within, far too mysteriously for their comfort, and they began to cross the road when they passed that way after dark. Rumor spread that the son had indeed come back to
make good his promise to keep the parents from making any money from the cottage. As no one wanted to rent the place it fell more and more into ruin. Even in its last years, when it was completely untenantable, the mysterious lights could be seen still.

The greedy parents nevertheless kept trying to rent or sell the place. No one would listen to them. The lights continued showing right up until the day when, with a muffled crash and a cloud of dry dust, the sagging roof finally fell in and the tottering walls collapsed into the cellar hole. Only then did the lights vanish, never to return.

No one could explain the mysterious lights, but many neighbors felt sure that the Waterford ghost had had its revenge....
In this age of nouvelle richesse, even food is subject to abrupt changes of status. Take polenta, the cornmeal mush often served with beans and sausage floating in it. An Italian peasant food whose primary virtue has traditionally been that it would stick to farmers' ribs during winter, polenta recently made an appearance on the grand stage of American cuisine. Eager diners at Manhattan's Le Cirque 2000 eschewed the restaurant's famous paupiette of black sea bass in Barolo wine sauce for the chance to have a large portion of the yellow gruel dumped directly on their table, just as poor Italian families used to do.

"More and more lower-social-status foods are making their way up the social scale," says nutritional anthropologist Solomon H. Katz, Ph.D., of the University of Pennsylvania. "The same thing is happening with blue corn tortillas. It used to be the other way around--the lower classes wanted what the upper classes had. But the farther up on the social
scale we get, the more secure we are in reaching down.” For Le Cirque 2000 chef Marc Poidevin, it all makes sense: “When the wealthy have tried everything else, they start expanding to the foods of the poor. They get bored and figure, ‘How bad could it be?’”

This is not the first time foods have followed the American dream from staple to delicacy. Lobster and salmon were once eaten only by indentured servants. At the turn of the century, caviar was so easy to get that it was given away in bars, like peanuts. Some theorists point to heightened health consciousness to explain the trend, but Betty Fussell, food historian and author of *I Hear America Cooking*, sees it as a perfect illustration of the irrational nature of class distinctions. “They’re often totally arbitrary, and never more so than right now in our celebrity culture. Look at Wolfgang Puck. He turned pizza into a high-end food by getting rich and famous people to eat it.”

For those used to expensive food, the experience is a form
of gastronomic slumming. "You sit there holding on to this extremely ornate silver spoon," says one recent diner, "and the cooks come and dump gruel on your table. You taste it and then instantly wish you were at a red-and-white-checked table in Italy, with a big peasant family in the background. You almost want to eat with your hands."

Forgotten amid the celebrations of those that reach the top, however, are those foods once considered A-list that have since fallen on hard times. Like parsley. Once a sign of gentility and used as a garnish, parsley has become so declasse that upscale eateries rarely place it on their dishes any more. "If you’re served a plate with parsley on it," says Fussell, "you know you’re not at Le Cirque."
**EYE-MISCUE ANALYSIS CODING FORM**

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<th>Eye-Miscue</th>
</tr>
</thead>
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<td></td>
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<table>
<thead>
<tr>
<th>TOTAL MISCUES</th>
<th>TOTAL WORDS</th>
<th>MPHW</th>
</tr>
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<tbody>
<tr>
<td>a + b</td>
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<td>a x b x 100</td>
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<table>
<thead>
<tr>
<th>Reader</th>
<th>Selection</th>
<th>Other Info/Date</th>
<th>Text</th>
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</table>

<table>
<thead>
<tr>
<th>a. TOTAL MISCUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. TOTAL WORDS</td>
</tr>
<tr>
<td>a + b x 100 = MPHW</td>
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</table>

<table>
<thead>
<tr>
<th>first pass fix duration</th>
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</tr>
</thead>
<tbody>
<tr>
<td>regression (# of regress) fix dur.</td>
<td>B</td>
</tr>
<tr>
<td>gaze duration</td>
<td>C</td>
</tr>
<tr>
<td>part of speech: OR/ER</td>
<td>D</td>
</tr>
<tr>
<td>multiple fix, forward: (#) dur.</td>
<td>E</td>
</tr>
<tr>
<td>multiple fix, regress: (#) dur.</td>
<td>F</td>
</tr>
<tr>
<td>fovea (1) parafovea (2) periphery (3)</td>
<td></td>
</tr>
<tr>
<td>Syntactic Acceptability</td>
<td>1</td>
</tr>
<tr>
<td>Semantic Acceptability</td>
<td>2</td>
</tr>
<tr>
<td>Meaning Change</td>
<td>3</td>
</tr>
<tr>
<td>Correction</td>
<td>4</td>
</tr>
</tbody>
</table>

**Meaning Construction**

- **No Loss**
- **Partial Loss**
- **Loss**
  - **Strength**
  - **Partial Strength**
  - **Overcorrection**
  - **Weakness**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
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<tr>
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<td>4</td>
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</table>

**Graphic Similarity**

<table>
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<tbody>
<tr>
<td>5</td>
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</table>

**Sound Similarity**

<table>
<thead>
<tr>
<th>Sound Similarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

**Notes**
APPENDIX D: Interview Form

Name______________________ Age______ Date__________ Sex______

Ethnic Group______________ Occupation (if Student, which grade/year)______ Right or Left handed__________

Education (last degree or grade achieved)______ Where did you go to Elementary School?__________

1. What type of reading do you like to do? Specific subjects, books, magazines, newspaper, etc.

2. In one sentence, what is "reading?"

3. Do you consider yourself a poor, fair, or good reader? Why?

4. When you are reading and you come to a word you don't know, what do you do?

5. How did you learn to read?

6. When you read, do you hear a "voice in your head" or does the meaning of the words just "pop" into your head?

7. Have you ever read a paragraph or a page, then realized you had no idea what you just read because you weren't paying attention? What was that like?

8. Do you speak more than one language? (If yes, answer A-D, below).

   A. What languages do you speak?

   B. Which is your "best" language?

   C. What language do you speak at home?

   D. What language did you grow up speaking?

   E. Are you "bilingual?"
9. Do you enjoy art and/or music? Which one do you enjoy more? Do you play a musical instrument or draw, paint, sculpt, etc.? Be specific:

10. What kind of hobbies do you enjoy?

11. What is (was) your favorite subject in high school?

12. If you could only pick one method of studying, would you rather be able to read the material or be able to have someone tell you the material? In other words, do you like to see new information, or hear it?
APPENDIX E: ASL 4000SU Eye-Tracker Schematic

Schematic Diagram of the Applied Science Laboratories 4000SU Eye-Tracker System

(From http://radiology.arizona.edu/-eye-mo/recordingsyst.html Reprinted with permission of Elizabeth Krupinski)
REFERENCES


http://webcom.com/center/30years/30years.html


