

SILENT, ORAL, L1, L2, FRENCH AND ENGLISH READING  
THROUGH EYE MOVEMENTS AND MISCUES

by

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SIGNED: Kathleen O'Brien de Ramirez

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## ABSTRACT

During 24 silent and oral readings of Guy de Maupassant and Arthur C. Clarke short stories (1294 and 1516 words) by proficient multilinguals, movement of the left eye was tracked and utterances were recorded. Three hypotheses investigate universality in the reading process: reading in English is similar in reading speed, miscues, and eye movements to reading in French (chapter 4); reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a second, or later acquired, language (L2) (chapter 5); silent reading is similar to oral reading in reading speed and eye movements (chapter 6). Hypotheses are partially confirmed; implications are drawn for teaching and research.

Silent reading is consistently faster than oral reading, with a mean difference of 28.7%. Reading speed is similar in English and French, but interacts differently with language experience: L2 readers of English read 50% slower than L1 readers, while in French, L2 readers read 13% faster.

Retelling scores demonstrate a slight comprehension advantage for oral reading over silent, a wider range after oral than after silent, L1 readers having a slight advantage over L2 readers, and improved scores after second readings. Proscribing rereading to increase oral accuracy may disadvantage some readers: Second oral readings in English (but not in French) produced more miscues than first oral readings. This requires further study with tightly controlled groups. Overall, English readings produced 36% more miscues than French readings.

Mean fixation durations are slightly longer during silent than oral reading, and show little variation between English and French reading. Wide variation in reading speed (L1/L2, silent/oral) is not reflected in mean eye fixation durations, although language dominance show an effect in French, where fixations during L1 readings are 18.6% shorter than during L2 readings.

Individual variation is a factor. Emotional affect, poetic style, construction of syntax, and attention to metaphor are all observed in this EMMA data. Future analysis of this database may look at anaphoric relations, metaphor, how texts teach; and how readers develop narrative, syntactic, semantic, and pragmatic relations in complete textual discourse.

## CHAPTER 1: READING WITH A MULTILINGUAL EYE

The aim of the descriptive analysis presented herein is to provide a view of the reading process as it occurs; capturing individual readers' visual and vocal responses to two complete short stories in their original English and original French. The first goal of this baseline investigation was to create a triangulating database representative of reading in multilinguals by tracking readers' eye movements during silent and oral reading sessions and by recording oral performance during reading, unaided retellings, and demographic interviews. The focus arose from theory that reading is a universal process. (Goodman, K. S. 2003a)

Twenty-six readings of complete short stories produced sizeable data sets for investigation of three potential areas of universality: a) text language: English and French, b) reader language: L1 and L2, and c) silent and oral reading tasks. There are fourteen readings in English and twelve in French; twelve in the readers' native or maternal language (L1) and fourteen in the readers' nonnative or second language (L2); thirteen silent readings and thirteen oral readings.

Analysis is initially descriptive, outlining central tendencies in an attempt to identify and ultimately compare both individual and common processes during the silent and oral reading of two distinct modern alphabetic languages by proficient adult readers. This chapter introduces the study and its relevance to contextualized reading by multilinguals. Chapter two provides an overview of some of the pertinent literature in the fields of second language acquisition, reading, and eye tracking. Chapter three describes the design, subject selection, materials, equipment, and procedures. Chapter four

compares descriptive statistics (reading speed, post-reading unaided story retelling scores, miscues, and eye movements) surrounding English reading sessions and French reading sessions. Chapter five compares these same dependent measures (reading speed, holistic retelling scores, miscue frequencies, and fixation durations) during first language reading (L1) and second language reading (L2). Chapter six compares silent reading with reading aloud. Chapter seven draws implications for teaching, rough conclusions about multilingual and silent and oral reading, and suggests areas of further research derivable from this database, as well as some of the limitations of this study. Appendices follow, containing subject recruitment and protection information in Appendix A; and the complete original short stories, the retelling guides which I created to verify reader comprehension, as well as a translation of the French legend in Appendix B.

### Reading, a Complex Language Process

Full-context authentic reading is the living representation of the reading act. Independent of the contextual variety in which normal reading occurs, components of reading, including word recognition/lexical access and sentence comprehension, are commonly observed in isolation from their full literary environments. Through controlled experimental designs such as picture naming, masked priming, and word recognition tasks; using brain imaging, eye tracking, and reaction times, researchers have attained numerous, detailed, linear understandings of isolated processes associated with reading.

Decontextualized findings have been generalized as justification for unfounded claims about reading in classrooms and real-world settings. Contextualized reading

involves more than a series of isolated mechanical processes matching sound to print. And fluent reading involves more than automating those processes. Reading is thought. With practice, some aspects become fast and automatic, but others require slow cognition. Incomplete representations cannot compositionally create complete systems.

One may argue that everything in existence, every action and every thought, must be composed of the sum of its parts. It is certain that if we could create all the parts of a tree we would build one rather than waiting for it to grow. Reading is language; and like the living organisms which create it, is the result of complex interactions of countless features. Like a tree, it takes time and multiple, contextualized exposures to a variety of conditions to grow a reader or a language user.

In the absence of concrete proof of how languages (and reading) are mastered, instructional programs in second language acquisition and literacy education (driven by marketing of products and materials, technological advances, as well as social, administrative, and financial pressures for quantification and accountability) embrace false assumptions that isolated and scattered component skills practiced repeatedly in a mostly arbitrary order-of-acquisition sequence, will either lead to, or are equivalent in value to, contextualized comprehension.

Extreme views even consider reading as separable and altogether independent from meaning and comprehension; measuring a child's reading skill through accurate pronunciation of lists of non-words. This morning I sat with two young English monolinguals (ages 2 and 6) and spoke several contextualized utterances in French while we played. They responded positively to the novelty, and repeated or created several

words and sounds, creating their own nonsense sentences imitating French phrase intonation and nasal sounds, prosodic features which are foreign to English but correct for French babbling.

This whole language (i.e. contextualized and complete) approach is similar to communicative pedagogies, which have grown in second language acquisition classrooms over the past several decades. The presentation of fully contextualized language is distinct from phonics training and skills-based grammar methods; and therefore neither method sufficiently replaces the other. Modern classrooms are often overcrowded and pressed for time. The art and joy of teaching and the individual and interactive aspects of learning have recently been sacrificed to quantifiably scripted lessons. Novelty and variety are principal elements in all human learning, and thus no one method in either research or pedagogy is ever universally sufficient. Yet we continue to put our faith in the silver bullet.

While skill building is an important aspect of gaining proficiency as a language user/reader, particularly if the method builds user confidence and creative freedom; skills alone are not the answer to skilled reading. We do not yet (and may never) possess a solid grasp of the myriad of complexities involved in the cognitive, linguistic process of reading. Mastering the parts of this elephant might never lead us to a fully functioning reproduction of the glorious creature itself.

The condition described by Vernon in 1985 continues: “Despite the years that have been spent teaching and researching reading, the basic process is still not

understood...In other words we still do not know what happens when a human being thinks.” (p. 21).

The complex processes involved in reading are inseparable from language, inseparable from thought itself. Discussing the child’s success in constructing an internalized grammar, Chomsky (1976/2006) reminds us that the child is “developing knowledge that is very complex, that cannot be derived by induction or abstraction from what is given in experience.” (p. 118). This complexity encompasses the use of language in the reading process. The magic of these intangibles, the black box of reading, has spurred my interest in contextualizing the study of reading. My goal is to apply the psycholinguistic methods of eye tracking and miscue analysis to full text reading events so as to capture authentic reading in a database reflective of natural reading.

Reading has often been compared to listening as a receptive language activity. Reading is similar to listening in that both involve interpreting messages received from an external source. There is at least one demonstrated difference between reading and listening: the orthographic encoding activity discussed by Carr and Posner (1995) in findings regarding brain activity during reading. Through positron emission tomography (PET, a functional imaging technique), they identified a region of the brain which is activated during reading, but not during listening: “...this left-medial prestriate site is only active during reading, producing no response to auditorily presented words...a specifically *orthographic* encoding mechanism- it is the structure we call the prestriate visual word form system.” (p. 275).

Orthographic encoding is a requisite feature of both silent and oral reading of alphabetic text. By assembling the fragmented images, which the eyes pick up when fixated, into thoughts guided by existing experiential knowledge, a reader creates or recreates the story. Orthographic encoding is only the beginning of the complex processes involved in comprehending meaningful text. High expectations for our readers require a myriad of exposures to complex, challenging, and novel reading environments.

An extensive amount of information has been discovered about how humans read. Investigations have focused on the physiological aspects of reading using brain imaging techniques, the textual influences through discourse analysis, and the evaluation of comprehension, vocabulary learning, and word recognition, as reader products. For more than a hundred years scientists have been observing how information on the page becomes intake to the reader via the eyes.

Early studies, such as those by Huey (1908/1968) or Buswell (1920, 1922, 1937) looked at reading paragraph or longer-length texts. More recent studies however have often restricted focus to nonwords, words, characters or sentences. Examination of a complex psycholinguistic act, as is reading, has logically mandated control through clear definition of a single, de-contextualized element. Conclusions are then drawn based on statistical averaging across numerous readers of minute elements of text. These de-contextualized findings however may represent neither authentic language use nor common reading.

Additionally, comparing these findings across studies, across languages, and across disciplines is difficult. Theoretical orientations differ within and between fields

and dictate specific procedures, which influence outcomes and interpretations. Solid findings have sometimes been misinterpreted and used to justify tenuous practice.

This study therefore broadens the focus to full text reading; to the complex environment of redundancy, innuendo, hypothetical-real, dialect, and ambiguity, because no part of any language process exists in isolation. Jakobson and Waugh (2002) while explaining the vital existence of every distinctive feature in spoken language, caution against inquiry in isolation:

In the process of communication, none of these features remains insignificant or immaterial. The obsolete but recurrent view of a phonetic description of articulatory and physico- and psycho-acoustic phenomena as one which disregards their role in language and their communicative significance not only inhibits inquiry, but above all arbitrarily suppresses the fundamental question of the manifold goals that these phenomena pursue. (p. 32)

Jakobson and Waugh were specifically addressing the composite elements of acoustic phonology present in spoken language rather than reading (see p. 74) the complexity, intricacy and requisite nature of each and every linguistic element holds true for written speech (text) as well.

### *Interdisciplinary Integration*

Starting from a holistic perspective and attempting to capture the ongoing synthesis of multiple cognitive processes is an endeavor with its own serious drawbacks. The problem of data complexity is highlighted by Singleton (2005) in an explanation of why research to date has mainly concentrated on identifying component skills:

“measuring higher levels of processing is difficult, whereas measuring word decoding is comparatively easy” (p. 7). This same explanation may account for quantitative movements toward the establishment of sometimes-arbitrary standards in educational assessment, particularly in regard to reading.

The baseline dataset created in this study draws its initial structure from four different disciplines: 1) Eye tracking requires expensive technology traditionally available primarily in medical schools and Psychology departments. 2) Miscue Analysis (Goodman, K.S., 1965, 1982) has developed as a low-cost, user-friendly taxonomy; a framework for understanding reader reaction to complete text, and has primarily been implemented in Education departments. 3) Analyses of spoken utterances while reading aloud and written texts both rely on several branches of Linguistics. 4) The complete short stories used as stimuli in this study are drawn from authentic Literature.

Broadly sanctioned, interdisciplinary research is rare, often leading to complex investigations precariously balanced between opposing theoretical camps. Traditional research encourages isolated scribbling of massive formulas and complex explanations on parallel whiteboards, unwittingly duplicating findings from other fields and leaving large gaps of unexplained blank zones within and between the disciplines. These blank areas remain the under-investigated regions where the magic of authentic language and the magic of real reading happens. This is where interdisciplinary communication and deep, contextualized research becomes essential.

Both compositional and holistic orientations are independently insufficient, premature, and incomplete. We can neither possess a clear understanding of every

element involved in reading nor fully grasp the harmonious symphony of ongoing cognitive interactions. Yet, by looking at the phenomena from multiple perspectives and through interdisciplinary conversations, an integrated picture may eventually evolve. This work is offered as part of that growing conversation.

As noted by Bernhardt (2005), “second language reading is a critical area for research and scholarship well beyond the borders of applied linguistics” (p. 133). I have therefore accumulated experience and training not only in second language acquisition, but in psychology, linguistics, anthropology, education, English, French, Spanish, music, literature, business and immigration law. I have spent a dozen years in the classroom as a master teacher, directing, observing, and advising students, colleagues, and school administrators. My interdisciplinary background has yielded experiences and beliefs of language-learning as a multifaceted, complex, and sometimes, as Smith (2003) describes reading, a “subversive activity” (p. 87).

#### *Orientations, Preparations and Pilot Studies*

Nourished within a thriving Graduate Interdisciplinary Program in Second Language Acquisition and Teaching (SLAT) at the University of Arizona, I learned from renowned theorists and researchers in all areas of linguistics, education, literacy, literature, cognitive science, statistics, second language acquisition, visual processing and speech production. My preliminary research included topics of code-switching, educating linguistic and cultural minorities, foreign language pedagogy and assessment, second dialect acquisition, cross-linguistic picture naming, investigations of high/low

attachment in sentence parsing, and masked priming using DMDX (Forster & Forster, 2003).

In learning about reading, I became the Coordinator of Graduate Research at the Eye Movement Miscue Analysis (EMMA) laboratory under the direction of professors Dr. Kenneth S. Goodman and Dr. Yetta M. Goodman, in the Department of Language Reading and Culture, within the College of Education at the University of Arizona. Technical Director, Dr. Joel Brown, and the previous Coordinator, Dr. Koomi Kim, taught me how to collect eye movement and miscue data during reading events using an eye tracker and video recorder, the operation of which is described in Chapter 3. I had numerous opportunities for pilot studies using EMMA with young readers of various language backgrounds as an assistant in the CATS Literacy Lab under the direction of Visiting Professor Dr. Dorothy King.

Spurred by this interdisciplinary methodology, my interests in multi-literacy led me to design collection strategies to generate reading corpora and descriptive analyses of silent and oral reading in English, French and Spanish (O'Brien de Ramirez & Goodman, 2005). In some of those studies I began working with the English short story, *Feathered Friend*, written by Arthur C. Clarke a well published and well known English science fiction writer who was born in 1917 and died in 2008. This tale later became one of the two stimuli in this dissertation research.

In the pilot studies I looked at narrative questions in the text such as personification of one of the principle characters, a bird,. I investigated some effects of word frequency, particularly with uncommon names like Claribel and Sven. I compared

the effects of named characters in the English story to allegorical characters (the devil and a saint) in the French tale, *La Légende du Mont-St-Michel* by one of France's most well-known storytellers, Guy de Maupassant, and to everyday common personalities (allegories) with no individual names as in a Spanish-language short story by Latin American author Juan José Millas entitled *El Hombre que salía por las noches* .

From a pedagogical perspective, questions arose as to how reading is measured; what are the essential components that educators or readers use to evaluate whether reading has occurred? Does reading speed vary when reading different languages? Do second-language readers produce miscues differently than first language readers when reading the same texts; and if so, do they pattern together, or are miscues individual variants unrelated to reader's language or the language of the text? Text analysis, discourse analysis, and Interlanguage studies (Selinker, 1972, 1992) reveal patterns in language production. A corpus of eye tracking data related to authentic text is essential for understanding these links.

The standard belief is that oral reading precedes silent reading. Despite Edmond Huey's early arguments for the efficacy of silent reading (1908, 1968), oral reading is usually emphasized, taught and evaluated in elementary schools. I disagree with these modern practices based on an assumption of primacy of oral reading, as is iterated by Jakobson and Waugh who claim that "the first stage of learning to read is reading out loud, and that the internalization of reading is a secondary, later process" (2002 p. 75). Physiologically, before one can utter an oral output corresponding to written text, a reader must first undertake a silent (speechless) perception process of the text (here measured by

eye movements). What is first seen becomes an internal observation and is reprocessed as an impetus for speech. Silent reading (creating an internal representation in response to external stimuli) must always precede oral reading. If the internal representation does not exist, there can be no oral response generated from it.

*Silent Reading: Kenny and JOE*

Two pilot studies lead to the research reported here by convincing me of the importance of silent reading and of EMMA+ technology.

*Kenny*. This wonderful young reader taught all of us in the CATS Literacy Lab a lot about reading. His concerned teacher and parents had referred him to our clinic because he would not read aloud in class, and thus they were convinced he was not learning to read. I invited him to the EMMA laboratory where his tutor chose a picturesque version of the classic tale, *Goldilocks* for him to read while I tracked his eye movements. A few pages into the reading, his tutor made an effort to halt the session because the child was using the computer mouse to turn the pages of the PowerPoint text, but was not verbalizing in any way. The common assumption to that point had been that Kenny, age six, was not reading.

Instead, I gestured to the tutor to follow the child's eyes on the video monitor, it was clear that he was moving in a proficient reader's way through the text. His eyes fixated an appropriate amount of words, returned line by line, looking occasionally at the pictures, regressed occasionally to view certain words or images and returned from the bottom of the page to the top of the next page which each page turn/mouse click. Kenny

was allowed to finish the reading. Then we asked him to “retell” the story, and he recounted the tale in much detail.

Without the eye tracking evidence, an observer may have claimed that Kenny was pretending to read, that he was just going through the motions of reading; and then retelling the story from memory of prior experience with this familiar fairy tale. Indisputably his eye movement record showed his eyes jumping from the word bear to the picture of a bear, and from the word porridge to its corresponding picture of a bowl. He was doing exactly what Duckett’s first grade readers had done in 2001, yet he was producing no oral output to authenticate his act. At the end of his session I praised him for being such an excellent silent reader. Weeks later his tutor commented on his excellent oral reading progress: He began reading aloud, as a secondary function to silent reading. His parents were very pleased, and by the end of the semester he had won the award for the most-improved reader amongst his peers. His literacy tutor and reading teacher did not teach him to read using phonics drills; they recognized that he was reading internally and created a safe and rewarding environment for him to risk reading aloud.

Economically and politically, silent reading has fallen out of favor in the United States. Pressures towards standardized education has undermined authentic reading, and in this last quarter century, many dedicated educators have left the profession. Those remaining are increasingly pressured by controversial federal and state standards and program mandates. Their professionalism is increasingly jeopardized by growing movements towards scripted lessons and externally-accountable, quantitative restrictions

on teacher and learner products. The economic goldmine which drives the testing craze has steered teachers away from areas where the individual, internal magic resides and forced them to focus of measurable characteristics alone. It has encouraged teachers and parents to assume that a child who does not perform a measurable oral reading is not reading at all.

The average classroom teacher has no access to an eye tracker to see that his or her students are actually reading. Legislation such as The Reading Excellence Act of 1998 mandated phonics lessons in all federally funded classrooms, pushing teachers and students further away from the probable successes of silent reading as advocated by Huey ninety years earlier. In this high-stakes environment a young reader like Kenny, who has brilliantly learned to read silently without first verbally producing phonetic articulation as a measurable sign of text comprehension, risks the failure of being labeled a non-reader.

*JOE.* The second outstanding EMMA demonstration of reading for meaning rather than simple word calling came to me via a reader who was at the opposite end of his reading career from Kenny. When I met JOE he was sixty years old and had already spent four years recovering from a stroke and ensuing left brain surgery to control extensive bleeding in his left parietal lobe. Joe cannot see in the right visual field of either eye and has impairment in the muscle functioning on the right side of his body. He is able to ride a motorcycle and took particular pride in that ability when the technicians who performed magnetic resonance imaging on his brain responded with shock upon seeing the extent of his damage. On a recommendation from the psycholinguist Dr. Merrill Garrett at the University of Arizona, who is well versed in aphasic issues, I

referred JOE to Dr. Pélagie Beeson, a specialist in adult language disorders in the Department of Speech, Language, and Hearing Sciences at the University of Arizona, and JOE began working on ways to navigate his severe aphasia. He asked me if I could help him learn to read again; that he had loved reading and felt frustrated at no longer being able to do so.

Knowing that both Strauss (2005, 1999) and Garcia Obregon (2002), under the direction of Ken Goodman, had worked with aphasics and their impaired literacy practices, I asked JOE if he would like to come into the EMMA lab and read some of the first-grade picture books that Duckett (2001) had used with emerging readers.

Although fairly fluent in his freely generated speech, JOE had difficulty producing even simple words like “saw” which came out more often as “was” when reading the repetitive narration in *I Saw a Dinosaur* (Cowley, 1988). Suffering from anomia, he struggled to produce words. He was convinced he was no longer able to read, yet when his eyes arrived at “I saw an elephant...” his eye fixated on the phrase, then he exclaimed “Oh, that’s my favorite!” His eye then fixated on the picture of the elephant and he beamed. His eye movement record clearly showed that he looked first at the word elephant and then at its picture. He demonstrated with his eyes what his voice was not able to pronounce: that he understood the meaning of the text; that he was reading silently despite an inability to read aloud.

Syntactically, he demonstrated continuing internal structures in his English L1 language with comments about the text; expressing frustration that in the picture book

*Cat and Dog*, there was never a “the” in front of the word cat. “It’s supposed to be the cat, isn’t it?” he said.

*Eye Movement Miscue Analysis (EMMA)*

Buswell called eye movements “symptoms of the process used in reading” (1937b, p. 8). Both eye movements and miscues are on-line, observable reading behaviors. Both occur in linear relation to a text stimulus. The difference between the two is what makes their combination potentially fruitful: Eye fixations reflect the reader’s search for cognitive input to meaning construction, while miscues in their traditional uses in research and pedagogy are speech events which reflect the meaning a reader is constructing as output. Using EMMA (Paulson, 2000, 2001; Paulson & Freeman, 2004) these two methodologies are recorded simultaneously, creating an integrated record of the reader’s comprehending processes.

EMMA, as an interdisciplinary research methodology, draws principally from the fields of literacy, speech production, psycholinguistics, and language acquisition. In 1963, Ken Goodman developed Miscue Analysis as a method for observing the reading process (Goodman, 1969; Goodman & Goodman, 1977). Miscue analysis has since been employed worldwide as a means of understanding the reading process, as a means of formative assessment by teachers, retrospectively as a reading strategy by individual readers, and by researchers, as a method of data collection with a typological analysis framework. Miscue analysis focuses on variations in the spoken production of a written text. Oral responses provide “windows” into the parallel text being constructed in the mind of the reader; the reader’s individual response to the text encountered.

EMMA technology augments the verbal behavior observed in miscues by recording the focal locations of the eye while subjects are reading visual presentations of text from a computer screen. By combining these two different observational techniques (eye movements and miscues), the reader-text transactions, ongoing in the reading process, emerge. As Rosenblatt (1978) observed, “the reader of any text must actively draw upon past experience and call forth the ‘meaning’ from the coded symbols” (p. 22). This drawing on past experience creates individual or group variation.

#### Theoretical Orientations

##### *The primacy of meaning*

“The word *reading* is properly employed for all manner of activities when we endeavor to make sense of circumstances; its original meaning was ‘interpretation.’ ” (Smith, 2003, p. 9). Meaning, or sense making, is inseparable from the reading process. Literature, once written, is a static object with no life of its own. It becomes a parasite; revived only by the anima of readers.

“If the words on the page are within the range of the reader’s experience and if the ideas conveyed are not beyond his level of maturity, the process of reading consists primarily in fusing a series of perceptual experiences into a set of meanings.” (Buswell, 1937a, p. 11). In 1922, Buswell identified meaning as the element of reading which distinguishes the mature reader, who “devotes practically his entire consciousness to the process of thought interpretation,” from the immature reader who concentrates on the “consecutive pronunciation of words”. Buswell clearly distinguishes the ability to recognize meanings from the ability to pronounce:

[Meaning] involves not only recognition of the word but also an extension of experience sufficient to provide a meaningful context with which the word may be associated. The word 'radio' is not difficult to pronounce, but until the present year few elementary children were familiar with its meaning because it was not a part of their experience. Since a recognition of the meaning of words demands a breadth of experience which includes the word (p. 8).

It is likely that once a word is learned contextually, it then becomes available in a broader print environment. In investigating the development of print awareness in children, Justice, Skibbe, Canning and Lankford (2007) used eye gaze technologies similar to the apparatus used in my study. "ERICA is a non-invasive compact technology that requires no attachments to be worn by participants." Investigating social constructivist perspectives, they examined the pre-literacy knowledge of children looking at storybooks and found that when looking at a "picture-salient storybook" that only 2.7% of their eye fixations focused on print (p. 17).

Their finding complements an earlier study of young readers who were further along in their reading development, which was conducted at the University of Arizona EMMA laboratory. Duckett (2001) found that, like adult readers, first-grade readers "were less likely to fixate function words" (p. 241), and that while looking at picture-salient story books, they spent more than 70% of their time fixating on the written text. In 1781 Kant proclaimed that "knowing is a combination of information the senses provide the brain and background knowledge" (Paulson, 2000, p. 251). Eye tracking

provides a partial picture of the visual input into the meaning a reader may be constructing.

Context is the essential medium of meaning. Our senses are continually searching for contextual input. Syntax and prosody, words/morphemes in relation, form an integral part of the complex web of contextual input and contextual processing involved in literacy. Often, however, reading has been studied in a decontextualized environment; a result of aiming towards simplicity and measurable accountability: context necessitates interpretation, and interpretation introduces variation. An alternative, ethnographic view, taken in this dissertation, is that context clarifies interpretation.

At present, it is widely believed that it does not matter all that much whether a reader is asked to respond to a simple word verification task or answer difficult comprehension questions after finishing a sentence or paragraph. Similarly, the differences in eye movement behavior, if any, in reading sentences, compared to paragraphs or much longer segments of connected text (such as whole books) remain unquantified (Radach and Kennedy, 2004, p. 20).

My goal is to conduct research which recontextualizes the complex process of reading: to describe comprehending long connected text, to quantify some of the individual and group behaviors which co-occur with reading a complete authentic short story.

Context being the prime control variable, three questions guided this research: the first centered on the effects of text language (English and French); the second addressed individual readers' linguistic backgrounds, whether reading in a first language (L1) differs from reading in a later-acquired language (L2), i.e. the effect of the reader's

internal language; and the third question looked at the reading performance, whether the reading event was silent or aloud.

*The Universality of the Reading Process*

Psycholinguistics often aims at identifying universal processes of language comprehension and production. K. Goodman (2003a) suggests there is a universal reading process:

Just as listening is a receptive oral language process, so reading is a receptive written language process. In productive language, speaking and writing, the language user begins with meaning and encodes it in language. In receptive language, the user starts with language and constructs meaning from it. (p.87)

In discussing the reading of English beyond the word level, K. Goodman identified a three-pronged cuing system to explain how readers create their own parallel text while reading:

There are 3 systems of cues that readers use to get from print to meaning:

*Grapho-phonetic* ...the system of relationships between the spellings and the sound patterns...

*Syntactic*...makes it possible to say the complex things one must with language.

In English order of the words in a sentence is the dominant feature of syntax...sentence patterns...grammatical functions.

*Semantic*...The reader must bring meaning to the passage in order to take meaning from it.” (2003a, p. 89)

These cuing systems represent universals in the reading process. More recently, Perfetti and Bolger (2004) also address universality in reading. In their study, theoretical questions of universality in the reading process are addressed through descriptive analyses of silent and oral reading behavior within and between participants and across languages. As expected, silent reading resembled oral reading to the extent that the text, the written input, remained constant between the two modes. This control variable (text) permitted comparisons in reading times, miscue type (based on an abbreviated version of the Goodman Taxonomy (Gollasch, 1982, pp. 215-302), in frequency of miscues, and in both local and global measurements of attention to text as with duration and location of eye fixations.

Intra- and interindividual variation emerged. Radach and Kennedy (2004) discuss such variation in reading as well as in the effect of task demands:

There is a body of literature on both intra- and interindividual variation in the reading process, but in relation to the total amount of empirical work in the field the proportion is surprisingly small. (p. 19).

They are not saying that the amount of variation is small, quite the contrary. They are issuing a call for methodologies and reports investigating variation. Traditionally research in the field of psychology, and also in educational psychology, deal with variation by sampling large numbers of readers and averaging across them. This well accepted procedure has the disadvantage of hiding variation rather than accounting for it. I have chosen a multiple (9) single-subject design so as to address variation at its root, the individual.

*Noticing, Attention, and Text Simplification*

Obviously, “text, by itself will not generate comprehension.” (Feldman, 1985, p. 94). There is a process of interpretation, of exchanging one medium of communication for another. And just like the old saying “translator = traitor” or the joy emerging from game of “Telephone,” the message changes as it is interpreted by each receiver. Miscues are a natural product of reading. Intentionally and inadvertently, text is given a unique life, a new beginning, a new message with every reader who takes note of it. And just as every reader is distinctive, each interpretation of a piece of writing bears an individual imprint of its reader.

Noticing requires attending. Thus, teachers for generations have asked students to pay attention so they will notice and learn material. One of the values of eye tracking is insight into what is being attended. Wigglesworth (2005) summarizes the background and the importance of noticing in current second language acquisition pedagogical practices:

...Schmidt (2001, pp. 3–4) has hypothesized that: “SLA [second language acquisition] is largely driven by what learners pay attention to and notice in the target language input and what they understand the significance of the noticed input to be.” Noticing, therefore, is a crucial concept in understanding how learners process their second languages. Equally, it is well established that learners are limited both in terms of their processing capacity (Skehan, 1998), and in terms of their access to attentional resources (Schmidt, 2001). Because second language learners are exposed to more linguistic data than they can effectively

process, they need to find some way to reduce the complexity of those data, which allows them to notice certain features of the data, and to make related hypotheses that they may subsequently test (Gass, Svetics, & Lemelin, 2003, p. 99).

Wigglesworth raises here the question of limited processing capacities and how second language learners may cope with the high volume of input in a later-acquired language by manipulating their environment so as to reduce complexity.

Working in the EMMA laboratory, Yamashita (2008) discovered that two young bilingual (English-Japanese) readers while reading a traditional story in Japanese (level 600 kanji with a large amount of hiragana, and no katakana), which was taken from a Japanese language textbook used for Japanese native language learners in Japan, were able to self select aspects of the text which matched their own individual levels of comprehension.

In the story, the particle *wa* has four functions: old-information, emphatic, contrastive, and negation. The lesser proficient of the two readers, H, fixated for a longer time than the older and more proficient reader, Y, on the old information *wa* and also on the emphatic use of *wa*. H never fixated the contrastive use of *wa*, while Y (proficient) consistently fixated contrastive *wa*. This same pattern was true for negation. The negation use of *wa* is more difficult in that these particles relate to the main predicate, which is upcoming in the sentence.

Through control of eye fixations, it appears that these emerging bilingual (English and Japanese) readers are capable of taking from a text that which they most need or are most able to integrate into their global comprehension process. Readers have the ability

to self-select the elements to which they are developmentally prepared to attend; thus making much of the popular simplification of texts for young or second language readers unnecessary. (O'Brien de Ramirez & Yamashita, 2002).

Text simplification is not a new concept in developmental literacy practice. Buswell (1937a), one of the earliest and most prolific eye movement researchers (he collected eye movement reading data from over 1000 readers while investigating low-levels of literacy in Chicago), discussed the common use of text simplification to deal with the problem of low levels of literacy: "One method of attack has consisted in an attempt to simplify or to improve the materials to be read." At the same time, he warned of the dangers inherent in text simplification practices: "It is not proposed that language should be impoverished and that all writing should be presented in a simplified vocabulary..." (p. 9). Renate Schulz, a renowned foreign language researcher and pedagogue, points out (conference communication, April 2002) a principal reason to avoid text simplification is the danger of losing naturally-occurring redundancy. Redundancy is essential to comprehension, and without it a reader gaining proficiency experiences increased difficulty understanding text.

Griffin (2004) in recounting her findings on eye gazes while naming objects, mentions the "interface-avoidance hypothesis" and states that "People also avert their gaze from computer monitors that display questions (Glenberg et al., 1998). Moreover, people were more likely to avert their gaze as the questions increased in difficulty." (p. 226).

The behavior of Yamashita's young reader appears to be a strategy of aversion to overly challenging material: rather than removing ones eyes from the computer screen, simply skip over incomprehensible morphemes and get on with the story. Miscue studies have revealed the omission of unknown words during an oral reading to be a common strategy used by developing readers (Brown, Marek, & Goodman, 1994).

Eye fixation studies of full text reading, however, still need to be conducted. If the hypothesis that readers naturally have the ability to self-select text, even at the finest and individualized grains of text difficulty, while reading to reduce complexity, a hundred years of text simplification (a large economic investment for certain publishers of English as a Second Language (ESL) and other graded reading material) may be unnecessary. Although this question has not been directly addressed in this study, the database created in these reading sessions is available for such analysis at a future time.

Reading, a natural cognitive and linguistic process, which is not unlike learning to speak one's first language, involves complex interactions of perception, language recognition, and language production. It occurs, like speech, in discourse contexts. This complexity merits further investigation and is the purpose of the research reported here. This study does not attempt to describe these complex processes in any definitive detail. It raises more questions than it answers. I do not propose a model of how language systems interact. I only hope to describe some of the ways individuals go about creating their own renditions of a text from a printed impetus.

The research presented here examines readings complete, authentic texts in their natural, single-language, literary state: uncut and unsimplified. None of the proficient

readers in this study experience any significant difficulty with either of the stories. More information about the readers and the texts is presented in Chapter 3 under the headings of *subjects* and *materials*.

#### Focus Questions which Guide this Investigation

Question 1: Text Language (English vs. French). How does reading in English compare with reading in French, within and between readers?

Question 2: Reader Language (L1 vs. Lx). How does reading in a later-acquired language compare with reading in the same reader's first language?

Question 3: Reading Mode (Silent vs. Oral). How does silent reading compare with reading aloud, within and between readers?

These questions evolved from the EMMA methodology within the theoretical orientation that reading is a universal process. Patterns reflecting universality should therefore be visible across different languages, across different readers, and across different output modes (silent or oral). The four dependent measures used to inform these three questions in this study are (a) reading speed, (b) completeness and accuracy of retellings, (c) miscue frequency and type, and (d) eye fixation frequencies and durations.

#### *Hypotheses*

Applying these dependent measures to the questions, I propose three corresponding hypotheses:

1. Reading in English is similar in reading speed, miscues, and eye movements to reading in French.

2. Reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a second, or later acquired, language (L2).
3. Silent reading is similar to oral reading in reading speed and eye movements.

Chapter 2 consists of a brief review of selected literature pertaining to multilingual silent and oral reading, eye tracking, and miscues. Chapter 3 contains a description of the methods, procedures, and design used to observe the fully contextualized silent and oral multilingual reading process. Chapter 4 presents an analysis of data confirming the first hypothesis (that reading in English is similar in reading speed, miscues, and eye movements to reading in French). The mean reading speed of approximately three words per second differed by only 0.25 of one letter space per second between English and French. Retellings demonstrated comprehension in all readers in both languages. In these readings, miscue frequencies were higher while reading in English than while reading in French. In eye movements, there was no significant difference in mean fixation duration between the English and French readings.

Chapter 5 addresses the question of universality in the reading process by looking specifically at data relating to the second hypothesis, that reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a second, or later acquired, language (L2). Both differences and similarities between native and nonnative reading are reported, concluding that speed as well as eye fixation durations may be more related to task and reading style than to language proficiency.

Chapter 6 consists of a presentation and discussion of data relating to the third hypothesis, that silent reading is similar to oral reading in reading speed and eye movements. Here as well, the variation is more with individual readers than with reading presentation mode. Although silent reading is faster than oral reading (Huey reported this a century ago), I report both similarities and differences in eye tracking measures across and within readers. Emotional effects emerge in eye fixation frequency and duration.

Chapter 7 summarizes the information presented in this dissertation, highlights the strengths and weaknesses of this study, and suggests implications of this research and applications to teaching reading and foreign languages, as well as potential areas for future research. Appendices include human subject protection and recruitment information, the two complete stories: the English short story *Feathered Friend* by Arthur C. Clark and the French short story *La Légende du Mont-St-Michel* by Guy de Maupassant as well as retelling guides for both stories and a translation of the French legend. A complete list of references closes this document.

## CHAPTER 2: RESEARCH CONTEXT

The complexity of the thinking/language/reading process is resistant to unraveling, diagnosis, simulation, proscription, and reconstruction. As discussed in Chapter 1, a century of theory and research into reading and literacy has evolved from diverse perspectives and yielded a wide range of results. Some studies have isolated and examined graphophonemic features or psycholinguistic factors in strictly controlled contexts; others have adopted broad holistic perspectives.

I have chosen eye movement miscue analysis (EMMA) procedures to observe authentic reading through coordinated data from two simultaneous reader activities: eye movements while viewing complete short stories, and vocal activity while reproducing these same texts aloud. To further triangulate this complex set of fully-contextualized reading data, I recorded the readers' unassisted retellings of the stories and conducted interviews regarding readers' linguistic and reading histories.

The driving questions in this study evolve from a theory that reading is a universal process (Goodman, K. S. 2003a) and are aimed at investigating variation within and amongst readers through three control variables:

- a) text language: French or English,
- b) reader language: native (L1) or nonnative (L2), and
- c) reading performance mode (silent or oral).

I offer here only a sampling of the rich interdisciplinary context which gives rise to my attempt to capture and describe the complex phenomenon of proficient multilingual silent and oral reading.

Shanahan (2002) remarks “reviews are difficult to write, because they turn into ‘mind-numbing lists of citations and findings that resemble a phone book - impressive cast, lots of numbers, but not much plot’ ([Bem, 1995] p. 172)” (p.148). The cast of prior authors in an interdisciplinary investigation is vast and I cannot do justice to the depth of their work. I briefly touch upon eight areas: (1) Reading and the Reading Process, (2) Eye Tracking Research, (3) Miscue Analysis, (4) Eye Movement Miscue Analysis (EMMA), (5) Reading in French and English, (6) Multilingual Literacy, (7) Silent and Oral Reading, and (8) Research Design. As with all good science, controversies over theory and practice abound in several of these areas and I will not attempt an unbiased estimation of their wealth; I request instead my readers’ tolerance of a bias-brevity tradeoff.

## Reading and the Reading Process

### *Meaning Making*

Smith insists: “Reading is the antithesis of nonsense; it strives always to find and make sense.” (2006, p. 2-3). Thinking readers construct meaning. Based on the assumption that reading speed reflects ease in making meaning, Wisher (1977) analyzed readers’ semantic expectations in 200 three-sentence mini-stories, and found that when one sentence followed logically from the preceding sentence, reading times decreased steadily (by 3, 9 and 12%) across the three sentences, thus confirming that logical context facilitates reading.

In describing how a reader constructs meaning from a printed text, K. Goodman (1973) suggests that the reader, “makes predictions of the grammatical structure, using control over language structure he learned when he learned oral language. He supplies

semantic concepts to get the meaning from the structure, in turn, his sense of syntactic structure and meaning makes it possible to predict the graphic input so he is highly selective, sampling the print to confirm his prediction.” (p. 9). The inference here is that what the reader sees in fluent reading is greatly influenced by what the reader expects to see. This inference is a strong motivation for eye movement studies of reading behavior: it may be possible that the eyes, like a reader’s miscues, reveal the reader’s expectations during the meaning making of text.

Candlin (1984; x), discussing the negotiative process a reader undertakes as “readers...entering into a dialogue not only with the writer but with their own knowledge and their own experience...” and argues that “...for our explanation of such phenomena we shall need a multi-disciplinary perspective.” K. S. Goodman (2003) argues for an interdisciplinary viewpoint as well, with related objectives giving rise to a “transactional sociopsycholinguistic view” (p. 10)

### *The Universal Process of Reading*

According to Goodman’s Revised Miscue Model, reading is a universal process involving a cycle of perception, selection of features, prediction, and verification. K. S. Goodman and Y. M. Goodman (1979 in Flurkey & Xu 2003) claim, “There is only one reading process. Readers may differ in the control of this process, but not in the process they use.” (p.363). One observable universal in the reading process is that those who read with their eyes fixate elements of the text while reading.

### On Eye Tracking Research

Reading is a highly skilled task that requires coordination among various perceptual, cognitive, and motor processes (Rayner, 1998; Rayner & Pollatsek, 1989).

This coordination is sufficiently great that it has been possible to use eye movement recording to study the perceptual and cognitive processes that take place during reading. (Yang & McConkie, 2004, p. 226).

### *Saccades, Fixations, Regressions, and Durations*

Much eye tracking research in the past three decades is aimed towards describing the physical and neurological mechanisms that control eye movements by initiating saccades. Saccadic eye movements are the fast changes in eye position that precede and follow relatively stable fixations. Saccadic eye movements differ from the smooth tracking of an object moving steadily along a distant horizon. A fixations provides stable viewing of small sections of stable text. Only a few letters at a time are in direct foveal focus, surrounded by a larger area in the parafovia with fading clarity, and the outer periphery with negligible visibility. One principle question in fluent reading is how a reader integrates these thousands of glimpses into integrated text (Paulson & Freeman, 2004).

The study of eye movements is now well established and widely used in experimental reading research. Radach and Kennedy (2004a, b) investigate eye movement control in fluent reading, and suggest areas needing further research: They call for a stronger grounding in basic research and increased integration with the neighboring area of research on single word recognition. This dissertation responds to the need for basic descriptive research of full text reading by creating a database of proficient multilingual silent and oral reading. Comparison and integration with findings from single word recognition experiments remains an open question.

Eye tracking as a measure of reading is well documented by Buswell (1920) and Huey (1908/1968). More recently, eye movements have been investigated as an indication of a reader's thinking process: "Measurements of fixation durations on words or on regions of text are central for investigating cognitive processes underlying reading (Liversedge & Findlay, 2000; Rayner, 1998)" (Engbert, Nuthmann, Richter, 2005, p. 777).

It has been noted that fixation durations vary with the text being viewed. Just and Carpenter (1987) and Rayner and Pollatsek (1989) claim that fixation times are longer on more difficult stimuli. While difficulty is independent of word length, Starr & Rayner (2001) found that, "as word length increases, the probability of fixating and refixating a word increases." These conclusions were based on studies of English where long words may have less predictability than in French. I address the issue of word length related to these two languages briefly in chapter 4.

Fixations are interesting in both their location (what does a reader look at) and their length (how long does one look at a particular section of text). Fixation locations are measured using horizontal and vertical coordinates on a plane. The amount of time the eye holds a relatively stable position (between saccades) is the fixation duration. I use the common quantifier of milliseconds when reporting fixation durations.

In 1920, Guy Buswell, in his dissertation written under the direction of Charles Judd and James R. Angell at the University of Chicago, found that nineteen high-school subjects reading an English passage of 43 words in length, had "an average for each subject of 14 fixations which are more than 20 fiftieths of a second in length. The length of these long fixations varied from 20 to 93 fiftieths of a second." (p. 79). Buswell's eye

tracker measured fixation durations relative to vibrations of a tuning fork cutting a reflective light source fifty times a second, or once every 20 milliseconds. He hypothesized that in these relatively long fixations (0.400 to 1.860 seconds each) resulted directly from the oral reading process, and hypothesized that the eye served as a placeholder for the voice: “the eye remains fixated until the voice catches up” (p.80).

The distance the eyes move is commonly measured in degrees of saccade arch, or in letterspaces. Buswell’s hypothesis had face validity, but when he analyzed the eye-voice span (the distance in letterspaces from where the eye is looking simultaneously with what the voice is saying) he found that an interpretation of the eyes as placeholders for the voice was only minimally justified. Instead of holding a fixation when advanced far ahead of the voice, the eye reacted to a wide eye-voice span equally as often with a series of short fixations (varying in location) as with a single steady place-keeping fixation.

In reading there is a relationship between viewing a text and interpreting the meaning of that text, and between viewing a text and orally reproducing that text. Yet, in fluent reading there exists no one-to-one correspondence of fixations to words. Proficient readers cognitively, correctly, and fluently fill gaps between fixations with words that were never in foveal focus. Also, readers’ eyes regress to sections of text they have already viewed, potentially in reaction to internal meaning-making processes.

McConkie and Hogaboam (1985), claim that readers do not always attend to the visual information available in a fixation since in normal reading it is often necessary to regress to “unattended words” in order to read them. Although determining exactly what a reader is attending to or thinking when the eyes fixate is still impossible, and therefore

interpretation of regressions is inferential, it is claimed that regressions correlate with a reader's reprocessing of text (Hyönä, Lorch, & Kaakinen, 2002). As Duffy (1992) notes, "reprocessing operations are a frequent occurrence during reading." Regressions are "movements of the eyes in which the reader refixates information that has already been fixated (p. 464).

Not all words have to be fixated in order to be read: Fisher and Shebilske (1985, p. 149) presented evidence that "processing of unfixated words is an integral part of reading semantically rich words in connected discourse." They reanalyzed fixation records published by Judd and Buswell in 1922, and found that less than two-thirds of all words were fixated in eight records and no more than three-fourths were fixated in the rest.

The average perceptual span (the region from which useful information is acquired during an eye fixation) when reading in English and in French is asymmetrical, representing the graphic left-to-right directionality of both languages: about 3-4 character spaces to the left and approximately 15 character spaces to the right of the fixated point are normally visible in each fixation. This region varies according to attentional factors; it is smaller for beginning readers than for skilled readers, and is diminished for skilled readers when text difficulty is increased (Rayner, 1986).

### *Tracking Cognition through Vision*

It is commonly agreed that eye tracking, as a measure of intentional sampling, can indicate a degrees of cognitive effort while reading. In 1992, Henderson showed that "covert shifts of attention and overt movements of the eyes are functionally related" (p. 261), and that attention is focused in the direction the eyes are moving; towards the next

fixation. Kennedy and Murray's work suggests that attention is oriented towards the next fixation location even before a saccade brings the eye to land there. (Psycholinguistics West, Lab Presentation by Wayne S. Murray, Tucson AZ, April 2008). "The control signals for saccades descending from higher centers specify the location of the target" (Krauzlis, 2008, p. 782)

Griffin (2004) gives "evidence for a tight relationship between gaze and speech." Although not directly applicable to reading, her investigations of "the role of eye movements in language production" (p. 215) may inform the study of fluent oral reading. She mentions pupil dilation as a measure of mental effort. Although I have not analyzed pupil dilation in this study, I did collect this data should future analysis require such a triangulation measure. Griffin examines numerous hypotheses regarding eye fixations in relation to language production. She suggests that semantic errors in speech production may be related to briefer gazes (at objects in picture naming tasks). Semantic error in speech production are a type of reading miscue (K. S. Goodman, 2003c).

Paulson (2000) found that miscues are related to equal or extended viewing time in the region. My miscue and eye tracking data provides a baseline dataset of short story reading by multilinguals. I present here a preliminary descriptive analysis eye movements, miscues, retelling scores, but the baseline dataset created for this study remains available for deeper analysis regarding fixation frequency, durations, and regressions globally and locally in relation to semantic and syntactic miscues.

An important question in sighted reading relates to the integration of information across saccades. It is an essential reason why the study of reading must extend beyond the level of word recognition. How can a series of glimpses at tiny segments of a text,

separated by a quick blur of movement, result in the fluid interpretation of information consciously acquired during reading? Information obtained from the periphery may help readers predict upcoming text. “The preview benefit effect is highly robust and has been demonstrated many times, not only in reading, but in scene perception and visual search (see Rayner, 1998, for a review)... the visual signal is processed in the brain such that the discrete inputs are smoothed out so that we maintain a stable coherent view of the text we are reading.” (Rayner & Liversedge, 2004, p. 68)

### On Miscue Analysis

Miscue analysis is a method for observing, classifying, and interpreting the effects of internal processes during contextualized reading -- a window into the reader’s mind: Ken Goodman (1973, 1982; 1975) suggests that there is much about reading that we cannot see and must infer from observations. Miscues are instances when an observed response during a reading event differs from the expected response. Miscues have been studied in both first and second language as an indicator of reading development (See Brown, Marek and Goodman, 1994, for a bibliography of miscue analysis studies). Miscue Analysis was developed as a research tool by Ken Goodman in order to systematically observe, and understand the reading process. Several conditions are required:

The written material must be new to the readers and complete with a beginning, middle and end. The text needs to be long and challenging enough to produce sufficient numbers of miscues for patterns to appear. In addition readers receive no help and are not interrupted. (K. Goodman, 2003b, p. 224).

*Reading Complete, Authentic Texts*

It has been shown that letters are easier to read when presented in words, and words are easier to read in sentence context than in simple lists (Goodman, 1993). Furthermore, readers are able to anticipate the syntactic frame of upcoming words and phrases when word order is relatively fixed, as in English and French. One common miscue type is a substitution. Kolars (1970) reported that 70% of all oral reading substitutions made by adults conformed to the same part of speech as the word written in the text.

Context has been shown to have a cumulative effect, changing the quality of miscues in an extended reading session: “Previous miscue research (Menosky, 1971) has indicated that the quality of miscues changes as the reader progresses past the initial portion of text. Miscues made on the first 200 words of the text produce a different reader profile than those associated with any given quarter of text examined. This difference is related to an increase in semantic and syntactic acceptability with an accompanying drop in graphic and phonemic similarity on the sections following the initial portion.” (Goodman, K. S. & Burke, 1973, 1982). Perhaps the readers become familiar with text elements, or more comfortable with the reading session; without knowing the cause of this effect, it is still important to recognize the effect of full context during reading.

One of the difficulties in comparing findings across disciplines has been the rich variety of methods and materials employed in research. Miscue analysis (most often employed in literacy education and research) is best conducted with complete authentic

texts, yet most of the existing reading studies in psychology and psycholinguistics have involved single word recognition, non-words, or sentences. Yang & McConkie (2004) included unaltered texts in their research and presented 47 pages of nine lines each taken from a novel (*The Mystery of Sasassa Valley*) written by Sir Arthur Conan Doyle in the early 1900s. The material was triple spaced with eighty characters per line, and typed in New Courier font having an 8 x 16 pixel space per character on a 640 x 480 display (p. 233). The stimulus presentation format used in my dissertation study greatly resembles this presentation, although the guiding questions and research purpose were quite different. Yang and McConkie created nine alternate versions of each page by substituting letters, symbols, or spaces for the original characters in the text (so as to study the degree to which words motivate saccades). I used only authentic unaltered text in this dissertation so as to picture genuine, proficient reading in a descriptive rather than experimental manner.

#### *Miscues, Speech Errors, and Second Language*

Strauss (2005) compares Garrett's analysis of errors in spontaneous speech, which occur "in natural contexts where language is used purposefully," to the Goodmans' study of miscues in the oral reading of authentic texts. Strauss concludes that "miscue analysis...follows contemporary linguistic methodological principals quite neatly, such as those used in the widely respected work of Merrill Garrett and others in the investigation of 'errors' of oral speech (Garrett 1990, 1984)." (p. 182).

Garret (1990) grouped spontaneous speech errors (utterances which do not match the speaker's intention) into two types: form-related (those which share phonetic or orthographic similarity) and meaning-related (semantic similarity, e.g.: "finger"

substituting for “toe”). He posited that speech errors reveal a serial model of speech production: Starting from a concept and impetus to speak, the structural form is outlined in the functional-syntactic stage from lemmas (abstract representations with meaning and syntactic properties) which indicate structural relationships between semantic units in the intended utterance, allowing the speaker to retrieve the phonetic and orthographic representations desired.

Models of speech production, based on Garrett’s analyses of speech errors, place semantic and syntactic processing at an earlier stage than phonological processing. (See for example Bock & Levelt’s 1994 production model in Traxler & Tooley, 2008).

Reading aloud differs from speech production in obvious ways, and could perhaps be considered as a subset of speech production, where the context of the utterance is constrained by the text.

Oral reading involves both text perception and speech production. A potential interpretation of miscues in oral reading is that they are examples of speech errors, as those described by Garrett (1975, 1993) or by Fromkin (1971, 1980). Jaeger (2005), in her Representation and Processing Components Model, borrows from Garrett’s levels of representation as well as his terminology. Like Garrett’s model, there is a feed-forward, staged progression through the levels (which she calls planning components) and representations in short term memory; but in addition to serial, incremental levels, Jaeger adds horizontal as well as forward and backward (even level skipping) feedback and interaction with representations in long term memory [including a content lexicon, a functional lexicon and rules of morphosyntax]. (pp. 6-11).

Jaeger (2005) claims that phonological errors “are likely to produce real words, at least for adults.” She attributes this phenomenon to elements that include an internal “self-monitoring system...which screen the final output of the planning mechanism for legality...before the utterance is produced.” (pp. 9-10). Her model does not specify how internal errors are corrected.

If an internal monitor exists in the mind of all readers, it appears from the data in the study I present here to function differently for native and for non-native language users as I discuss in relation to uncorrected miscues which produce non-words in chapter 5. Although it is possible that miscues may arise due to limits in the L2 lexicon or in the L2 syntax; I suspect that the reason more non-words are not filtered out by second language readers may be attributed to a reader’s *Interlanguage* (Selinker, 1972). English and French have phonological similarities as well as differences. The close-yet-far-away nature of these languages may cause self-monitoring in the nonnative language (L2) to be suspended, or remain inconclusive until a later (closer to production) processing stage is reached. Rather than selecting an alternate utterance (i.e., an actual word) in place of an unfamiliar lexical item at an early semantic or syntactic level, L2 language users may attempt pronunciation of the unknown word more often than L1 language users would, thus creating a greater frequency of nonwords.

Since many of these mispronunciation miscues go uncorrected by the speaker/reader, I relate them to uncorrected and semantically acceptable miscues produced by native speakers, assuming little to no detrimental effect on the content message, or meaning, of the passage. D. Goodman differs in regard to these nonwords which she calls placeholders. When producing a reader profile, these miscues are

considered semantically and syntactically unacceptable, as they do not demonstrate reader comprehension of the lexical item or text. (Hofstra Miscue Roundtable, June 2008).

Frequent production of unacceptable miscues could signal that a reader is struggling with a text. Separating language difficulties from literacy difficulties is thus important when choosing a pedagogical plan for emerging or L2 readers. The feature which distinguishes the mispronunciations of an emerging reader from those of a proficient L2 reader, who is already literate in L1, may be meaning. Meaning is closely related to comprehension, which I evaluated using *unassisted retellings*, a post-reading comprehension-verification procedure (Y. Goodman, 1982; Goodman, Y. M., Watson, & Burke, 2005).

#### *Miscues in Silent and Oral Reading*

Regarding semantic speech errors, one reason miscues (observed responses which differ from the expected response) appear more frequently than speech errors may be the ease of their detection. In free speech a listener would likely not notice if the speaker produces *laundry soap* when the intent was *laundry detergent*. A reader who substitutes a semantic near equivalent however is quickly judged as producing an utterance different from the printed text stimulus. (Strauss, 2005, p. 183)

When discussing speech production, Levelt (1998) explains how “errors of lexical selection occur in the 1 in a 1000 range.” (p. 172). Yet in Miscue Analysis research, miscue frequencies are reported as MPHWS – miscues per hundred words (Goodman, Watson, & Burke, 2005). Oral reading miscues are recognized more frequently than speech errors. The listener/researcher’s access to the text for verification of the speaker’s

intent may not, however, entirely account for this increase. It is likely that the reader creates more miscues when reading orally because of a cognitive conflict between the reader and the author: Due to the flexibility of language, the story the reader is creating in his/her head does not coincide exactly with what is being read. This phenomenon may cause more proficient readers to miscue more frequently than less proficient readers who may stick more closely to the text. A third factor in accuracy of text reproduction is the reader's response to the task; as I discuss in chapters 4 and 5, reading style and reader's feelings about accuracy and fidelity to the text affect miscue frequencies.

This dissertation examines both silent and oral reading. Silent reading, although perhaps the truest and most original form of reading, has always been difficult to observe: "To get as close as possible to natural reading, I should have studied silent reading, but silent reading does not provide easily observable events." (Goodman, 2008, p.11)

Miscues in silent reading are rarely reported, and do not play heavily in this dissertation. They are difficult to detect, but future analysis may show that they are exhibited in regressive or elongated eye fixations.

One reason silent reading tends to be faster than oral reading is that the reader does not need to be concerned with accurate oral production. To test whether conflict in the text would be detectable in the eye tracking record, Bohan and Sanford (2008) followed subject's eye movements when asked to read passages containing semantic anomalies. They wondered if there would be evidence that the reader's internal comprehension system registered the abnormality. They found that when the readers were not conscious of the anomaly, there was no difference from controls containing no conflicting semantic elements. Only when the subject made a conscious report that what

was being read did not make sense, was there evidence in the eye tracking record of a disruption. These findings suggest that many silent miscues would be undetectable through regressive eye movements or fixation frequency and duration.

### Eye Movement Miscue Analysis (EMMA)

The combination of eye tracking and miscue analysis, two quantitative methods for observing reading behavior, was developed by Paulson (2000), in response to teachers' need to know whether developing readers are paying attention to an area of text in which a miscue occurs. He examined naturally occurring miscues in the readings of authentic text by adults, and found that readers regularly fixate miscued regions. Even when the miscue involved an omission of lexical items in the oral reading, readers had increased looking time in the region.

Eye movement miscue analysis (EMMA) findings have shown that early readers spend more time looking at text than at accompanying pictures although they do attend to both: Duckett (2001) studied first graders reading picture books aloud using the same remote eye sensor used in this study (Applied Science Laboratories Model 504). He found that young readers spend about 30% of their time on pictures and 70% on text.

Paulson and Freeman (2004) used EMMA technology to demonstrate that: 1) readers sample text rather than looking at each and every word in a linear order - reading is therefore not a process of sequential word recognition, 2) both eye movements and miscues are functions of comprehension, and 3) reading is a constructivist act – that knowledge is not transmitted from the text to the reader, but rather is created by the reader in the active process of reading. They suggest that EMMA gives us a glimpse into the text, as the reader understands it.

### Reading in French and English

The Russian literary theorist Mikhail Bakhtin (1981) noted, “Each large and creative verbal whole is a very complex and multifaceted system of relations.” One of the interesting complexities of comparing English and French reading can be found in the historical intertwining of their Germanic and Romance roots. When William of Normandy, the mightiest feudal lord in France, crossed the English Channel/ La Manche and claimed the English crown in 1066; French became the language of the British king’s court and gradually blended with the Anglo-Saxon tongue. (For an excellent introduction to English-French contrastive linguistics see Van Roey, 1976).

Judd and Buswell in 1922 used text which mixed English and French, and required the reader to translate the French segments line-by-line into oral English. They noted the average number of fixations per line of mixed (English/French) text, and the average duration of fixation pauses. They concluded that the subject did not read French as she read English. The silent reading of mixed English and French was accomplished easily; but the reader had great difficulty finding oral English equivalents for French words when translating, and lost the thread of the narrative. They summarized, “Either the reader got the idea easily from a direct inspection of the French and was confused later by the demand that she find English equivalents for the French words, or else she slighted the passage in the first instance and missed the full meaning but had no such escape when it came to the translation.” (p. 107). Task design may certainly be implicated in the difference between French and English reading.

Although I am looking at reading in English and French I did not replicate Buswell’s work. Instead of mixed texts I chose complete, monolingual short stories in French and in English. My subjects are told only to read, silently or aloud at their own

pace. There is no mention of translation, and the retellings, which are used to evaluate post-reading comprehension and recall, are conducted in the language of the reader's choice.

*Literary Style: Le Passé Simple*

One tangible difference between the two texts I selected for this observation is that in English the past tense usage in literature closely resembles the past tense usage in spoken language. There is no literary past in English as there is in French (le passé simple). The full text of the English and French stories appear in Appendix B.

English and French both have past tense verb forms indicating achieved or continuing event quantification; syntactic elements with semantic and pragmatic import (Anstey & Mackenzie 2005). French has an additional past tense verb form which is used in written discourse to express a completed action. Monville-Burston and Waugh (1985) analyzed use of this tense, the passé simple, in journalistic discourse. The passé simple commonly portrays a perfected aspect of achieved events, and is often set against an imperfect backdrop. Used in storytelling and narration, it encompasses three semantic properties: past tense, dimensionalisation, and detachment.

The detachment represents a temporal separation from the present. It does not hinder comprehension, even in nonnative (L2) readers. I recently presented a group of university students in a second semester French as a foreign language (advanced beginners) class with individual printed copies of a familiar tale (*Le Petit chaperon rouge*). In class they had not received formal instruction in the passé simple, but had heard mention of a literary tense. I suggested they read it silently first, which they did. I then suggested that they discuss the story as a group. They used a mixture of L2 French

and L1 English, and participation was at a high level and evenly dispersed, owing perhaps to their pre-existing comfort and familiarity with the story (Little Red Ridding Hood). As they discussed the content, one student asked what all the words were that ended in *a*. (There may have been Spanish language knowledge in the group, but no one mentioned this.) After several references back to the text, another student said, “those words ending in *a* are verbs.” Later they all agreed that these were verbs in the past tense.

The semantic detachment of the *passé simple* does not present any difficulty in integrating what is being read into one’s comprehension, schema, or emotions. The detachment is a separation in time from the present tense, and comprehensible even for nonnative readers. Readers may have strong emotional interaction with texts written in the *passé simple* as I discuss in chapter 6 regarding FAY’s intense reaction to a passage in the French story *La légende du Mont-St-Michel*.

The *passé simple* verb form contrasts with the *passé composé* (which is the perfected past tense commonly used in spoken conversation) in its temporal distance from the present action. As Monville-Burston and Waugh point out, both verb forms can occur in a single written text. In the story I gave my readers, Guy de Maupassant uses the *passé simple* (as well as *l'imparfait*) when describing the sea, the landscape, the castle, and actions: *un paysan bas-normand m'aborda et me raconta l'histoire* [a Norman peasant approached me and recounted the story]. Contrastively, Maupassant uses the *passé composé* in dialog: - *Je suis venu te proposer une bonne affaire* [I have come to propose to you a good business affair]. This dialogic use of the spoken *passé composé* continues even when the dialog is set apart and obtuse; an abstract, difficult to decipher

saying, *entre guillemets* (set in quotation marks; a quote within a quote, contrasting with the dashes used consistently throughout the story to indicate conversation), as in *Un sceptique de génie a dit: «Dieu a fait l'homme à son image, mais l'homme le lui a bien rendu.»* [A skeptic with genius said: “God made man in his image, but man has well returned it to him.” –referring to the spectacular beauty of Mont St. Michel]

Dialog and its ensuing punctuation are an important area for further investigation; information is available in this baseline database, but I do not investigate this question in this dissertation. In the version of the Maupassant legend I used, the major portion of the story is told by a Norman local to the narrator who is a tourist. The entire recounting is encased in a single set of quotation marks (guillemets «...»), and dialog between the devil and St Michel is separated from the narrative text by an initial dash: – *Tu n'as pas été heureux dans tes affaires avec moi, disait-il...* [-You have not been (passé composé) happy in your dealings with me, he said (imperfect)...]

JAN, an L1 French Canadian, sixty years of age, who expressed great pride in her native language and read with great precision; changed one of the passé simple verbs to the commonly spoken passé composé form by preceding it with the auxiliary verb *avoir*: *Il a réfléchi pendant six mois...* [He reflected for six months...]. Since this substitution/insertion miscue occurred in the conjugation of a regular *ir* verb, it caused no noticeable phonetic difference between the written passé simple verb form and the observed past participle.

Overall, JAN read with great accuracy (her miscue frequency while reading in French was only 0.46 MPHW; less than half the average amongst these proficient multiliterates: 1.07 MPHW). JAN did not correct her miscue, an indication that she

considered her substitution of the *passé composé* as a perfectly acceptable, unremarkable part of the story. Although she did not change the other verbs, this single miscue (or intentional switch from distanced literary text to oral narration) complements the Monville-Burston and Waugh's findings. They noted between 6.245% and .793% use of the *passé simple* in the three periodicals they studied, used primarily as a stylistic means of separating a further past action from a more recent action. In the opposite direction, but replicating this frequency, JAN uses the *passé composé* to lessen the past distance; to bring the story to life.

I propose that JAN switches to the *passé composé* as a stylistic means of narrative storytelling. In English, it is common for a storyteller to switch from the past to the narrative present tense when recounting exciting parts of a story to give the listener (or reader) the feeling of being there. JAN's tense change similarly indicates her involvement in the reading. This multilingual reader demonstrates a narrative process in French which is similar to a narrative process in English; one example of universality in the reading (or story-telling) process.

### Multilingual Literacy

It is not clear to what extent reading in a foreign language is different from reading in a first language" (Alderson & Urquhart 1984, p. xv). Treville (1993) argues that English-speaking learners of French as a second language start with a major asset in that these two languages share a sizeable vocabulary. In her 1996 work, she describes a seven-lesson program designed to exploit the lexical similarities between the two languages with beginning university-level learners of French.

Cognates between the two languages are both an asset and a hindrance. Martinet (1968), while explaining plurilingualism, discusses unilingualism, multilingualism, and systems in contact, focusing on phonetic interference. Comparing the phonological systems of English and French, he notes phonemes which are not shared between the two languages (e.g. /y/ in French and /θ/ in English), as well as phonemes which have greatly different qualities in the two languages such as /r/, or the aspiration of /p/. (p. 655)

Readers in my study (particularly JAN, French Canadian, and AMY, bilingual French and Portuguese- who both have extensive academic and professional experience in English) frequently overcorrect in their L2 oral English, creating aspirated /h/ sounds where none exist, and often omitting an aspirated /h/ which native speakers would consider obligatory. Future analysis will likely reveal systematic and regular variation, and perhaps an interlanguage influence since with certain words in French the silent /h/ is considered aspirated, thus preventing *elision*, e.g.: *le hâte*. Systematic variation will also likely be discovered through further examination of my reader LUC's poetic style of oral text rendition, particularly in regards to « l'e muet, qui tantôt se prononce et tantôt s'élide » (Hamon, 1964, p. 141). I do not count these allophonic variations as miscues, using The Goodman Taxonomy of Reading Miscues (Goodman, K. S. & Burke, 1973; Gollasch, 1982) and its treatment of dialect as my guide:

Dialects of a language vary from each other through phonemes, intonation, vocabulary and structure. Phonemic and intonation variation almost never result in any meaning or structural changes. Only dialect miscues which involve vocabulary or structural changes will be added in this category. (Gollasch 1982, p. 217)

During the on-line reading sessions in my study, readers never self-corrected these phonetic substitutions to the text. As I stated regarding JAN's verb tense change, a lack of correction may be an indication that the reader is comfortable with his/her rendition of the text.

Based on Levelt's 1993 syllabary-based model of speech production, De Bot (2004, p. 30) proposes a multilingual processing model which "does not make a real distinction between bilingualism, trilingualism and multilingualism, since the same principals apply in all situations." He posits three stores of conceptual features, syntactic procedures, and form elements, each with language specific subsets that "overlap reflecting the cognateness of the languages involved." (p. 28).

Evidence from delayed reaction times to interlanguage homographs (like *coin* or *pain*) has shown non-selectivity between languages (Dijkstra & van Heuven, 2002); or differences depending on English or French language dominance (Jared & Szucs, 2002), but that both languages are accessed. Jordà (2005) prefers not to separate languages, but to link them into a user's language system: "interdependence characterizing third language learning leads us to consider learners' first, second and third languages as a whole linguistic system, which they command simultaneously." (p. 14). Looking at English-Russian eye movements, Marian, Spivey, and Hirsch (2002) found that bilinguals had longer fixations on homophones, demonstrating both between and within language competition and evidencing simultaneous activation in early stages of perception.

A productive question in multilingual investigations has been the degree of separation and interconnectivity between languages in the mind of a multilingual (Kroll

& De Groot, 1997). Paradis (2000) argues for an ‘interlanguage ambiguity’ hypothesis allowing for structural separation between two languages in the mind of the user as well as evidence of cross-language influences. Döpke (2000) argues for language separation: that multi-literates “predominantly produce language-specific structures at all stages of their development” and claims that simultaneous acquisition can occur within the structural scope of two languages (p. 1).

Psycholinguistic research often distinguishes perception (as in the activity of silent reading) from production (as in speech). These two areas of research become confused when investigating oral reading, as they do in discussing storage and recall of bilingual lexicons. “Research into lexical access in adult bilinguals has shown that, although activation of one of the bilingual’s languages inhibits the other language, it is not possible to suppress this other language entirely.” (Van de Linden, 2000, p. 39). When bilinguals select to communicate in a specific situation in only one specific language, the neuronal substrate of the language not in use is inhibited, while that of the language in use is activated, yet the speaker/reader can never entirely suppress the other language; it is always partially activated (Paradis, 1996, p. 60).

Jim Cummins (2000) argues for an interdependence hypothesis or a “common underlying proficiency” where cognitive and literacy skills established in the mother tongue (L1) transfer across languages. Kolers (1966) found that if he switched languages every two or three words while having fluent English and French bilinguals read aloud, readers could recall the content matter of the text, but could not remember the particular language in which it was encountered. Also, as they read, they easily substituted synonyms in the alternate language for what they encountered on the page.

Judd and Buswell were the first to use eye tracking to look at silent reading in first and foreign language German, Latin, French and English. They concluded that the manner of reading is fundamentally the same or “directly comparable” between these languages (1922, p. 92). Although this was principally a silent reading study, in this same report they included a few cases where a text was reread aloud in English or in French. Their findings in these cases may prove interesting for future comparison with the silent and oral rereadings I collected from multiliterates.

On an ESL proficiency test (UCLA-ESLPEI), Oller and Tullius (1973) found that non-natives tended to have markedly longer durations of eye fixations than native speakers, but that regressions were not significantly different for natives and non-natives. As I will discuss in chapter 5, I also found that L2 readers have longer mean fixation durations than L1 readers. Their global their reading times are longer in L2 English, but not in L2 French. There are many factors involved, including task and individual reading style; and much more analysis is needed in this area.

### *Noticing in L2; How Texts Teach*

Bernhardt (1991) advocates an integrated model of second language acquisition which “assumes that second language text processing abilities develop over time...they are not learned as unitary entities.” (p. 167). In 2005, she adds, “knowledge sources act in an integrative, synergistic fashion, not an additive one.” This holistic view of second language acquisition, rather than a skills based one, fits with the theoretical orientations of my study. Although my research does not directly address acquisition, findings drawn from EMMA research leads to implications about what a reader notices. Noticing, as a pedagogical technique involves bringing elements of the target language to levels of

awareness: making implicit items naturally found in the input, explicit with the intention of facilitating intake.

Future research available in the database created for this study could include a comparison of what readers notice when reading silently compared with what they notice when reading orally. Also the question of whether L2 readers notice the same elements in a text as L1 readers could be investigated. Although I have not yet tested this hypothesis, I believe that readers notice their own miscues when rereading a text, particularly if they noticed and corrected these miscues on the first reading.

Theories about noticing may mature into specific ways in which second language teachers may use extensive, full-text reading as a springboard for linguistic discovery and action research into the theory that texts teach. Basic language programs in large universities are often strictly structured so as to provide equal education in multiple classrooms taught by multiple instructors. Too often they allow little time for extended reading in the foreign language and therefore research in this area remains sparse.

After reading *Little Red Riding Hood* in French, my students asked me over and over if we could read more stories; an opportunity I did not feel at liberty to provide in our time-restricted and well-structured basic languages format. Traditional foreign language programs have been heavily based on language structure and order of acquisition rather than on language use. Dupuy (1998) suggests forming literary circles in intermediate classrooms and allowing learners opportunities for social interaction in the context of foreign language literature. More research is needed into how second language texts teach and the importance of extensive reading in second language

classrooms. Extensions on the data presented in this study may add to knowledge of L2 reading which could inform these practices.

### Silent and Oral Reading

In 1922, Judd and Buswell investigated a new, “in the last three years,” movement in the schools to teach silent reading for speed, accuracy and comprehension. This emphasis evolved from Huey’s work on the psychology and pedagogy of reading in 1908. This silent-first philosophy has been overlooked in recent times of accountability, as silent reading is difficult for the reader to prove and for the teacher to account for. Comprehension questions, retellings, and all post-reading forms of documentation are indirect and imperfect, testing recall, memory, and expression skills rather than reading. For purposes of public accountability, and to the detriment of certain readers, such as Kenny in chapter 1, oral reading continues to prevail.

Jerry Fodor (1985) differentiates *perception* (perceiving the words on the page), a fast, input-driven, domain-specific, computational process, from *cognition* (interpreting the message within the text seen), which is slow, unencapsulated, and often under voluntary control. The complex task of reading involves a quick serial access of input from the printed text and subsequent interaction with previously stored knowledge in constructing an internal representation that accounts for the particular input sequences.

The exact timing and interaction of data-driven (bottom-up) and knowledge-driven (top-down) processing strategies is still under investigation. A reader performing a literary piece aloud is constrained by prosodic conventions of speech and social considerations for the listener. If Fodor’s claim of the slow interaction of input with

existing knowledge is correct, an oral reader may lack sufficient time to internally process the input for meaning if the task requires accurate, fluent oral output.

Oral reading involves both text perception and speech production. Phillips (2006) claims “production involves going from meaning to form ...speakers must first access the lemma, which bears the meaning and the syntactic information of a message. Next to be accessed is the lexeme or word form” (p. 25). The act of reading a text however begins with the opportunity to view a written version of the lexeme. Fast perception then stimulates an internally generated meaning (perhaps a lemma representation which is connected to conceptual contexts). Cognitive slowdowns in reading may result from a disjoint between the textual lexeme and the reader’s internal lexeme and lemma.

Except perhaps for very early readers instructed with an oral method, it has been shown that silent reading is faster than oral reading (Buswell, 1937b). Bouma and deVoogd (1971) state values for maximum reading speeds: orally about 30 letter-spaces per second; and silently, 50 letter spaces/sec. McCallum, Sharp, and Bell (2004) had seventy-four students read passages from an individually administered test of reading comprehension and found students took 30% longer to read orally than silently, yet comparison of mean reading comprehension scores showed no significant difference between silent readers and oral readers.

Baccino and Colombi (2001, p. 128) state that the mean fixation duration in silent reading is 225 ms, and in oral reading the mean fixation duration is 275 ms. They also state that the average saccade in silent reading is two degrees of visual angle or approximately 8 letter spaces. The mean saccade distance (arc) in oral reading is shorter, approximately 1.5 degrees of visual angle, or about 6 character spaces. As I discuss in

chapter 6, overall mean fixation durations during my subjects' oral reading events are not longer than during their silent reading events, yet their mean fixation durations do fall within the range found by Baccino and Colombi.

The difference in reading rates has led some psychologists to claim that silent reading and oral reading proceed by different processes (Anderson & Dearborn, 1952). K.S. Goodman (2003a) however claims there is one universal reading process, which applies despite mode or language. This theoretical question drives my baseline, descriptive study. I ask: is reading in English similar to reading in French; is L1 reading similar to L2 reading; and is silent reading similar to reading aloud?

#### Design and Methods in Reading Research

The pedagogical problem identified by Judd & Buswell in 1922 is that:

It is by no means as easy to teach silent reading as to teach oral reading. The symptoms of success and failure in the latter field are open to direct observation. In silent reading, on the other hand the observable facts are relatively few and extremely difficult to interpret. (p. 2).

Their solution has enabled my own research. They found that eye movements vary with task. Their focus was on real reading in context:

in real life the word will always turn up as part of a sentence and ...it will have a particular shade of meaning through its contrast with other words or through its special relation in the total idea conveyed by the sentence. (p. 4)

Choosing EMMA methodologies in this study permits me to view reading in its fully contextualized form. Empirical psychological research in the past three decades has

focused heavily on minute measurements in decontextualized, controlled environments. Decontextualizing, however, changes the act of reading, making it potentially nonsensical.

Recently the importance of context in meaning making has been shown even at the sentence level by Filik and Leuthold (2008) who demonstrate the influence of context on the N400 effect. The N400 effect was discovered in electrophysiological brain research: event-related potentials (ERP) studies. Electrodes placed on the head can provide an accurate time course of activity in the cortex. It was known that readers typically experience processing difficulty when encountering a word that does not make syntactic or semantic sense in its local sentential context (Osterhout & Nicol, 1999). Filik and Leuthold use the example: The cat picked up the chainsaw. In isolation, this anomaly produced an N400 effect, a negative spike in brain activity about 400 milliseconds after hearing the word chainsaw.

They were able to eliminate the effect of the pragmatic anomaly (cat's can't pick up chainsaws) by placing the sentence in a fictional scenario that is well known to the reader (that being a Tom and Jerry cartoon). "This finding suggests that readers can rapidly integrate information from their common ground while interpreting incoming text and provides further evidence that incoming words are immediately evaluated within the global discourse."

The design of my study involves neither listening nor recording ERPs and thus these results are not directly applicable. But I do look at reading in full context. Whereas Filik and Leuthold's work is based in spoken sentence comprehension, my own used two complete short stories; one in English and another in French, which were read silently

and orally, with eye tracking and vocal recordings captured for later analysis. The stories provide a complete context for viewing authentic reading longitudinally (over the course of ten minute reading sessions and thousands of eye movements), as the reader becomes engrossed in the task. Semantic anomalies arise naturally due to the writing style of the authors and the mindset of the reader. In chapter 5, I describe the hypothetical-real anomalies Clarke uses in *Feathered Friend* and how they create difficulties in interpretation [particularly for nonnative (L2) readers].

Another experiment regarding perspective-driven text comprehension was conducted by Kaakinen and Hyöna (2008). Like my research, they use eye tracking and free recall. They found that perspective-related prior knowledge facilitates encoding relevant information to memory.

### *Single-Subject Design*

Radach and Kennedy (2004b) state a need for more work on individual variation and on the effects of task demands in reading. My multiple single-subject design allows in-depth analysis of individual variation across texts as well as a rich common context for direct comparison between readers.

“Numbers of participants need to be evaluated relative to the variability of the data.” (Sternberg & Grigorenko, 2006, p. 33). Although the standard method of coping with variation in experimental psychology is to average across a large number of subjects (N), an alternative way of dealing with both inter and intra subject variation is a multiple single-subject design. Similar to case studies, single subject research concentrates on individuals. This descriptive study investigates nine comparable subjects in multiple reading sessions (French/ English; L1/L2; silent/oral).

*Descriptive-Quantitative and Longitudinal*

The apparatus of data collection inevitably shapes the questions to be asked and as well as the available findings:

...with the development of methodologies for measuring online activities and activations (eye-tracking techniques, probing techniques, etc.) in the mid 1980's attention shifted from the product of reading, the memory representation, to the actual process of reading itself." The purpose of this second generation of research was to describe what readers do as they move through a text. (van den Broek, Young, & Tzeng, 1999, p.72)

The intent expressed by van den Broek, et al. has been rarely carried through. Perhaps due to the continuing expense of eye tracking laboratories, and the dismal lack of funding for education programs, most eye tracking research prior to the 21<sup>st</sup> Century was conducted in psychology departments bound by time, funding, orientations, and methodologies to controlled experimentation on discrete psycholinguistic or physiological observations. This study is firmly placed in the second generation of eye-tracking research, creating a potential for holistic description of what proficient multilingual readers do as they move through a text.

Although eye movement studies have not traditionally been viewed as longitudinal research, this data collection format, especially when reading a complete authentic story over a thousand words in length, provides an extensive amount of in-depth data with clear opportunities for observing how the treatment (in this case the written text) affects the learner/subject/reader; as well as evidence for time relationships among variables within and between readers. Ortega and Iberri-Shea (2005) describe the essence of my research design:

a descriptive (that is nonexperimental), quantitative design. Such studies focus on quantifiable variables, but without researcher's manipulation...descriptive statistics displayed in the form of frequencies, percentages, and proportions, and other analytical tools, such as visual displays and implicational scaling are favored. (p. 29).

The data in my French-English, L1-L2, Silent-Oral database is presented descriptively, comparing reading times, miscue frequencies, and eye fixations within and between readers and across three conditions: language – French or English; reader's language dominance – L1 or L2; and reading mode - silent or oral). Visual displays of fixation overlays appear in appendix C.

### Summary

This chapter offers a glimpse of the extensive literature pertaining to multilingual silent and oral reading, eye tracking, and miscues. This is by no means an exhaustive review of the research and does not address controversies prevalent in these fields. My goal is to situate this in current knowledge. The driving questions evolve from a theory that reading is a universal process (Goodman, K. S. 2003a) and aim to investigate variation through three control variables: a) text language: French or English, b) reader language: native (L1) or nonnative (L2), and c) reading performance mode: silent or oral.

Chapter 3, describes the design, materials, readers, equipment and procedures used to gather the database, which I analyze using four dependent variables (reading speed, retelling scores, miscue frequencies, and eye fixation durations). Chapter 4 focuses on the first hypothesis: that reading in English is similar in reading speed,

miscues, and eye movements to reading in French, and reports large levels of similarity in all aspects across these languages for this set of readers. The hypothesis, however is not confirmed due significant differences in miscue frequencies between languages. Chapter 5 investigates the second hypothesis: that reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a second, or later acquired, language (L2); and reports both differences and similarities between native and nonnative reading, concluding that certain types of variation may be due to individual style and response to task rather than to language proficiency. Chapter 6 focuses on the third hypothesis: that silent reading is similar to oral reading in reading speed and eye movements, and reports similarities and differences in these measures both between and within readers, confirming that silent reading is faster globally than oral reading.

Chapter 7 explains the preliminary nature of this analysis: that surface measures have been roughly presented, but that in-depth analyses and comparisons, available within this baseline database of 24 adult multilingual reading events, is still required to verify patterns of universality across all three independent variables. The blessing of EMMA data collection procedures is a rich representation of proficient reading behavior in multiple ways (eyes, voice, and text). The curse is the extensive amount of information captured. The blessing will emerge as this database undergoes continued analysis and interpretation. Therefore, I suggest areas of particular interest which present themselves in this database, including potential comparison with existing knowledge about the multilingual reading process. I suggest alternative ways of viewing the complexity inherent in the reading process, but cannot make specific nor replicable claims about multilingual reading.

### CHAPTER 3: RESEARCH METHODOLOGY

The goal of this study is to capture and analyze authentic reading of full text by adult proficient multi-literate readers. Multi-literacy here means the ability to incorporate literacy skills, processes, and products from more than one human language to extract meaning from text. The languages selected for this investigation are English and French: Two alphabetic languages sharing historic and cultural links, which results in a high degree (as much as 60%) of lexical borrowing. Two reading modes (silent and oral) are also observed, providing an opportunity for comparison within and between readers.

This chapter describes the methods, procedures, and design of the study, providing information about the readers' demographic and linguistic backgrounds, the equipment used in data collection, the texts read, how and why they were selected, the types of information gathered, and the analyses applied to the data.

The investigation of reading is the investigation of numerous cognitive behaviors, making it difficult to delineate and to isolate processes or stages in the process. The goal of this study therefore is not to isolate and investigate particular linguistic or psychological elements of the reading process, but rather to capture a series of naturalistic, fully contextualized reading events as a baseline data source for the investigation of reading universals. Since eye movement studies of reading have traditionally been conducted using small segments of text (words and single sentences, or four-line texts), this research is mostly exploratory, a descriptive study, designed to gather information on authentic, contextualized reading, which will lead to further investigational theories.

## Research Design

The design is observational, exploratory, and descriptive; rather than experimental. A mixed design, it features no treatment beyond the self-paced reading of authentic stories. The purpose is the discovery of authentic, naturalistic, full-text, contextually-embedded reading by multilinguals. The quantitative measures used to unearth the hidden behaviors involved in contextualized reading include reading times, retelling scores, miscue analysis, and eye tracking.

“Experimental design is not appropriate in those situations where altering the natural environment of a phenomenon, for the purpose of isolating one variable for study, qualitatively changes the nature of the phenomenon itself.” (Strauss, 2005, p. 52). One interesting option for future investigation (see Chapter 7) might involve a comparison of findings in a holistic reading context, such as is seen here, with those of reading studies in more limited and controlled environments, such as word recognition, sentence comprehension or those employing altered text. As stated, the purpose here is not to isolate specific elements, but to holistically capture naturalistic reading events.

Leedy iterates “a basic rule in the selection of research methodology: *the data dictate the research methodology.*” (1989, p. 89) This study samples the observational situation of individuals in the process of short story reading. The data are verbal and the means to elicit the data are verbally oriented and qualitative. Additionally, quantitative methodologies (miscues and eye movements) approach an analytical survey method, employing simple descriptive statistics to extract meaning from the numerical values of these quantitative observations.

### *Hypotheses*

The three hypotheses dictate the framework for data sampling:

1. Reading in English is similar in reading speed, miscues, and eye movements to reading in French.
2. Reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a second, or later acquired, language (L2).
3. Silent reading is similar to oral reading in reading speed and eye movements.

The three-factor framework is based on the independent variables of story language (English or French), readers' prior experience with the language being read (native/L1 or L2/non-native), and the reading performance mode required to perform the assigned reading task (silent or out-loud). Reading order was varied (see Table 3.1) so as to permit a contrastive opportunity in data analyses of global and local influences on reading behaviors.

*Table 3.1 Order of short story reading tasks*

Main Reading Order:	French Silent 1 <sup>st</sup> French Oral 2 <sup>nd</sup> English Oral 3 <sup>rd</sup> English Silent 4 <sup>th</sup>
Reverse Reading Order:	English Silent 1 <sup>st</sup> English Oral 2 <sup>nd</sup> French Oral 3 <sup>rd</sup> French Silent 4 <sup>th</sup>

To improve opportunities for between-subject comparisons, the order in which the short stories were presented to the subjects and the task required (silent or oral reading) was alternated. Five subjects read the stories in the main order, being presented first with the French story to read silently and then the same story again in its entirety to read out

loud. After a brief repose, the English story was presented to read aloud; lastly the same English story was presented to read silently.

Four subjects read the stories in the reverse order, reading the complete English story silently and then reading the exact same English story aloud before reading the French story orally then silently. This alternate order of stimulus presentation and task permits greater power in potential inferences and conclusions by adding controls in areas of potential confounds: experience in the lab, with the story (first or second encounter), or with the task.

Most subjects read both stories twice in their entirety. Aspects relating to repeated readings will be discussed further in subsequent chapters in relation to subjects' reading behaviors and *retellings*. Prior to reading, subjects are instructed that they will retell the story when finished. The retelling provides a purpose for the reading and serves to keep the readers on-task. Retellings also serve as a minimal measure of comprehension. If able to vocalize an element of the story, the reader has processed that element sufficiently enough to hold it in short-term memory. This does not imply that elements of the stories, which are not verbalized in these unassisted recall events were not perceived, understood or remembered; the assumption is that readers process and understand much more than they retell.

What constitutes the representative and sufficient samples in this study? There are nine readers. A total of twenty-six reading events were recorded (due to reader availability and lab conditions, not all readers read both stories silently and orally). Observations from more than four hours of reading time were collected, from which 257

miscues emerged and 34,103 fixations were processed.  $N$ , the number of pertinent data points in this analysis, depends therefore on the question being asked.

The small number of participants (nine readers) places this study in the realm of single-subject research, controlling for individual variation by comparing individual readers across conditions rather than averaging across large subject samples. The large amount of data collected from each reading permits quantitative statistical averaging.

### *Multiple Single-subject Design*

Every reader is unique, interpreting written text in his/her own manner, derived from individual experience. The personalities of readers and researcher introduce both bias and variation. Although one standard method of coping with variation is to gather data from a large  $N$ , that is, a great number of subjects; a viable alternative method for dealing with inter- and intra-subject variation is the single-subject design. As Sternberg and Grigorenko remark, “Numbers of participants need to be evaluated relative to the variability of the data.” (2006, p. 33)

These reading events are not case studies in the strict sense of the term: although every effort is made to record reading in as naturalistic a manner as possible (see equipment and procedures here below), reading in a laboratory situation is different from reading at home for pleasure or for information; reading aloud to researchers is different from reading to tell a story to an interested audience. Case study descriptive data by definition is gathered from individuals in their natural environment. Laboratory reading (like reading during high-stakes testing situations) is, at best, only somewhat natural.

### *Cluster sampling within large sets of reading data*

Gathering large amounts of data (dozens of miscues and thousands of eye fixations) from a single subject permits internal averaging and comparisons to establish consistency and validity. During reading, the eyes fixate approximately four times per second. Eye fixations occur more frequently than human heartbeats. They are discrete yet continuous, producing an immense number of observable situations.

Eye fixations are ordinal data, in that they occur in a linear order and can be evaluated longitudinally. And they are also interval data, which are measured in relation to fixed units of time (milliseconds) and of space (degrees on a horizontal and vertical axis). Like miscues, they are a rich and somewhat heterogeneous data source, creating a large conglomerate population worthy of probability sampling. Since the readers share characteristics (such as common first languages or national origins and high levels of reading expertise), and since they read the same stories presented in similar conditions, comparisons are possible both within and across reading events.

### Subject Selection

Readers were recruited from the local community through list-serves for French speakers and university students. A sample of the correspondence used in subject recruitment is included in the Appendix A.1. An ideal subject was an adult with uncorrected vision who was a proficient reader of both English and French and capable of reading comfortably from a computer screen at a normal distance.

Participants in this study do not comprise a random sample of bilingual or multilingual readers. They are all highly proficient and experienced readers and are all members of the University of Arizona community who were paid to participate in the

experiment. Table 3.2 lists the pseudonyms assigned to the nine readers and a summary of their language backgrounds. Readers' sex is stated for informational purposes only; gender was not an investigational factor in this study. Each of these mature readers (average reader age: 32.8 years; range: 23-60 yrs) was well versed in linguistic conventions, such as punctuation and sound-letter correspondences, which are common to English and French.

*Table 3.2 Demographics: 9 Readers, 5 Nations, 9 Languages*

Reader pseudonym	Native or first language(s) = L1	Other languages of fluency = L2
AMY (female)	Bilingual French & Portuguese	English, German
DAV (male)	American English	French, Japanese
EVE (female)	French	English, German
GUY (male)	American English	French, Spanish
FAY (female)	Greek	French, Spanish, English, Pular
JAN (female)	French Québécoise	English
LUC (male)	Bilingual French & Fon	English, German, Latin
MAR (female)	American English	Unknown
PAM (female)	American English	French, Spanish

Preference was for readers with uncorrected vision and normal speech/articulation skills. Although no readers wore glasses during the reading sessions, two readers (one native Canadian French speaking female, JAN, and one native American English speaking male, GUY) did read while wearing corrective soft contact lenses. Despite claims by the manufacturer of the eye camera that contact lenses should not affect the level of data collection, corneal reflections during the reading events of these two readers were not consistently maintained, making complete eye fixation difficult to obtain. [I followed McKnight, McKnight, Sidani, and Figueredo, (2007) in dealing with missing data.] I suspected tiredness, and invited JAN to complete the second (English) set of

stories during a separate session at the beginning rather than the end of the day, but tracking remained difficult. The specifics relating to these and other data issues, and how they were subsequently accounted for, is detailed in chapters four through six.

AMY is bilingual since birth in French and Portuguese; her family, of Portuguese origin, lives in France and speaks Portuguese in the home. She received most of her education in France and also attended early grades in Portugal. She does not consider herself dominant in either language. Her second language, English, is the specialization of her graduate studies; she also speaks and reads German fluently.

DAV is an American graduate student. A specialist in applied computer technologies and applied linguistics, his first language is English; his second language is French, and his third language of fluency is Japanese.

EVE is French. Having received her education in France, she is currently living in the United States, where she is a graduate student of French literature and language teaching. Her first language is French, her second language is English, and she also speaks German.

GUY is an American doctoral student specializing in the study of romance languages and language teaching. English is his native language (L1). He is fluent in French and Spanish, having lived and studied in both France and Spain.

JAN is a university employee with a Masters degree. Originally from the province of Quebec in Canada, her first language is French and her second language is English. At sixty years of age, she is the oldest participant in the study.

LUC is a graduate student from Benin, West Africa preparing a doctorate in African Francophone literature. He is bilingual and biliterate with an L1 in French and

Fon. He understands, but doesn't write two other Beninese languages (Goun, and Mina). He knows German, and Latin. He began studying English (L2) at fifteen years of age, and as an adult came to study in the United States, where he now lives and works.

In addition to these original seven readers, two other L1 English speaking American graduate students (MAR and PAM) volunteered late in the study after learning of the research methodology. They read only the English story, and their data was included for purposes of triangulation.

This study remains in the realm of single subject and small group research for philosophical and practical reasons: Burge (1998) made the claim that since “languages depend on the experiences, usage and psychological structures of individuals...no two people speak the same ‘version’ of any natural language or dialect” (pp. 328-329). As expected, I encountered much variation both within and between readers as is shown in chapters 4, 5, and 6, yet trends emerge which address the hypotheses proposed.

## Text Stimuli

### *Selection of written materials*

In French oral production, the voicing of a word's final consonant varies with its sentential context: if the word immediately following begins with a vowel, a normally silent final consonant becomes voiced in both reading and in fluent speech. This is compounded in oral reading by literary genre: a final *e* (or *es*), silent in prose oration, becomes a pronounced schwa in poetry and song. To control for such variation, I selected only short stories (prose) in both English and French, so that oral renditions would more closely match silent readings in both languages.

Both texts are complete and authentic short stories written (and read) in the authors' first language. There are no intentional manipulations of any kind made to the texts since the goal of data collection is to gather as much behavioral information as possible during a natural reading session to illustrate proficient readers' cognitive reconstructions of complete and authentic written materials. (For more on authenticity, see Aebersold & Field, 1997, p. 48).

Aspects of text considered in the selection of the reading materials included readability, one single original language, length (1000-1300 words), a narrative story line (a plot which would lend itself to retelling), and subject matter potentially appealing to a wide audience and appropriate for an academic setting.

According to Goodman and Burke, "four main criteria are used in choosing material: (1) the selection must be one which the reader has not previously seen or heard, (2) it must be sufficiently difficult to generate a moderate number of reader miscues, (3) it must be of sufficient length to insure the availability of syntactic and semantic context to the reader, and (4) the selection must be a semantically complete unit" (1973, p. 2)

The English story, *Feathered Friend*, is by Arthur C. Clarke, a world-renowned science fiction writer also known for television and movies. He was born in 1917 at the seaside in England. This short story first appeared in *The Herald*, an Australian newspaper in 1957. It is 1294 words long, and in this study it is presented to the reader in nine screens of 16-point New Times Roman font, comprising 102 lines of double-spaced fluid text. It is a tale of a pet canary that becomes an oxygen sensor on a space station.

The French story *La légende du Mont-St-Michel* is by Guy de Maupassant (1850-1893) and first appeared in *Gil-Blas* in 1882 with the author's signature appearing as

Maufrigneuse. Maupassant is considered to be one of France's greatest storytellers, and despite writing profusely, he was advised not to publish for the first twelve years of his writing career by his equally famous mentor, Gustave Flaubert. Thus Maupassant commonly used pseudonyms until his war tale *Boule de Suif*, published with the help of the famous naturalist writer, Emile Zola, received critical acclaim.

*La légende du Mont-St-Michel* is 1516 words in length and was presented to the readers in 131 lines (twelve computer screens with eleven lines of text and a title page) using a similar format to that described for the English story above. This legend, recounted by a local Norman, tells of trickery and Saint Michel's fight against the devil in northern France.

Although both writers are well known and have a large following, none of my readers had ever read either one of these two stories prior to entering the EMMA lab. The stories, and a translation of the French tale, are included in Appendix B.

#### *Comparability of the French and English texts*

No two authentic texts, just as no two readers, and no two authors can ever be matched perfectly. Every reading is an independent event. Further details comparing the two stories are presented in chapter 4 which delineates data relating to the first hypothesis, that reading in English is similar in reading speed, miscues, and eye movements to reading in French.

Both stories were written for an adult audience. Both stories have a first person narrator. They both contain vibrant scene descriptions, characters, and dialog. Dialog generally contains shorter sentences (fewer words per phrase or utterance) and is read faster than descriptive prose, and with greater expression (Y. Goodman, personal

communication regarding dialect change during reading of repetitive dialogue; March 2007). The wide spectrum of narrative structure found in these complete short stories provides a wealth of data for future analyses of prosodic tempo, eye fixations and miscues.

The stories are presented on lightly colored backgrounds of yellow and green. Although color has not been shown to have a major effect on data quality, for some readers it can reduce visual stress, especially those who suffer from migraines, as Guy de Maupassant himself did. For an excellent review of visual stress and reading from colored backgrounds see Singleton and Trotter (2007). More about the stories is presented in chapter 4, along with information about the subjects' retellings, eye movements and miscues in specific areas of the two texts.

#### Apparatus

Research was conducted in the Eye Movement Miscue Analysis (EMMA) Laboratory housed in the Department of Language Reading and Culture (LRC), part of the College of Education at the University of Arizona, in Tucson. Readers read texts presented in PowerPoint format from a 19" CRT computer screen situated approximately 26 inches in front of their faces at eye level. The camera sat on the same table directly to the left of the computer screen from which they viewed the text. Although the camera can capture the eye at distances from 18 to 40 inches, the recommended optimal distance from eye to camera is the mid twenties to lower thirties range.

The remote optics technology of the Applied Science Laboratories (ASL) Model 504 eye tracker pan/tilt camera operates on a standard 60 HZ, meaning it captures the position (of the left eye) 60 times per second, or every  $16 \frac{2}{3}$  milliseconds. The Model

504 has been shown to be accurate to half a degree of vision angle, or less than two letter spaces (Paulson and Henry, 2002).

The technique of corneal reflection employed by the eye tracker is non-invasive and causes no physical discomfort for the reader. The system is called remote, or head-free, because it neither touches nor constrains the reader; instead a circle of diodes in the eye-tracking camera, emit near infrared light which the technician directs towards the reader. When the camera is in position, the reader's cornea and pupil reflect the light back to the center of camera. A separate control unit synchronizes this positional (and temporal) information using the software (Eyenal by Applied Science Laboratories) to calculate horizontal and vertical eye position and dwell durations, following a short phase of calibration. The data from eye tracking is stored on a separate control computer operated by a technician who adjusts the luminosity and thus the quality of the reflections, and who records the data received from the control unit.

Two external monitors situated between the reader and the control computer provide feedback to the technicians regarding the ongoing quality of the data being collected. One monitor displays an image of the reader's left eye, providing feedback to a technician who moves the camera by remote control whenever necessary to maintain focus on the reader's eye. Although viewing is binocular, eye movements were recorded from the left eye only.

The second monitor displays the scene being viewed by the reader (i.e. the text presented on the reader's computer screen) simultaneously with his/her eye movements superimposed on this scene either as a bouncing ball cursor or as moving vertical and horizontal crosshairs. The view from the monitor displaying the eye movements on the

text is recorded on videotape along with all co-occurring oral productions (i.e. reading aloud) gathered from a microphone attached to the reader's chair. No images of the reader were recorded. There is no external video camera. Only the eye movements overlaid on the textual presentation, and the voices in the EMMA laboratory, were recorded on videotape.

### Procedures

Reading sessions were arranged at the readers' convenience. Readers were told a session would last approximately two hours. Actual laboratory sessions lasted between 50 and 130 minutes. Readers were addressed in either French or English. I was present and principally responsible for all interactions and data collection. I greeted the subjects in the language they would be reading first, and collected demographic information during informal interviews between reading events. Interviews were conducted in English or French depending on the subject's preference. One of two English-speaking technical assistants was also in the laboratory to assist with data collection.

Before readers began to read, I introduced myself and the technical assistant, showed them the lab and explained the procedure, where they would sit and read and how the camera worked; where the microphone was and requested they relax and speak in a normal voice. I answered questions, assuring them that their participation was voluntary and that they were free to stop at any time. Each subject read, discussed, and signed a permission form previously approved by the Internal Review Board and Human Subjects Protection Office of the University of Arizona. The consent form is included in Appendix A.2

Despite demonstrated safety of the eye camera, readers were informed before sitting at the computer that their participation was voluntary. They were encouraged to stop, close their eyes, or turn their heads away at any time if they felt the slightest discomfort. None of the readers did so.

Video recording began when the reader was seated comfortably. The technician focused the camera on his/her left eye and then calibrated; a process of matching visual focus (crosshairs of corneal and pupil reflections) on nine numbers evenly dispersed over the computer screen in three equidistant rows of three. Before and after reading each story, during the pre and post calibration phases, participants were instructed to look at each number, verifying the accurate recording of eye position.

Calibration of the eye-tracking camera can take up to twenty minutes, depending on the reader and technical details. When the camera calibration was satisfactory, instructions were given about the reading itself. The reader was told that after we began recording and went through the numbers one more time, she/he would press the mouse to turn the pages and read a story (either orally or silently), and that after the reading he/she would be asked to retell the story.

Then recording of eye movements was initiated through the control computer situated to the left and behind the reader. The reader was once more instructed to look at each of the nine numbers on the reader's computer screen. The reader was then told to click the mouse to turn the page and to read the story out loud or to read the story silently. Reading was unassisted and self-paced. It took readers about ten minutes to read each of the stories (complete details on reading times follow in chapters 4-6).

During the reading, the technicians remain silent. One technician operated the remote to ensure the camera was continually positioned on the eye. I, or another technician operated the control computer, adjusting the intensity of the light emitted by the camera so as to maintain strong pupil and corneal reflections, and marking page turns (mouse clicks) in the data.

Immediately after the reader finished the story, he or she looked at each of the nine calibration points to verify that calibration had been maintained; then the eye tracking file was closed, the camera was directed away from the reader, and the reader was encouraged to close his/her eyes for a moment.

I then asked for a complete retelling of the story that had just been read by saying, “You did a great job. Thank you so much. Now could you please tell me everything you remember from the story?” Or, if the reading had been in French I said, “*Merci beaucoup, vous avez très bien fait. Veuillez me raconter, s’il vous plaît, tout ce que vous vous rappelez de l’histoire.*”

Subjects retold the stories in the language of their choice. As per Goodman, Watson and Burke (2005, pp. 55-56; 260-261; 271-272), the retellings were unaided oral presentations of the story that had just been read. If prompting became necessary, I encouraged subjects by asking one of the following open-ended questions:

“Is there anything else you can tell me about the story?”

“What happened then?”

“Could you tell me more about that?”

Calibration, reading and retelling were all recorded on videotape. Demographic information (including language experience) was gathered during informal discussions

following the retellings and was also recorded on videotape. In order to attain as relaxed and natural a reading atmosphere as possible in this laboratory setting, subjects were encouraged to take breaks (to get up and walk) between reading events. They were offered drinks and snacks at this time.

Before each subsequent reading (see Table 3.1 for a review of the order of presentation of the reading materials) subjects were encouraged to sit once again in a comfortable position and the camera was again calibrated to the left eye. After reading each complete story (ten to thirteen pages of text with twelve to fourteen lines of text per screen) the calibration was rerecorded to verify that it had maintained throughout the entire reading event.

Readers controlled the reading speed and turned pages/computer screens by clicking a mouse when they were ready. Only GUY's silent English data required a subsequent correction of reading time because he accidentally skipped a page. He quickly noticed the disjoint completely on his own (a sign of he was making sense of what he read), reported the error, and had the screen reset so he could continue. Other readers had no observed difficulties.

At the end of each reader's reading session (up to two hours total), I and the other technician explained a bit about the importance of their participation and answered any questions they had about the research, the lab, or the stories they read. I asked them if they were willing to be contacted if questions arose during data analysis, invited them to contact me with any thoughts or feelings they might have, and provided them with my email and telephone information. Readers were then thanked for their participation and paid a nominal sum of twenty dollars to cover costs related to travel.

Only one of the readers returned for a second session. Due to difficulty I had maintaining the corneal and pupil reflections late in the afternoon, I thought perhaps JAN was tired; after she had read the French story silently and orally, I suggested she return another time to read the English story. When she returned a few mornings later she spoke in depth about the French story she had already read. She said she found it quite interesting, that she loved the author but had never previously seen that tale. She expressed concern about the miscues she had made, exhibiting a strong desire to give us good data by reading perfectly. She said that she had gone on the Internet, found the story and reread it at home.

It is possible that the best data is collected from relaxed readers. The technical director later suggested this could be the case, and further analysis and experimentation with readers' affective traits is warranted. Readers were encouraged to blink as they liked, since dry eyes seemed to have a negative affect of corneal reflections.

#### Analysis: Extracting Meaning from Accumulated Data

Reading universals were sought in trends and commonalities in behavior or in text interpretation across languages, across texts, across subjects, and across silent and oral modes of production. Since the purpose of this study is to describe contextualized reading, the statistics used in analysis are both descriptive and inferential. The parameters (eye fixations, miscues, and reading times) are clearly-defined concepts whose values vary. Parametric statistics used in this study include measures of central tendency and deviation: specifically, arithmetic mean, total number, size, type, and relative frequency. Reading speed is both a global and local measure: Global means of

reading times and fixation durations are compared to local means to contrast reading overall with reading in specific regions of text, within and between readers.

Videotaped recordings of the eye and voice behaviors provide a general reference of the time course of each reading event and were reviewed multiple times in verification and analysis of accuracy, miscues, retellings, demographic information, and for general eye position data. I digitized these videos for preservation and portability.

### *Miscue Analysis*

Miscue is the term given by K. Goodman to describe instances when an observed response during a reading event differs from the expected response. Miscues were transcribed from the voice recordings for comparison within and between readers; for overall frequency and type, and in their individual occurrence. I derived the manner of analysis from the Goodman Taxonomy of Reading Miscues (Gollasch, 1982) and from the Original Reading Miscue Inventory Questions (Y. Goodman et al. 2005, pp. 278-284). These questions are designed to investigate whether a miscue is a dialect variation, whether a shift of intonation is involved, the degree of graphic and sound similarity between the observed response and the expected response, and whether the original grammatical function is maintained.

I identified 257 miscues of interest. For reliability, each miscue transcript underwent four separate analyses, and each was then confirmed and discussed with Dr. Yetta Goodman, author of the *Reading Miscue Inventory* (2005). Not every instance of variance from the printed text are determined to be miscues. Details on varieties in production, such as dialect, accent, and repetitions, which were not counted in this miscue total, are presented in relation to readers' oral performance in chapters 4-6.

Miscue tallies, including syntactic and semantic acceptability, indicate comprehending, the in-process understanding as reading is ongoing. Comprehending is reflected in both miscues and eye movements and is the central focus of this study. Comprehending can be contrasted with comprehension, which is measured after a reading act is completed (as in the comprehension reflected in retellings), and which is filtered through the lenses of memory and verbal report.

### *Eye movements*

Eyenal is the software produced by ASL for use with the Model 504 eye tracker. It registers the visual fields of eye position for subsequent processing into fixations. A fixation is defined as a period of relative eye stability. To maintain focus, the human eye is continually moving in minute unconscious tremors (Andersson, 1985; Smith 2004). When reading, the eyes makes large, fast jumps (saccades, first observed and named by Emile Javal in Paris in 1879) and then rest (fixate) in another region to be viewed. Between saccades, during the fixations, the eyes gather a visual image for processing in the visual cortex.

The eye tracker, described in the Apparatus section above, registered vertical and horizontal eye position sixty times per second. From these visual fields, I separated saccades from fixation locations and durations using the default algorithm in the Eyenal software. Starting with a bin length of 6 consecutive camera measurements of visual field (approximately 100 ms.), if the eye moved less than one half of a degree (about 1½ to 2 letter spaces) a fixation was established. The length of time the eye remains within these distance parameters is known as the fixation duration (the total continuous resting time between saccades). Using Fixplot (ASL) I produced an Excel printout of each

reading event with fixations numbered longitudinally. The start and stop times of each fixation and the total duration of the each fixation, the horizontal and vertical location of each fixation, and the saccade arch and saccade duration were the pertinent eye movement data for this study. EyeNal also provides pupil diameters, information about blinks, and feedback to verify true corneal and pupil reflections in each visual field.

I created overlays of the readers' eye movement record (fixations and saccades) onto the text of each PowerPoint screen. Fixation points appear as dots, and saccades as lines between them. The presentation of fixations points can be varied in size representing the fixation duration.

These overlays were layered in Adobe Photoshop as a visual record and for presentation purposes. The results are a detailed record of which words are looked at, how many times, for how long, and in what order. Although I have only begun detailed analysis, areas of text complexity, are often accompanied by an increase in both frequency and duration of fixations, and a greater number of regressions. These areas of interest also have an increased potential for miscues during oral reading. Data relating to this prediction, and interpretation of the findings, is presented in the following chapters.

### *Retellings*

Comprehension of the text read was verified using a post-reading retelling procedure as recommended in the *Reading Miscue Inventory* (Goodman, Watson & Burke, 2005). After reading each story, the reader was asked to retell, unassisted and in the language of his/her choice, all she/he recalled of what was read. An unassisted retelling (Y. Goodman 1982; K. Goodman, 2003b) is used so as to allow the reader to

fully express his or her memory and reaction to the text by limiting the introduction of researcher bias.

Narrative retelling guides were constructed for each story as a standard format for evaluation and comparison and are included in Appendix B. The retellings by these proficient multiliterates display a good deal of comprehension, as they recall both details and main ideas from the stories.

### *16 Possible Reading Conditions*

The total number and type of data sets are summarized in tables 3.3 and 3.4.

*Table 3.3 Total number and type of English data sets*

Reading mode	Order of text presentation	Reader Language	First encounter or repeat reading	Readers (total count)
Oral	Main	L1	1 <sup>st</sup>	DAV (2) GUY
Oral	Main	L2	1 <sup>st</sup>	EVE (2) JAN
Oral	Main	L1	2 <sup>nd</sup>	PAM (1)
Oral	Reverse	L2	2 <sup>nd</sup>	LUC (2) AMY
Silent	Reverse	L1	1 <sup>st</sup>	MAR (1)
Silent	Reverse	L2	1 <sup>st</sup>	LUC (2) AMY
Silent	Main	L1	2 <sup>nd</sup>	DAV (2) GUY
Silent	Main	L2	2 <sup>nd</sup>	EVE (2) JAN
7 silent 7 oral	9 main order 5 reverse order	6 native 8 nonnative	7 novel encounters 7 repeat readings	14 English language data sets

Table 3.3 outlines the fourteen English language reading events. Table 3.4 outlines the ten French language reading events. Together table 3.3 and 3.4 present the contrastive pairings used to seek universalities in the reading process. Of the sixteen possible

reading conditions (8 in English and 8 in French; 8 native language and 8 non-native language; 8 oral and 8 silent; 8 novel encounters and 8 second time reading the same text) which are used to evaluate the hypotheses, two remained unmet.

*Table 3.4 Total number and type of French data sets*

Reading mode	Order of text presentation	Reader language	First encounter or repeat reading	Readers (total count)
Oral	Reverse	L1	1 <sup>st</sup>	LUC; (1)
Oral	Reverse	L2	1 <sup>st</sup>	Unmet condition
Oral	Main	L1	2 <sup>nd</sup>	JAN; (1)
Oral	Main	L2	2 <sup>nd</sup>	FAY; DAV; (3) GUY;
Silent	Main	L1	1 <sup>st</sup>	JAN; (1)
Silent	Main	L2	1 <sup>st</sup>	FAY; DAV; (3) GUY;
Silent	Reverse	L1	2 <sup>nd</sup>	LUC; (1)
Silent	Reverse	L2	2 <sup>nd</sup>	Unmet condition
5 silent 5 oral	8 main order 2 reverse order	4 native 6 nonnative	5 novel encounters 5 repeat readings	10 French language data sets

As shown in Table 3.3, the English story, *Feathered Friend*, was read seven times silently and seven times aloud (an oral reading mode). In six of these reading events, English is the native language (L1) of the reader, and in eight of these reading events, English is a later-acquired language (L2).

Table 3.4 describes the ten recordings of the French story, *La légende du Mont-St-Michel*. Of these, five are oral readings and five are silent. Native speakers of French (L1) perform four of the readings and six readings are by non-native (L2) French speakers. For an explanation of main and reverse reading orders see table 3.1.

In order to predict specific regions of text that might cause readers increased difficulty in comprehending while reading, I looked at both stories specifically with an

eye towards low frequency locutions and non-canonical word order. I then asked five informants (two native language English and three native language French) for off line impressions of the two texts. None of these informants were previously familiar with the stories. Together we identified antiquated locutions, and complex syntactic or semantic frames, which could require an intensity of computation. An example of these are the contrary to fact statements which are worded without overt negativity: Specifically, in the English text, Clarke wrote, “had this been so” meaning that what had just proceeded was not true.

In such segments of seemingly complex text, I proactively expected to find increased eye activity (such as more frequent fixations, regressions, or fixations with longer durations) and possibly an increase in spoken miscues. The specific sections of text that were identified (and others which were added later such as first person use of the passé simple which has noticed by Linda Waugh) will be discussed in the following chapters.

Chapter 4 addresses the question of whether reading in English is similar to reading in French. Textual features including syntax, semantics, orthography, word order and cognates are investigated. Universality in the reading process is demonstrated in reading behaviors that hold across readers and across languages. Data is presented which addresses the first hypothesis: Reading in French is similar in eye movements, miscues, and reading speed to reading in English.

Chapter 5 addresses the question of universality in the reading process by looking specifically at data from native (L1) and nonnative (L2) readers. First language or subsequently acquired reading abilities, including proficiency, experience and fluency,

are discussed. These data relate directly to the second hypothesis: Reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a second, or later acquired, language (L2). I predicted that L2 fixations would be both more numerous and longer in duration since cognition in a second language is slower (less automatic) than cognition in a first language.

Chapter 6 presents data looking specifically at silent and oral reading both within and between subjects. The third hypothesis is addressed: Silent reading is similar to oral reading in reading speed and eye movement durations. I predicted that since articulation is slow, silent reading is faster than oral reading with fewer fixations, shorter fixation durations, or both.

The final chapter summarizes findings which describe full text authentic reading by proficient multilingual adult readers, draws implications for pedagogical applications, and proposes further research and continued analysis of miscues and eye movements in relation to authentic textual discourse, in an effort towards explication of the universal process of reading.

## CHAPTER 4: READING IN ENGLISH AND FRENCH

In this chapter, I present and discuss data relating to the first hypothesis: Reading in French is similar in eye movements, miscues, and reading speed, to reading in English. Two further hypotheses, addressing reading in a first or native language compared to reading in a later-acquired language, and silent reading compared to reading aloud, are explicated in chapters five and six respectively.

As described in chapter three, proficient volunteer readers, recruited from an adult French and English bilingual population in the southwest of the United States, were asked to read complete short stories silently and orally in the Eye Movement Miscue Analysis (EMMA) laboratory at the University of Arizona. The two stories read were *Feathered Friend* by Arthur C. Clarke and *La Légende du Mont-St-Michel* by Guy de Maupassant. These two texts and a translation of the French text can be found in Appendices B1, B3, and B5. My goal being to observe authentic reading, both stories were read in their entirety and in their original language. No intentional alterations were made to either text.

### Full Text Stimuli

Reading involves the complex internal interpretation of numerous linguistic features (including syntactic, semantic, and graphophonemic cues) and of contextual, pragmatic, sociolinguistic information sought from an external source. Reading complete texts provides a vast number of observation points in a controlled and comparable manner. Short stories provide a rich variety of *in situ* stimuli for the researcher, as well as interest for the reader.

*Arthur C. Clarke, Author of Feathered Friend*

Arthur Charles Clarke died in March of 2008 at age ninety. He is known both as an inventor and as one of the world's greatest writers of science fiction. During World War II, Clarke taught and developed radar systems in the Royal Air Force. In 1945, he proposed using this wartime technology in peacetime satellite communications systems, for which he later received a Nobel Prize nomination. He was also nominated for a Nobel Prize in Literature, and was knighted in 1998.

Clarke was born in England in 1917, and at the age of forty, having dedicated himself to writing (and scuba diving), he emigrated, gaining dual citizenship in Sri Lanka. When the short story *Feathered Friend* was published, Clarke had twice served as chairman of the British Interplanetary Society, and had been awarded the Kalinga Prize for the Popularization of Science by UNESCO. This story exemplifies Clarke's passion for space, as well as his skill as a writer popularizing science. He describes life in a space station in palpable ways, leading readers to experience new feelings through comparison to known situations (such as construction crews working on tall buildings):

Sven's team had one great advantage over the construction gangs you see putting up sky-scrapers down on Earth. They could step back and admire their handiwork without being abruptly parted from it by gravity. (Clarke, 1957)

His subtle style appears simple to native readers of English, yet is surprisingly complex as is discussed in subsequent chapters. This story is geared intended for a reader who is adept in the culture of a modern industrial world. By contrast, Maupassant's legend has a classic timelessness of rural culture.

*Guy de Maupassant, Author of La Légende du Mont-St-Michel*

Guy de Maupassant was born in 1850, sixty-seven years earlier than Clarke. Maupassant, however, lived a much shorter life: He suffered from a mental disorder, perhaps resulting from syphilis, attempted suicide, and died in a private asylum in Paris at the age of 43. Had he lived as long as Clarke, they would have spent twenty-seven years as contemporaries. Maupassant, of the naturalist school, is one of France's most famous storytellers.

*Comparison of the Authors and Texts*

Due to financial hardships, neither author obtained a university education, and both found early professions in low-level government bureaucracy. Both experienced war prior to writing these stories: Maupassant enlisted during the Franco-Prussian War and lived in Paris during the Commune; Clarke gained his technological expertise while serving in the Second World War.

*Story Settings and Descriptive Style*

Each of these stories introduces the reader to a setting he or she has likely never experienced, but one about which the author is very passionate. For Clarke it is fictional life on a space station, inhabited by technical experts; for Maupassant it is a 12<sup>th</sup> Century castle-monastery surrounded by shifting sands and rising tides on the shores of Normandy where he lived as a child and saved lives as a young man. He emphasizes the singular and shocking perfection of this site by writing, « rien au monde peut-être n'est plus étonnant et plus parfait. ».

Mont Saint-Michel, as a setting, holds both exotic and familiar elements. It is an actual place, but which only one of my readers had ever visited. And, although at the time it was written, the setting of a space station was more exotic than it is for today's audience, it continues to hold both exotic and familiar elements.

### Dependent Measures

The hypothesis that reading in French is similar in eye movements, in miscues, and in reading speed to reading in English encompasses three dependent measures to evaluate similarity of specific aspects of the reading process across languages, these being: eye fixations, oral miscues, and reading time.

A fourth measure, a concession to the tradition that reading can be demonstrated through post-reading memory and production, is a measure of comprehension. Prior to being instructed (in the same language as the text) to read silently or to read orally, subjects were told that at the end of the story they would be asked to recount all they remembered from what they had just read. *Retellings* are well tested as a pedagogical/research technique (Goodman, et al. 2005), and also as a holistic method for evaluating reading comprehension. Following the Goodman model for creating reader profiles using Miscue Analysis, I developed Retelling Outlines for each of the stories. These outlines formed the basis for Retelling Guides, which I used in quantifying readers' recall for purposes of between-subject comparisons. These Retelling Guides are included in Appendix B2 and B4.

I present these four dependent measures in the following order: reading times; retellings; miscues, and eye tracking data.

### Reading Speed in English and French

Table 4.1 compares the mean reading times of individuals for the complete short story *Feathered Friend* (across silent and oral repeated readings), and the mean reading time across all readers.

*Table 4.1 Global English reading times compared across readers*

Reader	Mean amount of time spent reading English story ( <i>Feathered Friend</i> )
AMY	07:14.358
DAV (L1)	05:36.636
EVE	10:21.504
GUY (L1)	07:04.017
JAN	10:20.492
LUC	14:28.467
MAR (L1)	05:51.271
PAM (L1)	09:52.636
Mean across readers	08:51.173

(L1) indicates that the reader read in his/her native language. Further analysis of first and second language reading is presented in Chapter 5. The reader FAY is not included in this table of English reading times because she read in French and Spanish. The Spanish language data, readings of the Latin American tale *El Hombre que salia por las noches*, silently and aloud, is not presented in this dissertation.

These global reading times represent the total amount of time the reader spent looking at the text. The text was read from a CRT computer screen. Readers pressed a mouse to change screen pages. All readers (except MAR and PAM) read the story twice, once silently and once orally. The global mean is an average of those two reading times.

Notable is the wide variation: the fastest mean is almost three times faster than the slowest. The range in mean English reading time is from 5 minutes 36.636 seconds (DAV) at the fastest to 14 minutes 28.467 seconds (LUC) at the slowest. This is a difference of 8 minutes and 51.831 seconds, representing a wide variation of reading speeds. Factors involved in this difference may include reading style and proficiency

(experience reading in one's native or non-native language). JAN (age 60) and PAM (age 50) were the two oldest readers. They both had issues of visual acuity, which may have caused a delay in their reading times.

French reading times are presented separately in table 4.2 because the two stories differ in length and are thus not directly comparable.

*Table 4.2 Global French reading times compared across readers*

Reader	Mean amount of time spent reading French story
DAV	12:09.562
EVE (L1)	09:02.028
FAY	08:28.492
GUY	08:52.284
JAN (L1)	11:20.381
LUC (L1)	13:29.463
Mean across readers	10:33.702

(L1) indicates that the reader was reading in his/her native language. AMY, MAR and PAM are not included in table 4.2; they were not recorded reading the French story.

The range in French reading times is from 8 minutes 28.492 seconds (FAY) at the fastest to 13 minutes 29.463 seconds (LUC) at the slowest. This difference, 5 minutes 0.971 seconds, represents a wide range of variation in reading speeds, although less extreme than that which is discovered in the English reading times of table 4.1. Furthermore, the variation in French reading times is not directly attributable to language proficiency: The slowest reader (LUC), although bilingual in his L1, considers French as a native language; while the fastest reader (FAY) considers French to be a second (acquired in adolescence) language. Findings related to reading in a native or a non-native language are discussed in chapter 5.

*Words-per-minute comparisons between languages*

A superficial comparison of table 4.1 and table 4.2 begs a hasty conclusion that this group of readers reads faster in English than in French by a difference of almost two minutes (01:42.529). However, these two tables are presented separately because the two stories vary in length and I cannot compare the reading times directly.

To quantify English reading speed with French reading speed, I divided each reader's reading time by the number of words in the story, arriving at a more comparable words-per-minute reading time value. *Feathered Friend* is 1294 words in length.

According to the University of Toronto website from which I took the text of *La légende du Mont-St-Michel*, it has 1516 different word forms. (For further information on this story, see: <http://tactweb.chass.utoronto.ca/french/legende.htm>, and for word frequencies see <http://tactweb.chass.utoronto.ca/french/maumenu.htm>)

Table 4.3 provides a rough comparison between reading times in English and reading times in French. To compute words per minute, I first converted seconds (a 60 based system) to percents of a minute (a 100 based system). The formula used to compute words-per-minute reading times has two steps:

- 1) Convert seconds and milliseconds to % of minutes (i.e. decimals): multiply seconds by 100 then divide by 60.
- 2) Divide the total number of words read by the total number of minutes read, to arrive at the number of words read per minute.

Table 4.3 Average number of words/min by language and reader

Reader	Mean words/minute	
	English	French
AMY	182.76	
DAV	272.96	124.72
EVE	126.31	168.72
FAY		182.365
GUY	183.49	175.08
JAN	132.23	140.07
LUC	88.17	112.49
MAR	221.03	
PAM	131.01	
Mean across readers	165.99	150.57

Blank cells indicate that no data was collected for that reader in that condition.

In self-paced reading of complete short stories, these readers read an average of 15 more words per minute in English than in French. One explanation for this difference in reading speed may be that some Latin-based lexical items in Romance languages contain more letters than their English counterparts; compare for instance the English subject and verb *we eat* to its French equivalent *nous mangeons*.

Contractions are also a factor in text density. In French, words undergo obligatory contractions. In the stories used in this study, contractions occur two times more frequently in French than in English, accounting for an increased density in the French text.

*What is a word? Is a contraction one word or two?*

High quality miscues on English contractions occur frequently and are an interesting phenomenon, which merits further study. It is obvious that an author's writing of a contracted form does not change the reader's pre-existing linguistic knowledge that the English contraction occurs optionally. For this simple reason, reading

miscues on English contractions are often attributable to dialect or register variations rather than to mistaken articulations. An excellent example of this phenomenon is when the reader JAN contracts *I am* to *I'm*, expands *can't* to *cannot*, and omits the contracted auxiliary *have* from “I’ve never listened...” to utter the grammatically sufficient “I never listened...” In French, by contrast, contractions are not optional and miscues on contracted forms are rare. DAV did say “*le aff...*” but even before finishing the utterance, immediately corrected himself to say “*l'affaire.*”

One problem with obtaining a definite word count for a text is the difficulty in arriving at an adequate definition of what constitutes a word (Katamba, 2005; Matthews, P. H. 1991). As L. Waugh notes, “The issue about what is a word has a huge literature...there are many, very substantive, differences across linguists about what the word is. This is particularly true for French these days, certainly in the spoken language.” (personal communication. June 9, 2008).

In the statistics presented in table 4.3 concerning words read per minute, word units in English were arbitrarily determined by a computer count of blank spaces. When an apostrophe fills this space, two words, previously independent, are counted as one single word unit. As stated the French word count used to arrive at the statistics in Table 4.3 came from the University of Toronto count of word forms. A computer count of words defined by letters between spaces reduces the number of *words* in the legend to 1420 rather than 1516.

In French, there are two types of contractions and both are obligatory. One merges two words without using an apostrophe. In *La Légende du Mont-St-Michel*, there

are 27 examples of this type of contraction: twelve instances of *de + le = du* ; seven of *de + les = des* ; seven of *à + le = au*, and one instance of *de + lesquelles = dont*.

In French an apostrophe replaces the preceding vowel when the following word begins with a vowel sound (*l'histoire; d'eau; n'eut; c'est; t'offre; jusqu'à*). This type of contraction is called *Elision*. With *élision*, two words, which would occur independently in other contexts, are merged graphically to represent a phonetic reduction of vowel sounds. In linear-production order, the first word is shortened and the vowel is replaced by an apostrophe: e.g.: *je + avais = j'avais* (I had). In French, these contractions are obligatory, not optional as in English. In English, an apostrophe can replace several letters and the space between two previously independent words, and the second of the two words in linear order is reduced, as when *we would* is contracted to *we'd*.

A count of the number of apostrophes in each of the two stories provides a rough indication of language density and may also provide insight into comparable reading times between these languages. The French text, *La Légende du Mont-St-Michel*, contains 72 apostrophes, while the English story, *Feathered Friend*, has only 35. Comparatively, the English text has more spaces overall than the French text (18.99% compared to 18.30% respectively), indicating that the French text is slightly more dense than the English text.

In English, however, apostrophes do not always indicate a contraction. In *Feathered Friend*, of the 35 apostrophes, 4 were used to indicate possession. The 31 remaining English contractions fell into three main types: the most common, with 13 tokens, was the auxiliary joined with a contracted form of *not* (i.e.: *don't; isn't; can't*).

There were 10 contractions with the copula *to be* (for example: I'm; where's; you're), and six with the auxiliary *to have* (there's; she'd, we've).

*There's* (which could represent either *there is* or *there has*) can only be disambiguated by its sentential context and therefore necessitates reading beyond the word level. It occurs in the very first line of the text, indicating a significant level of density and difficulty of this story: "...there's never been a regulation that forbids..." The past participle *been* signals to a proficient reader that the contacted auxiliary must be the third person singular form of the verb *to have*. Of the seven readers who read this story aloud, only one (EVE) elongated it to read "there has never been..." and none miscued.

#### *Characters per second reading times*

Due to cross linguistic inequalities in word length, a more accurate comparison of reading speed between these two languages comes from comparing letter spaces or characters read per minute in English and in French, rather than poorly-defined words read per minute.

The first three rows of Table 4.4 reiterate the per minute reading rate differences which were presented in Table 4.3. The next two rows compare the mean reading times across all readers using the dependent measure of characters (without spaces) read per minute. This statistic reduces the fifteen words per minute reading time difference between the languages to only three words per minute difference (There are approximately 4.64 letter-spaces per word in the English story and 4.94 letter-spaces per word in the French story).

*Table 4.4 Mean reading speed across languages*

	English	French	Difference
Word count	1294	1516	222
Mean reading time across readers	08:51.173	10:33.702	01:42.529
Mean number of words read per minute across readers	165.99	150.57	15.42
Character count (without spaces)	6009	7010	1001
Mean number of characters read per minute across readers	678.76	663.72	15.04
Mean number of character spaces read per second	11.31	11.06	0.25

The difference in reading rate between English and French, as shown in the final row of Table 4.4, amounts to only 1/4 of a letter space per second showing that reading speed in English is similar or perhaps only slightly faster than reading speed in French.

My first hypothesis (that reading in French is similar in eye movements, miscues, and reading speed, to reading in English) is confirmed in terms of reading speed, for this group of proficient multilingual subjects.

#### Text Comprehension Evidenced in Retellings

Comprehension is an important reason for, and simultaneously a factor in, reading. Both reading and comprehension are multi-faceted constructs lacking fixed, concrete definitions. Reading involves the perception of a text. Eye movements and miscues occur during the ongoing reading process and thus can provide indicators of comprehending a text during the reading process. The post-reading products in response to a text, which are commonly used to evaluate reading comprehension, involve memory and value judgments both of which may differ from those occurring during the reading.

In this study the text is written, literary language, and (the) reading comprises the individual's actions in interpreting that language. Measurement of the readers' interpretation of text involved four separate areas of evaluation:

- 1) The visual input dimensions (eye tracking measures such as saccades, fixations, and regressions) elucidate readers' ongoing perception of text.
- 2) Oral performance during reading, including miscues, illustrates readers' online creation of a simultaneous text.
- 3) Reading times (both globally and locally), calculated in words per minute or letter-spaces per second, as well as in fixation durations, provide a basis of comparison across readers, languages, and texts.
- 4) Retellings provide insight into
  - a) readers' memories of the texts read, and
  - b) readers' judgments of which aspects of the text read are critical to the storyline or to the assigned task.

Memory for aspects of a text is a common measure of comprehension; after each reading I asked my readers to recount all they had read as a verification of text comprehension. Their *retellings* of the stories were recorded and then assigned a numerical value using retelling guides (Appendices B2 and B4) in order to facilitate cross-reader comparison.

Comprehension, being an abstract construct, difficult to quantify; there existed no standard measure of comprehension for either of these stories. Following the format proposed by Goodman et al. (2005), for developing narrative retelling guides, I created such, based on a 100 point scale. The results represented here provide a general ranking

and do not reflect a true amount understood by the readers, these scores represent performance on the retelling guides I developed (see Appendices B2 and B4).

*Table 4.5 Retelling scores indicate text comprehension*

Reader	Feathered Friend ENGLISH		La Légende du Mont- St-Michel FRENCH	
	AMY	61	89	
DAV	54	74	61	68
EVE	46	-----	61	66
FAY			48	81
GUY	75	-----	57	75
JAN	44	60	53	82
LUC	60	58	78	75
MAR	-----			
PAM		51		
Mean across readers	56.45		67.08	

Blank spaces indicate data was not collected in that condition. Dotted lines in a cell show that the reader satisfactorily retold the story, but that technical difficulties prevented recording the retelling for later transcription and analysis.

The language of retelling was left to the reader and consistently matched the language of reading except in the case of LUC who chose to retell mostly in French (one of his first languages) even after reading the story in English. A continued comparison of native and nonnative reading is presented in chapter five.

As stated, the quantifiers in table 4.5 are based on an arbitrary 100-point system. And they do NOT indicate that a reader understood a particular percentage of the story. Retellings provide an indication of what a reader determines to be the essential details necessary to adequately portray the story (and thus to respond to the task). These numbers are an unknown percentage of what each reader actually remembers, and an under-specified percentage of what the reader understood while reading.

These retelling scores are not comparable across languages in a detailed sense, since they are not a true measure of comprehension. It is not possible to say that readers understood more in English than in French, only that these readers grasped multiple linguistic concepts in both languages.

This study, being descriptive in nature, aims to present a picture of the reading process as it is occurring. Miscue Analysis was developed by the Goodmans, as a method to document and understand a reader's creation of oral text when encountering written text. A miscue occurs when the expected response (ER) differs from the observed response. Analyzing the oral record collected during a reading session provides "a window" into the linguistic aspects of the reader's language use (K. S. Goodman, 1973). For decades, analysis of miscue percentages, type, and quality, has provided the most complete picture available of a reader's comprehending while reading.

#### Miscues in English and French

Table 4.6 presents a statistic commonly reported in miscue studies, a gross percentage of miscues versus non-miscues, known as miscues per one hundred words (MPHW). "To compute the MPHW, count the total number of miscues coded, divide by the number of words read, and multiply by 100." (Y. M. Goodman et al 2005, p.116)

The reader MAR is not included in table 4.6 since she only read silently and miscues were only counted when the observed response differed from the expected response in oral reading. Blank cells indicate that no data was collected for that reader in that condition: FAY did not read in English and AMY and PAM did not read in French.

Table 4.6 Miscues per 100 words

Reader	English Miscue count	English MPHWH	French Miscue count	French MPHWH
AMY	12	0.93		
DAV	10	0.77	29	1.91
EVE	22	1.70	13	0.86
FAY			21	1.39
GUY	5	0.39	17	1.12
JAN	26	2.01	7	0.46
LUC	48	3.71	19	1.25
PAM	28	2.16		
Total # miscues across all readings	151		106	
Total # words read in all readings	10,352		9,906	
Mean # MPHWH across all readings		1.46		1.07

Overall, there were fewer miscues in French than in English. This may be attributable to more phonetic representation in the text. It could be that the French story was easier for these readers; or, that the French story was more straightforward requiring less attention to the task of oral presentation than that required by the English story.

The Goodman Taxonomy of Reading Miscues (Gollasch vol. 2. pp. 215-302; adapted version in Y. M. Goodman et al 2005 pp. 279-284) provides for multiple levels of variation from the expected response (ER). Observed responses (OR) relate to dialect variation, so only miscues involving vocabulary or structural changes are analyzed. Thus I did not count miscues which were potentially related to dialect or to second language (L2) phonology; the frequency of miscues reported in Table 4.6 might be less than miscues reported in other studies.

As seen in Table 4.6, there is a wide range in the frequency of miscues produced by these readers. In comparing miscues per one hundred words, the range in English was from a low frequency of 0.39 MPHWS (GUY) to a high of 3.71 MPHWS (LUC). LUC produced 9 ½ times the quantity of miscues, while reading in English, as GUY did.

In French the variation in miscue frequency was less extreme (Remember that the variation in reading speeds was also less extreme in French than in English). JAN produced the fewest miscues, at a rate of 0.46 per hundred words; and DAV produced the most, at a rate four times higher than JAN's (1.91 MPHWS). Overall, the readers who produced the least number of miscues were reading in their native languages (L1) and those who produced the highest number of miscues were reading in later acquired languages (L2). This simple finding, although seemingly straightforward, is important to teachers who must set expectations for native and nonnative readers. These same expectations are often based on standards which may not match reality and might therefore never be met. Language proficiency is discussed further in chapter five in relation to the second hypothesis.

### *Repeated Readings*

Another potential confound, besides language proficiency, arose from the design: In order to compare silent reading to oral reading, readers were asked to read each story twice in its entirety. It is possible that a second reading resulted in fewer miscues due to a decrease in the cognitive load imposed by novel text. It is also possible that a second reading could produce more miscues as the reader becomes more comfortable with the

content and feels freer to construct novel interpretations (observed responses) of the printed text (expected response).

Of the seven oral English data sets reported in table 4.6, four were from a first reading of the text, and three from a second reading. The range of MPHW for first readings in English was from a low of 0.39 (GUY) up to a high of 2.01 (JAN). Only one of the readers read the French story orally on his first encounter (LUC). He produced 1.25 MPHW in French, a number that differs only slightly from the mean of the first English readings (1.22 MPHW). This similarity in frequency of miscue production potentially confirms my null hypothesis that reading in French is similar in miscues to reading in English.

In comparing the readers' second reading of each complete story, we can look at the miscue frequencies of three readers (AMY, PAM, and LUC) in English; and five readers in French (JAN, EVE, GUY, FAY, and DAV). The range in English is from 0.93 to 3.71 with a mean of 2.27 MPHW. In French the range is lower, and again, more restricted: from 0.46 to 1.91 with a mean of 1.15 MPHW. By averaging across readers, the frequency of English miscues produced on the second reading is almost double that of the frequency of French second reading miscues. Overall, however, the frequency of miscues is relatively small in both languages.

Second French readings were similar in mean miscue frequencies to first readings in English and in French (1.15, 1.22, and 1.25 MPHW respectively), confirming that reading in English is similar in miscue frequencies to reading in French. Second readings in English, however, differ from these other groups with a mean miscue frequency which

is almost double the others at 2.27 MPHW. This English trend may disconfirm the null hypothesis that reading in the two languages is similar in miscues, or it may be an artifact of the design: Readers were not randomly assigned to the main or reverse reading order groups. Instead they were assigned in a manner meant to maximize reader comfort to produce a natural reading situation. Nonnative readers of English were allowed to read the story silently before having to perform it aloud, more often than were native language readers.

Evaluating my first hypothesis, that reading in French is similar in miscues to reading in English the results are mixed:

*How miscues are similar across languages*

- + Amongst these proficient readers the miscue count is low in both languages.
- + The average frequency of miscues produced on a first reading of a story was similar in English and in French. The English mean of four readers was 1.22 MPHW while a single French first oral reading produced 1.25 MPHW

*How Miscues differ across languages*

- As with reading speed, the range of reader variability in miscue production is wider in English than in French. There is a greater disparity in number of English miscues than in number of French miscues.
- The average frequency with which miscues were produced on a second reading of a story was almost twice as high in English as in French.

The frequency of miscues is higher overall in English than in French, perhaps due to the fact that English orthography is less regular (it is deeper) than French orthography.

Or perhaps the English story was conceptually more difficult than the French story. This is an unpredicted result; prior to data collection, the concern (from an American perspective) was that the French story would be harder than the English story. Miscue findings show this not to be the case.

*Miscue Quality: Miscues or Mistakes?*

The percentage of self-correction of miscues by a reader can provide insight into the perspective of the reader toward the task. Some readers (JAN in particular) stated concern with producing an accurate reproduction of the text. Others may have felt freer to be creative. A common misunderstanding is that miscues represent a lack of proficiency or of comprehension on the part of a reader, but this is precisely where miscues distinguish themselves from mistakes: Miscues can demonstrate both language proficiency or fluency and a reader's ongoing process of comprehending.

In constructing a parallel text to the one presented visually, a reader draws on his or her knowledge of the language structure (the syntax, phonology, graphology, prosody and intonation), as well as its pragmatic (cultural context) and semantic (lexical morphology) import. Much of this knowledge extends well beyond the individual word or morpheme level. Some of what is produced by the reader in an oral reading may not even be accessible from the text. Reading and writing adhere to principles of communication: A writer cannot portray all the innuendo of a language, and thus, a reader is obligated to co-construct the text as he/she reads.

Table 4.7 presents a sample of observed responses (OR) compared to expected responses (ER) produced during an oral reading of the English text by one reader (DAV).

*Table 4.7 High quality miscues demonstrate text construction*

Expected Response (text)	Observed Response (reader)	Corrected
skillful	skilled	No
backward loop	back loop uh	Yes
, and <b>we</b> sometimes <b>had</b> to think	and sometimes <b>has</b> to think	Yes
Claribel's passed	Claribel passed	No

The semantic and syntactic acceptability of these miscues is notable even out of context, as are the form similarities of the OR to the ER. They all demonstrate how the reader is constructing a parallel text rather than mechanically reproducing the print. Since the miscue *skilled* fits perfectly in the context of the story, DAV did not correct it, and it is possible to assume this high-quality miscue was produced intentionally since the sentence produced was both semantically and syntactically acceptable.

The second miscue summarized in Table 4.7 also fits well in context and was grammatically acceptable. There was no obvious reason why DAV would have corrected himself from back loop to backward loop. One reason could be prosody; in listening to his own production of the oral flow of syllables in sentential context, he may have heard a gap.

The third miscue (...and sometimes **has** to think ...) clearly demonstrates that reading, for DAV, goes beyond word calling. He is creating the story he is telling:

ER: A space station has more hiding places than you can count; the only problem was that Claribel got rather noisy when she was upset, and we sometimes had to think fast to explain the curious peeps and whistles that came from ventilating shafts and storage bulkheads.

In this complex miscue, DAV omits the subject pronoun *we*, thus making Claribel the subject of this clause as well. He then proceeds with appropriate verb agreement (Claribel has), changing from declarative past tense to a narrative historical present, showing his active involvement in telling the story. This miscue is not attributable to simple problems in word recognition and instead involves phrase level substitution of object for subject, perhaps a result of syntactic priming.

In the last miscue in Table 4.7, DAV changes the ER to a more conversational form by dropping the auxiliary verb contraction of *has*. The change goes uncorrected as the OR fits perfectly with the urgency of the dialog in that part of the text. Further analysis of the plentiful miscue data provided by these multilingual readers would undoubtedly lead to greater insight into the similarities and differences between English and French in terms of the comprehending process while reading.

#### The EMMA Microscope

The beauty of eye movement miscue analysis (EMMA) is that this technique developed by Paulson (2000) integrates a record of physiologic reading behavior (eye tracking) with the oral reading. It feels like I have been given a microscope into the reading process.

DAV miscued on the ER *skilled* and said instead the OR *skillful* and he did not go back and change his response. By looking at his eye fixation durations we can see that he had no regressive eye movement to this word. He fixated on *skilled* (the ER) only once (fixation number 252), and that fixation was only slightly longer than his average global fixation duration; a 12.6% increase in fixation time.

When correcting his miscue on *backward loop* (the second miscue in table 4.7), DAV's eyes returned to the place of the omission (a regressive eye movement), and although the fixations in that area were 94 ms shorter than his global mean, the overall time spent looking at those two words was 600 ms longer.

These two examples show how EMMA can provide further information about a reader's comprehending process while reading. It is possible that EMMA methodologies may serve to inform outside observers of a reader's intentions and thoughts while reading. Eye tracking in this sense may be particularly useful when observing silent reading, as is discussed in chapter 6.

#### Eye Fixation Comparisons Between Languages

All but three readers (AMY, FAY, MAR) read in both English and French. A blank cell in Table 4.8 below indicates that data was not collected for that reader in that condition. FAY read in Spanish rather than English. Omitted from the means are durations from five readings in which the corneal and pupil reflections were insufficiently maintained in to order to reliably calculate fixations across the entire reading session. PAM is therefore not included here.

To compare eye fixations in English with eye fixations in French, I first averaged individual readers' fixation durations across each story for a global mean fixation time. Table 4.8 shows the mean fixation duration in milliseconds for each of the readers in each language. In all cases except MAR, who only read silently, Table 4.8 presents a mean of fixation durations while reading both silently and aloud. An in-depth comparison of silent and oral reading is presented in chapter 6.

*Table 4.8 Mean fixation duration in English and French*

Reader	Mean fixation duration while reading ENGLISH (in milliseconds)	Mean fixation duration while reading FRENCH (in milliseconds)
AMY	353.680	
DAV	312.664	359.047
EVE	225.683	217.917
FAY		327.125
GUY	226.020	228.648
JAN	212.365	219.221
LUC	343.864	321.942
MAR	297.371	
All Readers	Mean fixation duration (across 13 readings of the English story) = 281.664 ms	Mean fixation duration (across 12 readings of the French story) = 278.983 ms

Averaging fixation times across all readers, there is a difference of only 2.68 milliseconds between the English and the French mean fixation durations in full text reading. These means are averaged from the individual durations taken from a total number of 31,263 fixations: 13,956 fixations while reading in English and 17,307 fixations while reading in French.

The hypothesis, that reading in French is similar in eye movements, miscues, and reading speed to reading in English, predicts no noticeable difference in fixation durations between the two languages. The difference between fixation duration while reading in English and while reading in French is 2.681 ms, with a probability value of .00961 (while including the less stable fixation data the difference rises to 9.556 ms, with  $p = .03575$  in the opposite direction). Variability in eye data is the rule, yet we can say with a reasonable degree of confidence that eye fixation durations while reading in English are similar to eye fixation durations while reading in French.

## Chapter Summary

Data relating to the first hypothesis, that reading in French is similar in eye movements, miscues, and reading speed, to reading in English, is presented. The findings show that while reading the unaltered complete short stories *Feathered Friend* by Arthur Charles Clarke and *La Légende du Mont-St-Michel* by Guy de Maupassant, reading speeds by this group of nine proficient multilinguals are similar across languages. The mean reading speed of approximately three words per second differs by only 0.25 of one letter space per second between English and French.

Retellings demonstrate comprehension in all readers in both languages. More miscues are produced while reading in English than while reading in French. There is no sizeable difference between English mean fixation times and French mean fixation times. Unlike the wide variation in reading times, particularly in English, the range of fixation means is more restricted; and the slowest reader overall does not have the longest eye fixation durations. There are no outliers in comparing global fixation durations.

In searching for reading universals across texts, the first hypothesis, that reading in French is similar in eye movements, miscues, and reading speed to reading in English, is partially confirmed. Similarity in reading speeds, eye fixation durations, and memory/comprehension imply a degree of universality. Second readings in English resulted in significantly more miscues than a second readings in French, but this result has no generalizability due to peculiarities in the design related to each readers' language dominance. This repeated reading effect may however have important pedagogical implications for teaching reading, English, and language arts.

## CHAPTER 5: NATIVE (L1) AND NONNATIVE (L2) READING

This chapter focuses on describing the multilingual reading process by looking specifically at data relating to the second hypothesis: Reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a second, or later acquired, language (L2).

In this chapter, reading speed is compared between L1 and L2 readers of English and of French reading complete short stories silently and aloud. Text comprehension in L1 and L2 is verified through subjects' unassisted retellings immediately after reading. Frequency and quality of L1 and L2 miscues are analyzed from recordings of oral readings of the English short story *Feathered Friend* and of the French short story *La Légende du Mont-St-Michel*. Frequency and duration of eye fixations are compared across first and second language readers. Findings show a marked difference between L1 and L2 reading in specific aspects as well as individual differences within readers and across languages.

Chapter 1 of this document is an introduction to the need for this baseline study of eye movement miscue analysis and multilingual reading. A brief review of selected literature pertaining to multilingual silent and oral reading, eye tracking, and miscues is presented in chapter 2. A description of the methods, procedures, and design used to observe the silent and oral multilingual reading process appears in chapter 3.

An analysis of data partially confirming the first hypothesis (Reading in English is similar in reading speed, miscues, and eye movements to reading in French) comprises chapter 4. The mean reading speed of approximately three words per second differs by

only 0.25 of one letter space per second between the two languages, demonstrating no significant difference. Unassisted retellings demonstrate comprehension in all readers in both languages. More miscues were produced overall while reading in English than while reading in French. Regarding eye movements, there was no significant difference in mean fixation durations between English and French.

Chapter 6 presents a discussion of data relating to the final hypothesis: Silent reading is similar to oral reading in reading speed and eye movements. The hypothesis is not confirmed. Silent reading is faster than oral reading. Oral readings produced a greater number of eye fixations than silent reading. Fixation durations during silent reading were slightly longer in mean duration than in oral reading. Emotional reaction to an offensive region of the French text is also noted differently in silent reading fixations than in oral reading fixations. The complete stories and retelling guides appear in Appendix B.

Chapter 7 summarizes the information presented in this baseline descriptive study of multilingual silent and oral reading, highlights the strengths and weaknesses of this study, and suggests implications of this research and applications to teaching reading and foreign languages, as well as areas for further research. Appendices provide subject recruitment information, materials, and data samples.

## L1 and L2 Reading Speed

### *Reading English as a First or Second Language*

Table 5.1 compares the overall reading times (across silent and oral repeated readings) by eight subjects reading the complete English story *Feathered Friend*, and

averages across those reading English as a first language in one group and those reading English as a second language in another. None of the readers in this study had previously encountered the story.

*Table 5.1 L1 and L2 reading times in English*

Reader	Reader's L1	Mean Global Reading Time of <i>Feathered Friend</i> in English	
		L1 Readers	L2 Readers
AMY	French & Portuguese		07:14.358
DAV	English	05:36.636	
EVE	French		10:21.504
GUY	English	07:04.017	
JAN	French		10:20.492
LUC	French & Fon		14:28.467
MAR	English	05:51.271	
PAM	English	09:52.636	
Mean across all readers		08:51.173	
Mean across L1 readers		07:06.140	
Mean across L2 readers			10:36.205
Difference between L1 & L2 English mean reading times		+ 03:30.065	

Blank cells indicate that no data was collected for that reader in that condition.

The global reading times in table 5.1 represent the mean amount of time the reader spent looking at the text presented on a CRT computer screen in the EMMA laboratory. All readers (except MAR and PAM) read the story twice, once silently and once orally; in table 5.1 the two readings are averaged. PAM, an American living in the Southwest of the United States, was the slowest L1 reader of English, taking 9 minutes and 53 seconds to read the complete short story orally. She admitted having difficulties seeing some of the text and her miscues included guessing at words. Her L1 low-visual-acuity reading time approached the reading times of L2 readers of English.

JAN (age 60) and PAM (age 50) were the two oldest readers. JAN commented on the size of the letters (16 point font double spaced) although she did not admit to having difficulty seeing the text. Comparison of her French (L1) to English (L2) reading times in table 5.2 shows that she takes longer on average to read in French than in English, even though French is her first language. This is opposite to the trend which emerges for other readers who read faster in their L1 than in their L2. JAN is French Canadian; her global reading time closely resembles the L2 mean, and differs by only one second from EVE (a 23-year-old from France)'s ten minute reading time.

There is much variation in reading time: LUC, a bilingual (French and Fon) L2 reader of English, took the longest to read the story, 2.66 times longer than DAV, the fastest reader in L1 English. AMY who is bilingual in her native languages, read the story twice as fast as LUC. She is the fastest amongst all L2 readers of English. The contrast between LUC and AMY's reading times illustrates the danger inherent in quick conclusions regarding bilingualism as either a facilitating or a hindering factor in subsequent language acquisition and performance.

Visual acuity and age are not decisive factors in reading speed: Both PAM and LUC were slower than the mean when reading orally in their native languages. LUC had clear visual acuity and a poetic style.

*English L2, Slower than L1*

The first factor in the second hypothesis that reading in L1 is similar to reading in L2 in relation to reading speed, is not confirmed for authentic full text reading in English; amongst this group of readers, there is a significant difference in reading speed between

first and second language readers. All were adult, well educated, and highly literate. Overall, the second language readers spent about 50% more time reading the complete English story than the first language readers.

The implications of increased reading time for nonnative readers of English are far-reaching since at various age groups second language readers are held to the same standards of L1 readers in many contemporary testing, professional, and educational settings. The findings show that it is not unreasonable to allow nonnative readers time and a half to complete tasks that require extensive reading or intensive oral language production. These and other accommodation issues will be discussed further in the implications and applications sections of chapter 7.

#### *Reading French as a First or Second Language*

In English, reading speed in L1 is significantly faster than reading speed in L2 for this group of readers overall. This finding however is not true with French L1 and L2 reading speeds, which pattern in the opposite direction. The difference between first and second language readers of French is also less extreme: Reading English as a second language was approximately fifty percent slower than reading English as a first language, but reading French as a second language was approximately 13% *faster* than reading French as a first language. Emotional, environmental, stylistic, and linguistic confounds all require further investigation.

Table 5.2 compares the overall reading times of each reader for the French story *La Légende du Mont-St-Michel* (averaged across silent and oral repeated readings) by Guy de Maupassant, and then averages these times to arrive at a mean reading time

across first and second-language readers. As discussed in chapter 4, the English story contains fewer words than the French story. Therefore they are presented in separate tables and compared independently across readers.

*Table 5.2 L1 and L2 reading times in French*

Reader	Reader's L1	Mean reading time of the FRENCH story <i>La Légende du Mont-St-Michel</i>	
		By L1 readers	By L2 readers
DAV	English		12:09.562
EVE	French	09:02.028	
FAY	Greek		08:28.492
GUY	English		08:52.284
JAN	French	11:20.381	
LUC	French & Fon	13:29.463	
Mean across all readers		10:33.702	
Mean across L1 readers		11:17.291	
Mean across L2 readers			9:50.113
Difference between L1 & L2 global FRENCH reading times		-01:27.178	

AMY, MAR and PAM are not included in table 5.2 because they were not recorded reading the French story. Each reading time shown is the mean of two consecutive readings of the short story complete *La Légende du Mont-St-Michel* by Guy de Maupassant. None of the readers had previous experience with this story.

Table 5.2 shows that the L2 readers of French read faster overall than the L1 readers or French. Reading time varies significantly within both groups. EVE is a native French speaker from France, JAN is a native French speaker from Canada, and LUC is a native French speaker (bilingual with Fon) from Benin, Africa. On average, these three native speakers of French took eleven minutes and seventeen seconds to read the complete story with variation spread among the readers (9 minutes 2 seconds, 11 minutes 20 seconds, and 13 minutes 29 seconds, respectively). The cause of variation in reading

times requires investigation beyond the scope of this dissertation. Personality or style, interpretation of task, or early multilingualism all could play a role.

A comparison of reading times in tables 5.1 and 5.2 shows within reader variation: LUC reads slowly in both his L1 and L2, while DAV is the fastest reader in L1 English and the slowest amongst the group of L2 readers of French. In French DAV read slower than the mean of all readers by about 1 ½ minutes, and slower than the mean of his language experience group (L2 readers) by 2 ¼ minutes. DAV's reading of L2 French patterns more like the L2 readers of English shown in table 5.1, but to less of an extent.

It is possible that DAV's extended reading time in L2 French is related to his L3. DAV and GUY are both highly fluent French instructors at a university. They are both Americans with English as their L1. The significant difference between their L2 French reading times may be attributable to hidden facilitation from a third language: DAV is fluent in Japanese (L3) and GUY is fluent in Spanish (L3). FAY is also fluent in Spanish (L3) but Greek, rather than English is her L1. Her L2 French reading time resembles that of GUY with whom she shares this common L3 romance language.

*French. L2, Faster than L1*

When averaged together, the L2 readers of French read as quickly or faster than the L1 readers who had been reading French throughout their lifetimes. The nonnative readers of French shown in table 5.2 read about 13% faster than their L1 French counterparts. The average amount of time these L2 readers of French took to complete the entire French story was only nine minutes and fifty seconds, almost 1 ½ minutes

faster than the L1 French readers reading the same story in their native language. FAY and GUY (both reading French as a second language) were the fastest readers of French in this study. Both FAY and GUY are also literate and fluent in Spanish. They both read the French story in the main reading order (silently and then orally), as did DAV, EVE and JAN. For more detail on the readers' linguistic backgrounds as well as the design, please refer to chapter 3.

*English L1 < L2; French L1 > L2; Conflicting Results*

The results of L1 and L2 reading times in French (table 5.2) differ from the results of L1 and L2 reading times in English (table 5.1), patterning in the opposite direction: The L2 English readers are about 50% slower than the L1 readers of the English story; the L2 French readers are about 13% faster than the L1 readers of the French story.

This contrary result between languages shows that reading in a native or a foreign language is not a simple, straightforward a comparison, but involves other factors such as reading style, text genre and difficulty, task expectations, and experience with the foreign language. The result could differ for novice readers; all of the readers in this study are highly literate in their first language. They all have university degrees, and all had experience living in environments where the second language is spoken regularly.

Due to the intrinsic face value of second languages taking longer to process than first languages, I considered the English finding (1.5 times longer to read in L2 English) an anticipated result, until a colleague from the International Reading Association insisted on a need for national publication so as to inform procedures and standards

which fail to distinguish multilinguals, requiring second language readers to read with the same speed and accuracy as first language readers.

The French findings suggest that the difference amongst adult proficient readers may be less a question of a reader's language dominance than of linguistic differences between the two languages. Sound letter correspondence may be an important factor, since English orthography is more dense than French. The need continues for further investigation into how orthographic differences between languages affect language perception (Frost, 2005; Share, 2008).

#### *Stylistic Considerations in L1 and L2 reading*

I conducted discussions between reading events with each reader to gather demographic and linguistic history information (such as age, language dominance, reading preferences, experience with silent, oral, and foreign language reading, and experience living in a foreign-language environment). These are potential factors in reading speed. Notice that JAN takes longer on average to read in French than in English, even though French is her first language. After reading the French story, she discussed how much she treasures the French language, and that Maupassant is her favorite storyteller. Currently living in an English dominant environment, she seeks literature written in French. Perhaps she languished in reading the French tale or strove for perfection for sociolinguistic or emotional reasons.

JAN is the only reader who read the French and English stories in two separate lab sessions. When returning to the lab to read *Feathered Friend* she discussed her feelings surrounding *La Légende du Mont-St-Michel* which she read in the first session.

She had visited the physical location in Normandy where the story is set, and she comments on how much pleasure she took in the descriptions, as though she were there once again. She also confessed to going home and searching for the legend on the Internet so as to read it again. She was concerned about having read it correctly, even though accuracy was not part of the task requirement.

*LUC's poetic style in English and French*

During the interview, LUC confessed to being a poet, composing original poetry in his native languages of French and Fon. LUC is not in the habit of reading in English, and his English reading time is much slower than any of the other readers. He takes about twice as much time as AMY, who is also a bilingual native speaker of French. Her L1 is French and Portuguese, his L1 is French and Fon; she grew up in Europe, he grew up in Africa. (See table 4.1 for a comparison of English reading times. For more detail on readers' linguistic backgrounds see the section entitled *Subject Selection* in chapter 3).

LUC's reading in French is also the slowest amongst all readers, both L1 and L2. He reads daily and is pursuing a doctoral degree in francophone literature, so familiarity, experience, or proficiency with written language is not a factor involved in his delayed reading speed. Research design may be an issue. Table 3.3 displays the reading order of all subjects: LUC is the only reader who was asked to read the French story in reverse order, orally first and silently second. Overall, oral reading is slower than silent reading as will be shown in chapter 6.

Yet familiarity with the text (here controlled through reading order) is not the single factor affecting his slow reading speed. Listening to LUC's oral reading, it

becomes clear that his style is that of a storyteller. It seems to enjoy every word. Whether reading silently or orally, novel or familiar text, LUC appears to relish the sounds and the poetry within the prose. When asked about this in the post-reading interview, he admitted that he enjoys storytelling and does it often; that it is part of his heritage. LUC is from Benin, famous for its *griots* (storytellers). He pursues a Ph.D. in francophone literature and is passionate about the combination of words into stories and poems. Extended analysis of his recorded oral reading in French is in order as he appears to adhere to rules of versification even when reading prose.

*Text Analysis: Narrative Discourse*

Still needing investigation are the details of reader interaction with authentic text. As mentioned in chapter 4, the authors of these stories are skilled wordsmiths. Guy de Maupassant is considered one of France's greatest storytellers and Arthur C. Clarke was nominated for a Nobel Prize in literature. Their styles of writing differ in how they accomplish descriptions of story settings; Maupassant's descriptive style is visual and Clarke's is palpable: Maupassant uses color, geographical descriptions, and metaphor to represent grandeur; Clarke bumps his character into low-hanging beams illustrating cramped quarters.

Hamon (1964, p.140) suggests that a storyteller (un prosateur) can be a poet, *un magicien du verbe*; that verse and prose are independent of poetry which can occur in either context. In *La Légende du Mont-St-Michel*, Maupassant narrates first encountering the physical site through the eyes of a tourist: « Je l'avais vu d'abord de Cancale, ce

château de fées planté dans la mer. » [I saw it first from Cancale, this castle of fairies planted in the sea.] The text used and a translation are found in Appendix B.

With poetic style, Maupassant paints a colorful picture (gray, red, almost black, purple) in strong, repetitive strokes. When LUC reads this passage aloud he adopts a musical tone, as one would with poetry or song, and a slower rhythm with increased harmony. He institutes one of the main principles in poetic syllabification: attention to the silent *e*. In classic French verse a final *e*, silent in prose, becomes pronounced in poetry; counting in the meter, it adds another syllable to the word. Whether the *e* is pronounced or remains silent (*s'élide*) is regulated by its surrounding environment, particularly whether the following letter is a consonant or an aspirated /h/. Further detailed examination of LUC's adherence to these rules of versification could reveal his strategies for interpretation and rendition of text. Children's books often rhyme, adding a phonetic context in a limited-word-count environment. Future work on rhyming and non-rhyming texts may demonstrate that rhyming facilitates oral reading or comprehension.

Rhythmically, LUC pronounces the color adjectives in the descriptive passage above with long, slow vowels, particularly the *ou* in rouge, a repeating an element which lends a poetic style to Maupassant's prose. Both PAM and LUC are slower than the mean when reading orally in their L1. Case studies beyond the scope of this dissertation could prove useful by focusing on eye movements related to particular areas of text (e.g. description vs. dialog) or compared across readers (Luc the poet; FAY who enjoys

reading aloud; JAN, who loves the language; EVE who adopts a no-nonsense manner in completing the task).

Maupassant is a master of metaphor. Rather than the hypothetical-real contrastive descriptions of Clarke, Maupassant's description relies heavily at first on simile (large like a mountain, chiseled like a cameo, and vaporous like a foam, as if I had discovered the home of a god), and later on adjectival metaphor:

J'allai vers elle le lendemain dès l'aube, à travers les sables, l'œil tendu sur ce bijou monstrueux, grand comme une montagne, ciselé comme un camée et vapoureux comme une mousseline. ...Et j'errai, surpris comme si j'avais découvert l'habitation d'un dieu à travers ces salles portées par des colonnes légères ou pesantes, à travers ces couloirs percés à jour, levant mes yeux émerveillés sur ces clochetons qui semblent des fusées parties vers le ciel et sur tout cet emmêlement incroyable de tourelles, de gargouilles, d'ornements sveltes et charmants, feu d'artifice de pierre, dentelle de granit, chef-d'œuvre d'architecture colossale et délicate.

Reading poetry may be slower than reading prose. It is possible that LUC's elongated reading times (both silently and orally and in both English and in French) are a way of paying tribute to the poetry of the text. It is also possible that LUC's slow reading times are an artifact of an educational experience in which students are regularly required to recite and read aloud poetic text.

*Hypothetical-Real: Clarke's Contrary to Fact Locutions*

Clarke's style in the English story *Feathered Friend*, although more prose-like than poetic, is dense and complex. One syntactic complexity which proved difficult for nonnative readers is his use of contrasts in description.

Clarke's style extends beyond the sensibilities of a beginning reader and caused difficulties in interpretation which is seen in the retellings. Clarke employs a depth of syntax in several of his descriptions, which requires the reader to construct a hypothesis and hold it in memory for subsequent negation. This hypothetical-real (term from Peter Fries, personal communication, April 25, 2008) escaped L2 readers. One example in which Clarke describes a situation and then refers back to it in order to prove the opposite is in the character description of Sven:

With a name like that, you will picture Sven at once as a six-foot-six Nordic giant, built like a bull and with a voice to match. Had this been so, his chances of getting a job in space would have been very slim; actually he was a wiry little fellow, like most of the early spacers, and managed to qualify easily for the 150-lb. bonus that kept so many of us on a reducing diet.

The complexity arises with "Had this been so..." The demonstrative pronoun *this* signals not a proximal location (as in *this book*) but rather, an ellipsis, referring to previously stated information that is now omitted. For an L2 reader the complex referent may be difficult to grasp.

When I write such English phrases as "Had this been so..." the grammar editor in my word processor insists that I end with a question mark, for this inversion of subject

(this) and auxiliary verb (had) is most commonly found in questions, both in English and in French (e.g.: *A-t-il fait ce devoir?*). This syntactic complexity is aggravated for L1 speakers of French: In French this particular inversion for purposes of contrariness is not an option. In French, one must begin such a clause with the signaling word *If* and a canonical word order of pronoun-precedes-verb: If this were so... (*Si c'était vrai...*). The wording (Had this been so...) is a low frequency locution in English; rare, and thus potentially confusing for an L2 reader, a developing reader, or a reader who is skimming for information. This can be noted in the subjects' post-reading retellings.

*Section Summary:*

*Factors in L1, L2 Reading Speed*

Regarding the first aspect (reading speed) of the second hypothesis (that reading in L1 is similar to reading in L2), it appears from this group of readers that the similarity between L1 and L2 reading is greater in French than it is in English. L2 readers of French may have an advantage over L1 readers of French in regards to reading speed. Reading English as a second language is approximately fifty percent slower than reading English as a first language, but reading French as a second language is approximately 13% faster than reading French as a first language. Linguistic emotional, environmental and stylistic confounds were discussed. Text analysis is an important component of any reading study and merits further investigation beyond the scope of the investigations presented here.

Disparity between L1 and L2 reading speeds which patterns differently between languages implies that L2 reading in English is distinct from L2 reading in French. This

is an important finding. It has become common in the field of second language acquisition to distinguish between native and nonnative language users, and to roughly think of them as two distinct groups, as the English data certainly implies. After reviewing the English data, it appeared that time and a half would be an appropriate accommodation for an L2 reader, yet with the French readers such action seems unnecessary.

The opposite patterning of L1 to L2 comparisons between English and French, which share common alphabetic features as well as interwoven histories and an overlapping lexicon, mandates further multiliteracy research. Share (2008) calls English an outlier and warns “the field as a whole, Anglophone and non-Anglophone, is unwittingly a victim of the peculiarities of English orthography.” EMMA studies can benefit from knowledge gained in contrastive linguistics. Language complexity is an important consideration in reading speed (Flurkey, 1997). This and other areas meriting further investigation are discussed in chapter 7.

#### L1 and L2 Retellings: Learning by Reading

In a retelling procedure (Y. M. Goodman et al. 2005), subjects are asked to recount all they remember from what they have just read; in this case, complete short stories. Retellings can be used as a rough estimate of reading comprehension, based on the assumption that creating an episodic trace in memory is facilitated by comprehension.

The hypothetical-real locution “*Had this been so...*” requires extra thought, as is apparent in retellings by nonnative readers. JAN, after her first (oral) reading of *Feathered Friend* shows her confusion when retelling:

Sven is a giant, a big fellow, 150 pounds, but that's not so big; but in space he's weightless, he can float. There's a contrast, man is big, and the bird is tiny and powerful.

She does not clarify the actual size of the character Sven until her second (silent) reading of the story:

He's not a big guy; the name tells us that he could be a giant. I thought, oh God, yes, I read it the first time. I knew that! It said he was airy, no wiry.

JAN loves to read for pleasure and does so mostly in French. She reads novels, which she imports from her home city of Québec. She pursued a Masters degree in Business Administration in New Jersey and has lived in the southwestern United States for many years. She prefers to read in French, her L1, saying she finds it to be "more soothing."

After reading the English story silently, she commented, "It's a pretty story... I understood the story, but I have to think more in English." There may be effects of cognitive load revealed in her retellings. She confuses the character Sven with the story's narrator, and is creative in filling information gaps, deciding that the canary flew onto the space station [it was actually brought on, probably as a pet, by Sven] and was discovered when Sven "hears something and there's a canary." It is the narrator (an unnamed person of responsibility on the space station) who recounts hearing Claribel. Whether JAN further differentiates the two characters in her second reading is unknown, as she did not include this aspect of the text in her second unassisted retelling.

AMY is highly proficient in English, having completed a Masters degree in English language and having lived in both England and the United States. After her first

(silent) reading of the English story, AMY (bilingual L1 French and Portuguese) describes Sven as a “tall Nordic giant” using actual words from the text. She says, “Sven is gigantic and weighs a lot. He is handy in his own work.” Then after her second (oral) reading she states, “I want to change my story at the beginning...He’s not that big and tall. If he were, it would be troublesome to work on a space station. He’s a wiry little fellow; thin.”

AMY scored the highest of all retellings on the English story. She has a good memory for detail and vocabulary and during her unassisted retelling inquired about several expressions that were new to her such as *girder*, *dovetailed* (which she translated to French as *la queue de pigeon*), *technical stores*, *sluggish*, and *keeled* (putting this new word into context she said, “She revived at once then fell down again; she keeled again.”). In our post-reading discussion, AMY mentioned her strategy for remembering the spelling of new or unknown words and for guessing the meaning from the whole sentence. These are good examples of how texts teach (Meek, 1988).

One interesting example of AMY’s strategies of processing novel vocabulary from the text comes in relation to the word *smuggled*. Clarke wrote:

He had smuggled her up on the last ferry from Earth. When he came back from leave-partly, he claimed out of sheer scientific curiosity. He wanted to see just how a bird would operate when it had no weight but could still use its wings.

AMY seems to use context to recognize *smuggled* as a verb. She segments out the *ed* past tense morpheme when asking, “What is smug her on...snug?” She may be somewhat familiar already with the adjectives *smug* and *snug*.

In EVE (L1 French)'s first retelling, she correctly refers to Sven as "the owner of the bird," but she does not describe his physical characteristics; her second retelling was lost due to a technical error during data collection. Reflecting her own experience in recreating the text, Eve recounts that in the first two pages she thought the characters were dancers (she herself is a dancer); Clarke does refer to the delicate operation of construction in space as a ballet. Please refer to Appendix A for the complete text of *Feathered Friend*.

LUC thought for a while after he finished reading, before he began retelling the story, and was the only reader who retold the English story using mostly French. Although he reported using English when at his job in a department store, he spoke to me mostly in French. In his first retelling after reading the story aloud, he refers to Sven as a giant, as the owner of the dog, and said that Sven worked in construction before going into space. After reading the story a second time, he persists in two of these misconceptions; LUC still refers to Sven as a giant but says that he does construction. He debates whether Claribel is a dog or a bird, then decides she is a guard dog.

The hypothetical-real "Had this been so..." caused no apparent problem for the native English readers. None of the L1 readers of English exhibited any confusion as to Sven's actual size, mainly saying that Sven was small while also commenting on the contrast (DAV, GUY); or skipping this information in their retelling entirely (PAM). After his first (oral) reading DAV commented on Sven not being a giant, but rather a "150-lb guy," and after his second reading (silent), he notes that Sven is Swedish or Norwegian. GUY compares Sven to "Arnold, big... but actually thin" after his first

reading, and is the only reader to mention the 150-lb bonus after reading the story the second time. No one remarked on British/American standard weights and measures issues and they were not informed that Clarke was a British author. Weight in Europe is measured in grams. Pounds are currency rather than weight in the UK, and for readers familiar with European culture, *lb* may be an abbreviation relating to Luxembourg. Multiple interpretations of text is an interesting unexplored complexity.

### *L1 and L2 Retelling Scores Compared Between Languages*

Scoring of post-reading retellings is holistic (meaning that elements of the story are judged as integrated rather than discrete) and provides a global confirmation of text comprehension rather than a detailed account of all that is taken in, remembered, and considered significant or salient enough to report. Retellings provide an indication of the reader's interpretation of the text and of the task.

*Table 5.3 L1 & L2 Retellings Indicate Text Comprehension*

Reader	Feathered Friend ENGLISH		La Légende du Mont- St-Michel FRENCH	
AMY	61 (L2)	89 (L2)		
DAV	54	74	61 (L2)	68 (L2)
EVE	46 (L2)	-----	61	66
FAY			48 (L2)	81 (L2)
GUY	75	-----	57 (L2)	75 (L2)
JAN	44 (L2)	60 (L2)	53	82
LUC	60 (L2)	58 (L2)	78	75
MAR	-----			
PAM		51		
Mean across readers	61.09		67.08	
L1 retelling mean	63.5		69.17	
L2 retelling mean	59.71		65.0	

Table 5.3 expands on table 4.5, adding information on language dominance (in parentheses after the retelling scores) and adding L1 and L2 means in the final rows. Blank spaces indicate that data was not collected in that condition. Dotted lines in a cell show that the reader did satisfactorily retell the story, but technical difficulties prevented recording the retelling for later transcription and analysis. The scores in both cases are out of 100, but do not in any way indicate a percentage of story understood.

Retelling scores can not be compared between languages or between texts since neither the stories nor the instruments I created (see appendices B.2 and B.4) are comparable. Within language comparisons however show that in both languages the L1 readers had higher mean retelling scores than the L2 readers. This gross measurement replicates what is often the case with high-stakes American testing: Language proficiency is often a factor in reading test scores.

Reading times indicate that L2 readers of English may require extra time, perhaps compensating for a greater cognitive load. A supplemental hypothesis with face validity, that retelling scores after rereading the story show sizeable improvement over retelling scores after initial readings, is born out here.

Four readers read the same story twice in their L1: DAV in English [GUY's second retelling was lost]; and EVE, JAN, and LUC in French. Except for LUC, the L1 readers all showed improvement in their retelling scores after the second reading. LUC (the story teller) refused to retell what he had already told the first time, preferring only to supplement his original retelling. DAV improved 20 points; EVE, 7; and JAN, 29.

Averaging across them, the L1 readers improved 13.25 points between the two readings of the same English story in their native tongue.

Six readers read the same story twice in their nonnative language (L2): AMY, JAN, and LUC in English; DAV, FAY, and GUY in French. The average improvement in retelling scores in L2 English reading was 14 points, ranging from a loss of 2 points (LUC) to a 28 point gain (AMY). The average improvement in retelling scores in L2 French rereading was 19 points, with a range from 7 (DAV) to 33 (FAY). According to these means indicating improved comprehension with rereading, the L2 readers of French have a greater gain (about five points more in their retelling scores) than did the L2 readers of English.

To see if the L2 readers resemble L1 readers on their second retellings, I compared their second reading scores to the L1 means. When reading in English as a second language JAN and LUC did not attain the mean of L1 readers (-3.5 and -5.5 points respectively). AMY however improved greatly between the first and second English retellings and achieved the highest score of all readers in any condition. She gained 28 points on her second retelling, earning 89 points on the retelling guide's (Appendix B.2) 100 point scale.

When reading in French as a nonnative language (L2), FAY showed the greatest gain by rereading, increasing her second retelling score by 33 points over her first retelling score. Her second score surpasses the L1 mean by almost 12 points. DAV's second L2 reading showed a 7 point improvement in retelling scores, and fell just below the L1 average of 69.17. GUY's second L2 reading of the French story improved his

retelling score by 18 points and surpassed the L1 mean by almost six points. A pedagogical implication for L2 readers may be that extra time on task permits near-native achievement.

#### *Section summary: L1 & L2 Comprehension*

After reading each story, readers were asked to recount all they remembered from what they had just read. Using these retellings as a verification of text comprehension, all of these readers understood, remembered, and retold much of what they read. The range in retelling scores following the first reading of the story *Feathered Friend* was from 44 (JAN an L2 reader of English) to 75 (GUY, an L1 reader of English). The range in retelling scores following the first reading of the story *La Légende du Mont-St-Michel* was from 48 (FAY, an L2 reader of French) to 78 (LUC, an L1 reader of French).

Except in the case of LUC who chose not to repeat in his second retelling information which he felt he had already sufficiently explicated in his first retelling, all retelling scores (L1 and L2) improved on the second reading. Comparing across languages, L1 readers improved an average of 12.75 points between the two retellings, and L2 readers improved an average of 16.67 points when reading the same story a second time. This gain suggests that all readers, and particularly nonnative readers' comprehension benefits significantly from extra time spent examining the text

#### Miscues in L1 and L2

In chapter 4, I showed that reading events in English and French are similar in reading speed (i.e., the average number of letter spaces read per second differed only

slightly), and that this same group of proficient multilingual readers strayed from the text, creating miscues, more frequently while reading the English story than while reading the French story.

A frequency statistic commonly reported in miscue studies is a gross percentage of miscues versus non-miscues, known as miscues per one hundred words (MPHW). “To compute the MPHW, count the total number of miscues coded, divide by the number of words read, and multiply by 100.” (Y. Goodman et al. 2005, p. 116)

*Table 5.4 L1 and L2 Miscues per 100 words*

Reader	ENGLISH Miscue count	ENGLISH MPHW	FRENCH Miscue count	FRENCH MPHW
AMY	12	0.93 (L2)		
DAV	10	0.77	29	1.91 (L2)
EVE	22	1.70 (L2)	13	0.86
FAY			21	1.39 (L2)
GUY	5	0.39	17	1.12 (L2)
JAN	26	2.01 (L2)	7	0.46
LUC	48	3.71 (L2)	19	1.25
PAM	28	2.16		
Total # miscues across all readings	151		106	
Total # words read in all readings	10,352		9,906	
Mean # MPHW across all readings		1.46		1.07
L1 MPHW		1.11		0.86
L2 MPHW		2.09		1.47

Table 5.4 expands on table 4.6. The reader MAR is not included since she only read silently and miscues were only counted when the observed oral response (OR) differed from the expected written response (ER). Blank cells indicate that no data was collected for that reader in that condition: FAY did not read in English and AMY and PAM did not read in French.

In both English and French, L2 readers miscued more frequently than L1 readers. It is also interesting to note a language difference in these findings: Readers of English as a native language miscue 30% more often than readers of French as a native language, and L2 readers of English miscue 42.5% more often than L2 readers of French.

The second aspect of my second hypothesis, that reading in a first, or native language (L1), is similar in miscues to reading in a second, or later acquired, language (L2) prompts interesting questions in relation to language competence or language experience, and miscues. Do more proficient readers exhibit more confidence, feel less constrained by the text, and create more miscues than less proficient readers? Do second language readers tend to substitute known vocabulary items or syntactic structures for unfamiliar or complex constructions? EMMA, of which this dissertation offers an example (see also Duckett, 2001; Freeman, 2001; Gerard, 2007; Paulson, 2000; Specker, 2008; Yamashita, 2008) provides an ideal microscope for the examination of numerous questions regarding text and reader interactions. I provide here only a glimpse at central tendencies seen in these 24 reading events, and invite further investigation.

In Chapter 4, I show that these readers produce a greater number of miscues overall while reading in English than while reading in French. Table 5.4 shows that in both English and French, the readers who read in both languages (DAV, EVE, GUY, JAN, LUC) produced fewer miscues in their L1 than in their L2. Across all readers, the miscue count is low with LUC producing the most, making three times as many miscues when reading in L2 English than when reading in L1 French.

PAM, an L1 reader of English, patterns like a nonnative reader, producing more miscues than the L2 mean. This is likely due to her issues of low visual acuity. A proficient reader, she is able to hold large segments of text in mind as demonstrated by her corrected miscue:

ER: We stared at each other for a minute; then, before I had quite recovered my wit, she did a curious kind of backward loop I'm sure no earthbound canary had ever managed, and departed with a few leisurely flicks.

OR (miscue): ... she did a curious kind of backward loop I'm sure **AN earthbound canary had ever managed,** (correction) **no earthbound canary had ever managed,** and departed...

On her first reading, PAM substituted the two letter function word *an* for the two letter function word *no*. This word substitution may have been facilitated by a rightward attention to a peripheral view of the word *and* (Garrett, 1975; K. S. Goodman, 1997; Wilde, 2000). Upon attaining the comma, calling for a pause, the prosody of her incomplete clausal production alerted her to her miscue and she regressed to produce a correction. For the substitution *an* to suffice syntactically, she would have wanted a verb, not a comma. Her correction of the miscue demonstrates her linguistic knowledge of English sentence structure (see Jaeger's 2005 model of speech production which includes production monitoring).

PAM did not wear corrective lenses during the reading (GUY and JAN did wear contact lenses), and did not tell the researchers of seeing problems. Her visual difficulty

in reading the story from the CRT became apparent during her oral reading when she inserted a frustrated aside:

ER: ...Before I could retort that she usually woke me up, too, Sven came in through the...

OR: ... Before I could I CAN'T SEE THAT ONE retort that she usually woke me up, too, ...

Table 5.4 shows that when reading in her native language, English, PAM produces 2.16 miscues per one hundred words of text (almost double the L1 English mean of 1.11 MPHW), a slightly higher frequency than the second language mean of 2.09 MPHW in English. Since the English story *Feathered Friend* and the French story *La Légende du Mont-St-Michel* differ in length, the frequency statistic of miscues per one hundred words (MPHW) is used to compare across texts, and in this study, across languages, in a similar manner in which it has been used in prior miscue studies to report miscue frequencies across various texts and readers (Brown, Marek, and Goodman, 1994).

The Goodman taxonomy (in Gollasch, 1982) provides structure for determining if a miscue results in a syntactic or semantic interruption. Both the gravity of miscues and their frequency may be task-specific. Reading for precision and accuracy may result in a different miscue count than reading for meaning. A reading test evaluated purely on accurate pronunciation could easily result in the failure of competent second language readers. FAY, for example, who is a native reader of Greek and a strong L2 reader of Spanish and French, pronounced many of the /ə/ short schwa vowel sounds as in *de, le, me*, as /e/ like *des, les, mes*, etc. while reading the French story aloud. Although these nonnative pronunciations could be interpreted as word substitutions, I did not mark these

allophonic variations as miscues and would not consider them miscues since I believe they resulted in no loss of meaning and were a consistent artifact of FAY's idiolect/interlanguage. This coding follows the procedures for miscue analysis research.

With L2 readers, however, it can be difficult to judge whether a mispronunciation results in loss of comprehension. As discussed earlier in this chapter, in her retelling of the story, AMY, an L2 reader of English, was able to substitute an appropriate synonym for an unfamiliar word *keeled* ("fell"). Thus, she demonstrated meaning comprehension despite mispronunciation (she substituted a short vowel /ɪ/ for the long /i/ making *keeled* sound like *killed*; the oral record of which could be interpreted as a word substitution miscue) indicating either her lack of knowledge of this lexical item or her own difficulty pronouncing English L2 vowel sounds. (Appendix C.3 displays her fixation on the text.)

L2 Miscue counts remain a sticky issue: Mine are relatively low due to the fact that I did not count most interlanguage pronunciation differences. Reliability here was attained through multiple evaluations (each recorded oral reading was listened to at least four times) and through expert consultation (miscues were discussed and analyzed with two other experts in this field, Dr. Yetta Goodman and Dr. Joel Brown). I chose to include miscues that resulted in syntactic or semantic change, but not phonetic idiolect and dialect changes (such as FAY's /e/ for /ə/).

Often, when a miscue produces only a slight semantic change and the syntactic change is virtually unnoticeable or synonymous, a reader may not correct the miscue, but continue on with reading as when JAN (L2 English) read:

ER: "He's looking for Claribel," someone answered. "Says he can't find her anywhere. She usually wakes him up." Before I could retort that she usually woke me up, too, Sven came in through the...

JAN; OR (uncorrected): ... She usually WAKES UP WITH HIM"...

This same passage caused EVE (L2 English) and PAM (L1 English) to miscue as well, but in a manner which later created less syntactic acceptability, and thus stimulating correction:

EVE and PAM; OR (corrected): ... SHES usually wakes- She usually wakes him up."

And PAM, an L1 reader with low visual acuity, miscued in a similar manner:

OR (corrected): ... SHES- She usually wakes him up."

EVE and PAM may have predicted that the author would write about Claribel's location or morning state (as in, she's usually up before him, or, she's usually in his room). Their miscue demonstrates a high level of comfort with the text and the language. Their continued skill is demonstrated by correcting their miscue when another verb appeared making their *is* insertion impossible.

Table 5.4 showed that these readers made almost twice as many miscues when reading in their nonnative language as when reading in their native language. The universal process of reading however may be the same for both groups: Both L1 and L2

readers predicted upcoming text while reading and corrected themselves if their predictions proved unacceptable.

*Miscues: Non-word Substitutions on Long Words*

L2 mispronunciations, which develop into non-words, are common on long (multi-syllabic words). For example:

*Table 5.5 Sample Mispronunciations On Long Words*

Reader	Expected Response (text)	Observed Response	Corrected
AMY (L2)	...apologetically...	\$ hapolatically	no
JAN (L2)	...apologetically...	\$ opologically...	no
EVE (L2)	...apologetically...	\$ apologically	no
DAV (L2)	...invraisemblablement...	\$ invraisable.	\$invraisemble invraisemblablement
EVE (L2)	...infinitesimal...	\$ infitesimal	no
PAM (L1)	...infinitesimal...	\$ infintesimal	no

In accord with the Reading Miscue Inventory (Y. M. Goodman et al. 2005), a dollar sign (\$) is used to represent oral production of a nonword.

Less proficient readers are more apt to produce non-words when they miscue.

These non-word observed responses often contain graphic or phonetic similarities to the cues in the expected response; and it is sometimes difficult to separate miscues from L2 interlanguage/dialect/idiolect idiosyncrasies. The distinction may be important, however, when attempting to access how the reader is comprehending the text. Comprehending can be underestimated due to a developing phonology in the L2. This dissertation does not tackle this question, but suggests that EMMA techniques may inform reading assessment.

Although there may be multiple attempts at pronunciation, the reader rarely corrects or changes the ultimate non-word once it is decided upon and uttered. Perhaps

the readers do not notice a failure to pronounce the words “correctly” or perhaps they adopt a strategy which involves a best attempt at a difficult to pronounce word, determination that the response is sufficient, and moving forward in the story even if attention (which may be reflected in eye regressions or long fixations) remains in this region.

AMY’s eye movements in relation to this miscue are plotted in appendix C.3, figure 4. The first three of the miscues in table 5.5 were produced by readers reading in their language of less experience (L2), and all of the miscues shown in the table shortened the expected response by at least one full syllable, thus creating a nonword, simplified version of the ER.

DAV, an L1 speaker of American English, miscues on the six-syllable word *in-vrai-sem-bla-ble-ment* while reading in his L2, shortening the word from six to four syllables. During his oral and second reading of the Maupassant story (the first was done silently and oral miscues were not recorded), he omits the middle nasal vowel *em*, a sound which does not exist in his L1, and he omits the final syllable *ment* containing the same nasal vowel. He produces this sound successfully elsewhere in the text; it is a frequent sound in French: Although this miscue occurs in the second paragraph of the text, DAV had already produced the phoneme successfully five times.

He notices his miscue and attempts correction, yet his first correction generates another nonword: \$invraisemble which carries a degree of semantic plausibility as a created verb form with meaningful parts (untrue seems: in-vrai-semble). If he lacked familiarity with the ER (the target lexical item), he might have judged this production

acceptable, left well-enough alone, and continued on; but his attempted correction has also only four syllables rather than the full six required, and he judges his own OR insufficient in comparison to his target utterance. On the third try he successfully produces the entire word, *invraisemblablement*.

Lastly, PAM's miscue demonstrates that these nonword/mispronunciations can arise from influences other than language experience: In the case of PAM, an extremely proficient L1 reader of English, it is likely low-visual acuity, or a dialect issue when she omits a middle syllable from the expected response: infinitesimal, shortening it to five syllables. This is a low frequency, but not an unknown word for her. Like AMY and JAN, she makes no attempt at correction.

#### *Corrected vs. Uncorrected Miscues*

In chapter 4, I discussed DAV's acceptable substitution of *back loop* for *backward loop* and suggested that he over-corrected (read with more precision and fidelity to the text than the task required) when he corrected his miscue while reading in his L1 English. This type of miscue (with syntactic acceptability) commonly goes uncorrected when produced by native speakers if the word substitution continues to carry the main thrust of the meaning. In the examples in table 5.6, EVE similarly overcorrects in her L1 French, and PAM does not correct a miscue which is syntactically acceptable and which causes minimal semantic or pragmatic change.

Table 5.6 Some Corrected and Uncorrected L1 Miscues

Reader & Experience with language of text	Expected Response (ER)	Observed Response (OR)	Types of miscues	Corrected
PAM (L1)	"Give her a shot of oxygen," suggested somebody, pointing to the green-banded emergency cylinder in its recess beside the door.	"Give her a shot of oxygen," suggested somebody, pointing to the green-banded emergency cylinder in THE recess BEHIND the door.	Substitution Substitution Same part of speech	No No
PAM (L1)	To our delighted surprise, she revived at once.	To our delighted surprise, WE revived at once, she revived at once.	Substitution Same POS - perseveration	Yes
PAM (L1)	"...She's never done this before."	"...She () never () this before."	Complex Omissions	No
EVE (L1)	« Dieu a fait l'homme à son image, mais l'homme le lui a bien rendu. » Ce mot est...	... CES mot(s)- Ce mot est ...	Substitution-Semantic vs. Syntactic number agreement	Yes
EVE (L1)	Le diable...possédait les prairies...; tandis que le saint ne régnait que sur les sables.	...; tandis que le saint SE ne régnait que sur les sables.	Syntactically acceptable Substitution with meaning change	Yes
EVE (L1)	Le saint reprit : - Ecoute d'abord. Tu me céderas toutes tes terres.	Le saint reprit : TOUT d'abord. Ecoute, TOUT d'abord. Tu me céderas toutes tes terres.	Insertion (Anticipation of qualitative adj)	Correction attempt is semantically and syntactically acceptable
EVE (L1)	- Je t'assure que je n'y ai point pensé du tout ; ca s'est trouvé comme ca ;	- Je t'assure que je N'AI point pens- Je n'y ai point pensé A tout CA ; ca s'est trouvé comme ca ;	Complex miscue Late Closure	Partially Successful Correction
EVE (L1)	On but du cidre pur, mousseux et sucré, et	On but du cidre pur, mousseux et sucré, et	Complex: Omission &	Partially Successful Correction

	du vin rouge et capiteux, et, après chaque plat,...	du vin DU CA- et capiteux, et, après chaque plat,	subsequent substitution - change in POS	
EVE (L1)	Et, regardant au loin le Mont fatal...	Et, regardant au loin DE le Mont fatal...	Substitution - change in Part of Speech	Yes

Examples of L1 miscues are many in this database and merit further investigation. The perseveration in PAM's observed response, refers to her having continued the first person plurality of the possessive pronoun OUR in the preceding clause when she substituted the subject pronoun WE in place of she. Preservations are common in speech errors (see Garrett 1993) and the question of how errors in speech production compare with miscues in oral reading is still open to investigation.

*Table 5.7 Some Corrected and Uncorrected L2 Miscues*

Reader (Relationship to language of text)	Expected Response (ER)	Observed Response (OR)	Type of miscue	Corrected Yes / No / Attempt
EVE (L2)	It was quite obvious that she'd already learned how to operate in the absence of gravity, and did not believe in doing unnecessary work.	It was quite obvious that she'd already learned how to operate in the absence of gravity, and did not believe in GOING unnecessary work.	Substitution Same POS	No
EVE (L2)	To our delighted surprise, she revived at once. Beaming broadly, Sven removed the mask, and she hopped on to his finger. She gave her series of	To our delighted surprise, she RECEIVED at once. To our delighted surprise, she RECEIVED at once. Beaming broadly, Sven	Substitution; Substitution; Omission; Repetition; Substitution	Unsuccessful repetition of RECEIVED, No attempt to correct THE insertion, THE

	"Come to the cook-house, boys" trills-then promptly keeled over again.	removed the mask, and she hopped on THE his finger. She gave her series of "Come TO COOK-house, boys" trills-TRILLS- then promptly KNEALED over again.		omission, or KNEALED substitution
EVE (L2)	... I whirled on the duty engineer and said urgently: ...	... I WALLED on the duty engineer and said urgently: ...	Substitution	No
EVE (L2)	"Er- the second alarm circuit isn't connected up yet," his assistant reminded him. That shook Jim; he left without a word while we stood arguing and passing the oxygen bottle around like a pipe of peace.	"EH- the second alarm circuit isn't connected up yet," THIS his assistant reminded him. That shook Jim; he left without a word while HE stood arguing and passing the oxygen bottle around like a pipe of peace.	Substitution; Substitution	Corrected this> his;  No attempt to correct HE for we.
EVE (L2)	... we'd had one of our rare eclipses by Earth's shadow that night;...	... WE had one of our rare ECLIPSE by Earth's shadow that night;...	Omission of contracted modal; Omission of plural morpheme	No No
GUY (L2)	Et j'errai, surpris comme si j'avais découvert l'habitation d'un dieu...	Et j'errai, surpris comme JE L'avais découvert l'habitation d'un dieu	Complex: Omission & Insertion	No
GUY (L2)	... le saint s'ennuya de cet état de choses et pensa à passer un compromis avec le diable;...	... le saint s'ennuya de cet état de choses et pensa à passer un COMPRIS avec le diable;	Substitution Different POS Noun > past participle (/adj.)	No

EVE's L2 correction of her substitution of THIS for HIS was neither necessary to the global task nor to the local syntactic, semantic or pragmatic context. She demonstrates universality of the strategy of over-correction (precision; accuracy to text) in both her L1 and her L2 by showing that text dependence is not immediately attributable to lack of skill or to a lack of confidence in the language.

GUY's complex miscue in the phrase *Et j'errai, surpris comme si j'avais découvert l'habitation d'un dieu*. [I wandered, surprised as if I had discovered the home of a god] involves omitting the conjunction *si* (meaning *if*; part of *comme si*, as if) creating neither a semantic nor syntactic anomaly. However, when he inserts the direct object pronoun *l'* (it) before the auxiliary verb *avoir*, GUY creates a syntactic frame which obliges him to make the past participle agree in gender with the referent of this new preceding DO (that is. the following feminine noun, *habitation*). Agreement with this preceding direct object pronoun would mean adding a silent *e* to the past participle *découvert* causing the silent *t* to be pronounced. GUY does not fulfill this new mandatory agreement requirement created by his miscue. This is an interesting example of proficient L2 reading: He has taken liberties with the text, felt the freedom to diverge, to be creative; yet he is still less than self-reliant and is closely bound to the printed text (the ER), and thus unwilling to fully modify its contents.

I suspect that memory for text may be an issue, particularly for L2 readers. Diverging from the text creates a greater memory load, like having to remember the lie one has told in order to carry it over to the next context. This complex miscue of GUY's probably produced prosodic changes in his OR. Although those are not examined in this

dissertation, the oral readings have been digitized and are available for further study. A slight pause either when the *si* is omitted or earlier after the word *surpris*, and also after *découvert* could indicate further universals in reading. The addition of software for assisting with the analysis of the speech stream, could be an informative future augmentation to EMMA procedures. Further in-depth examination of eye tracking records would also tell which readers are looking at referents and at prosodic cues.

Looking back at EVE's L1 corrected miscues, one might surmise that prosody plays an important role in editing ones oral production while reading aloud. If this is the case, more investigation is needed to verify this theory and a comparison between L1 and L2 readings of the same text, such as is presented here, may be useful. GUY does not seem to notice having lost a syllable when he says COMPRIS (understood) in place of *compromis* (compromised) and it is probable that an L2 reader will not have the same prosodic sense about a language as an L1 reader. Since such parameters may be reset early in second language acquisition (Bley-Vroman, 1997; this theory requires further investigation using EMMA techniques.

#### *Miscue Section Summary*

Adding to the claim that reading in English is not the same as reading in French, miscue frequencies are higher in English than in French in both L1 and L2 (see table 5.4).

L2 readers create miscues with almost double the frequency that L1 readers do. The types of miscues however are similar for both groups: omissions, insertions, substitutions, and complex miscues occur with native and nonnative readers of both English and French. Readers over-correct and also fail to correct miscues in both their

first and second languages as though adopting one universal process of reading across languages and proficiencies.

#### Eye Fixation Comparisons Between L1 and L2

An earlier section in this chapter shows that L1 reading speed in English is faster overall than L2 reading speed in English, but that the opposite is true for French. These measurements are based on global reading times taken from 24 reading sessions involving two complete short stories. In self-paced reading from a computer monitor, nonnative readers of French (from Greece and the United States) read *La Légende du Mont-St-Michel* by Guy de Maupassant approximately 1½ minute faster than native French readers (from Africa, Canada, and France), as is reflected in table 5.2.

Nonnative reading in English shows an even greater variation from native reading: L2 readers of English took about 3 ½ minutes longer to read the complete English story *Feathered Friend* by Arthur C. Clarke, than L1 readers did (see table 5.1).

The question arises whether slower full text reading times are matched by longer eye fixations. Since the L2 readers of English spent about 50% more time reading the story than the L1 readers, do their mean fixation durations also last 50% longer? Starting from an intuition that cognition in a second language is slower (less automatic) than cognition in a first language, there is face value in a prediction that L2 fixations will be longer in duration so as to allow for increased attention to linguistic details such as novel syntax or vocabulary, and extra processing time.

French patterned in the opposite direction however, with L2 readers, reading faster than L1 readers. Therefore, will L1 readers of French have longer fixation

durations than L1 readers of English? The last line in table 5.8 suggests that there is no direct universal correlation between language experience and reading speed for adult proficient multilingual readers.

Nonnative readers' fixation durations overall last longer in both languages than do fixation durations of L1 readers. The French L1/L2 comparison in table 5.8 is the most surprising: Even though nonnative readers read the story faster than native readers, their fixations were 17% longer than those of their L1 peers, implying that global reading speed may not correlate directly with fixation duration.

*Table 5.8 Mean fixation duration in L1 and L2 English and French*

Reader	Mean fixation duration while reading ENGLISH (in ms)		Mean fixation duration while reading FRENCH (in ms)		Difference (in ms) L2 - L1	
	L1	L2	L1	L2		
AMY		353.680				
DAV	312.664			359.047	+ 46.4	
EVE		225.683	217.917		+ 7.8	
FAY				327.125		
GUY	226.020			228.648	+ 2.6	
JAN		212.365	219.221		- 6.9	
LUC		343.864	321.942		+ 21.9	
MAR	297.371					
Across all readers	Mean fixation duration while reading in ENGLISH (across 13 readings) 281.664		Mean fixation duration while reading in FRENCH (across 12 readings) 278.983		Difference 2.68	
	ENGLISH reading fixation duration			FRENCH reading fixation duration		
	L1 mean	L2 mean	Difference	L1 mean	L2 mean	Difference
	278.685	283.898	+ 5.2 ms	253.027	304.94	+ 51.9 ms

Mean fixation durations of L2 English readers were only 5.2 milliseconds longer than those of L1 English readers overall. This 1.8% difference in fixation durations

cannot account for the 50% difference in full text reading times. This group of L2 readers of English fixated the text more frequently than did the L1 readers of English.

Table 5.8 expands on table 4.8 to include specific information about fixation durations in relation to language dominance within and across readers. A blank cell indicates that data was not collected for that reader in that condition. As stated in chapter 4, these means are averaged from a total number of 31,263 fixations: 13,956 fixations while reading in English and 17,307 fixations while reading in French. Omitted from these tables are durations from five readings in which the corneal and pupil reflections were insufficiently maintained in order to reliably calculate fixations across the entire reading session.

One question which has been asked in eye tracking research relates directly to the physical control of eye movements (Leigh and Zee, 2006) and whether saccades are driven mechanically in a manner which is relatively independent of external stimuli, or whether attention is focused on a more local level of text interpretation (Reichle, Vanyukov, Laurent, and Warren, 2008). Averaging fixation times across my readers, the difference between the English and the French mean fixation durations in full text reading is very slight, only 2.68 milliseconds as shown in table 4.8. The difference between native (L1) and nonnative (L2) fixation durations while reading the English short story is also relatively small: Overall L1 reading in English involved fixations which were 5.2 milliseconds shorter on average than L2 reading fixations in English (across silent and oral readings).

The range in fixation times shows a great deal of individual variation.. DAV had the longest mean fixation durations, and GUY the shortest in reading English as a first language. DAV read the entire story faster than his peers (see table 5.1). DAV also had the longest mean fixation durations while reading in his second language French, and a wider difference between his L1 and L2 fixations than the other readers. The variation between L1 and L2 fixation durations is also most apparent in DAV's readings. His L2 (French) fixations were 46 milliseconds longer overall than his L1 (English) fixations.

French fixation durations pattern differently from English fixation durations : Overall, eye fixation durations during L1 reading of complete French text were almost 52 milliseconds faster than L2 fixation durations reading the exact same text (across silent and oral readings), a difference of 18.64%. This variation in fixation durations is not consistent across individual readers however: GUY showed little change in mean fixation duration from L1 reading in English to his L2 reading in French (only 2.6 milliseconds, matching the small overall difference between the English/French language means : 2.68 ms, rather than the larger difference of 51.9 ms between the L1/L2 means). His mean fixation durations were consistent across his language proficiencies.

JAN also exhibited a small degree of change in her L1 and L2 fixation durations, although in the opposite direction: Her L1 French reading fixations were 7.5 ms shorter on average than her L2 English fixations, even though she admitted to reading the French text with great care.

Although this effect is small, and requires further examination with a larger group of subjects, the implication may be that eye fixations are influenced by cognitive, stylistic

or emotional factors in addition to the pure physiologic response to task. It is certainly the case with LUC, whose L2 (English) reading fixation durations averaged 21.9 ms longer than his L1 (French) fixations (a 6.6% difference), that the text had an influence. These issues merit further study as discussed in chapter 7.

### Chapter Summary and Discussion

In Chapter 5, I present data relating to the second hypothesis: Reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a second, or later acquired, language (L2). The hypothesis is not upheld in its entirety as both similarities and differences emerge on these dependent measures for this group of readers.

There is significant variation amongst L1 and L2 reading groups, both individually by reader (LUC reads both languages with a studied poetic style; JAN reads her L1 slower than her L2) and by language: L2 global reading speed is 50% slower overall in English than L1 global reading speed. Conversely, global reading speeds in L2 French average about 13% faster than L1 French. This finding suggests that it is not proficiency and experience with a language that matters most, but the language itself.

Retellings demonstrate comprehension for all readers in both L1 and L2 in both English and in French although LUC had a difficult time correcting an error once he settled on an interpretation, even in the face of evidence (birdsong, animal's small size), and even after a second reading (Claribel, is she un chien (dog) or a bird?).

The readers who read in both languages (DAV, EVE, GUY, JAN, LUC, a total of 20 readings of complete short stories) produced fewer miscues in their L1 than in their

L2. In chapter 4, I found that these readers produced a greater number of miscues overall while reading in English than while reading in French. This chapter shows that in both languages L2 readers create miscues with almost double the frequency that L1 readers do. Although overall miscue frequencies were low, miscues are more frequent in English than in French in both L1 and L2 reading events (table 5.4).

Whether readers are using the same information-seeking process when reading in a non native language as when reading in a native language cannot be answered definitively by this uneven result. Miscues, while a window into the reading process, are a product of the process rather than the process itself. Universally, the same types of miscues are produced by both L1 and L2 readers: Omissions, insertions, substitutions, and complex miscues occur with native and nonnative readers of both English and French. Readers correct, over-correct, and fail to correct miscues in their L1 and in their L2 as though adopting one universal process of reading across their languages and proficiencies. They respond to the quality of their own miscues (in terms of syntactic and semantic acceptability) reflecting their predictions (Y. Goodman, personal communication, December 2, 2008). One reader (FAY) read in L2 Spanish, and demonstrated the same tendencies towards a global reading process across languages.

It appears in general that slower reading involves more, rather than longer, eye fixations. While the L1 readers of French read the Maupassant story about 13% slower on average than the L2 readers did, their mean eye fixation durations were 18.64% faster than those of the L2 French readers. And even though the L1 English readers read the story 50% faster than their L2 colleagues, their eye fixations durations were not

comparatively quicker, being only 1.8% faster. Again, individual variation (see DAV and LUC) is notable.

Chapter 6 follows with a presentation and discussion of data relating to the third and final hypothesis, that silent reading is similar to oral reading in reading speed and eye movements. I observe that overall, oral readings produce a greater number of eye fixations than silent reading, and that fixation durations during silent reading are slightly longer in mean duration than in oral reading. Emotional reaction to an offensive region of the French text is also noted differently in silent reading fixations than in oral reading fixations.

Chapter 7 summarizes the information presented in this dissertation and highlights the strengths and weaknesses of this study. I suggest implications of this research and applications to teaching reading and foreign languages, as well as potential areas for future research.

## CHAPTER 6: SILENT AND ORAL READING

This chapter addresses the question of universality in the reading process by looking specifically at data relating to silent and oral reading modes: How does silent reading compare with reading aloud, within and between readers? The third and final hypothesis, that silent reading is similar to oral reading in reading speed and eye movement durations, is evaluated for merit.

An introduction to this baseline study of EMMA and multilingual reading appears in chapter 1. Chapter 2 offers a review of selected literature pertaining to multilingual silent and oral reading, eye tracking, and miscue analysis. A description of the methods, procedures, and design follows in chapter 3.

Data partially confirming the first hypothesis (that reading in English is similar in reading speed, miscues, and eye movements to reading in French) comprises chapter 4. Mean reading speed differs insignificantly between English and French. Retellings demonstrate comprehension in all readers in both languages. More miscues were produced while reading in English than while reading in French, suggesting increased difficulty in English text interpretation over French text interpretation, although such an interpretation is unwarranted without further analysis into miscue quality. Regarding eye movements, there is no significant difference in mean fixation duration between readings in the two languages.

Chapter 5 presents within and between subject data failing to confirm the second hypothesis, that reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a later acquired, second language (L2).

Reading the full text short story *Feathered Friend*, L2 readers of English read 50% slower than L1 readers of English. A contrary, and less marked effect emerged in French: L1 readers read 13% slower than L2 readers in this group of proficient multilinguals.

Mean eye fixation durations of L1 readers are faster than those of L2 readers. L1 readers of French took 13% longer to read the Maupassant story than L2 readers, yet their mean eye fixation durations are 19% faster; their slower reading times resulted from more frequent fixations. The greater disparity of L1 and L2 reading times in English (the L1 readers read the story 50% faster than their L2 colleagues), had a negligible effect on eye fixation durations: English L1 readers' mean fixation durations are only 1.8% faster than those of L2 readers of English. Individual variation (see DAV and LUC) is notable.

Both L1 and L2 readers produce omissions, insertions, substitutions, and complex miscues - in both English and French. They correct, overcorrect, and do not correct miscues in their L1 and in their L2, indicating a universal process of reading across languages and across proficiencies. One reader (FAY) read in L2 Spanish, demonstrating these same tendencies. Frequency of miscues is affected by language experience: Readers produce almost half as many miscues when reading orally in their L1 as when reading orally in their L2. In both L1 and L2, miscue frequencies are higher in English than in French.

### Silent and Oral Language Systems

K. S. Goodman refers to written text as a parallel language system to oral language (2008, p. 11). Miscues emerge as a natural product of a reader's interpretation of a written language system through an oral language system.

Pedagogy and research in reading have principally focused on reading aloud. Sounds produced while reading are a tangible system which can be recorded, transcribed and reproduced. One pitfall in defining reading by its vocal production is the risk of underestimating a readers' abilities. Kenny (the six-year old emerging reader described in chapter 1) was thought to be a non-reader by his teachers and family because he produced no tangible oral record while reading. In reality he was reading proficiently, efficiently, and silently, a skill his parents and teachers neither anticipated nor knew how to measure.

Much pedagogical practice ignores silent reading in favor of the more readily measurable oral response. Eye Movement Miscue Analysis (EMMA) technologies provide an opportunity to demonstrate reading of both silent and oral varieties. Prior to seeing him read in the EMMA literacy lab, Kenny's caregivers, based solely on the observable evidence of vocal reproduction of text in an oral language system, feared illiteracy. As the microscope did for previously unobservable cells, the eye camera does for eye fixations, making observation of the silent reading process possible.

### Silent and Oral Reading Speed

How does a silent reading event compare to an oral reading event? It has been shown that silent reading is faster than oral reading. Buswell (1937) investigating the

problem of illiteracy in Chicago, conducted studies of 1,120 readers. He looked at silent and oral readings of 12-line paragraphs with eye tracking and an oscillograph to simultaneously record voice. He found that in fluent reading only a percentage of words are fixated, and that silent reading is faster than oral reading because translating text into an oral message takes time and interferes with internal meaning making.

The difference in silent and oral reading rates has led some psychologists to claim that silent reading and oral reading proceed by different processes (Anderson & Dearborn, 1952). Global comparisons of reading speed provide a glimpse of general trends in silent and oral reading. Table 6.1 compares reading times of each of my readers and averages silent and oral reading times across languages and across readers.

*Table 6.1 Global silent and oral reading times compared across readers*

Reader	SILENT Reading Times (min:sec)			ORAL Reading Times		
	English	French	Mean	English	French	Mean
AMY	06:10.004			08:18.712		
DAV	03:24.085	11:59.050	07:41.568	07:49.187	12:20.074	10:04.631
EVE	09:16.456	08:19.779	08:48.121	11:26.551	09:44.769	10:40.362
FAY		07:18.221			09:38.762	
GUY	06:44.701	07:29.933	07:07.317	07:23.333	10:14.635	08:48.984
JAN	07:56.727	08:55.200	08:25.964	12:44.264	13:45.561	13:16.913
LUC	14:02.739	13:04.101	13:33.420	14:54.194	13:54.824	14:23.509
MAR	05:51.271					
PAM				09:52.636		
Mean across readers	07:29.506	09:30.974		10:21.239	11:36.451	

Blank cells indicate that no data was collected in that condition.

DAV, EVE, GUY, and JAN read in the main reading order: reading the complete French story, *La Légende du Mont-St-Michel*, silently before reading the same story orally; then reading the English story, *Feathered Friend*, orally before reading the same story silently. AMY, LUC, MAR, and PAM, read in the reverse order: reading the French story orally before reading it silently; then reading the English story silently

before reading it again orally. FAY read in the main reading order, but instead of reading the English story she read a Spanish story, *El Hombre que salía por la noche*, written by the Latin American author Juan José Millas (1946).

Table 6.1 shows that oral reading times are consistently longer than silent reading times, across readers and across languages. Overall, silent readings of these complete short stories are 2 minutes and 19 seconds faster than oral readings. Across these self-paced reading events, readers read 21.7% faster when reading silently than when reading orally.

Comparing the number of words read silently per minute and the number of words read orally per minute is also informative: Across readers and languages, the mean silent reading speed is 165.83 words per minute, while the mean oral reading speed is only 133.24 words per minute.

The French story (8,579 characters in length, including spaces) is longer than the English story (7,418 characters, including spaces). Although it is logical that the shorter story would require less time to read, EVE and LUC took more time reading in English (the shorter story) than reading in French both orally and silently. For both of these readers, English is a second language. EVE read in the main reading order; LUC read the stories in the reverse order. Regardless of reading order, they both read faster (silently and orally) in their L1 (French) than in their L2 (English). For further information on native and nonnative reading, refer to chapter 5 of this study.

JAN has the widest range in her silent and oral reading speeds, with a mean global reading speed of 13 minutes and 17 seconds between the two stories when reading orally,

and a mean of only 8 minutes and 26 seconds when reading the same two stories silently; a difference of almost 5 minutes, or 36.5% faster when reading silently. Both JAN and LUC are slower than average when reading orally.

LUC reads slower than his colleagues in all conditions, and, contrary to JAN, has the smallest difference between his silent and oral reading speeds: The mean of his silent reading times is only about 50 seconds faster than the mean of his oral reading times. This 5.8% difference, is not as great as that of other readers (21.7% overall), suggesting perhaps that LUC, unlike his colleagues, employs a consistent reading style whether reading silently or orally. His versification style, discussed in chapter 5, merits analysis beyond the scope of this dissertation.

The global reading times presented in Table 6.1 provide details on individual readings, but are not truly comparable across languages because the French story is longer than the English story. Table 6.2 compares the difference between silent and oral global reading times across readers, and within texts.

*Table 6.2 Mean silent and oral reading times by language*

English ( <i>Feathered Friend</i> )			French ( <i>La Légende du Mont-St-Michel</i> )		
Silent	Oral	Difference	Silent	Oral	Difference
07:29.506	10:21.239	3:51.733 37.3%	09:30.974	11:36.451	2:05.477 25.1%

Table 6.2 shows that silent reading is faster than oral reading in both English and French. Since the number of reading sessions in each language and the order of silent and oral repeated readings is not evenly matched, the 12% difference between the English and French percentages shown here does not generalize to other reading situations.

That silent reading is faster than oral reading is not a surprising result. In 1908 Huey advocated silent reading in school even for emerging readers partially because of its expeditious nature. Judd and Buswell (1922) claimed, “a skillful reader reads silently several times as fast as he reads aloud” and, “The element which makes oral reading slow is the relatively cumbersome process of pronouncing words.” (p. 1).

DAV’s silent reading speed in his native language English appears to match Judd and Buswell’s claim. His second, silent, L1 English reading is almost 4 ½ minutes faster than his first, oral reading of *Feathered Friend*; he is more than twice as fast when rereading silently. This speed may be attributed to a task-based silent reading behavior such as skimming. Knowing his task is to retell the story in his own words immediately after finishing the reading, he likely focused on principle story elements such as details relating to characters and plot when reading in his native language the second time. Reading, as a tool, adapts to its purpose. His style of reading shifts according to his goals and the task demands (when rereading he is already familiar with the narrative).

FAY (L1 Greek) read in French and Spanish instead of French and English. She read the complete French story first (silently then orally) and a complete Spanish story second (orally then silently). Her second, and silent, reading of the story *El hombre que salia por las noches* is much faster than her first oral reading of this same story, approaching a skimming style similar to DAV’s skilled silent reading in his L1. Further analysis of her nonnative readings would complement the supplemental analysis remaining of DAV’s L1 silent and oral readings. This database contains information which could inform or define shared reading styles and strategies.

One purpose of this dissertation is to identify general trends in silent and oral reading among multilinguals. Further investigation in this corpus of fully contextualized reading might include a comparison of eye movements during repeated readings which could further inform knowledge of reading styles and behaviors. One interesting

question still to be answered is: What does a reader look at or focus on while rereading a text? I predict that on the second time through the English story, despite reading faster, DAV looks intently at his own corrected (thus noticed) miscues from his first reading. This, and more analysis is arising out of this extensive baseline dataset, as will be discussed in Chapter 7.

### *Silent and Oral Reading Experience*

Adult readers may be more experienced in silent than in oral reading and may do so more frequently. During the demographic interviews conducted as part of this study, most readers stated a preference for silent over oral reading, but GUY, LUC, and FAY admit to significant experience reading aloud for particular purposes. As shown in table 6.1, the difference between FAY's silent and oral reading means matches the average for all readers. GUY has a reduced degree of variance in his silent and oral reading means, and LUC's silent and oral readings are most similar in speed.

#### *GUY's comprehension strategy*

GUY described reading aloud as a study habit he developed; a strategy to maximize recall. He explained that when he really needed to understand or remember what he was reading, especially in French (a nonnative language), he found reading aloud to be a significant help. Rummer and Engelkamp (2003) investigated the effect of multi-modal stimulation on short term recall. They had subjects read sentences silently and aloud and found that the added acoustic-sensory information contributed significantly to the regeneration process. This appears to hold true in GUY's retelling scores as seen in table 6.4.

*FAY's attention seeking strategy*

As an adolescent, Fay developed an intense reading-aloud strategy as a way of gaining attention from her father who was always busy with work. The family kept a quiet home so the father could work, but had trouble objecting to FAY when she insisted she needed to read her lessons (often great long pieces of literature in various languages) aloud to prepare her schoolwork.

*LUC's oral presentation tradition*

LUC, from Benin, is proud of his heritage and traditions. Like *un griot* (a storyteller) from his homeland recounting a tale, LUC appears to adopt a poetic performance style. Throughout his silent and oral reading of English and French one sees the formal written register proscribed by Safire (2005), "...lengthen and slow my cadence, eschew all appealing childlike mannerisms and call up the majesty and sonority of Standard English usage." (p. 22). LUC employs formal and traditional rules of French versification proscribed for poetry, even while reading prose (see Hamon's 1964 discussion of *prose et vers*).

*Pedagogues' Oral Practice*

Teachers may have greater facility due to increased practice with oral reading and speaking. PAM, MAR, and FAY all have extensive experience as public school teachers. AMY, DAV, EVE, GUY, and LUC are all instructors of French at the university level and are accustomed to hearing themselves speak and read French aloud. AMY and EVE were both educated in France where the oral language tradition includes frequent recitations (students' oral performance of memorized text). LUC grew up in

francophone Africa where perfect French was required in school and for academic and economic advancement. JAN grew up in Québec, where as a teenager awareness pride in correct usage of the French language was stressed in and out of school after a monumental speech by visiting dignitary Charles de Gaulle.

### *Comparison with Other Studies*

Except perhaps for very early readers instructed with an oral method, it has been shown that silent reading is faster than oral reading (Buswell, 1937). Bouma and deVoogd (1971) state values for maximum reading speeds: orally about 30 letterspaces per second; and silently, 50 letterspaces/sec. As shown in table 6.3, my readers read at only half that stated maximum velocity, but their task is to read to retell the story; they are not reading for speed.

McCallum, Sharp and Bell (2004) had seventy-four students read passages from an individually administered test of reading comprehension and found students took 30% longer to read orally than silently, yet comparison of mean reading comprehension scores showed no significant difference between silent readers and oral readers. Table 6.3 shows a similar difference in silent and oral reading times among my adult multilingual readers and table 6.4 demonstrates consistently strong comprehension across both reading modes.

Table 6.3 combines silent and oral reading times across the English and French stories. Remember that Table 4.4 presented the mean number of letterspaces read per second (without spaces between lexical items), demonstrating that no significant difference is found in reading times between English and French.

Table 6.3 Silent &amp; Oral letterspaces/second; % difference

Reader	Silent		Oral		% Difference Between Silent & Oral
	Mean Silent Rdg Time (min:sec.ms)	Letterspaces Read per Second	Mean Oral Rdg Time	Letterspaces Read per Second	
AMY	06:10.004	21.62	08:18.712	16.04	34.8 %
DAV	07:41.568	17.33	10:04.631	13.23	31 %
EVE	08:48.121	15.15	10:40.362	12.49	21.3 %
FAY	07:18.221	19.58	09:38.762	14.82	32.1 %
GUY	07:07.317	18.72	08:48.984	15.12	23.8%
JAN	08:25.964	15.81	13:16.913	10.04	51.5 %
LUC	13:33.420	9.83	14:23.509	9.26	6.2 %
MAR	05:51.271	21.12			
PAM			09:52.636	12.52	
Mean across readers	08:19.405	16.02	10:38.064	12.54	28.7 %

Table 6.3 compares reading times with the blank spaces between lexical units included as letterspaces, resulting in a letter-spaces count of 7,418 for *Feathered Friend* and 8,579 for *La Légende du Mont-St-Michel*. (See Appendix B for complete texts of both stories). I used the mean number of letterspaces between the two stories for subjects who read both stories silently or both stories orally (7998.5) and the mean amount of time spent reading both stories, to calculate the number of letterspaces read per second silently and orally; dividing the mean number of letterspaces in each reading by the mean number of seconds spent reading:

The formula for letter-spaces read per second is quantity divided by time:

$$\frac{\text{mean \# letter-spaces read}}{\text{mean \# seconds read}}$$

The formula for % difference:

$$\frac{(\text{\# Silent letterspaces} - \text{\# oral letterspaces}) \times 100}{\text{\# oral letterspaces}}$$

Overall silent reading is faster than oral reading in all conditions. Although these measures of letterspaces read per second silently and orally represent a significantly slower reading speed than the maximum speeds reported by Bouma and deVoogd, these self-paced reading events emphasized comprehension over speed or fluency. The percentage of difference between oral and silent reading speeds is similar to that reported by McCallum et al. While my readers take approximately 29% longer to read aloud, than to read silently, theirs took 30% longer to read aloud. They found no significant difference in comprehension scores after silent and oral reading on a standardized test of reading comprehension. I verified my readers comprehension holistically using retelling guides I designed for each story.

#### Retellings: Comprehension in Silent & Oral Reading

Immediately after each reading, subjects are asked to recount everything they remember about the complete short story they have just read. They receive no instruction as to which language to use in the retellings, yet all spoke in the language matching the text except LUC who retold mainly in French after his first reading of *Feathered Friend* silently and also after his second, oral reading the same English story.

As per Goodman, Watson and Burke (2005), I employ unaided holistic retellings as a comprehension verification measure. If prompting became necessary, I encouraged subjects to continue by asking an open-ended question such as, "Could you tell me more about that?" Retellings were recorded on videotape for later transcription and analysis. Table 6.4 summarizes the retelling scores which are arbitrarily based on a 100 point scale

by no means representing a percentage of text understood. The retelling guides created for this study are included in Appendices B2 and B4.

*Table 6.4 Retellings indicate silent and oral text comprehension*

Reader	After Silent Reading		After Oral Reading		% Gain (+) / Loss (-) Between Silent&Oral Retelling Scores
	After Initial Reading	After Repeated Reading	After Initial Reading	After Repeated Reading	
AMY	61 (E)			89 (E)	+ 31.46 %
DAV	61 (F)	74 (E)	54 (E)	81 (F)	0%
EVE	61 (F)	----	46 (E)	66 (F)	(- 8.93 %)
FAY	48 (F)			81 (F)	+ 40.74 %
GUY	57 (F)	----	75 (E)	75 (F)	+ 24 %
JAN	53 (F)	60 (E)	44 (E)	82 (F)	+ 10.32 %
LUC	60 (E)	75 (F)	78 (F)	58 (E)	+ 0.74 %
PAM				51 (E)	
MAR	----				
Mean Across All Readers	57.29	69.67	59.4	72.88	+ 9.89 %

Blank cells indicate no data was collected in that condition. Dotted lines (EVE, GUY, and MAR) indicate that the reader satisfactorily retold the story, but that technical difficulties prevented recording the retelling for subsequent transcription and analysis. Stories were read twice: once silently and once orally, except PAM and MAR who read the English story once.

A plus sign in the percent gain or loss column indicates mean retelling scores which are higher after reading aloud than after silent reading. AMY had a 31% gain in her oral retelling score, but this high percentage is confounded by the fact that her silent reading was her initial encounter with the story (E for English), and her oral reading was her second reading of the same story. Repeated readings are therefore included as separate columns in table 6.4 because this second exposure to the material appears to have a significant effect on retelling scores. As explained in Chapter 3, DAV, EVE,

GUY, and JAN read in the main reading order: reading the complete French story, *La Légende du Mont-St-Michel*, silently before reading the same story orally; and then reading the English story, *Feathered Friend*, orally before reading it again silently.

AMY, FAY, LUC, MAR, and PAM, read in the reverse order: reading the French story orally before reading it silently; and then reading the English story silently before reading it again orally.

Except in the case of LUC, repeated readings result in higher retelling scores. [Remember that LUC is also the reader who displayed very little variation between his silent and oral reading speed (table 6.2)]. His retelling style did not allow him to repeat in his second retelling information he had already given in the first. LUC's silent and oral retelling scores do vary widely between English (E) and French (F), but not in the direction of significant gain after repeated readings. His initial oral reading was in his L1 French; being a doctoral student of francophone literature, he is well accustomed to reading in that language and would be apt to achieve a high score. His repeated oral reading was in his L2 English, and contained evidence of confusion over a basic fact (whether Claribel is a dog or a bird).

As reflected in table 6.4, the retelling scores exhibit greater variance after oral reading of a story, than after silent reading. The initial silent reading range of retelling scores is limited: 53 to 61, a variance of only eight points; whereas the initial oral reading retelling range is broad: 44 to 78, a thirty-three point spread. This common and unified response to silent reading, across both language of text and language dominance of the reader, suggests that the universal process of reading resides first in silent processing of

written text; that oral reading introduces variation in relation to the secondary action of reporting on an initial response to an internal, silent reading process.

Averaging across all conditions (language of text, language dominance of reader, novel or familiar reading order), the retelling scores overall were slightly higher after oral readings than after silent readings. The mean retelling score after all silent readings (N=10) is 61; the mean retelling score after all oral readings (N=13) is 67.69. This represents a 9.89% stronger retelling score after oral reading than after silent reading, supporting GUY's strategy for increased memory of text through oral reading. This finding is not conclusive as an argument for the efficacy of oral reading, since the sample is small and not evenly balanced (See also Rummer and Engelkamp, 2003).

Large gains in retelling scores after oral reading over retelling scores subsequent to silent reading (AMY, + 40.74%; FAY, + 31.46%; and GUY, + 24 %) are probably due to a bias in the design which over-compensated for reader comfort (see chapter 3). Initial readings in the nonnative language (L2) were done silently in all three cases. Issues of reading in a native compared to a nonnative language are covered in chapter 5, and retelling scores based on language dominance are presented in Table 5.3.

Although the mean score of his retellings after silent and after oral reading is the same, DAV gained 20 points between the retellings which followed his initial readings and the retellings which followed his repeated reading of both stories. Theoretically, reading order in this database is arbitrary, but my attempt to replicate natural (outside the laboratory) conditions created a probable imbalance in this finding. Whether a reader's first or second encounter with the story makes a greater difference in retelling scores than

does reading mode (silent or oral) would require further investigation of the interaction of these two variables.

### Silent Miscues, Pure Speculation?

The essential task in accomplishing reading is to adapt the author's language to one's own to construct meaning. Slips and glitches in this process result in miscues. A miscue is, by definition, an event in oral reading in which the observed response (OR) differs from the expected response (ER). (K. S Goodman, 2008, p. 11)

Silent reading miscues occur although they have yet to be consistently documented or studied. Any reader can occasionally notice feeling misdirected while reading silently. Regressing to reread or reinterpret text may be evidence of a corrected miscue, but theory and definition need to be clarified before silent miscues can be considered the window on the reading process that oral reading miscues are. Eye movement miscue analysis (EMMA) potentially provides a research structure for furthering understanding of silent reading miscues.

### *Comparing Silent Reading Miscues to Errors in Speech Production*

Silent reading miscues are notable/salient in their scarcity. Silent reading miscues probably approach a frequency resembling that of speech errors: Levelt (1998) claims that "errors of lexical selection occur in the 1 in a 1000 range" (p. 172) although Merrill Garrett suggests a lower frequency (personal communication, May 10, 2005). Low frequencies of occurrence could suggest that silent reading miscues pattern with speech errors, and that speech production models, such as those based on Garrett's analyses of

speech errors could inform analyses of silent reading miscues. Garrett (1984, 1990, 1993; and Levelt, 1989) proposed a serial order in speech production in which semantic and syntactic processing occur at an earlier stage than phonological processing. This early stage is the lemma stage.

Such an analysis of reading at the lemma stage accounts for the measurable speed of silent reading over oral reading. Proficient silent readers (as are the subjects in this study) synthesize semantic and syntactic information from the text independent of phonological information. According to speech production models, phonological processing would occur late in the oral reading process (while planning speech production for a vocal reading performance). Silent reading can be accomplished without phonological speech production, especially as proficiency increases.

Proficient silent reading principally takes place at a lemma stage of syntactic and semantic activation. At this level of linguistic functioning, adapting the language of the text to a reader's internal language is direct and quick, and results in few miscues.

Applying speech production models to oral reading, the frequency of oral reading miscues suggests that the majority arise at the stage of phonological matching of lemmas to phonemes. A silent and oral reading model coordinated with existing speech production models would incorporate late processes (such as phonological access) in monitoring output.

If the lemmas (syntactic and semantic representations of language) a reader selects lack a strong internal link to phonologic encoding, is that seen in the pronunciation of long (multi-syllabic) words examined in chapter 5. Lack of a direct and

automatic link to phonological forms results in slow computational production of phonemes (similar to the dual route introduced by Harris and Coltheart in 1986). This computational slowdown for phonological production purposes can occur independently from reader comprehension as is indicated by the lack of regressive eye movements and the absence of miscue correction in these areas of text.

If the lemmas a reader selects link to differing phonetic output (OR) than the lexical items in the written text (ER), a miscue ensues. This miscue may go unnoticed and uncorrected, may be noticed and uncorrected, or may be noticed and corrected. The time course of correction of oral reading miscues is an underdeveloped area of research which requires detailed analysis of contextualized reading events as this database provides.

The time course of miscues, silent and oral, requires further study. Self editing a silent reading event may differ from self-editing an oral reading event, affecting the frequency of detection and correction of silent miscues. As noted in table 6.3, oral reading is slower than silent reading overall. Detection of oral reading miscues is facilitated by the time delay which oral reading provides. Jerry Fodor (1985) differentiates *perception*, a fast, input-driven, domain-specific, computational process, from *cognition*, which is slow, unencapsulated, and often under voluntary control. Oral reading provides sufficient slowing of the reading process so as to allow a reader the necessary time to think about the sound and the text, and to recognize discrepancies. Silent reading, more closely linked to perceptual processes, may involve numerous undetected miscues.

Another possible factor in the higher reported frequency of oral miscues than silent miscues is the large quantity of investigations conducted of oral reading and the continuing scarcity of investigations of fully contextualized silent reading: logically, there is a higher probability of finding that which one expects and seeks.

A nagging confound in the frequency of oral compared to silent miscues is the problem of obtaining concrete comparable records. Reading aloud produces a sound wave which can be recorded and reproduced with minimal technological expertise or expense. Multiple experts can then evaluate an oral recording and a written text, increasing inter-rater reliability. This is not the case in silent reading. The silent reading record remains individual, subjective, fleeting, and difficult to measure.

Further investigation of eye tracking records of contextualized silent reading could reveal whether silent miscues co-occur with longer fixations, a local increase in fixation frequency or duration, or with increased regressions to the miscued region of text. Analysis of the baseline database collected for this dissertation could provide a start in this direction, but correlation requires theory, experimentation, and definition beyond the scope of this study.

Most authentic silent reading occurs without the assistance of an eye tracker, and reports of silent reading miscues are virtually nonexistent since self-report requires trained and consistent documentation of miscue observations. The Goodman Taxonomy of Oral Reading Miscues (1973/1982, pp. 215-300) has enabled uniform miscue data collection in numerous languages world-wide, but its application to silent reading

miscues has not been tested. Silent reading miscues have never been gathered on a large scale and remain an untapped resource of information about the reading process.

Until a method is devised to make internal silent miscues measurable, they remain a rarely reported event. Liwanag and Zambuto (2008) at SUNY Geneseo, have recently begun using eye tracking in combination with retrospective miscue analysis (Y. M. Goodman, 1989; Y. M. Goodman & Marek, 1995) of oral reading events, structuring readers' self-reflection about their own miscues. Their intention is to provide further information to the reader for developmental purposes. Similarly trained readers would be qualified to report on their own silent reading miscues and a corpus of silent reading miscues could be gathered in a manner similar to the collection of speech errors developed by Garrett and Fromkin

#### Eye Movements During Silent & Oral Reading

Averaged across readers and languages, oral reading takes more than 25% longer than silent reading, as shown in tables 6.2 and 6.3. There is a logic and face value in the assumption that faster reading times may correlate with shorter fixation durations. In chapter 4, similar reading times between languages also led to similar eye fixation durations between reading in English and reading in French. Table 4.8 shows only a slight language difference in mean fixation durations averaged across silent and oral reading and across readers: 282 ms in English and 279 ms in French.

In chapter 5, however, I asked whether slower global reading times are matched by longer mean eye fixation durations, and found this not to be the case: slower reading times were accompanied by a greater number of fixations overall rather than longer

fixation durations. Eye fixations of L2 readers are longer in duration than those of L1 readers, perhaps allowing increased attention to linguistic detail, such as novel syntax or vocabulary, perhaps reflecting longer segmental processing time (i.e., increased time for cognition as opposed to fast automaticity). Table 5.6 shows that nonnative (L2) readers' mean fixation durations are longer in both English and in French than the mean fixation durations of native (L1) readers reading the same texts. This holds true even though L2 readers of French had faster reading times (thus fewer fixations) overall than L1 readers of French.

Language experience does appear to have an effect on eye fixation durations; L1 fixation durations are faster overall than L2 fixation durations. The correlation between reading speed and mean fixation duration, however, is far from direct. Even though global reading times differed greatly for L1 and L2 readers of English (50%), the difference in their mean eye fixation durations was quite small, less than 2%. A lack of a clear correspondence between reading times and eye fixation durations bodes poorly for an assumption that in oral reading (25% slower than silent reading), the eyes will fixate for longer durations than in silent reading.

Oral reading mandates a linear order pronunciation of words and phrases as suggested by a written text. Limitations in focal view logically require sighted readers to maintain a positional connection with novel visual input so as not to "lose one's place" during continuous reading of full texts. It seems possible that during oral reading the eyes might serve as placeholders for the voice, holding still and stable in long durations as the slower voice recounts the story seen. This assumption has a great deal of face

value and was originally proposed by Buswell (1920) who suggested that “the eye remains fixated until the voice catches up” (p. 80). He discovered that an interpretation of the eyes as placeholders for the voice was only minimally justified. Instead of holding a fixation when advanced far ahead of the voice, the eye reacted to a wide eye-voice span equally as often with a series of short fixations (varying in location) as with a single steady place-keeping fixation.

Baccino and Colombi (2001) did find longer fixation durations in slower oral reading. They found the mean fixation duration in silent reading to be 225 ms, and in oral reading to be 275 ms. Since articulation is slower than word recognition, and silent reading is faster than oral reading, this is a logical result.

I predicted that silent reading, being faster than oral reading, would have fewer eye fixations, shorter fixation durations, or both. As shown in table 6.5 eye fixation durations in this study fell within the range found by Baccino and Colombi. However, despite a great deal of variability, my predictions of shorter fixation durations during silent reading proved erroneous.

In the 22 reading sessions represented in Table 6.5, five reading events resulted in shorter fixation durations while reading orally than while reading silently (see GUY, JAN, LUC), and five resulted in longer fixation durations (see AMY, DAV, FAY, and LUC). LUC’s eye fixations were about 3% shorter while reading silently in French (his L1) than orally, but were almost equal when reading silently and orally in English (his L2).

*Table 6.5 Silent fixation durations compared with oral fixation durations*

Reader	Mean Fixation Durations (in milliseconds)		
	SILENT	ORAL	Difference
AMY	322.502 E/L2	385.109 E/L2	+ 62.6 ms = 16.3 %
DAV	342.318 F/L2	375.775 F/L2	+ 33.5 ms = 8.9 %
	284.481 E	340.847 E	+ 56.4 ms = 16.5 %
EVE	201.687 E/L2	-----	
FAY	195.721 F/L2	217.927 F/L2	+ 22.2 ms = 10.2 %
GUY	238.638 E	213.401 E	- 25.2 ms = 10.6 %
	234.367 F/L2	222.929 F/L2	- 11.4 ms = 4.9 %
JAN	212.37 E/L2	187.252 E/L2	- 25.1 ms = 11.8 %
	241.943 F	217.147 F	- 24.8 ms = 10.2 %
LUC	344.369 E/L2	343.358 E	- 1 ms = 0.3 %
	317.615 F	326.268 F	+ 8.7 ms = 2.7 %
MAR	297.37 E		
Mean across readers	269.45 ms	263.99 ms	- 5.46 ms = 2.03 %

A blank cell indicates that data was not collected for that reader in that condition. Dashes in a cell indicate that I omitted the statistic from this table because the corneal and pupil reflections were insufficiently maintained and did not allow for reliable averaging of fixations across the entire reading session. E indicates reading in English. F indicates reading in French. L2 signifies that the reader was reading in a non-native language.

Overall, oral reading (being slower than silent reading) results in a greater number of eye fixations. GUY's oral reading of English (L1) produced 1030 fixations while his silent reading amounted to only 931 fixations. His silent reading fixations are longer in mean duration than his oral reading fixations: 0.239 seconds compared to 0.213 seconds respectively (a 10.6% difference as reflected in table 6.5). Whether reading in an L1 or an L2, GUY and JAN both have silent reading fixations which are longer in duration than their oral reading fixations.

JAN's mean fixation durations during silent reading are longer than during oral reading: 0.212 seconds while reading orally, and 0.187 seconds while reading silently in her L2 English; and 0.242 seconds during silent reading, and 0.217 seconds during oral

reading, of her L1 French. The percent difference between her silent and oral fixation durations in both languages (11.8% and 10.2%) is very similar to GUY's percent difference between silent and oral fixation durations while reading his L1 English (10.6%) showing a trend towards universality of fixation durations across languages and across readers.

LUC's mean fixation time is only slightly longer while reading silently than while reading orally in English: 0.344 seconds and 0.343 seconds respectively, resulting in 2198 fixations while reading orally and 2090 fixations during silent reading of the English text (his L2). Table 6.1, shows that LUC is the slowest reader overall, and that his silent reading times in both English and in French are only about 50 seconds longer than his oral reading times demonstrating a fairly consistent reading style across texts, languages, and reading modes.

If reading order (or text novelty) and language dominance play a role in eye fixation durations, it is not evident in this database. AMY and DAV have the greatest difference between their silent and oral reading fixation durations in English (16.3 and 16.5% difference, respectively). Both have shorter fixation durations while reading silently than while reading orally. There is no consistent and reliable global effect of reading mode on fixation duration: DAV read in his L1 and AMY in her L2. DAV read in the main order (reading the English story orally first and then silently) and AMY read in the reverse order (reading the English story silently first and then orally); for reading order see table 3.3 and 3.4.

### *Emotional Affect and Eye Fixations*

Similarities in attentional effort to text appeared in eye fixations across readers' silent and oral readings. Irregular, implausible or unexpected aspects of the written text, such as non-canonical word order or low-frequency locutions, create an observable effect in both eye movement and miscue behaviors as is seen in FAY's emotional reaction to an offensive region of the French text in figure 6.1.

**Figure 1. Emotional Affect Reflected in Eye Fixations (FAY)**

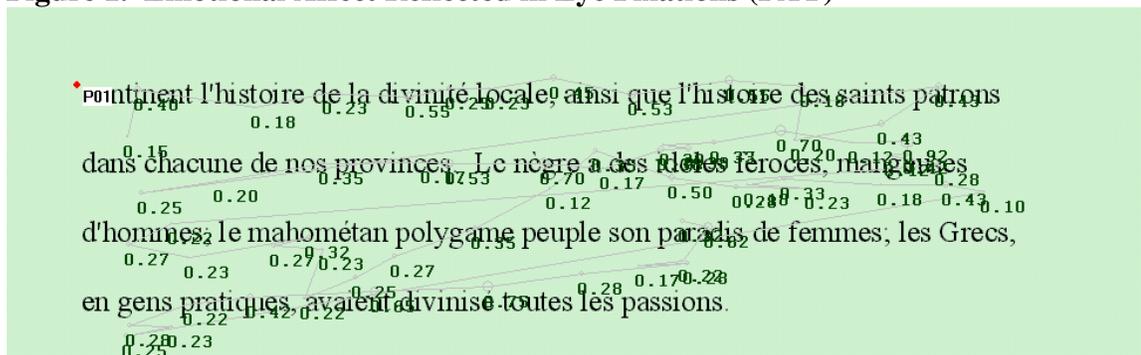


Figure 1 displays eye fixation location and duration overlaid upon the first four lines of text from a screen-page containing eleven lines in all. The text appeared on the third full screen of the French story (out of twelve screens plus a preceding title page-screen). The narrow lines drawn between regions of text represent the saccade arch linking individual fixations. These represent the path of FAY's left eye as she perused the text during oral (repeated) reading. Saccades are fast movements separating relatively stable fixations.

Decimal numbers appear directly below the calculated fixation locations, and describe eye fixation durations in seconds. The fixations shown in figure 1 are numbered

(numbers not shown in figure 1) 384 through 447 in the processed (using Applied Science Laboratories Fixplot software) eye data; a total count of 63 fixations is represented in this figure. Of these sixty-three fixations, 10 (15.87%) are horizontal regressions (when the eye looks back, leftward, at previously viewed segments of text). The total amount of time her eyes spent looking at these four lines of text, while reading them aloud, is 23.09 seconds. This is her second time reading this previously unfamiliar short story. FAY read in the main reading order, reading this French legend silently in its entirety before reading it again orally.

FAY (L1 Greek) has worked extensively with minorities and is sensitive to issues of racial, linguistic and cultural discrimination. She found a section of the French text offensive, and her strong negative reaction is reflected in her increased looking time in this area. The amount of time her eye fixates in this region is double her global fixation time and patterns differently in her silent reading fixations than in her oral reading fixations.

FAY's initial silent reading of this same section of text is represented by fixation numbers 451 through 506 of the processed eye movement data. These 55 fixations comprise a total looking time in this four-line region of 17.10 seconds. Of these fifty-five fixations, 9 (16.36%) are regressions .

During her oral reading shown in figure 1, FAY made two uncorrected miscues, and inserted an interjection expressing her exasperation with the meaning she was interpreting.

Table 6.6 High quality emotional miscues

Expected Response (text)	English translation	Observed Response (reader)	English translation	Corrected
continent l'histoire de la divinité locale, ainsi que l'histoire des saints patrons <b>dans</b> chacune de nos provinces.	continent as well as the history of the patron saints <b>in</b> each one of our provinces.	continent l'histoire de la divinité locale, ainsi que l'histoire des saints patrons <b>DE</b> chacune de nos provinces.	continent as well as the history of the patron saints <b>OF</b> each one of our provinces.	No
Le nègre a des idoles féroces, <b>mangeuses</b> d'hommes;	The Negro has his ferocious man-eating idols;	Le nègre a des idoles féroces, <b>OH OH, \$mangUeuses</b> d'hommes;	The Negro has idols ferocious <b>OH OH</b> , man-eating (substitution of hard for soft consonant);	No

\$ precedes a miscue production of a nonword.

FAY produces a high-quality miscue, changing the preposition *dans* in the second line to an equally plausible preposition, *de*. This substitution affected neither meaning nor syntax, and she did not correct her miscue, demonstrating her process of constructing her own text in reference to the written words rather than strictly recreating the author's words verbatim. Her eyes do not regress to this miscued area of text, despite numerous regressions elsewhere in the passage.

She inserts two interjections (Oh, Oh) in the region of increased fixation frequency, and mispronounces the soft *g* sound of the adjective *mangeuses*. LUC who is a native speaker of French (bilingual with Fon) also produces this same alteration of this same consonant in this same word, and also does not correct the miscue. The other readers all pronounce the phrase correctly. LUC is the only African reader. FAY, the

only Greek reader, has spent years on the African continent. They may have experienced this segment of text (which mentions Greek and Negro peoples) differently from other readers.

Noticeable in FAY's oral reading is an increase in frequency of fixations as the four lines of text unfold. When reading orally, she re-fixates offensive areas of text resulting in an extended total looking time which is twice that of her global mean. This is her second reading of the story. Her initial reading of the text was silent, and she did not express any dissatisfaction during the silent reading or during the post-reading retelling which followed, merely mentioning this section of text, saying, "*Il parle des musulmans et des grecs.*" (He talks about Muslims and Greeks.) Yet while even during this initial silent reading, her fixations in this region were significantly longer in duration with the effect of doubling her looking time in the region.

After her second (and oral) reading of the story FAY did discuss the offensive text in her retelling:

*Il y avait une partie là bas qui m'ennuyait beaucoup au début : Les musulmans, même les mots pour les musulmans ; c'est tellement négatif qu'il ne faut pas l'utiliser : Les Maho- mahomédiens. Mais, en tout cas, c'est Guy de Maupassant. C'est la fin du 19ème siècle.* [There was a part there which annoyed me a lot in the beginning : the Muslims, even the words for the Muslims ; it is so negative that it must not be used : the Mohammedans. But in any case, that's Guy de Maupassant. It's the end of the 19th century.]

Preliminary analysis reveals that similar increases in looking time may have been associated with the word “gang” in LUC’s English readings and with potentially negative expressions in MAR’s silent English reading, but further investigation is in order to determine whether frequency and fixation duration effects are consistent in the eye movements of other readers reacting to emotionally disturbing text.

### Chapter Summary

This chapter addressed the question of universality in the reading process through an analysis of silent and oral reading modes. The third and final hypothesis, that silent reading is similar to oral reading in reading speed and eye movement durations was evaluated for merit and found lacking.

Amongst this group of proficient multilinguals, oral reading times are consistently longer than silent reading times, across readers and across languages. Overall, self-paced silent readings of complete short stories in English and French were 21.7% faster than oral readings of these same two stories. The range in reading speed variation between silent and oral readings is from 36.5% faster when reading silently than orally (JAN) to 5.8% faster when reading silently than orally (LUC). Both of these readers are slower than average when reading orally.

As reflected in table 6.4, the retelling scores exhibit greater variance after oral reading of a story than after silent reading. The initial silent reading range of retelling scores falls between 53 and 61, a variance of only eight points; whereas the initial oral reading retelling range is from 44 to 78, a thirty-three point spread. This common and unified response to silent reading, across both language of text and language dominance

of the reader, suggests that the universal process of reading resides first in the silent processing of written text; that oral reading introduces variation by adding the secondary action of verbal reporting on an initial response to an internal, silent reading process.

Oral reading events produce a greater number of eye fixations than silent reading events. Averaging across all readers, fixation durations during silent reading events are slightly longer in mean duration than eye fixation durations during oral reading events.

Emotionally upsetting text causes one reader's looking time in the region to double both when reading orally and when reading silently. The extra looking time is a result of longer fixation durations while reading silently and of more frequent fixations while reading orally. Both her silent and oral readings contain a higher frequency of regressions in this section of text, an indication of a universal reading process across reading modes.

Chapter 7 summarizes the information presented in this dissertation, highlights the strengths and weaknesses of this study, and suggests implications of this research and applications to teaching reading and foreign languages. Numerous questions still remain and several are outlined as well as potential areas for future research.

## CHAPTER 7: FINDINGS, IMPLICATIONS, EXTENSIONS

This study exposes three lesser-understood aspects of proficient reading: fully contextualized fluent reading, silent reading, and multilingual reading. Through the independent control variables of language, reader, and task, universals in the reading process are sought. Three questions guide data collection and analysis:

- 1) How does reading in English compare with reading in French, within and between readers?
- 2) How does reading in a later-acquired language compare with reading in the same reader's first language?
- 3) How does silent reading compare with reading aloud, within and between readers?

Nine multilingual adults read two complete short stories (*Feathered Friend* by Arthur C. Clark, and *La Légende du Mont-St-Michel* by Guy de Maupassant) silently and orally in reading sessions lasting up to two hours. Between reading events, subjects were interviewed regarding language dominance, as well as literacy experiences and preferences. Videotaped recordings were collected providing a dynamic view of the eye path on the text screen and a record of utterances made during oral readings, retellings, demographic interviews, and pre or post reading discussions. Immediately after reading each story, subjects retold without assistance all they remembered from the story just read. Retellings were recorded and evaluated as a measure of post-reading comprehension.

An Applied Science Laboratories (ASL) eye camera, remotely placed so as not to interfere with normal reading practices, tracked eye movements during silent and oral reading events. Saccades and fixations were calculated using ASL Fixplot software. Krauzlis (2008) discusses a “tight linkage between visual attention and the planning of eye movements.” Although the link between visual attention and complex thought, two necessary conditions for sighted reading, is not directly observable, eye tracking does provide an important data source in the study of multilingual reading.

My theoretical orientations and training are interdisciplinary; and my goal is to present research which is useful to psycholinguistics, discourse analysis, literacy practices of multilinguals, and language education. The principal methodology used in this descriptive analysis is eye movement miscue analysis, or EMMA (Paulson, 2000). Combining two data collection techniques provides a triangulated record of reading, comprehending, and production processes as they occur. An essential assumption in this research is that meaning is the central impetus for reading. Reading is viewed as “a linguistic and perceptual transaction between the published text and the reader in which meaning and a parallel reader’s text (Goodman, 1994) are constructed.” (Paulson and Goodman, 2008, p. 27).

Reflecting the complexity inherent in reading and thought, sixteen possible control conditions emerge from the four-factor design of this study: language of text (English or French), readers’ native or nonnative language experience with the language of the text (L1 or L2), reading mode (silent or oral), and readers’ experience with the text (initial or reread).

In chapter 1, I describe three pilot investigations demonstrating the importance of eye tracking in understanding fully-contextualized emerging, impaired, and bilingual reading, which led to this study of proficient multilingual reading. Chapter 2 briefly highlights literature pertaining to multilingual silent and oral reading, eye tracking, and miscue analysis. Chapter 3 explains the naturalistic research design, and describes EMMA procedures, the nine readers, and the 24 short story reading events with eye movements, miscues, and retellings.

#### Contents of this Database

10 readings of the French story *La Légende du Mont-St-Michel* by Guy de Maupassant

14 readings of the English story *Feathered Friend* by Arthur C. Clark.

- The effect of text language is discussed in chapter four.

10 readings in the reader's native language (6 in L1 English, and 4 in L1 French)

14 readings in the reader's nonnative language (8 in L2 English, and 6 in L2 French).

- The effect of readers' language experience is discussed in chapter five.

12 silent readings (7 in English and 5 in French).

12 oral readings (7 in English and 5 in French).

- The effect of silent or oral reading output mode is discussed in chapter six.

12 first encounters with the text (7 in English and 5 in French).

12 rereadings of the same text (7 in English and 5 in French).

23 retellings (11 after reading in English and 12 after reading in French)

257 miscues

Miscues are instances where an observed response during an oral reading event differs from the expected response. Miscue coding is based on the Goodman Taxonomy (Gollasch, 1982, pp. 215-302).

34,103 eye fixations

Eye fixations are processed from visual fields, captured at 60Hz (every 16 2/3 ms) with a remote, head-free, near-infrared eye camera (ASL Model 504).

Included in 16 hours of videotaped reading sessions are demographic interviews providing rich samples of each subject's spoken language production while not in the act of reading. Contextualizing eye movement data within a triangulating framework of miscue, demographic, phonetic, and prosodic information about individual readers results in a thorough, and rich baseline dataset for in-depth research and analysis. Thus, one of the principle contributions of this study is in the continuing analysis of this English/French, L1/L2, silent/oral database of proficient, adult, full-text reading.

#### Hypotheses Tested

4. Reading in English is similar in reading speed, miscues, and eye movements to reading in French.
5. Reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a second, or later acquired, language (L2).
6. Silent reading is similar to oral reading in reading speed and eye movements.

The two dependent measures of mean eye fixation durations and comprehension, as measured in retellings, are mostly consistent across the three independent variables of language (English or French), reader experience (L1 or L2), and reader production mode

(silent or oral). Miscue frequency and global reading speeds display more variability, and, as is shown in table 7.1, none of the hypotheses is confirmed in all aspects.

*Table 7.1 Summary of findings*

Hypotheses	Reading Speed	Miscue Frequency	Mean Fixation Duration	Retellings as Comprehension
English/French	≈	≠ E > F	≈	≈ F > E
L1/L2	≠	≠ L1 < L2	≈ L1 < L2	≈ L1 > L2
Silent/Oral	≠ Silent < Oral	≠ Silent < Oral	≈ Silent > Oral	≈ Silent < Oral

Table 7.1 presents an abbreviated overview of the findings from chapters 4-6. The symbol ≈ indicates no significant difference between the two independent variables relative to the dependent measure; i.e. English reading events are similar to French reading events in global reading speed, differing by only 0.25 of one letter space per second. The > and < symbols indicate the direction of trends, i.e. silent reading events are significantly faster than oral reading events. An ≠ symbol indicates sizeable difference between the two independent variables in relation to the indicated dependent measure; i.e. miscue frequencies, while low for all readers, are 36.45% higher while reading in English than in French.

#### *English Reading Compared to French Reading*

The first hypothesis, that reading in English is similar in reading speed, miscues, and eye movements to reading in French, compares reading in these two languages through dependent measures of global reading time, miscue frequency, and mean eye fixation duration. As summarized in table 7.1, in the row labeled English/French, reading speed and eye fixation durations, are similar across the two texts. The hypothesis is not confirmed, however, due to the large degree of variation in miscue production.

#### *Reading Speed*

As detailed in chapter 4, self-paced reading of complete short stories produces little difference in mean reading speed between languages. Across all readers, the mean reading speed of just over eleven letter spaces per second differed only slightly between

languages with English reading being 0.25 of one letterspace per second faster than French.

This finding agrees with early work by Judd and Buswell (1922) who looked at silent reading in German, Latin, French and English by High School students in Chicago, and concluded that the manner of reading is fundamentally the same or “directly comparable” between these languages (p. 92). Like Judd and Buswell, I found less variation in silent reading than in oral reading.

### *Comprehension*

I created holistic retellings guides to measure comprehension and demonstrate comprehension in all readers in both languages. Retelling scores are higher overall after readings in French than in English, but neither the retelling guides, nor the stories themselves, are directly comparable. Individual readers did experience specific information gaps in retelling both the English and French stories.

### *Eye movements*

The difference in mean eye fixation duration between the English and French readings is small. Comparing mean fixation durations across all readers, eye fixations while reading in English are 2.68 milliseconds longer overall than while reading in French.

### *Miscues*

Frequencies in the production of miscues indicate a difference between oral reading in English and oral reading in French. These readers miscue 36.45% more often while reading in English than while reading in French (see table 4.6). Furthermore, the

average frequency with which readers produce miscues when reading the same story a second time is almost twice as high in English as in French. This has important implications for the teaching of oral reading in English, since increased practice may not show a benefit in increased accuracy.

The difference in miscue frequencies (an indication of the readers' comprehending process) potentially implies complications in the oral interpretation of English that are not present in the oral interpretation of French. Further research is needed to reveal any causal relationships between miscue frequencies and orthographic regularity in a language. English is notable for the depth of its orthography.

### *Implications*

Early reading teachers in America are sometimes mandated to spend a large percentage of teaching time and energy reinforcing basic sound-letter correspondences. Since these adult well-educated and highly proficient readers still miscue more in reading oral English, it is possible perfect English oral reading is not attainable and that the time teachers spend teaching phonics could be better used teaching math. Since silent reading is faster (and potentially more accurate if miscue frequencies relate to accuracy) teaching time could be saved by allowing students to spend additional time reading silently (Preddy, 2007) or reading in a language other than English. This dissertation thesis is in no way meant to be proscriptive, but this description of authentic reading by highly educated proficient multilinguals does raise questions.

The range of variation in miscue frequencies is less extreme in French than in English. The range of variation in reading speed is also less extreme in French than in

English (and less extreme in silent reading than in oral reading) despite an overall similarity of mean reading speeds across the two languages.

Table 4.6 explicates a wide range of miscue frequencies by reader. The range in English varies from a low frequency of 0.39 miscues per one hundred words (MPHW) produced by GUY reading in his native language (L1) to a high of 3.71 MPHW by LUC reading English as a nonnative language (L2). Experiences with reading and language dominance both play a role. In French the variation in miscue frequency is less extreme: JAN produced the fewest miscues, at a rate of 0.46 MPHW while reading in her L1, and DAV produced the most, at a rate four times higher than JAN's (1.91 MPHW), while reading in his L2.

Miscue frequencies in both languages are clearly confounded by reader proficiency, with L1 readers producing fewer miscues than L2 readers in both languages. Continued investigation in this area, however, must aim for tighter matching of language proficiencies across readers than is available in this baseline dataset.

This simple finding, that readers who produce the fewest miscues are reading in their native language (L1) and those who produce the highest number of miscues are reading in a later acquired language (L2), is important to teachers and schools. Assessments based on oral reading will continue to punish schools with immigrant populations, even after their students have attained a high level of literacy in English. The readers in this study all hold graduate degrees. Language dominance persists even into adult reading proficiency. Anglocentric expectations and standards may not match

the reality of proficient multilingual readers, blacklisting talented readers, teachers, and schools via discriminatory gate-keeping.

Repeated reading does not decrease miscue production in English, although initial and repeated readings do interact with miscue frequencies. The average frequency of miscues produced on a first reading of a story is similar in English and in French, although the number of reading events in this study is not evenly matched and therefore this finding is not generalizable: The mean of four English readers was 1.22 MPHW, while a single first oral reading in French produced 1.25 MPHW. In comparing readers' second reading of each complete story, we can look at miscue frequencies of three readers in English (AMY, PAM, and LUC), and five readers in French (JAN, EVE, GUY, FAY, and DAV). The range of miscue production in English is from 0.93 to 3.71 with a mean of 2.27 MPHW. In French the range is lower, and again, more restricted: from 0.46 to 1.91 with a mean of 1.15 MPHW.

Averaging across readers, the frequency of English miscues produced during a second reading is almost double that of the frequency of French miscues produced during a second reading. In these cases, the first reading of the story is always silent, potentially adding minimal phonological practice to the second (oral) reading.

It is possible that pre-existing semantic and pragmatic knowledge is more useful for reading aloud in French than in English. In-depth analysis of the quality of miscues produced on second, compared to initial, readings may clarify this question (Fries, 2008, is in the process of developing computational methods for comparing miscue quality). In this study, it appears that oral reading in English is more likely to produce miscues

than oral reading in French, across all conditions. The stories are not equal and no two stories (even translations) are ever equal. More research is need to understand the difference found here.

### *Summary*

The first hypothesis is thus not wholly confirmed. For this group of proficient multilingual readers, reading speed and eye movements were similar in English and in French, but miscues were more frequent while reading in English than while reading in French. There are similarities in measures of the reading process across these two alphabetic languages which indicate universals in the reading process, yet reading English is different from reading French in some aspects. Further investigation of this question should include other authentic texts, perhaps with single subjects, so as to facilitate within-language comparison.

### *L1 Reading Compared to L2 Reading*

The second hypothesis, that reading in a first, or native language (L1), is similar in reading speed, miscues, and eye movements to reading in a second, or later acquired, language (L2), is not upheld.

### *Reading Speed*

I predicted that L2 reading would be slower than L1 reading, and this is true in English but not in French. Amongst this group of adult, well educated, and highly literate readers, there is a difference in reading speed between first and second language readers, although in opposite directions in the two languages. The L2 English readers are about

50% slower than the L1 readers of the English story; the L2 French readers are about 13% faster than the L1 readers of the French story (see tables 5.1 and 5.2).

Variation amongst individuals is evident in the L1 and L2 reading groups: LUC reads with a slow studied poetic style in both his L1 and L2; JAN reads her L1 slower than her L2 and admits to cherishing her native French Canadian language; DAV is simultaneously the fastest reader in L1 English and the slowest among the group of L2 readers of French. Environmental influences (living in an English-speaking region) are an unexplored confound in this study. L1 readers of French in the United States may read slower than L2 readers of French due to affective factors not fully investigated here.

### *Comprehension*

Retellings demonstrate comprehension for all readers in both L1 and L2 in both English and in French. As expected, L1 mean retelling scores are slightly higher than L2 retelling means, as shown in table 5.3.

### *Eye movements*

Across both languages, L1 reader's eye fixations are of shorter mean duration than those of L2 readers. In general, slower reading speed involves more, rather than longer, eye fixations. Even though the L1 readers of French read the Maupassant story 13% slower than the L2 readers, they fixate for less time while reading. While reading in French, L1 readers' mean eye fixation durations measure 18.64% faster than L2 readers' eye fixation durations. Eye fixations of L1 readers of English are also of shorter duration than those of L2 readers of English, but to a lesser degree. While the L1 readers

read the Clarke story 50% faster than their L2 colleagues, their eye fixation durations are only 1.8% faster.

### *Miscues*

Readers who read orally in both languages (DAV, EVE, GUY, JAN, LUC) produce fewer miscues in their L1 than in their L2. As stated in relation to the first hypothesis, these readers produce a greater number of miscues while reading in English than while reading in French. However, in both languages L2 readers create miscues with almost double the frequency of L1 readers.

To what degree L1 and L2 readers are using the same reading process cannot be definitively answered by these uneven results. All of these sighted readers do fixate the text, and all readers produce miscues while reading orally, miscues being a natural (and universal) product of the reading process. The same types of miscues are produced by both L1 and L2 readers: omissions, insertions, substitutions, and complex miscues are uttered by native and nonnative readers of both English and French. Also, all readers correct, over-correct, and fail-to-correct miscues in their L1 and in their L2, thus seeming to adopt a universal process of reading across language proficiencies. One reader (FAY) who read in L2 Spanish, demonstrates these same tendencies as well. The parameters of the universal process vary with text, language, reader, and reading mode.

### *Silent Reading Compared to Oral Reading*

The third hypothesis, that silent reading is similar to oral reading in reading speed and eye movements, is not confirmed.

### *Reading Speed*

Logically, silent reading is a precursor to oral reading in that perception of linguistic information from text must precede production of linguistic information related to the text. This assumption is born out in the fact that oral reading times are consistently longer than silent reading times across readers and across languages. These readers read 21.7% faster overall when reading silently than when reading orally. The mean silent reading speed in this study is 165.83 words per minute, while the mean oral reading speed is only 133.24 words per minute. Comparing letterspaces read per second between readers, the range of difference between silent and oral reading times is 6.2% to 51.5% with a mean difference of 28.7%. These numbers are within the range of silent-oral reading speed difference reported by McCallum et al. in 2004.

### *Comprehension*

Oral reading introduces variation into the reading process. As reflected in table 6.4, retelling scores exhibit greater variance after reading a story orally, than after reading the same story silently. Following an initial silent reading, retelling scores fall into a limited range of 53 to 61, a variance of only eight points; whereas the retelling range following an initial oral reading is from 44 to 78, a thirty-three point spread. This indication of a more unified response to silent reading, across both language of text and language dominance of the reader, suggests that the universal process of reading resides first and foremost in the silent perception of written text. Oral reading introduces variation as the reader verbally responds to his or her perception of the text.

### *Eye movements*

An observable indication of silent reading preceding oral reading is in the eye-voice span (Anderson & Dearborn, 1952; Buswell, 1920), which is not a focus of this study due to the analog rather than digital nature of the video data collected here. Eye movements indicate the visual search, the silent perception of text. In proficient readers, the eyes' perception commonly precedes the voice's production of a text demonstrating the way that silent reading precedes oral reading.

While reading orally, the eyes are independent from the voice; yet eye tracking demonstrates only slight variance between silent and oral reading events. In the 22 reading sessions represented in table 6.5, five reading events result in shorter mean fixation durations while reading orally than while reading silently, and an equal number of reading events result in longer mean fixation durations in these same conditions. Oral reading, because it is slower in its performance, results in a greater number of eye fixations than silent reading. If reading order (text novelty, in the form of initial or repeated readings) or language dominance plays a role in eye fixation durations, such interaction is not immediately evident in this database.

### Limitations, Implications, and Questions

This study offers a limited description of a baseline dataset collected using eye movement miscue analysis (EMMA) methodologies with multilingual readers reading full, authentic texts. I claim no generalizability to readers beyond these multiliterates, but do contend that the size of the dataset (34,103 eye fixations and 257 miscues) permits robust analysis. I suspect that the behaviors and variability described herein is common

among proficient readers. This study does not replicate previous research, and a thorough comparison with existing psycholinguistic research in reading, sentence processing, and multilingualism is yet to be carried out. The dataset created for this study provides a complex view of the reading process and remains available for continuing investigation.

### *Text Analysis, Genre, and Discourse Analysis*

One important question still open for further investigation in this database is the process by which a text unfolds in the mind of the reader. Text analysis and discourse analysis coordinated with EMMA will permit inferences regarding the processes by which silent and oral readers seek textual information in developing a story line; how readers focus on critical elements such as setting, character and plot, and whether this varies between languages, texts or readers. Since the task is to retell the story, I suspect that attentional focus (notable in eye fixations) reflects aspects of the developing storyline in the early part of the reading event.

Expansion of the research presented in this dissertation could involve application of techniques used herein to differing genres of text and differing purposes for reading. This baseline dataset illustrates only one type of reading, that of complete short stories. The task requires readers to remember the storyline (usually plot, characters, setting, conflict, and resolution) for later recitation. Reading fiction in this manner differs significantly from reading scientific texts, mathematical word problems, newspaper articles, business and technical reports, data files, or owners' manuals. Reading complete fictional short stories leads readers to adopt a linear, top to bottom, page by page reading

order. In evidence, one reader clicked the control mouse twice during the self-paced reading event and accidentally skipped a screen-page. He quickly declared the disjoint, “I think I skipped a page.” For the proficient readers in my study, short stories represent a familiar and well practiced genre.

A comparison is therefore necessary between my research and investigations into the reading of expository text. Hyönä, Lorch, and Kaakinen (2002) looked at eye fixations to study the strategies used by adult readers of expository text. They hypothesized three different global strategies and found that fast linear readers did not refixate previous text, while slow linear readers reinspected each sentence before moving on. Readers they called topic structure processors paid attention to headings and wrote accurate text summaries. Their proficient readers (48 college students in Finland) read expository texts in Finnish, and then summarized from memory. The texts read were similar in length to the short stories my readers read in English and French, and readings were self-paced. They inferred strategies and processes from forward eye fixations and regressions on specific types of sentences. Their typology could be applied to my data set, or my descriptive statistics could be compared with similar statistics available in their dataset. These English/French findings may or may not coincide with their Finnish readers, but the comparison could further inform our knowledge of the universal process of reading.

### *Reactions to Text*

Discourse analysis including examination of pragmatic questions would also be an ideal use for the database created in this study. Full text oral reading represents a

complex series of speech acts. “Each miscue is not random but is the result of complex, causal configurations in the text, in the reader, and in the transaction of the reader with the text.” (K.S. Goodman, 2008, p.16). As described in chapter six, FAY’s reading speed and eye movements change in reaction to emotionally upsetting text, both while reading silently and orally. FAY expresses her disgust, cuing me to analyze the text which I had not anticipated would have an effect. Longer fixation durations while reading silently and more frequent eye fixations while reading orally both result in her doubled reading time in the offensive region. I suspect that continued analysis of readers’ transactions with the texts will reveal similar reactions in regions of text which cause emotional reactions.

Universal similarities in attentional effort to text are seen in eye fixations across texts and across readers’ silent and oral readings. I suspect that irregular, implausible or unexpected aspects of the written text, such as non-canonical word order and low-frequency locutions, will consistently create an observable effect in both eye movement and miscue behavior. The difficulty is in predicting precisely which aspect of text will create a reaction (e.g. regressive fixations, longer fixation durations, or miscues). Like miscues, emotional reactions do not occur consistently across readers. A significant difference from global reading times, or from mean fixation frequencies or durations can indicate text effects, but not all readers find the same text disturbing and I predict not all readers will react in the same way to disturbing text. As K.S. Goodman (2008) declares, “My theory cannot predict that any given reader will produce a particular miscue at a particular point in the text.” (p. 9)

### *Reading Style*

*LUC's versification.* Measurements of LUC's reading fit within the universals confirmed in this study:

- longer eye fixation durations in L2 than in L1,
- producing a greater number of miscues in L2 than in L1,
- slower reading orally than silently.

Yet he is an outlier in aspects of global reading speed, miscue frequency, and text interpretation (retellings). Bold individual variation within the norm merits continued analysis. The importance of context and variability in and among individuals leads several researchers to apply dynamic systems theory to second language acquisition (De Bot et al., 2007; Kintsch and van Dijk, 1978; Pienemann, 2007; Van Dijk, 2003). These fully contextualized reading events, performed by LUC and his fellow readers, provide an ideal environment for the study of multilingual variation in both reading and speaking systems.

Of all the readers, he has the least variation in his silent and oral reading speeds; he adopts a slow, studied, poetic reading style across languages and texts. When reading prose, meter and rhythm would normally not play an essential role (Bénac, 1961). But LUC's oral reading, emphasizes assonance as he elongates the nasal vowel in the repeated word *blanche*. He versifies and poeticizes the prose, creating metric structure. He pronounces silent *e* endings as if in poetry or song. Further in-depth analysis of his eye movements, in relation to these expanded literary conventions, and in comparison

with other readers, could potentially inform theory of how readers construct text in L1 French and in L2 English.

Sociolinguistic and ethnographic influences inform a reader's style and performance in all literacy events (Gee, 1991; Heath, 1982; Reder & Davila, 2005; Street, 1995). During the demographic interview, LUC declares himself a poet and discusses his cultural origins from Benin, famous for its *griots* (storytellers). He admits he enjoys storytelling. When reading *Feathered Friend*, he constructs the story rather than reciting the author's words. This becomes clear when a factual conflict arises between the two versions (his own, and Clarke's) and causes him to debate aloud with himself over whether the character Claribel is a bird or a dog. In his story, Claribel is a watchdog. In his retelling, he recalls evidence to the contrary (birdsong, the animal's small size), discusses both options, and ultimately chooses the version he created. This error in text interpretation does not signal a need for remedial instruction; LUC is a doctoral candidate in literature and a very experienced reader. It alerts us to the fact that communication (written or oral) is always open to interpretation by a literate perceiver. The reality that proficient readers create, rather than reiterate, text is important in consideration of current trends in standardization and assessment.

*DAV's skimming.* Reading, an information-seeking skill, adapts to its purpose. Familiar information may be inferred, skimmed, or omitted as a reader searches for pertinent details and generates meaning. DAV's repeated, silent, L1 English reading of *Feathered Friend* is almost 4.5 minutes faster than his initial, oral reading of the same story. This speed hints at a task-based reading behavior, such as skimming. Knowing his task is to retell the story immediately after finishing the reading, he rereads quickly, focusing on principle story elements, refreshing his memory, and adding details relating

to characters, setting, or plot. His style of reading shifts according to his goals and how he interprets task demands. I predict that further analysis of his eye fixations during his repeated reading of familiar text in his native language will show increased looking time at his own corrected oral reading miscues. This is an example of the way texts teach. (Meek, 1988)

Pilot data collected in preparation for this study includes reading events by other readers using other fictional tales. FAY (L1 Greek) read in French and Spanish. She read the complete French story twice, first silently and then orally, and then read a complete Spanish story orally and then silently. Her second, and silent, reading of the story *El hombre que salia por las noches* (Millas, 1946/1994) is much faster than her first oral reading of the story. Her silent L2 rereading approaches a style similar to DAV's skilled L1 silent reading. Further investigation of shared reading styles is one potential future use of the database collected for this study.

#### *Anaphora, Neighborhood/Frequency Effects, and Prosody*

Miscues appear when the internal text the reader is constructing does not match the external printed text to which the reader attends. Eye tracking displays distinctions the reader notices, and possibly those he or she does not notice (Henderson, 1992; Bohan & Sanford, 2007), since it is possible that conscious awareness of text may not always accompany eye fixations. This full text corpus of fluent reading offers a rich environment for further analysis and comparison with existing studies of word recognition, as well as with research in specific areas in sentence processing such as anaphora (Garrod & Sanford, 1994).

The data set in this dissertation contains instances of naturally occurring semantic interference from same language neighbors (words which could be simultaneously or subsequently activated due to similarities in form) and from cross-language cognates. It would be informative to examine when readers do, and do not, notice garden paths or glitches in meaning or form. Interference is sometimes reported in retellings (such as when DAV accuses me of tricking him into the miscue “baisa la main” (kissed his hand) in response to the antiquated and low-frequency ER “baisa le bas de sa manche” (kissed the bottom of his sleeve). A miscue of this type is not purely a failure in word recognition, but also a conflict in frequency of pragmatic events. Full text reading reveals linguistic influences in information processing which are not available in more discreet studies. (Filik and Leuthold, 2008; Fleischman and Waugh, 1991).

While I am in accord with Liversedge and Blythe (2007) that word identification provides the basis for intact language comprehension, I agree strongly with Ferreira, Ferraro, and Bailey (2002) that while an “assumption of compositionality seems eminently plausible,” in reality the linguistic representation alone is not robust, and requires almost immediate support from context. Meanings gathered from recognized words are incomplete and “communicative context would support the interpretation.” (pp. 12-13).

Although Rayner (1998) claims that “researchers can have some confidence that results obtained with standard naming and lexical decision tasks generalize to word recognition processes while reading” (p. 392), the evidence he cites involves placing words from lexical decision tasks into context-neutral sentences (Schilling, Rayner, and

Chumbley, 1998). Natural full text reading is not context neutral. Full text reading provides an environment for studying real language perception and production.

Language requires context due to its non-compositionality. My foreign and second language students often attempt translating their complex thoughts between languages via word-by-word equivalency searches in a dictionary. The laborious result of assembled isolated words is inevitably incomprehensible. Even the best on-line translation programs and dictionaries hover at only 85% accuracy and always require editing.

Conversely, once a complex message is selected, languages as tools can represent complex concepts in few words. Single words are powerful, especially in rich context. Understanding developmental progression from simple to complex linguistic thought and utterances is an area of second language literacy acquisition which still requires investigation. Combining eye movements and miscues provides a wealth of information for the study of language, written and interpreted.

#### *How Texts Teach*

Further analysis may inform pedagogical practice by asking what readers notice and how texts teach (Meek, 1988). Language users can successfully perform tasks, such as multiple oral repetitions, without understanding concepts, and readers can perform the act of reading without understanding content. This paradox is a principal reason for the lack of a consistently accepted definition of reading.

Readers can learn to read and they can read to learn. They can produce language without, or prior to, comprehension; "...it is through coming to understand what is meant by what they produced that language learning occurs." (Swain & Lapkin, 2008, p. 302).

My reader AMY is a good example of this. In her retellings, she remembers and utters new English vocabulary and asks for meanings. Without fully understanding new vocabulary in her L2 English, she demonstrates comprehension of the part of speech by changing verb tense and by segmenting morphemes. I believe that vocabulary learning from text demonstrates prosodic bootstrapping, as readers analyze semantic, syntactic and pragmatic elements of text in coding a novel locution. EMMA research is an important key to developing our understanding of this phenomenon.

### *Noticing and Rereading*

What does a reader look at or focus on in a second reading of a text? Rereading was not a central question of this study, but emerged as an artifact of the design to enable comparison of full text silent and oral reading within readers. Seven readers were asked to read the same story twice resulting in a total of thirteen second readings; six in English, six in French, and one in Spanish.

Rereading also occurs as part of the normal, proficient reading process. Small segments of text are read again when a reader notices a miscue, or an information gap in the meaning he or she is building. This universal strategy is found in both silent and oral reading, in both languages, and in L1 and L2. Readers may choose to reread, or may be instructed to do so, but often rereading occurs as either a conscious strategy or an automatic reflex in meaning-making.

Rereading can occur for different purposes than initial reading, although both are tools for making meaning. Research into what a reader notices on a first or second time reading a text, as well as reader interaction with text and meaning during repeated

readings, is needed. Discovering trends in rereading behavior could help teachers and readers understand how focusing on important elements of the text correlates with the process of comprehending.

JAN is my oldest reader and I had difficulty maintaining a strong corneal reflection throughout her reading events. She sincerely wanted to be of service to this research, and she is the only reader who was brought back for a second reading session in the EMMA lab. To test whether time of day (factors such as tiredness) affect eye tracking, she returned two days later in the morning before work; having read in the late afternoon after working a full day in an office. During the first afternoon session she read the French story silently then orally; during the second morning session she read the English story orally and then silently. There were no instructions between sessions except to relax.

She is French Canadian and her personal pride seems to have provided intrinsic motivation to reread. Returning for the second session, she spoke in depth about the Maupassant story she had already read, saying she found it quite interesting, that she loved the author, but had never previously seen that tale. She exhibited concern about the miscues she had made, expressing a strong desire to provide good data by reading perfectly. She then confessed to finding the story on the Internet and rereading it at home. This behavior raises an unexplored question of how naturally-occurring miscues motivate readers to reread. From this perspective, miscues are an important impetus for learning.

This study shows that rereading increases memory for or comprehension of texts as indicated by increased retelling scores after second readings, particularly for L2 readers of French. This finding validates the common pedagogical practice of asking students to read materials again. Detailed analysis of what is reread (or re-fixated) and what is retold, should further inform pedagogical practices related to rereading. How fixated and unfixated lexical items become memories, how they are reinforced in retellings and rereadings are important questions relating to second language acquisition. (On repeated readings, eye movements and miscues see Hyönä, & Niemi, 1990; Martins, 1997; O'Connor, White, & Swanson, 2007.)

### *Comprehending in Process*

Reader interpretation is poorly accounted for in most literacy research, despite the fact that teachers are increasingly pressured to measure the distance a reader strays from an accurate and fluid repetition of text stimulus. The standard leaves little to no allowance for reader input, non-standard inferences, or variations in style. Tests of reading skill and comprehension require readers to arrive at a correct, monolithic meaning, ignoring individual interpretation which is a reality of meaning making. Yetta Goodman comments that this privileges the author or the text making the reader subservient to the author's authority (personal communication, December 4, 2008).

Most reading comprehension tests measure memory and recall, distinct constructs from comprehension. Meaning is difficult to measure and comprehension is difficult to define. Eye tracking provides a method to infer a reader's construction of meaning as it unfolds. Coupling eye tracking with in-process comprehending as described by Y.

Goodman et al. (2005) opens a potentially fruitful methodology for assessing reading comprehension. Many examples of readers comprehending may be extracted from extended reading times, regressive eye movements, and miscues. The database created for this dissertation requires further analysis in relation to ongoing comprehending processes.

*L1, L2, L3, ...*

Although my original desire was to refer to later acquired languages as L<sub>x</sub>, I conform to conventional nomenclature for purposes of wider dissemination. I use the term L1 for first language, even if the first language is bilingual (AMY, Portuguese and French; LUC, Fon and French), and L2 for the later-acquired or non-native language, even when the reader has multiple nonnative languages (FAY, English, French, Spanish, Pular; DAV, French, Japanese;...).

Most of the readers in this study are multilingual. An analysis of their reading and non-reading (in pre- and post-reading interviews) language use is an essential future area of research. I discovered common reading times between readers who share a common second and third language (FAY and GUY, L3 Spanish, as opposed to DAV L3 Japanese). Research in L3 linguistics, education, and the psycholinguistic processes involved in the acquisition and use of more than two languages is steadily growing (see publications of the International Association of Multilingualism; Cenoz, Hufeisen, and Jessner, 2001; Gallardo del Puerto, 2007; Moore and Castellotti; O'Brien de Ramirez, and Goodman, 2005; Sikogukira, 1993). This study contributes to that discipline.

### *Silent Reading*

This dissertation presents gross measurements of miscue frequencies, but only touches upon miscue typology. K.S. Goodman (2008) states that early in his research he discovered that all readers miscue. My data confirms that finding. All readers miscue while reading in English and French both as a native and a nonnative language. Much more analysis is needed, however, to understand silent reading miscues.

K.S. Goodman, the researcher who developed miscue analysis, declares that “the procedures of miscue analysis elicit oral literacy events.” (2008, p. 11). The third hypothesis of my study does not include miscue measures as a dependent variable when seeking comparisons between silent and oral reading. Although miscues in silent reading do not appear to occur with the same frequency as oral reading miscues, silent reading miscues certainly do occur, and probably pattern in ways that fit categories of the Goodman Taxonomy (K. S. Goodman & Burke, 1973/1982). Further analysis of miscues and other pertinent aspects of my silent reading database is in process.

Further investigation of the eye tracking records of contextualized silent reading will reveal whether silent miscues co-occur with longer fixations, a local increase in fixation frequency, or with increased regressions to the miscued region. Further analysis of the baseline dataset collected for this dissertation will provide a start in this direction, but a truly reliable correlation requires theory, experimentation, and definition beyond the scope presented here.

### Summation, Reflection, Invitation

This chapter reviews the descriptive analysis presented in this dissertation and suggests further investigations using this baseline dataset or these data collection methods. Collecting a significant corpus of eye tracking and oral reading data has value only if its analysis proves fruitful. Necessary care, expensive equipment, and lengthy procedures have limited the amount of eye tracking research conducted on full-text reading, even though this research provides an essential, microscopic view of the nature of reading.

I learned quickly to handle the data with meticulous consistency. When transferring a set of visual fields, previously analyzed in DOS, to Windows, the frequency of fixations increased by one third even as the basic parameters in the two algorithms ostensibly appeared unchanged. Maintaining consistency across a single corpus of data is essential to reliability and validity. My goal is to share not only analyses and findings, but also raw data from different labs and different studies. A searchable database of eye movements in relation to text or other stimuli would be a valuable resource to researchers engaged in understanding a myriad of psycholinguistic processes. This goal, far off, is not impossible.

I settle meanwhile for presenting descriptive data and preliminary analysis of a rich baseline dataset designed to attain multiple views of the interactive processes involved in proficient reading in two alphabetic languages. The purpose of seeking universality across readers, across languages, and across modes is only tentatively met. Demonstrating universals in the reading process remains an ongoing endeavor.

## APPENDICES

### Appendix A: Subject Recruitment

### Appendix B: Short Stories and Retelling Guides

B.1. Feathered Friend by Arthur C. Clarke

B.2. Retelling Guide for Feathered Friend

B.3. La Légende du Mont-St-Michel by Guy de Maupassant

B.4. Retelling Guide for La Légende du Mont-St-Michel

B.5. A Translation of the French story into English

### Appendix C: Processed Data Sample

C.1 Snapshot of Crosshairs during Reading (DAV)

C.2 Seeing Syntax and Metaphor (LUC) L1 French Oral Initial Reading

C. 3. AMY L2 English: Fixations with Miscue

## Appendix A: Subject Recruitment

Text of initial email correspondence:

“I am seeking a few volunteers who can read well in English or French, to be subjects in my dissertation research at the University of Arizona. Due to limitations of the eye camera, you must be able to read comfortably from a computer screen without the use of eyeglasses. As you read, your eye movements will be recorded using corneal reflections from a near-infrared camera placed next to the computer screen. Your voice will be recorded on videotape. By synchronizing what you look at with what you say while reading, I hope to identify universal processes and individual differences in English/French, silent and oral, first or second language reading.

Since this project does not have outside funding, I can only afford to pay \$20 per session (to cover your parking or transportation). A reading session (two stories, each read twice: once silently, once aloud) usually lasts about two hours. You are free to stop participating at anytime, or to get up and move around to relax between stories. If you would like, I will later make you a copy of your videoed eye movements and voice, and will be available to talk with you by phone or email about your videotaped reading as I analyze your data in the coming months.

If you would like to read, please call or email me so we may arrange a time at your convenience.”

Text of sample correspondence with a volunteer reader:

Dear \_\_\_\_\_,

Thank you for volunteering to participate in my dissertation study (Silent & Oral Reading in French and English). I hope that we can now set up a time for you to come in to the Lab (Rm. 532 - 5th floor of Education Building on the UA campus - 2nd street).

A reading session takes about 2 hours.

Below I am including all my phone numbers so you can contact me.

Are you willing to give me a phone number, or will this email address still be the best way to contact you?

Currently my Lab assistant/technician is available afternoons, and my schedule is open, although I do need one day's notice to line up a lab assistant.

How would Friday May 26th work for you?

Thank you!

Looking forward to hearing from you soon,  
Kathleen

## **SUBJECT'S CONSENT FORM**

Project Title: Silent, Oral, French & English Reading: EMMA

**You are being asked to read the following material to ensure that you are informed of the nature of this research study and of how you will participate in it, if you consent to do so. Signing this form will indicate that you have been so informed and that you give your consent. Federal regulations require written informed consent prior to participation in this research study so that you can know the nature and risks of your participation and can decide to participate or not participate in a free and informed manner.**

### **PURPOSE**

You are being invited to participate voluntarily in the above-titled research project. The purpose of this project is to identify universal processes and individual differences in English/French, silent and oral, first or second language reading.

### **SELECTION CRITERIA**

The Principal Investigator or a member of his/her study staff will discuss the requirements for participation in this study with you. To be eligible to participate, you must be able to read comfortably from a computer screen without the use of eyeglasses or contact lenses. You must be literate in either English or French and able to read a complete short story silently and aloud. A total of 4-12 individuals will be enrolled in this study locally.

### **PROCEDURE(S)**

The following information describes your participation in this study which will last up to two hours:

You will read short stories in English or French, either aloud or silently, at your own pace from a computer screen. You will click a mouse when you're ready to turn pages. After reading you will retell in your own words everything you remember from what you just read. Your voice will be recorded on videotape along with the locations of your eye gaze. While you are reading, a camera placed next to the computer screen will record what you look at by reflecting light off the outer surface of your left eye. You may move freely during all aspects of your participation, but if you sit still we can monitor your eye movements with the camera. You may close your eyes at any time and blinking regularly actually improves the data we collect.

Two researchers will be in the room with you during a reading session. One person operates a another computer, and the other person sits behind you and uses a remote control to keep the camera focused on your eye. It can take up to 20 minutes to adjust the camera to your eye's position before you start reading. This process is called calibration. A quick calibration (reading nine numbers off the computer screen) will also be repeated between each story to be sure that the camera is still focused on your eye.

## **RISKS**

Occasionally a reader may become stiff or tired from nervous tension during a reading and their eyes may water or become dry while reading a long text. If your eyes feel tired or warm please close them briefly or end the reading session. The eye camera has been documented to operate within safe levels of near infrared irradiance, but some glass and steel workers who have been exposed to 800 times this amount of irradiance and for extensive periods of time (10 or more years) have developed vision blurring. Should you feel any concerns you may stop reading and withdraw from the study at any time.

## **BENEFITS**

There is no direct benefit to you from your participation. The greater benefit may be an increased understanding of how we read: What are the processes readers use when reading silently and orally as well as in English or in French. This knowledge may contribute to recommendations for good teaching practices and aids to literacy acquisition.

## **CONFIDENTIALITY**

To protect your privacy, your name will not be directly associated with any data we collect. Instead you will be assigned a three-letter (eg: Amy, Ron) fake name which will be used in all recording and record keeping. Your actual name and any other identifying information will be stored in a locked file cabinet separate from the laboratory.

**PARTICIPATION COSTS AND SUBJECT COMPENSATION** There is no cost to you for participating except for 2 hours of your time. You will receive \$20 for your participation.

## **CONTACTS**

You can obtain further information from the principal investigator (Kathleen O'Brien de Ramírez, Ph.D. Candidate) at (520) 621-7868, or by email at [kdo@u.arizona.edu](mailto:kdo@u.arizona.edu). If you have questions concerning your rights as a research subject, you may call the University of Arizona Human Subjects Protection Program office at (520) 626-6721. (If out of state use the toll-free number 1-866-278-1455.)

## **AUTHORIZATION**

**Before giving my consent by signing this form, the methods, inconveniences, risks, and benefits have been explained to me and my questions have been answered. I may ask questions at any time and I am free to withdraw from the project at any time without causing bad feelings. My participation in this project may be ended by the investigator for reasons that would be explained. New information developed during the course of this study which may affect my willingness to continue in this research project will be given to me as it becomes available. This consent form will be filed in an area designated by the Human Subjects Committee with access restricted by the principal investigator, Kathleen O'Brien de Ramírez, Ph.D.**

**Candidate. or authorized representative of the Language Reading & Culture Department. I do not give up any of my legal rights by signing this form. A copy of this signed consent form will be given to me.**

---

Subject's Signature

Date

**INVESTIGATOR'S AFFIDAVIT:**

Either I have or my agent has carefully explained to the subject the nature of the above project. I hereby certify that to the best of my knowledge the person who signed this consent form was informed of the nature, demands, benefits, and risks involved in his/her participation.

---

Signature of Investigator or her designee

Date

## Appendix B. Short Stories and Retelling Guides

B.1. The short story *Feathered Friend* by Arthur C. Clarke

B.2. Retelling Guide for *Feathered Friend*

B.3. The short story *La Légende du Mont-St-Michel* by Guy de Maupassant

This version of Maupassant's classic folktale, was downloaded from the University of Toronto website: <http://tactweb.chass.utoronto.ca/french/legende.htm>

B.4. Retelling Guide for *La Légende du Mont-St-Michel*

B.5. A translation of *La Légende du Mont-St-Michel* into English.

This translation of the Maupassant story was downloaded June 2, 2005 from the website: <http://www.online-literature.com/maupassant/235/>

### Notes

1) No translation was ever seen by any of the readers and none was used to collect data. All reading was done in the original language of the text. The readers also never saw the Retelling Guides.

2) The stories were presented double-spaced, 16 pt font on a CRT computer screen in their original languages.

*Appendix B.1: Feathered Friend by Arthur C. Clarke*

## Feathered Friend

To the best of my knowledge, there's never been a regulation that forbids one to keep pets in a space station. No one ever thought it was necessary - and even had such a rule existed, I am quite certain that Sven Olsen would have ignored it.

With a name like that, you will picture Sven at once as a six-foot-six Nordic giant, built like a bull and with a voice to match. Had this been so, his chances of getting a job in space would have been very slim; actually he was a wiry little fellow, like most of the early spacers, and managed to qualify easily for the 150-lb. bonus that kept so many of us on a reducing diet.

Sven was one of our best construction men, and excelled at the tricky and specialized work of collecting assorted girders as they floated around in free fall, making them do the slow-motion, three-dimensional ballet that would get them into their right positions, and fusing the pieces together when they were precisely dovetailed into the intended pattern.

I never tired of watching him and his gang as the station grew under their hands like a giant jigsaw puzzle; it was a skilled and difficult job, for a space suit is not the most convenient of garbs in which to work.

However, Sven's team had one great advantage over the construction gangs you see putting up sky-scrapers down on Earth. They could step back and admire their handiwork without being abruptly parted from it by gravity.

Don't ask me why Sven wanted a pet, or why he chose the one he did. I'm not a psychologist, but I must admit that his selection was very sensible. Claribel weighed practically nothing, her food requirements were infinitesimal-and she was not worried, as most animals would have been, by the absence of gravity.

I first became aware that Claribel was aboard when I was sitting in the little cubbyhole laughingly called my office, checking through my lists of technical stores to decide what items we'd be running out of next.

When I heard the musical whistle beside my ear, I assumed that it had come over the station intercom, and waited for an announcement to follow. It didn't: instead, there was a long and involved pattern of melody that made me look up with such a start that I forgot all about the angle beam just behind my head. When the stars had ceased to explode before my eyes, I had my first view of Claribel.

She was a small yellow canary, hanging in the air as motionless as a hummingbird - and with much less effort, for her wings were quietly folded along her sides.

We stared at each other for a minute; then, before I had quite recovered my wit, she did a curious kind of backward loop I'm sure no earthbound canary had ever managed, and departed with a few leisurely flicks. It was quite obvious that she'd already learned how to operate in the absence of gravity, and did not believe in doing unnecessary work.

Sven didn't confess to her ownership for several days, and by that time it no longer mattered, because Claribel was a general pet.

He had smuggled her up on the last ferry from Earth. When he came back from leave-partly, he claimed out of sheer scientific curiosity. He wanted to see just how a bird would operate when it had no weight but could still use its wings.

Claribel thrived and grew fat. On the whole, we had little trouble concealing our unauthorized guest when VIPs from Earth came visiting. A space station has more hiding places than you can count; the only problem was that Claribel got rather noisy when she was upset, and we sometimes had to think fast to explain the curious peeps and whistles that came from ventilating shafts and storage bulkheads. There were a couple of narrow escapes (but, then who would dream of looking for a canary in a space station?)

We were now on 12-hour watches, which was not as bad as it sounds, since you need little sleep in space. Though of course there is no "day" and "night" when you are floating in permanent sunlight, it was still convenient to stick to the terms.

Certainly when I woke up that "morning" it felt like 6 a.m. on Earth. I had a nagging headache, and vague memories of fitful, disturbed dreams. It took me ages to undo my bunk straps, and I was still only half awake when I joined the remainder of the duty crew in the mess. Breakfast was unusually quiet, and there was one seat vacant.

"Where's Sven?" I asked, not very much caring.

"He's looking for Claribel," someone answered. "Says he can't find her anywhere. She usually wakes him up."

Before I could retort that she usually woke me up, too, Sven came in through the doorway, and we could see at once that something was wrong. He slowly opened his hand, and there lay a tiny bundle of yellow feathers, with two clenched claws sticking up pathetically into the air.

"What happened?" we asked, all equally distressed.

"I don't know," said Sven mournfully. "I just found her like this."

"Let's have a look at her," said Jock Duncan, our cook-doctor-dietitian. We all waited in hushed silence while he held Claribel against his ear in an attempt to detect any heartbeat.

Presently he shook his head. "I can't hear anything but that doesn't prove she's dead. I've never listened to a canary's heart," he added rather apologetically.

"Give her a shot of oxygen," suggested somebody, pointing to the green-banded emergency cylinder in its recess beside the door. Everyone agreed that this was an excellent idea, and Claribel was tucked snugly into a face mask that was large enough to serve as a complete oxygen tent for her.

To our delighted surprise, she revived at once. Beaming broadly, Sven removed the mask, and she hopped on to his finger. She gave her series of "Come to the cook-house, boys" trills- then promptly keeled over again.

"I don't get it," lamented Sven. "What's wrong with her? She's never done this before."

For the last few minutes, something had been tugging at my memory. My mind seemed to be very sluggish that morning, as if I was still unable to cast off the burden of sleep. I felt that I could do with some of that oxygen- but before I could reach the mask, understanding exploded in my brain. I whirled on the duty engineer and said urgently:

"Jim, There's something wrong with the air! That's why Claribel's passed out. I've just remembered that miners used to carry canaries down to warn them of gas."

"Nonsense," said Jim. "The alarms would have gone off. We've got duplicate circuits, operating independently."

"Er- the second alarm circuit isn't connected up yet," his assistant reminded him.

That shook Jim; he left without a word while we stood arguing and passing the oxygen bottle around like a pipe of peace.

He came back 10 minutes later with a sheepish expression. It was one of those accidents that couldn't possibly happen; we'd had one of our rare eclipses by Earth's shadow that night; part of the air purifier had frozen up, and the single alarm in the circuit had failed to go off. Half a million dollars' worth of chemical and electronic engineering had let us down completely. Without Claribel, we should soon have been slightly dead.

So, now, if you visit any space station, don't be surprised if you hear an inexplicable snatch of bird song. There's no need to be alarmed; on the contrary, in fact. It will mean that you're doubly safe-guarded at practically no extra expense.

Word count = 1,296 (including title -2)

Character count without spaces = 6,009

With spaces = 7,418



*Appendix B.3: La légende du Mont-St-Michel*

La Légende du Mont-St-Michel

Par

Guy de Maupassant

Je l'avais vu d'abord de Cancale, ce château de fées planté dans la mer. Je l'avais vu confusément, ombre grise dressée sur le ciel brumeux.

Je le revis d'Avranches, au soleil couchant. L'immensité des sables était rouge, l'horizon était rouge, toute la baie démesurée était rouge; seule, l'abbaye escarpée, poussée là-bas, loin de la terre, comme un manoir fantastique, stupéfiante comme un palais de rêve, invraisemblablement étrange et belle, restait presque noire dans les pourpres du jour mourant.

J'allai vers elle le lendemain dès l'aube, à travers les sables, l'oeil tendu sur ce bijou monstrueux, grand comme une montagne, ciselé comme un camée et vaporeux comme une mousseline. Plus j'approchais, plus je me sentais soulevé d'admiration, car rien au monde peut-être n'est plus étonnant et plus parfait.

Et j'errai, surpris comme si j'avais découvert l'habitation d'un dieu à travers ces salles portées par des colonnes légères ou pesantes, à travers ces couloirs percés à jour, levant mes yeux émerveillés sur ces clochetons qui semblent des fusées parties vers le ciel et sur tout cet emmêlement incroyable de tourelles, de gargouilles, d'ornements sveltes et charmants, feu d'artifice de pierre, dentelle de granit, chef-d'œuvre d'architecture colossale et délicate.

Comme je restais en extase, un paysan bas-normand m'aborda et me raconta l'histoire de la grande querelle de saint Michel avec le diable.

Un sceptique de génie a dit: «Dieu a fait l'homme à son image, mais l'homme le lui a bien rendu.»

Ce mot est d'une éternelle vérité et il serait fort curieux de faire dans chaque continent l'histoire de la divinité locale, ainsi que l'histoire des saints patrons dans chacune de nos provinces. Le nègre a des idoles féroces, mangeuses d'hommes; le mahométan polygame peuple son paradis de femmes; les Grecs, en gens pratiques, avaient divinisé toutes les passions.

Chaque village de France est placé sous l'invocation d'un saint protecteur, modifié à l'image des habitants.

Or saint Michel veille sur la Basse-Normandie, saint Michel, l'ange radieux et victorieux, le porte-glaive, le héros du ciel, le triomphant, le dominateur de Satan.

Mais voici comment le Bas-Normand, rusé, cauteleux, sournois et chicanier, comprend et raconte la lutte du grand saint avec le diable.

«Pour se mettre à l'abri des méchancetés du démon, son voisin, saint Michel construisit lui-même, en plein Océan, cette habitation digne d'un archange; et, seul, en effet, un pareil saint pouvait se créer une semblable résidence.

Mais, comme il redoutait encore les approches du Malin, il entourra son domaine de sables mouvants plus perfides que la mer.

Le diable habitait une humble chaumière sur la côte; mais il possédait les prairies baignées d'eau salée, les belles terres grasses où poussent les récoltes lourdes, les riches vallées et les coteaux féconds de tout le pays; tandis que le saint ne régnait que sur les sables. De sorte que Satan était riche, et saint Michel était pauvre comme un gueux.

Après quelques années de jeûne, le saint s'ennuya de cet état de choses et pensa à passer un compromis avec le diable; mais la chose n'était guère facile, Satan tenant à ses moissons.

Il réfléchit pendant six mois; puis, un matin, il s'achemina vers la terre. Le démon mangeait la soupe devant sa porte quand il aperçut le saint; aussitôt il se précipita à sa rencontre, baisa le bas de sa manche, le fit entrer et lui offrit de se rafraîchir.

Après avoir bu une jatte de lait, saint Michel prit la parole:

– Je suis venu pour te proposer une bonne affaire.

Le diable, candide et sans défiance, répondit:

– Ça me va.

– Voici. Tu me céderas toutes tes terres.

Satan, inquiet, voulut parler:

– Mais...

Le saint reprit:

– Écoute d'abord. Tu me céderas toutes tes terres. Je me chargerai de l'entretien, du travail, des labourages, des semences, du fumage, de tout enfin, et nous partagerons la récolte par moitié. Est-ce dit?

Le diable, naturellement paresseux, accepta.

Il demanda seulement en plus quelques-uns de ces délicieux surmulets qu'on pêche autour du mont solitaire. Saint Michel promit les poissons.

Ils se tapèrent dans la main, crachèrent de côté pour indiquer que l'affaire était faite, et le saint reprit:

– Tiens, je ne veux pas que tu aies à te plaindre de moi. Choisis ce que tu préfères: la partie des récoltes qui sera sur terre ou celle qui restera dans la terre.

Satan s'écria:

– Je prends celle qui sera sur terre.

– C'est entendu, dit le saint.

Et il s'en alla.

Or, six mois après, dans l'immense domaine du diable, on ne voyait que des carottes, des navets, des oignons, des salsifis, toutes les plantes dont les racines grasses sont bonnes et savoureuses, et dont la feuille inutile sert tout au plus à nourrir les bêtes.

Satan n'eut rien et voulut rompre le contrat, traitant saint Michel de «malicieux».

Mais le saint avait pris goût à la culture; il retourna retrouver le diable:

– Je t'assure que je n'y ai point pensé du tout; ça s'est trouvé comme ça; il n'y a point de ma faute. Et, pour te dédommager, je t'offre de prendre, cette année, tout ce qui se trouvera sous terre.

– Ça me va, dit Satan.

Au printemps suivant, toute l'étendue des terres de l'Esprit du mal était couverte de blés épais, d'avoines grosses comme des clochetons, de lins, de colzas magnifiques, de trèfles rouges, de pois, de choux, d'artichauts, de tout ce qui s'épanouit au soleil en graines ou en fruits.

Satan n'eut encore rien et se fâcha tout à fait.

Il reprit ses prés et ses labours et resta sourd à toutes les ouvertures nouvelles de son voisin.

Une année entière s'écoula. Du haut de son manoir isolé, saint Michel regardait la terre lointaine et féconde, et voyait le diable dirigeant les travaux, rentrant les récoltes, battant ses grains. Et il rageait, s'exaspérant de son impuissance. Ne pouvant plus duper Satan, il résolut de s'en venger, et il alla le prier à dîner pour le lundi suivant.

– Tu n'as pas été heureux dans tes affaires avec moi, disait-il, je le sais; mais je ne veux pas qu'il reste de rancune entre nous, et je compte que tu viendras dîner avec moi. Je te ferai manger de bonnes choses.

Satan, aussi gourmand que paresseux, accepta bien vite. Au jour dit, il revêtit ses plus beaux habits et prit le chemin du Mont.

Saint Michel le fit asseoir à une table magnifique. On servit d'abord un vol-au-vent plein de crêtes et de rognons de coq, avec des boulettes de chair à saucisse, puis deux gros surmulets à la crème, puis une dinde blanche pleine de marrons confits dans du vin, puis un gigot de pré-salé, tendre comme du gâteau; puis des légumes qui fondaient dans la bouche et de la bonne galette chaude, qui fumait en répandant un parfum de beurre.

On but du cidre pur, mousseux et sucré, et du vin rouge et capiteux, et, après chaque plat, on faisait un trou avec de la vieille eau-de-vie de pommes.

Le diable but et mangea comme un coffre, tant et si bien qu'il se trouva gêné.

Alors saint Michel, se levant formidable, s'écria d'une voix de tonnerre:

– Devant moi! devant moi, canaille! Tu oses... Devant moi...

Satan éperdu s'enfuit, et le saint, saisissant un bâton, le poursuivit.

Ils couraient par les salles basses, tournant autour des piliers, montaient les escaliers aériens, galopèrent le long des corniches, sautaient de gargouille en gargouille. Le pauvre démon, malade à fendre l'âme, fuyait, souillant la demeure du saint. Il se trouva enfin sur la dernière terrasse, tout en haut, d'où l'on découvre la baie immense avec ses villes lointaines, ses sables et ses pâturages. Il ne pouvait échapper plus longtemps; et le saint, lui jetant dans le dos un coup de pied furieux, le lança comme une balle à travers l'espace.

Il fila dans le ciel ainsi qu'un javelot, et s'en vint tomber lourdement devant la ville de Mortain. Les cornes de son front et les griffes de ses

membres entrèrent profondément dans le rocher, qui garde pour l'éternité les traces de cette chute de Satan.

Il se releva boiteux, estropié jusqu'à la fin des siècles; et, regardant au loin le Mont fatal, dressé comme un pic dans le soleil couchant, il comprit bien qu'il serait toujours vaincu dans cette lutte inégale, et il partit en traînant la jambe, se dirigeant vers des pays éloignés, abandonnant à son ennemi ses champs, ses coteaux, ses vallées et ses prés.

Et voilà comment saint Michel, patron des Normands, vainquit le diable.»

Un autre peuple avait rêvé autrement cette bataille.

Word count = 1516

Character count without spaces = 7,010

Character count including spaces = 8,579

Retrieved May 9, 2005 from the University of Toronto Web site:  
<http://tactweb.chass.utoronto.ca/french/legende.htm>



*Appendix B5: The Legend of Mont-St-Michel*

I had first seen it from Cancale, this fairy castle in the sea. I got an indistinct impression of it as of a gray shadow outlined against the misty sky. I saw it again from Avranches at sunset. The immense stretch of sand was red, the horizon was red, the whole boundless bay was red. The rocky castle rising out there in the distance like a weird, seignorial residence, like a dream palace, strange and beautiful-this alone remained black in the crimson light of the dying day.

The following morning at dawn I went toward it across the sands, my eyes fastened on this, gigantic jewel, as big as a mountain, cut like a cameo, and as dainty as lace. The nearer I approached the greater my admiration grew, for nothing in the world could be more wonderful or more perfect.

As surprised as if I had discovered the habitation of a god, I wandered through those halls supported by frail or massive columns, raising my eyes in wonder to those spires which looked like rockets starting for the sky, and to that marvellous assemblage of towers, of gargoyles, of slender and charming ornaments, a regular fireworks of stone, granite lace, a masterpiece of colossal and delicate architecture.

As I was looking up in ecstasy a Lower Normandy peasant came up to me and told me the story of the great quarrel between Saint Michael and the devil.

A sceptical genius has said: "God made man in his image and man has returned the compliment."

This saying is an eternal truth, and it would be very curious to write the history of the local divinity of every continent as well as the history of the patron saints in each one of our provinces. The Negro has his ferocious man-eating idols; the polygamous Mahometan fills his paradise with women; the Greeks, like a practical people, deified all the passions.

Every village in France is under the influence of some protecting saint, modelled according to the characteristics of the inhabitants.

Saint Michael watches over Lower Normandy, Saint Michael, the radiant and victorious angel, the sword-carrier, the hero of Heaven, the victorious, the conqueror of Satan.

But this is how the Lower Normandy peasant, cunning, deceitful and tricky, understands and tells of the struggle between the great saint and the devil.

To escape from the malice of his neighbor, the devil, Saint Michael built himself, in the open ocean, this habitation worthy of an archangel; and only such a saint could build a residence of such magnificence.

But as he still feared the approaches of the wicked one, he surrounded his domains by quicksands, more treacherous even than the sea.

The devil lived in a humble cottage on the hill, but he owned all the salt marshes, the rich lands where grow the finest crops, the wooded valleys and all the fertile hills of the country, while the saint ruled only over the sands. Therefore Satan was rich, whereas Saint Michael was as poor as a church mouse.

After a few years of fasting the saint grew tired of this state of affairs and began to think of some compromise with the devil, but the matter was by no means easy, as Satan kept a good hold on his crops.

He thought the thing over for about six months; then one morning he walked across to the shore. The demon was eating his soup in front of his door when he saw the saint. He immediately rushed toward him, kissed the hem of his sleeve, invited him in and offered him refreshments.

Saint Michael drank a bowl of milk and then began: "I have come here to propose to you a good bargain."

The devil, candid and trustful, answered: "That will suit me."

"Here it is. Give me all your lands."

Satan, growing alarmed, wished to speak "But--"

The saint continued: "Listen first. Give me all your lands. I will take care of all the work, the ploughing, the sowing, the fertilizing, everything, and we will share the crops equally. How does that suit you?"

The devil, who was naturally lazy, accepted. He only demanded in addition a few of those delicious gray mullet which are caught around the solitary mount. Saint Michael promised the fish.

They grasped hands and spat on the ground to show that it was a bargain, and the saint continued: "See here, so that you will have nothing to complain of, choose that part of the crops which you prefer: the part that grows above ground or the part that stays in the ground." Satan cried out: "I will take all that will be above ground."

"It's a bargain!" said the saint. And he went away.

Six months later, all over the immense domain of the devil, one could see nothing but carrots, turnips, onions, salsify, all the plants whose juicy roots are good and savory and whose useless leaves are good for nothing but for feeding animals.

Satan wished to break the contract, calling Saint Michael a swindler.

But the saint, who had developed quite a taste for agriculture, went back to see the devil and said:

"Really, I hadn't thought of that at all; it was just an accident, no fault of mine. And to make things fair with you, this year I'll let you take everything that is under the ground."

"Very well," answered Satan.

The following spring all the evil spirit's lands were covered with golden wheat, oats as big as beans, flax, magnificent colza, red clover, peas, cabbage, artichokes, everything that develops into grains or fruit in the sunlight.

Once more Satan received nothing, and this time he completely lost his temper. He took back his fields and remained deaf to all the fresh propositions of his neighbor.

A whole year rolled by. From the top of his lonely manor Saint Michael looked at the distant and fertile lands and watched the devil direct the work, take in his crops and thresh the wheat. And he grew angry, exasperated at his powerlessness.

As he was no longer able to deceive Satan, he decided to wreak vengeance on him, and he went out to invite him to dinner for the following Monday.

"You have been very unfortunate in your dealings with me," he said; "I know it, but I don't want any ill feeling between us, and I expect you to dine with me. I'll give you some good things to eat."

Satan, who was as greedy as he was lazy, accepted eagerly. On the day appointed he donned his finest clothes and set out for the castle.

Saint Michael sat him down to a magnificent meal. First there was a 'vol-au-vent', full of cocks' crests and kidneys, with meat-balls, then two big gray mullet with cream sauce, a turkey stuffed with chestnuts soaked in wine, some salt-marsh lamb as tender as cake, vegetables which melted in the mouth and nice hot pancake which was brought on smoking and spreading a delicious odor of butter.

They drank new, sweet, sparkling cider and heady red wine, and after each course they whetted their appetites with some old apple brandy.

The devil drank and ate to his heart's content; in fact he took so much that he was very uncomfortable, and began to retch.

Then Saint Michael arose in anger and cried in a voice like thunder: "What! before me, rascal! You dare--before me--"

Satan, terrified, ran away, and the saint, seizing a stick, pursued him. They ran through the halls, turning round the pillars, running up the staircases, galloping along the cornices, jumping from gargoyle to gargoyle. The poor devil, who was woefully ill, was running about madly and trying hard to escape. At last he found himself at the top of the last terrace, right at the top, from which could be seen the immense bay, with its distant towns, sands and pastures. He could no longer escape, and the saint came up behind him and gave him a furious kick, which shot him through space like a cannonball.

He shot through the air like a javelin and fell heavily before the town of Mortain. His horns and claws stuck deep into the rock, which keeps through eternity the traces of this fall of Satan.

He stood up again, limping, crippled until the end of time, and as he looked at this fatal castle in the distance, standing out against the setting sun, he understood well that he would always be vanquished in this unequal struggle, and he went away limping, heading for distant countries, leaving to his enemy his fields, his hills, his valleys and his marshes. And this is how Saint Michael, the patron saint of Normandy, vanquished the devil. Another people would have dreamed of this battle in an entirely different manner.

## Appendix C: Processed Data Samples

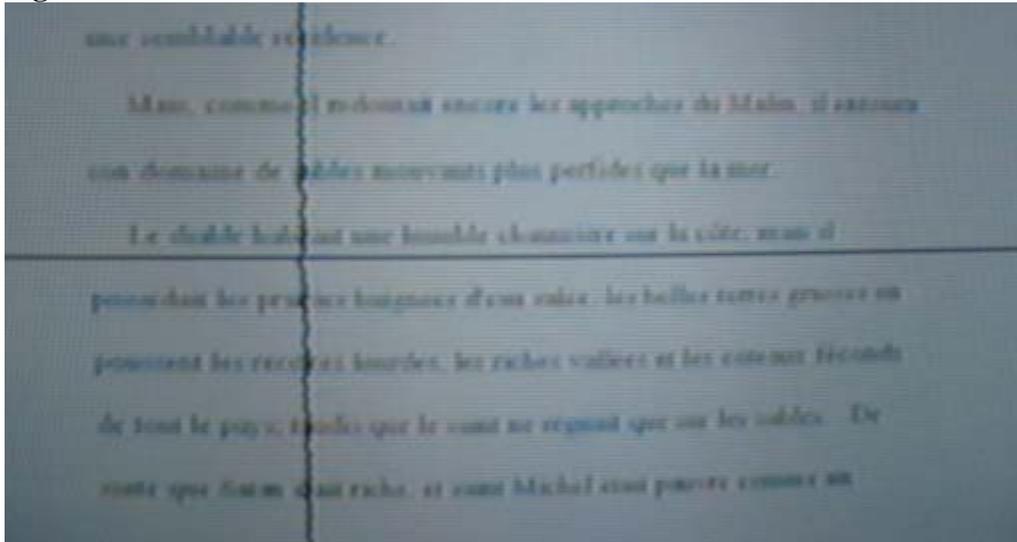
C.1 Snapshot of Crosshairs during Reading (DAV)

C.2 Seeing Syntax and Metaphor (LUC) L1 French Oral Initial Reading

C.3. AMY L2 English: Fixations with Miscue

Appendix C.1 Snapshot of Crosshairs during Reading (DAV)

**Figure 2. Corneal Reflections: Crosshairs on a Monitor**

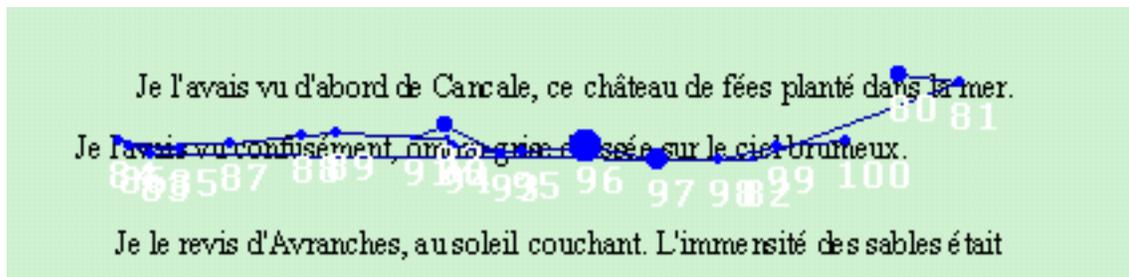


Researchers and teacher trainers at EMMA labs at the University of Arizona, the State University of New York at Geneseo, and at New Mexico State University at Las Cruces, allow students to watch one another read so they can see how the eyes move while reading authentic text.

Figure 2 displays only part of the monitor, showing here the bottom eight lines of the text, out of eleven lines on this screen page; the fifth page of text in the story *La légende du Mont-St-Michel* by Guy de Maupassant. The image in figure 2 was taken with a digital camera to represent what observers of an EMMA reading session can view on the monitor as the eye reads. This is a rough representation of the dynamic data which was recorded on video tape and later digitized.

Appendix C.2 Seeing Syntax and Metaphor (LUC)

Figure 3. LUC's L1 Syntactic Eye Search



In this image from the software Fixplot, the circles represent fixations their size is scaled according to duration. A small circle is a quick fixation and a large circle (like number 96 on *dressée*) is a long fixation. The numbers in white against the green background are in linear order and appear directly below the fixation location. The obscured text reads:

Je l'avais vu d'abord de Cancale, ce château de fées planté dans la mer.

Je l'avais vu confusément, ombre grise dressée sur le ciel brumeux.

These are the first two lines of the story *La légende du Mont-St-Michel* by Guy de Maupassant, and this is the reader's first time seeing this story. Although he has read work by this author before.

In chapters 4 and 7, I spoke of LUC as a poet. The sample of EMMA data in figure 3 exhibits how he pays close attention to syntax and metaphor as he builds the story. Two separate accounts of his eye fixations attribute his increased regressions and fixation frequency in this region to either syntactic ambiguity or an appreciation of metaphor.

While reading in French (L1, bilingual with Fon), his eye movements portray how he is constructing the logical syntax and semantics of the sentence. Earlier fixations are not shown here, but between fixations numbered 81 and 82, his eyes betray him as a poet; instead of making a complete return sweep from the word *mer* (sea) to the beginning of the next line, stops to fixate *ciel* (sky).

A syntactic explication of his eye movements in this region of text relates to verb phases and how the verb is not a complete and independent lexical unit. A verb must gather meaning from its context. (Andrew Carney, personal communication at the SLAT Round Table University of Arizona, 2008).

Verbs are central to creating meaning and discourse when reading aloud, and LUC fixates first on the imperfect auxiliary *avais* (fixation number 82; the order of his eye fixations are presented in table 8.1). Looking at this verb form he knows it is in the past, but cannot judge whether it first or second person (*je* or *tu*) without first seeking information from the subject pronoun. So his next fixation is a regression to the preceding pronoun *Je* (I). His eyes then move forward to land once again on the auxiliary verb [the home base of all structural interpretation – the purpose of all subject and object arguments], *avais*.

His eye then regressed again and landed on the preceding direct object pronoun *l'* (it). This pronoun however, because it is in a pre-vocalic contracted form, does not reveal the gender of its antecedent, so LUC 's eyes move forward to land on the past participle *vu* which tells him that the *l'* from the previous fixation is masculine singular.

From there his eyes move rightward along the line of print searching for a referent to accompany this masculine singular object pronoun, and he fixates the feminine noun *ombre* four times before moving on to the feminine adjective *grise* (gray) which follows next; and then he lands twice on the feminine past participial adjective *dressée* (dressed) then continues to the preposition *sur* (on), *le ciel* (the sky) which he had previously fixated when his eyes made the line return, a masculine noun but not the correct referent he's looking for, not the antecedent of the preceding direct object pronoun. His eye then lands three times on the masculine adjective *brumeux* (stormy). His repeated regressions to *ombre* (4 fixations numbered 90-92, 94), *grise* (2 fixations numbered 93 & 95) and *dressée* (2 fixations numbered 96 & 97) provide insight into his search to make syntactic sense of the sentence. The referent for the preceding direct object pronoun *l'* must be masculine because there is not feminine agreement on the past participle *vu*. But all of the nouns and adjectives he finds are feminine metaphors for the antecedent *chateau* (castle).

Exactly what LUC is thinking as he reads this passage is impossible to determine. Is he seeking to make syntactic sense of the prosodic structure and noun/pronoun genders ? Or is he taking time to enjoy the vibrant metaphor of the castle as a dark shadow dressed by the cloudy sky ? Is he situating himself early in the story with the narrator who is seeing it confusedly (*confusément*) ?

The L1 readers of French in this study took longer to read the story than the L2 readers did. LUC was certainly the slowest, taking his time to truly look at the text. The

linear progression of LUC's eye fixations while reading aloud in this area is delineated in table 8.1:

*Table 8.1 L2 Metaphor and syntax in eye movements (LUC)*

Fix	#82	#83	#84	#85	#86	#87	#88	#89	#90
#81									
la mer	ciel	avais	Je l'	avais	L'avais	vu	confus	sément	ombre
[sea]	[sky]	[had]	[I it]	[had]	[it had]	[seen]			
#91	#92	#93	#94	#95	#96	#97	#98	#98	#99
ombre	ombre	grise	ombre	grise	dressée	dressée	le	ciel	brumeux

While speaking the sentence fluidly and correctly, his eyes see :

mer - ciel - avais – Je – avais - l' – vu – confus-ément - ombre - ombre – ombre  
 grise – ombre – grise - dressée – dressée – sur – le - ciel – brumeux - brumeux –  
 brumeux

This syntactically logical, but not word-by-word linear progression of eye movements provides an example of how the eyes and the brain function together, seeking and interpreting the discrete, critical features necessary in making sense of written language.

Appendix C.3 AMY L2 English: Fixations with Miscues

Figure 4. AMY L2 English Oral Initial Reading of *Feathered Friend*

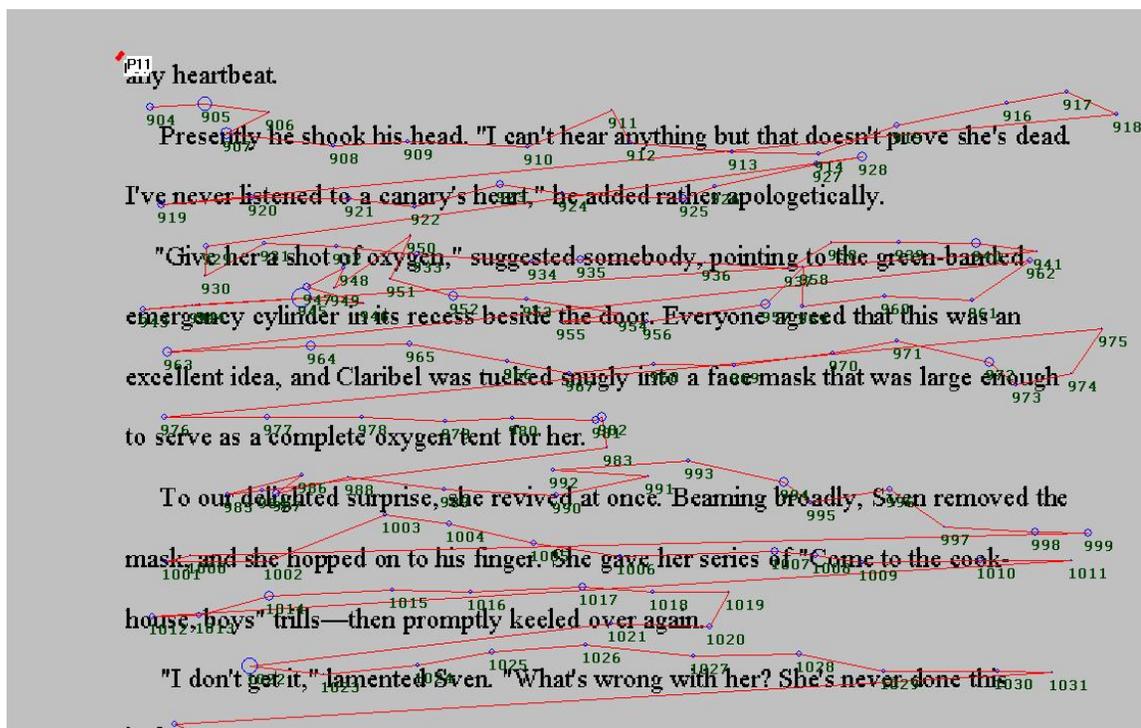


Figure illustrates the concepts behind EMMA as a methodology for understanding reading. Lines are drawn between fixations which are plotted using ASL Fixplot software. Fixations are represented by dots/circles. Longer fixation durations are illustrated with wider circles, as seen near the words heartbeat, apologetically, banded, **cylinder**, recess, and don't get. This is the seventh of nine full screens of text AMY viewed consecutively in her oral reading. Three more lines of text, not represented here, appear on this same screen. The full text of the story by Arthur C. Clarke appears in appendix B.1

Table 8.2 highlights locations where increased attention is paid to text. AMY, reading in her nonnative (L2) English, miscued, creating a nonword in place of the lexical item cylinder. Her vertically regressive eye movements to the prepositional phrase “of oxygen” in the preceding line demonstrate to an observer watching her eye fixations precisely how she searches for meaning. After a long first fixation, she does not regress to the word cylinder, instead she regresses to meaningful semantic units nearby.

Although AMY is a proficient L2 reader of English (she has a Masters degree from France in English language and has lived in both the US and the UK), she fixates five times around the word delighted. Perhaps the silent *gh* is intriguing or represents novelty for her. She did not miscue on this or the surrounding words, producing a fluid oral rendition of the story.

In the same line her eyes regressed for a second look at the area of the word *revived*. A summary of these expected responses, observed responses and fixations is presented in table 8.2:

*Table 8.2 Oral L2 English fixations and miscue (AMY)*

Lexical Item (ER)	Miscue (OR)	Fixation #	Fixation durations	Line of text
apologetically	\$ hapolatically	926,-928		0703
cylinder	\$ cyclinder	945-950 (vertical regression)	Long first fixation	0705
delighted		983-987		0708
revived		990 + 992 (regression)		

AMY’s reading represents one example of proficient multilingual reading. Other readers react similarly to the text:

- When reading this same passage, EVE (L2 English) miscues on the word revived, saying instead “received”; she does not correct her miscue.
- The L2 English reader JAN also miscued on the word cylinder, saying “islander.”
- JAN and EVE also miscued the 7-syllable word *apologetically*, creating nonwords. AMY devotes at least three fixations to this word and mispronounces it, but does not correct her miscue. JAN’s pronunciation of the preceding word is altered. See table 5.5)

Long first fixations such as on the dialog “I don’t get it” merit future investigation. Although AMY did not miscue here, both AMY and JAN do miscue frequently on contractions, elongating them when the shortened form is presented in the text, or shortening them when the long form is in the text. These alterations do not change meaning and are optional in English, although obligatory French.

Interesting for future study is the lack of significant eye movement reaction to novel vocabulary. AMY mispronounces the word *keeled* as “killed” and does not correct her miscue. During her retelling after finishing reading she asks about the word using it semantically correctly, paraphrasing the original context from memory even though it is a new to vocabulary item to her. (Further discussion relating to AMY’s vocabulary-learning strategy is in chapter 5 in the section titled L1 and L2 Retellings: Learning by Reading, and in the summary on L1 & L2 Comprehension in that same chapter.)

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