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**PROCESSING VERBAL ARGUMENTS IN A FIRST AND SECOND
LANGUAGE:
THE ROLE OF IMMERSION EXPERIENCE**

A Thesis in
French
by
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ABSTRACT

Past research examining the processing of structurally ambiguous modifiers, such as adjunct phrases consisting of a complex noun phrase followed by a relative clause show that bilingual speakers sometimes resolve this ambiguity when reading in their first language (L1) using parsing strategies from their second language (L2). Years of immersion experience in the L2 has been found to account for this result (Dussias, 2003; Dussias & Sagarra, 2007). The primary goal of the present research was to determine whether the information directing parsing decisions for verbal arguments are as vulnerable to intrusion from the L2 as the factors that affect the parsing of adjuncts. In addition, some current empirical evidence suggests that when L2 learners read sentences in their L2 they are not guided by the same structurally-based principles typically evidenced during monolingual sentence parsing. Therefore, the secondary aim of this research was to assess whether L2 speakers use structure-based parsing principles or lexical-semantic information to process structurally ambiguous arguments in their L2. To address these questions, monolingual English speakers, monolingual French speakers, French-English bilinguals immersed in the L2 environment (English) and English-French bilinguals who lived in a bilingual environment read ambiguous object/subject sentences in English and in French were selected and tested.

The results imply that when bilinguals have regular access to only one of their two languages, the dominant language guides the way they process sentences containing object/subject ambiguities and when bilinguals use both their languages on a regular basis, they are able to parse each language following the linguistic constraints of that

language. Additionally, the results obtained showed that certain bilinguals appear to parse argument constructions using structure-based principles, whereas others may primarily rely on lexical-semantic information and perform a shallower interpretation of sentences.

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Chapter 1: INTRODUCTION

1.1 Overview

Our understanding of the cognitive processes underlying language comprehension in humans is based in large part on data from monolingual speakers. Yet, the majority of the world's population is able to interact in more than one language (Grosjean 1982), which means that most people can understand and use not only their native language, but at least one other language. Bilingualism is standard rather than exceptional in today's world (Poullisse, 1997); it is therefore important to understand how the bilingual brain adapts to comprehending a second language, and how it deals with the task of actively maintaining multiple languages in daily use.

Extensive research efforts have been devoted to understanding how a first language affects the learning and processing of a second language (Butler & Hakuta, 2004). In the last fifty years, research on the role of the first language in second language acquisition and processing has taken different forms. During the early 1960s, it was believed that the first language played a major role in shaping second language acquisition. Theoretical linguists and language practitioners alike conducted extensive comparisons of the grammars of two languages in order to predict problematic areas during the process of acquiring a second language. Due in part to the influence of Chomsky's work (1957, 1959), the 1970s saw a turn to the opposite view. Thus,

researchers proposed the notion of *creative construction* (Dulay & Burt, 1974), which suggested that the existence of certain universal cognitive strategies played a significant role in second language acquisition. During this time, the role of the first language was believed to be minimal, if at all existent. However, in recent years, a rich knowledge base stemming from studies aimed at explaining the persistence of non-native characteristics in the competence and performance of second language speakers indicates that the first language can influence multiple facets of second language acquisition and processing, ranging from orthographic and phonological processing to grammatical structures and pragmatic uses. Within this literature, various studies provide evidence that an interaction between first language (L1) and second language (L2) knowledge exists while speakers process sentences in their second language. Research has shown, for example, that speakers of two languages often use information from the L1 to guide the construction of syntactic structures (i.e., *parsing*) when reading sentences in the second language (Fernández, 1999; Felser, Roberts, Gross, & Marinis, 2002; Hahne & Friederici, 2001; Hernández, Bates & Avila, 1994; Papadopoulou & Clahsen, 2003; Marinis, Roberts, Felser & Clahsen, 2005). Variables related to the linguistic characteristics of the target sentences, such as sense-semantic information (thematic and plausibility information), syntactic-category based information, and structurally-driven parsing principles have all been shown to affect how L2 speakers obtain a syntactic analysis of an input string and an interpretation of such a string. In addition, learners' characteristics and specific linguistic experience have also been shown to determine the overall degree of success in sentence comprehension tasks. In this respect, one important variable that has emerged is

the influence of the linguistic environment and immersion experience. Specifically, the time a speaker spends immersed in the second language has been shown to affect the way in which certain constructions are processed. For example, Dussias and Sagarra (2007) showed that when Spanish-dominant bilinguals read Spanish sentences containing structurally ambiguous relative clauses preceded by a complex noun phrase (NP) (e.g., *Alguien mató al hijo de la criada que estaba en el balcón/Someone shot the son of the actress who was on the balcony*), those who had been immersed in the L2 English environment for an average of 6 years interpreted the relative clause as referring to the second noun in the complex noun phrase (*the actress* in the example above), despite the fact that the preference in Spanish is overwhelmingly for interpretation of the relative clause to the first noun (i.e., to *the son*). The results obtained by Dussias and Sagarra suggest that the processing of adjunct phrases, such as relative clauses, can be influenced by immersion experience. However, given that the findings are limited to the examination of ambiguous adjunct phrases, it is unclear whether immersion experience can affect the processing of argument phrases, which unlike adjunct phrases, are not considered to be peripheral to the syntactic integrity of the sentence as a whole.

1.2 Specific aims

The present dissertation has two main goals. The first goal is to test whether the processing of verbal arguments is affected by the immersion experience of the speakers. There are several linguistic and psycholinguistic reasons to assume that the processing of

arguments and that of adjuncts may not be equally susceptible to environmental influences. In linguistic terms, the arguments of a verb (or of a noun or of another word) are constituents that bear a close grammatical relation to that verb (or noun), and typically denote a central aspect of an action or an assertion. Hence, in *John is weighing the apples, the apples* functions as the direct object of the verb, and the entire predicate describes an action being carried out at the moment of speaking. Arguments are also semantically selected by the verb; they are assigned a thematic role by the verb, and thus form part of the verb's entry in the lexicon. Adjuncts, on the other hand, are not selected by particular verbs; any verb can appear in a sentence accompanied by an adjunct. In this sense, adjuncts are always syntactically optional, a feature that makes them different from arguments, which can be either obligatory or optional. Because arguments are closely tied to the verb that subcategorizes for them, they may be susceptible to environmental influences than adjuncts.

In addition to the linguistic characteristics that set arguments apart from adjuncts, some psycholinguistic models assume that the processing of arguments and that of adjuncts is not guided by the same types of structural principles. For example, the *Construal Hypothesis* (Frazier & Clifton, 1996) postulates that the processing of arguments is guided by the application of structure-based universal principles, whereas the processing of adjuncts primarily follows universal discourse principles that interact with language specific rules.

In short, the purported linguistic and psycholinguistic behavior of arguments versus adjuncts suggests that they might be influenced by different types of information

during processing. If we find that immersion in the second language environment does not affect arguments in the same way it affects adjuncts, this would provide indirect support for processing models, such as the *Construal Hypothesis*, which postulate different parsing mechanisms for different types of phrases.

The second aim of this dissertation is to investigate whether L2 speakers use structure-based parsing principles or whether they rely on lexical-semantic information to process structurally ambiguous arguments in their L2. As will be discussed in greater detail in Chapter 2, some current empirical evidence suggests that during L2 sentence reading, L2 learners are not guided by the same structurally-based principles typically evidenced during monolingual sentence parsing. According to Clahsen and his colleagues (e.g., Clahsen and Felser, 2006), L2 speakers instead privilege lexical-semantic information encoded in verbs when assigning a syntactic structure to an L2 input string. Given that the bulk of the evidence for this claim comes from the parsing of adjunct phrases, it remains to be seen whether the claim can be extended to the parsing of other structures, such as verbal arguments.

To summarize, examining whether the processing of verbal arguments is constrained by the linguistic context in which bilinguals find themselves is crucial to be able to determine how immersion can modulate the way bilingual readers can process sentences. It can also highlight the importance of theoretical accounts such as structurally based theories like the *Construal Hypothesis*, which explicitly stipulates that there are processing implications of adjunct/arguments constructions or experience-based models,

such as *Linguistic Tuning* (Cuetos & Mitchell, 1988; Mitchell & Cuetos, 1991) that recognize the importance of exposure as a variable modulating parsing.

1.3 The structure under investigation

In this dissertation, the structure under investigation involved the so-called object/subject ambiguity, illustrated in sentences such as *When the naïve explorer lands the damaged helicopter stops in a chaotic manner*. In English, this construction is structurally ambiguous because the noun phrase *the damaged helicopter* can be (incorrectly) interpreted either as the direct object of *lands* (i.e., the naïve explorer lands the helicopter) or as the subjects of the ensuing clause (i.e., the damaged helicopter stops in a chaotic manner), which is the correct parse for the sentence. The ambiguity arises in English because *lands* is optionally transitive. In French, this ambiguity does not occur because the translated equivalent verb (i.e., *atterrir*) used intransitively. By exploiting this cross-linguistic difference, it is possible to assess the effect that continuous exposure to L2 input has on the parsing of verbal arguments (i.e., the first goal of the experiments in this dissertation). In addition, object/subject ambiguities allow for the examination of how arguments are parsed by L2 speakers (i.e., the second goal of this dissertation). Performance on reading times for this construction was compared to a control condition, which crucially contained verbs that were intransitive (*When the naïve explorer panics the damaged helicopter stops in a chaotic manner*).

1.4 The participants

Two types of highly fluent second language speakers, French-English bilinguals and English-French bilinguals read the ambiguous constructions in English and in French. The French-English speakers were living in the US at the time of data collection, and they varied with respect to the years of immersion experience in the (L2) English environment. The English-French bilinguals resided in Montreal, Canada. These bilinguals were chosen because many residents of Montreal are proficient speakers of both French and English, and are exposed to both languages in their daily lives and in a variety of contexts, both academic and non-academic. It was thought that if immersion played a role, it would differentially affect the two types of bilingual speakers. For each group of participants, a proficiency measure and a working memory span measure were gathered to study the effect of individual differences in parsing.

1.5 Organization of the dissertation

The remaining chapters of this dissertation are organized as follows. In chapter 2, the field of bilingual sentence processing is defined, providing a review of studies that have shown the importance of two types of variables: linguistic and individual. Linguistic information related to verbal, thematic, and plausibility information, as well as structure-based parsing principles have been found to modulate the way L2 speakers process sentences. Individual variables such as proficiency level, immersion experience and

working memory span have also been shown to affect bilingual sentence parsing. In the context of the bilingual literature, Chapter 2 also incorporates a brief discussion of two monolingual models of sentence processing that form the basis of the predictions for the proposed experiments. These models are the *Garden Path Model* (Frazier, 1979, 1987), and *Linguistic Tuning* (Cuetos & Mitchell, 1988; Mitchell & Cuetos, 1991). The last section of Chapter 2 outlines the specific research questions addressed in the dissertation and their respective predictions.

Chapter 3 presents an overview of the experimental approach. First, demographic information about the monolingual and bilingual participants are reported. This is followed by a description of two objective measures of English and French proficiency, which were used to assess the level of competency of the bilinguals in their two languages. Subsequently, the test results are presented. Next, I discuss the Waters and Caplan (1996) working memory test, which is an individual-difference measure that has been shown to impact syntactic ambiguity resolution in monolingual speakers. I then describe the reading moving-window technique and the methodology used to collect data for the experiments proposed in this dissertation, and I briefly discuss the reasoning behind the selection of the moving window technique and review its limitations. The chapter ends with a description of the materials used in the experiment and the procedures followed during data collection.

In Chapter 4, I present and discuss the experimental results of the four groups of participants. First, the results for both English and French monolinguals are presented, followed by the findings for the two bilingual groups. Independent ANOVAs were

performed on reading times at the following regions: The subordinate verb, the following determiner and accompanying adjective, the noun, and the disambiguating region of the sentences--i.e., the verb of the second clause. All analyses treated subjects and items as random variables. In general terms, the results show that the monolingual English speakers exhibited more difficulty reading the disambiguating region in the experimental, structurally-ambiguous condition than in the control condition. This finding replicates previous results in the monolingual literature (e.g., Frazier & Rayner, 1982) and suggests that the English monolinguals employ structure-driven principles to parse the ambiguous construction. The monolingual French speakers, on the other hand, show similar reading patterns at the disambiguating region for the two types of sentences, a result that is expected given that both sentence types contained intransitive verbs. The results for the French-English bilinguals were differentially affected by years of immersion in the L2 environment. For the group with extensive L2 immersion experience, the English sentences caused similar patterns of reading difficulty evidenced in the monolingual English speakers. Reading patterns for the French sentences also showed that these speakers experienced processing difficulties, despite the fact that the French constructions do not present any ambiguities. These results suggest that immersion experience in only one of the two languages influences sentence parsing in the other language. In this case, the fact that the French-English bilinguals find themselves in an overwhelmingly English-speaking environment and are surrounded by English renders the lexical information of English verbs more available, making it more accessible than the French lexical information when processing French sentences. This explanation finds

converging support from the results of the English-French bilinguals. Similar to the English monolingual speakers, these participants showed difficulties when parsing the English object/subject temporary ambiguous sentences, but showed no signs of difficulty when reading in French, a pattern that replicates the French monolingual results. These results suggest that when bilinguals have access to both their languages and use them on a regular basis, they are able to parse each language following the linguistic constraints of that language.

The final chapter begins with a summary of the results, followed by a discussion addressing several essential issues linked to bilingual sentence processing. Results are discussed in a theoretical context, focusing on the role of immersion experience. Then, I explain the results of this dissertation in the context of a recent proposal which argues that structure-building processes during online L2 sentence comprehension are dissimilar from the representations built by native speakers. Finally, the issue of L1 transfer in second language processing is addressed, emphasizing the importance of reevaluating the concept of proficiency as it is usually measured by standardized test, as it does not capture the psycholinguistic dimension reflected in parsing processes.

Chapter 2: BILINGUAL SENTENCE PROCESSING

2.1 Introduction

The framing question underlying the studies on bilingual sentence parsing is to what extent L2 processing is qualitatively similar or different from L1 processing. In addressing this question, researchers have studied a number of variables that appear to affect reading processing among L2 learners. Some of these variables are linguistic in nature in that they are concerned with the specific sources of linguistic information that L2 learners access and use during L2 sentence comprehension (cf. Clahsen & Felser, 2006; Cramer & Dussias, 2006; Dussias & Cramer Scaltz (submitted); Felser, Roberts, Gross & Marinis, 2003; Felser & Roberts, 2004; Fernández, 2003; Frenck-Mestre, 1997; Frenck-Mestre & Pynte, 1997; Gass, 1987; Harrington, 1987; Juffs & Harrington, 1996; Juffs, 1998a, 1998b; Sasaki, 1991; Su, 2001; Papadopoulou & Clahser, 2003; Williams, Möbius & Kim, 2001; Williams, 2006). Other variables are related to the characteristics of the learners and to their linguistic experience (cf. Frenck-Mestre, 2000; Hahne & Frederici, 2001; Hopp, 2006; Dussias & Sagarra, 2007; Fernandez, 2003; Juffs, 2004, 2005, 2006; Ojima, Nakata and Kakigi, 2005; Omaki, 2005; Su 2001). For example, learners' characteristics such as cognitive abilities (e.g., working memory), proficiency and type of immersion experience have been found to interact with linguistic aspects of the input in producing a parsing outcome. This chapter begins by discussing the

participants' characteristics and the linguistic variables that are pertinent to the research questions that motivate the experiments in this dissertation. In doing so, I will also present a monolingual comprehension model known as the *Garden-Path* model (Frazier, 1979) and will discuss how the premises of the model could account for some of the L2 sentence comprehension findings reported in past L2 sentence comprehension literature. The chapter then provides a brief description of the motivation for the proposed experiments and concludes with a section addressing my specific research questions and predictions.

2.2 Participant variables

A number of participant variables have been found to influence sentence parsing. In the following discussion, I will focus on three such variables because they are of central importance to the experiments in this dissertation. These are working memory capacity, language proficiency and immersion experience.

2.2.1 Working Memory

Working memory is a component of cognition that allows humans to store information while processing other information. In order to comprehend a sentence, readers must quickly retrieve the representations of previously processed words, as well as integrate them with newly processed words and phrases (Kintsch & vanDijk, 1978) and therefore, working memory capacity plays an important role in language processing. Working memory has been defined as a system in which small amounts of information

are simultaneously stored and manipulated in the service of accomplishing a task (Caplan & Waters, 1999). In the last decade, working memory capacity has become the object of numerous investigations in the monolingual literature (Ardila, 2003; Daneman & Carpenter 1980; Gordon & Levine 2002; MacDonald, Just, & Carpenter 1992; Miyake, Just, & Carpenter 1994), which have established that memory span may influence parsing behavior (for a review, see Miyake & Friedman, 1998). For instance, evidence that working memory constrains syntactic ambiguity resolution comes from studies conducted by MacDonald, Just, and Carpenter (1992). They investigated the effect of reading span on main verb (e.g., *The experienced soldiers warned about the dangers before the midnight raid*) and reduced relative clause ambiguity (e.g., *The experienced soldiers warned about the dangers conducted the midnight raid*). In both cases, subjects are expected to interpret *warned* as a main verb, and not as a participle, because it is most often used with a main verb reading. Their findings revealed that only the high-span readers took longer to read the ambiguous verb in the main verb condition. As the authors suggested, high span readers entertain both the main interpretation and the less frequent relative clause interpretation, causing the increase in reading time. On the other hand, the readers with low working memory capacity only compute the more frequent structure, allowing them to process main verb condition more rapidly than the high span readers.

Given that results from the monolingual literature suggest that the parser adopts different parsing strategies depending on the working memory capacity of readers, a number of researchers in the L2 domain have asked whether differences in working memory capacity between monolingual and bilingual speakers may account for

differences in processing. As Omaki (2005) pointed out, assuming that L2 parsing places a higher burden on the processing mechanisms because the retrieval of lexical and grammatical information is more difficult, it is feasible that a variation in working memory capacity also affects the parsing strategies adopted by bilinguals when reading in both their languages. Only few studies have investigated whether working memory capacity is an influential factor during sentence processing. In line with the results obtained by MacDonald et al (1992) L2 learners may adopt similar parsing strategies like native speakers with smaller working memory capacity. Consequently, bilinguals reading in their L2 may adopt native like strategies only if they possess sufficient cognitive resources.

The evidence gathered to date suggests that differences in working memory capacity do not influence L2 processing abilities. For example, in a series of studies examining object/subject ambiguous constructions (e.g., *After the children cleaned the house looked very neat and tiny*), Juffs (2004, 2005, 2006) found no significant correlation between reading span (as measured by a version of the Daneman and Carpenter, 1980 reading span test) and L2 processing performance. These results indicate that working memory capacity does not influence L2 sentence processing; however, Juffs tested only a few types of ambiguous constructions and exclusively used the Daneman and Carpenter reading span test. In an attempt to further examine the possibility that working memory capacity is an influential participant variable in L2 sentence processing, Omaki (2005) using a different measure of reading span (e.g., the Waters & Caplan, 1996 reading span test), also concluded that differences in span size did not affect how

Japanese-English bilinguals processed ambiguous relative clause constructions (e.g., *The doctor said that the sister of the bishop who injured himself (herself) last summer was concerned about the infection*). Despite the lack of evidence that working memory affects L2 sentence comprehension, a recent magnetic resonance imaging (MRI) study (Hasegawa, Carpenter & Just, 2002) showed similar cortical activation during L1 and L2 processing, although the volume of activation was greater during L2 sentences processing. This suggests that the L2 participants require more cognitive effort to process sentences in the L2 and that differences do exist between the processing of a native and a second language.

2.2.2 Proficiency

One essential difference between monolingual and bilingual readers is that the latter have a fully developed language system before they started learning the second one (Su, 2001). The acquisition of a second language is consequently influenced by the primary language system of bilinguals at various levels (*i.e.*, *phonological, lexical semantic, syntactic*). Consequently, an important issue in bilingual sentence processing is to understand the influence that a first language has on L2 processing abilities, more specifically the role of the level of proficiency that they achieved and to what extent can bilingual resemble their monolingual counterpart in terms of the parsing routines they adopt when reading sentences.

Bilingual sentence processing studies have generally found that there is a variation in terms of processing routines along the continuum of proficiency. Research suggests that only the highly proficient L2 learners bear a resemblance to native speakers

when processing syntactic ambiguities. For instance, in an eye-tracking study French-Mestre (1997) investigated syntactic ambiguity resolution in low-proficiency learners of French which were native speakers of English or Spanish. The constructions under investigation contained a temporarily ambiguous relative clause, preceded by a complex noun phrase, as in *John knows the girls of the nanny who are leaving*. The ambiguity in this sentence arises because the relative clause *who are leaving* can potentially be attached to one of the two nouns in the complex noun phrase *the girls of the nanny* (hence the temporary ambiguity), although only one attachment site will produce the correct interpretation. If it is attached to the first noun (i.e., *NP1* attachment) in the complex noun phrase, the resulting (correct) interpretation is that *the girls are leaving*. Attachment to the second noun (*NP2* attachment) results in the interpretation that the *Nanny are leaving*. Empirical evidence from monolingual speakers indicates that in English relative clause ambiguity resolution is resolved in favor of *NP2* attachment (Carreiras & Clifton, 1999). On the other hand, in Spanish, French, and many other languages, the ambiguity is resolved in favor of *NP1* (evidence in Spanish comes from Carreiras, Salillas and Barber, 2004; Carreiras and Clifton, 1999; Cuetos and Mitchell, 1988; Cuetos, Mitchell, and Corley, 1996; Dussias, 2003; Gibson, Pearlmutter, and Torrens, 1999; Mitchell and Cuetos, 1991; Thornton, MacDonald, and Gil, 1999. Evidence for French is found in French French-Mestre and Pynte, 2000a and b; Zagar, Pynte, and Rativeau, 1997).

French-Mestre (1997) showed that when attachment preferences were congruent between the learner's two languages (i.e., L1 Spanish-L2 French), learners showed a preference for *NP1* attachment. However, when attachment preferences were incongruent

(i.e., L1 English-L2 French), the L2 learners showed a trend towards attachment of the ambiguous relative clause to NP2. Frenck-Mestre interpreted this trend as evidence that the learners' native language influenced the parsing of sentences in a second language, and attributed the transfer of parsing strategies to the limited L2 proficiency of the participants. The importance of proficiency level was underscored in a more recent study by Frenck-Mestre (2002), in which it was reported that English speakers proficient in their L2 French resolved the same type of relative clause attachment ambiguity in favor of NP1, the pattern generally associated with French monolinguals.

Other bilingual processing studies investigating different types of constructions and focusing on theta-role assignment under the *Competition Model* (e.g., Bates & MacWhinney, 1982) also generally find that L2 learners use parsing strategies that are more consonant with the structure of the L2 as they become more proficient. In such a study Su (2001) examined the theta-role assignment of English and Chinese learners at three different stages of L2 acquisition (e.g., beginning, intermediate and advanced). The findings showed that L2 learners use parsing strategies that are more consonant with the structure of the L2 as they become more proficient in the L2. Additional evidence that proficiency level is an influential variable comes from a more recent study. Hopp (2006) investigated subject/object ambiguity resolution in German with two participants who had various levels of mastery of their L2. The results showed that near-native speakers of L2 German reliably used syntactic features in phrase-structure reanalysis, and showed evidence of incremental reanalysis patterns typically found in native German speakers. However, advanced L2 learners did not show differences in response latencies associated

with native syntactic reanalysis. The results suggest that proficiency level modulate readers' ability to access and use syntactic information in a second language.

However, it is important to note that level of proficiency is not a key element affecting processing at all linguistic levels. A series of ERP studies (Ojima, Nakata and Kakigi, 2005; Hahne & Friederici, 2001; Weber-Fox & Neville, 1996) has been conducted at the semantic level and the evidence gathered suggest that natives and non-natives readers with various proficiency levels use comparable brain response patterns when processing semantic violation. The results showed that the processing of anomalous semantic information produced a comparable effect for the native speakers as well as the highly proficient learners and the less proficient ones.

Overall, the empirical findings at the semantic level indicate that proficiency attainment is not a key factor which differentiates native and non-native readers. However, during syntactic ambiguity resolution this participant variable appear to have a significant importance as the results of several studies indicate that competency in the second language impacts the parsing routines that speakers use when processing sentences in their second languages.

2.2.3 Immersion experience

Studies in the monolingual literature have suggested that parsing preferences may be experience-based, and that initial parsing choices are made on the basis of the experience that the individual readers or listeners have with the language spoken in their surroundings (Cuetos & Mitchell, 1988; Mitchell & Cuetos, 1991; Cuetos, Mitchell, & Corley, 1996). *Linguistic Tuning* states that in the course of comprehension, the parser's

initial analysis of an ambiguous structure is influenced by a speaker's previous encounters with similar types of ambiguities. That is, the parser keeps track of the way in which ambiguous structures are resolved and uses this information to resolve future encounters with ambiguous structures of the same type. The tuning account predicts that in cases of ambiguity, there should be a close correspondence between corpus data and behavioral data. To test this prediction, Mitchell, Cuetos and Corley (1992, cited in Cuetos, Mitchell and Corley, 1996) conducted a corpus analysis of relative clause ambiguity resolution in English to determine attachment preferences in discourse, and found that in English, most tokens of the ambiguity are resolved in favor of low attachment. Contrary to this, and in support of the tuning hypothesis, in Spanish the ambiguity is resolved in favor of high attachment.

A few studies have examined whether immersion experience modulates L2 sentence comprehension, and whether, learners immersed in their L2 are able to adjust their parsing strategies based on the linguistic information that the L2 environment provides them. Studies investigating this participant variable have exclusively focused on the attachment preferences of relative clauses.

One study that investigated relative clause attachment in L2 learners of English and Spanish living in an Anglophone environment is Fernández (2003). Using an offline measure, she investigated relative clause attachment preferences for clauses of various lengths. The two groups read short relative clauses (e.g., *The nephew of the teacher that was divorced*) and longer ones (e.g., *The nephew of the teacher that was in the communist party*). Previous research suggested that length variation of this type

affects attachment preferences (Fodor, 1998; Pynte & Colonna, 2000). Fodor (1998) argued that to equalize prosodic weight size of constituents, the parser tends to attach long relative clauses to the NP1 and conversely, favors NP2 attachment for shorter versions. The bilingual data revealed that Spanish-English speakers were sensitive to the length of the relative clause when reading in English. However, these same learners did not exhibit length effects with Spanish materials, despite the fact that Spanish was their native language. To explain the Spanish results, Fernández postulated that sensitivity to length only emerges in the language that the participants use more frequently. The fact that the Spanish-English bilinguals had been immersed in an English environment for an extensive period of time and were consequently reading in their L2 more frequently than in their native language may have influenced the insensitivity to relative clause length in their native language.

Building on the assumption that amount of exposure may be responsible for parsing preferences, Dussias (2003) reported similar findings. In this study, Spanish and English monolinguals as well as Spanish-English speakers read constructions similar to example (1) below, which contained a complex noun phrase followed by a relative clause.

- (1) *El perro mordió al cunado de la maestra que vivió en Chile con su esposo*
“The dog bit the brother-in-law of the teacher _(fem) who lived in Chile with her husband.

Congruent with the previous literature, the data showed that the control groups (i.e., Spanish and English monolinguals) attached the relative clause to NP1 and NP2,

respectively. However, the data for the Spanish-English bilinguals exhibited a preference for attachment to NP2 in both Spanish and English sentences. To explain this pattern, Dussias postulated that the amount of L2 exposure experienced could have played a role. The bilingual participants had been living in the L2 environment for approximately 8 years, during which time they had extensive exposure to English, which favors NP2 attachment of ambiguous relative clauses. Consequently, the regular contact with English may have made NP2 attachment more available.

In an attempt to specifically identify the role of exposure to a second language and how immersion in a second language environment may modulate the processing of ambiguous relative clauses, Dussias and Sagarra (2007) conducted an experiment testing bilingual participants who had either limited or extensive immersion experiences. The participants read temporarily ambiguous constructions similar to (1) in their native Spanish. The results indicated that Spanish monolingual speakers, as well as Spanish-English bilinguals who had been immersed in their L2 for a limited time processed the material using the same strategies employed by the monolingual Spanish group. On the other hand, the Spanish-English bilinguals with extensive L2 immersion experience exhibited attachment preferences towards NP2, which is the preferred strategy exhibited by monolingual English speakers. Dussias & Sagarra's findings were strengthened after the L2 proficiency of the bilinguals with limited and extensive exposure was matched, underlining that the parsing differences observed were not due to heterogeneous mastery of the target language, but was instead linked to immersion experience. The studies reviewed unanimously indicate that the amount of immersion in a second language may

be responsible for changes in the processing patterns of L2 learners. More specifically, findings suggest that extensive L2 exposure not only impacts processing strategies during L2 reading but can also alter processing patterns in the bilingual's first language (see Linck, Kroll & Sunderman, under review, who provide evidence suggesting that immersion in an L2 environment affects the native language during lexical processing)

To summarize, past studies examining the processing of structurally ambiguous modifiers, such as adjunct phrases consisting of a complex noun phrase followed by a relative clause, show that bilingual speakers sometimes resolve this ambiguity when reading in their first language using parsing strategies from their second language. Years of immersion experience in the L2 have been found to account for this result. One unanswered question is whether this finding extends to other syntactic relationships such as those between verbs and their core arguments (e.g., direct objects). One may speculate, for example, that information directing parsing decisions for verbal arguments may not be as vulnerable to intrusion from the L2 environment as the factors that affect the parsing of adjuncts.

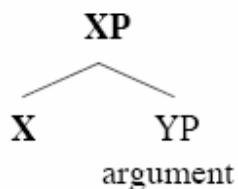
2.3 Linguistic and processing differences between arguments and adjuncts

There are a number of reasons to believe that arguments might be less vulnerable than adjuncts to intrusion of linguistic information available in the L2 environment. First, arguments are constituents that bear a close grammatical and/or semantic relation to verbs. They are idiosyncratically selected by verbs and as such, form part of the verb's lexical entry. Adjuncts, on the other hand, are constituents that add extra information

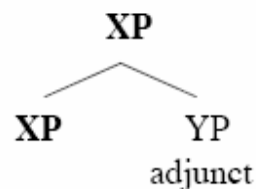
about certain elements in a sentence; they do not bear any close syntactic relation to such elements. There are also structural distinctions between arguments and adjuncts. In the Chomskyan syntactic framework, arguments are sisters to the head X that subcategorizes for them (i.e., they are on the same phrasal level as the verb in a phrase structure configuration). Adjuncts, on the other hand, are attached as sisters¹ to XP- the intermediate phrasal category that the head projects (a phrase structure level dominating the VP that is at a higher level in the phrase structure configuration of the sentence).

This configurational difference between arguments and adjuncts is illustrated below in (2) and (3).

(2) structure for arguments



(3) structure for adjuncts



Also, arguments of the verb are often obligatory. For example, in *Paul put the car in the garage*, the arguments of the verb *put* are obligatory; if they are omitted, the sentence becomes ungrammatical. Unlike arguments, however, the presence of adjuncts

¹ In syntax the term 'sister' is used in the constituent structure to refer to a node B is the sister of a node C if B and C are immediately below the same node A (equivalently: if they are immediately dominated by node A; also equivalently: if they are both daughters of the same node A).

is always optional. Thus, for example, in *Someone shot the servant of the actress who was on the balcony*, the relative clause *who was on the balcony* can be omitted without rendering the sentence ungrammatical.

The configurational difference explained above is also useful to account for the variation of these two types of constituents when undergoing movement. In the formation of *wh* –questions, object arguments must leave a *wh*-trace which has to be governed by the verb assigning the internal theta role to this trace as in (4):

- (4) a. *Who_i does Marc like t_i?*
 b. *Who_i did Ann think that Marc liked t_i?*
 c. *Who_i did Julie believe that Ann thought that Marc liked t_i?*

Wh-movement of arguments can move unboundedly far from the clause where they initially appeared at D-structure, as exemplified in (4). This feature of *wh*-movement is, however, not possible with adjunct clauses, which are sometimes referred to as islands. Ross (1967) postulated that an island is a constituent dominated by some nodes that bar extraction. The apparent unboundedness of *wh*-movement does not apply to adjuncts, given that they must obey subjacency as in (5).

- (5) a. *They met someone who knows Julia Roberts.*
 b. * *[Which celebrity]_i did they meet someone who knows t_i?*

The *wh*-movement of adjuncts is only grammatical within the confines of an island, but not beyond its boundaries. Overall, in linguistic theories, a variety of evidence has showed that argument and adjunct constructions present dissimilar characteristics and consequently behave differently.

The linguistic distinction between arguments and adjuncts has been captured in the processing literature as well. For example, the central argument of the *Construal Hypothesis* (Frazier and Clifton, 1996) is that the parser distinguishes between two kinds of phrases or structural relations: primary and nonprimary. Primary relations exist between verbs and their core arguments. Nonprimary relations are not defined in terms of the syntactic properties of verbs, but rather involve relative clauses and adjunct predicates. In terms of parsing processes, the crucial difference between primary and nonprimary phrases is that primary phrases are initially analyzed in accordance with universal parsing principles, such as *Minimal Attachment* and *Late Closure*, whereas nonprimary phrases are parsed according to a number of factors, such as the thematic processing domain, interpretative principles (e.g., the Referentiality Principle and Gricean maxims), and language-specific rules.

To summarize, a number of distinguishing characteristics exist between arguments and adjuncts both in the linguistic, as well as in the psycholinguistic literature. Given this, it is important to study whether the linguistic information that becomes readily available when speakers are immersed in the second language environment can affect the processing of verbs and their arguments in the bilingual's first language. Investigating this question is one of the aims of the present dissertation.

2.4 Linguistic variables

A number of linguistic variables have been identified that influence the parsing decisions that bilinguals make when processing sentences in both their languages. Thematic information, plausibility information, verbal information and structure-based

parsing principles have been found to affect how bilinguals construct a syntactic analysis of an input string (Clahsen & Felser, 2006; Cramer & Dussias, 2006; Dussias & Cramer Scaltz (submitted); Felser, Roberts, Gross & Marinis, 2003; Felser & Roberts, 2004; Fernández, 2003; Frenck-Mestre, 1997; Frenck-Mestre & Pynte, 1997; Gass, 1987; Harrington, 1987; Juffs & Harrington, 1996; Juffs, 1998a, 1998b; Sasaki, 1991; Su, 2001; Papadopoulou & Clahser, 2003; Williams, Möbius & Kim, 2001; Williams, 2006; for a review, see Dussias & Piñar, in preparation). Among these, the role of verbal information and that of structure-driven parsing principles have received much attention in the L2 sentence processing literature, given the central role that these variables have played in monolingual sentence parsing studies. I will discuss these two variables in turn.

2.4.1 The role of verbal information

One type of information that is believed to be listed as part of the lexical entry of a verb is its subcategorization information. Verb subcategorization refers to the number and type of syntactic arguments with which a verb co-occurs (Frenck-Mestre & Pynte, 1997; Cramer & Dussias, 2006; Juffs, 1998b; Juffs, 2004; Juffs & Harrington, 1996). For example, the verb *kiss* is simple transitive verb because it subcategorizes for a subject noun phrase and single object noun phrase, as illustrated in the sentence *I kiss my pet*. *Give*, on the other hand, is said to be ditransitive because, in addition to requiring a subject noun phrase, it also requires a direct object and an indirect object noun phrase (e.g., *I gave the apple to Mary*). Another type of information that is assumed to be encoded in the lexical entries of verbs is subcategorization bias, which refers to the probabilistic relation between verbs and their arguments. For example, the verb *believe*

can be followed either by a direct object noun phrase (e.g., *I believe your story*) or by a subordinate clause (e.g., *I believe your story is not true*). Because *believe* is most often used with a subordinate clause (cf. Garnsey, Pearlmutter, Myers & Lotocky, 1997), it is normally referred to as a subordinate-clause or sentential-complement bias verb.

Given that verb subcategorization and verb bias information vary cross-linguistically (cf. Frenck-Mestre & Pynte, 1997; Cramer & Dussias, 2006), one important question is whether bilinguals are able to access verbal information specific to the second language and use it while parsing structures in their L2. In an eye-tracking study investigating the processing of a class of verbs that is optionally transitive in English and obligatorily intransitive in French, Frenck-Mestre and Pynte (1997, Experiment 2) found evidence that English-dominant and French-dominant bilinguals relied on subcategorization information when processing temporary object/subject constructions that were syntactically ambiguous only in one of their two languages. An example is provided below:

- (6) *a. Whenever Sarah walked her pretty poodle followed happily behind.*
 b. Où que Sarah marchât son joli caniche suivait derrière gaiement.

The ambiguity in example (6a) arises because in English, the noun phrase *her pretty poodle* may be interpreted as either the direct object of *walked* or as the subject of the following clause. This ambiguity is absent in the French translation equivalent (6b) because *marchât* is intransitive. In other words, a noun phrase following *marchât* cannot be interpreted as its direct object. If participants reading English sentences similar to (6a) initially interpret the syntactically ambiguous noun phrase *her pretty poodle* as the direct

object of *walk*, they are expected to display processing difficulties when encountering the verb *followed* (the so-called *disambiguating region*), because it is at this point that they realize that the initial direct object analysis needs to be abandoned, and the subject analysis must be constructed instead. Hence, participants are expected to slow down to revise their initial analysis. No such processing delay is expected at the disambiguating region when the verb in the first clause is intransitive (e.g., *Whenever Sarah went her pretty poodle followed happily behind*).

The findings showed that when reading in English, English-dominant and French-dominant bilinguals displayed processing difficulties at disambiguating region in condition (6a) relative to the intransitive control condition. In addition, the results also indicated that at the beginning of the ambiguous noun phrase region, both groups of bilinguals showed a trend toward longer reading times on the noun phrase following intransitive verbs than on that following optionally transitive verbs.² Taken together, the results indicated that native and non-native readers of English interpreted the post-verbal noun phrase as a direct object, but committed to such an analysis only when the verb was optionally transitive.

How can monolingual models of sentence parsing explain these results? Two stage models, such as the *Garden Path Model* (Frazier, 1979) provide an account for the findings reported in Frenck-Mestre and Pynte (1997). The Garden Path model is typically referred to as a two-stage model because the first stage of processing involves parsing that is guided only by syntactic category information (i.e., information about whether a

² This result only approached statistical significance, probably owing to the small number of subjects in each group.

word is a noun, a verb, a determiner, etc.) and by two structure-driven parsing principles. The processor does not use semantics, real world knowledge, verb subcategorization or any other lexical or contextual information until later, during the second stage, when the initial analysis is evaluated and is subsequently confirmed or disconfirmed by newly available information.

One structure-building principle that forms the core of the Garden Path model is *Minimal Attachment*. Minimal Attachment ensures that when faced with syntactic ambiguity, the parser initially selects the simplest--and therefore the quickest--structure to build (the other principle, dubbed *Late Closure*, will be discussed later, in the section on the role of structure-driven parsing principles). To illustrate how Minimal Attachment works, consider example (7) from Bever (1970):

(7) *The horse raced past the barn fell.*

Fragments like *The horse raced* are structurally ambiguous because the same morphological marker “-ed” is used for most English verbs for the past tense form and the past participle form. Hence, a fragment beginning with a noun followed by a verb + “ed” is often ambiguous between the beginning of a main clause (e.g., the horse raced by the barn and fell) and the start of a relative clause (e.g., the horse that was raced past the barn fell). A number of experiments show that when readers encounter *the horse raced*, they interpret *the horse* as the subject of the sentence and *raced* as the main verb (cf. Frazier, 1979, 1987; Frazier & Rayner, 1982; Juffs, 1998a; MacDonald, Pearlmutter & Seidenberg, 1994). Upon reaching *fell*, readers experience difficulty because they are unable to integrate the verb into the syntactic frame currently being built. *Minimal*

Attachment predicts this difficulty because parsing *the horse raced* as the subject noun phrase followed by a main clause verb, is structurally simpler (it involves the postulation of fewer syntactic nodes) than parsing it as a reduced relative clause. In other words, postulating the correct reduced relative clause structure would involve positing potentially unnecessary nodes.

Returning now to the findings reported in Frenck-Mester and Pynte (1997), following the application of Minimal Attachment, the English-dominant speakers and the French-dominant speakers alike initially analyze the post-verbal noun phrase as a direct object, and momentarily ignore the subcategorization frame of the verbs involved (i.e., optionally transitive in (6a) and intransitive in the control condition). As the post-verbal noun phrase is integrated into the syntactic tree, subcategorization information becomes available (the second stage of processing), and the direct object analysis is deemed untenable for intransitive verbs. This initiates a revision process and a concomitant increase in processing time at the noun phrase immediately following the verb for intransitive verbs only. For optionally transitive verbs, this revision process is not initiated, because optionally transitive verbs like *walk* allow a direct object to follow them. However, because the direct object analysis eventually leads to an incorrect syntactic structure, participants are forced to reanalyze when additional evidence becomes available (i.e., when they encounter *followed* in the second clause).

Many additional studies have shown that L2 speakers make use of L2 specific subcategorization information to parse structures in the second language. For example, in a self-paced reading experiment, Juffs (1998b) examined how L2 learners of English

from various L1 backgrounds processed sentences in which the verb in the first clause could unambiguously be categorized as a participle (e.g., *The bad boys seen during the morning were playing in the park*) or was ambiguous between a past tense form and a participle form (*The bad boys criticized during the morning were playing in the park*). Juffs found that both native English speakers and L2 learners of English from typologically different language backgrounds (Chinese, Japanese, and Korean speakers) showed evidence of being garden-pathed if the initial participle looked like a transitive main verb. Just as in the Frenck-Mestre and Pynte (1997) study, these findings suggest that L2 learners are sensitive to argument structure information during parsing in a way that is comparable to monolingual speakers. Further evidence for this is found in Juffs & Harrington (1996), Juffs (1998a) and Hoover and Dviwedi (1998).

A recent question that has emerged from the L2 processing literature is whether subcategorization bias information is also used during the process of sentence comprehension. A number of experiments in the monolingual literature have indicated that native readers keep track of the relative frequencies of different subcategorization alternatives for verbs and use this information to resolve syntactic ambiguity during reading (e.g., Garnsey et al. 1997; Wilson & Garnsey, 2001). This fact allows L2 researchers to ask whether non-native readers rely on similar types of information when processing sentences in their second language.

In a recent self-paced reading study, Dussias and Cramer Scaltz (submitted) examined whether Spanish-English L2 learners utilize verb bias information during the comprehension of syntactically ambiguous sentences. The temporary ambiguity of the

material emerged because an NP immediately following a verb could be interpreted as either the direct object of the verb as in *The CIA director confirmed the rumor when he testified before Congress*, or as the subject of an embedded complement in *The CIA director confirmed the rumor could mean a security leak*. In a first experiment with English monolingual participants, Dussias & Cramer Scaltz demonstrated that native speakers were guided by subcategorization bias during sentence comprehension, and replicated the findings reported in earlier monolingual literature (e.g., Wilson & Garnsey, 2001). In a second experiment with Spanish-English bilinguals, data indicated that L2 learners are also able to keep track of the relative frequencies of verb-subcategorization alternatives and use this information when building structures in their second language.

To summarize the findings reviewed above, evidence suggests that bilingual speakers resemble their monolingual counterparts in that they are able to access and use lexical information carried by the verb when reading sentences in a second language.

2.4.2 Structure-driven parsing principles

There is an ongoing debate in the field of sentence processing as to the involvement of structure-driven principles during the initial phase of parsing. As indicated earlier, structure-based principles, which have been proposed within the framework of the *Garden Path Model* (Frazier, 1979, 1987), are postulated to explain the parser's preference for initially computing certain syntactic analyses over others. A classic example of this is illustrated in (8) below:

- (8) *Molly said that she will go to Miami yesterday.*

In this example, the ambiguity is produced by the adverb *yesterday* which can be linked either to the higher clause *Molly said*, and imply that it was yesterday that Molly expressed her desire to go to Miami, or to the lower clause *she will go to Miami*. In the latter case, which is frequently attempted by readers, as it is the simplest and consequently quickest structure to build, this interpretation results in the incorrect semantic implication that Molly will go to Miami yesterday, which is absurd and therefore forces readers to reanalyze such a sentence.

One of the principles that have been proposed to explain the parser's initial attachment preferences (i.e., *Minimal Attachment*) was presented earlier in the discussion of the role of verbal information during L2 sentence comprehension. Another principle is *Late Closure*, which allows for incoming material to be structured more rapidly, by immediately incorporating it to already processed material. In example (8), *Late Closure* requires that readers attach incoming material to the phrase currently being processed—hence, attachment of *yesterday* to *she will go*, with a consequent garden path effect that arises due to the mismatch between the temporal information in the adverb and the tense of the verb phrase to which it initially attaches.

Recent evidence indicates that when L2 learners parse ambiguous relative clause constructions for which no lexical-semantic information is available to guide the parsing process, some learners do not show any preference for one attachment site over the other (Papadopoulou & Clahsen, 2003; Felser, Roberts, Gross, & Marinis, 2003). Based on this and other evidence for the lack of intermediate gap effects during second language reading, Clahsen and Felser (2006) have recently argued that the structure-building

processes during online L2 sentence comprehension are fundamentally different from the representations built by native speakers of the target language. In light of such findings, Clahsen and Felser posited *the Shallow Structure Hypothesis*, which postulates that the syntactic representations constructed by second language learners during the processing of L2 input are 'shallower' and less detailed in comparison to those built by native speakers. They argue that contrary to native speakers who use structure-driven strategies and syntactic information, even advanced L2 learners favors lexical-semantic and pragmatic information, as well as world knowledge during the processing of sentences.

As previously mentioned, one of the arguments that Clahsen and Felser (2006) use as evidence supporting the shallow processing by L2 speakers is their claim that proficient L2 learners do not show a particular preference for high or low attachment when processing constructions in their L2 that contain temporarily ambiguous relative clauses (but see Frenck-Mestre, 1997, 2002; Dussias, 2003; Dussias & Sagarra, 2007; Miyao & Omaki, 2006 for counter-evidence). The data on which this hypothesis is based comes from two studies that contrast the behavior of L1 and L2 speakers while processing syntactically ambiguous relative clauses (*The dean liked the secretary of the professor who was reading a letter*). In a self-paced reading task Papadopoulou and Clahsen (2003) investigated how native speakers of Spanish, German and Russian which are languages that have been identified to favor high attachment relative clauses processed such constructions in their second language Greek, which is also a high attaching language. The L2 speakers did not exhibit any attachment preferences when parsing the relative clauses under investigation. However, when L2 readers processed

ambiguous relative clauses containing the theta assigning preposition “with” (*i.e.*, A man called the student with the teacher who was disappointed by the new educational system), they appear to use this lexical cue to guide their attachment decisions. According to Clahsen and Felser (2003) such results illustrate that L2 speakers do not primarily rely on structure-based information, but rather mainly use lexical cues to guide their parsing (for similar findings, see Felser, Roberts, Gross & Marinis, 2003). Interestingly, in their study, subjects did not simply follow the attachment preference in their L1, since there was no preference for either high or low attachment. Thus, Clahsen and Felser argued that the subjects’ behavior could not be explained by language transfer from the L1.

Frenck-Mestre (2005) argues that the absence of an attachment preference observed in studies like that conducted by Papadopoulou and Clahsen (2003) may be due to group averaging, rather than an inability to utilize structure-based parsing principles. They postulate that some learners may have displayed non-local attachment preferences while others attached locally, which consequently affected the results (which did not show any preferences). Omaki (2005), similarly found no attachment preferences when Japanese learners of English read ambiguous relative clause constructions, conducted individual analyses to verify that the effects obtained for the L2 English learners were not due to a similar misinterpretation of the results. This individual examination of the learners revealed that some participants showed target-like relative-clause attachment preferences while others transferred their Japanese preferences. Because Papadopoulou and Clahsen (2003) did not conduct comparable analyses, it is not feasible to eliminate the possibility that their results are due to group averaging effects.

Moreover, additional evidence suggests that the difficulties L2 speakers experience while parsing temporarily ambiguous structures could be explained by universal principles of parsing. Earlier, an account of how *Minimal Attachment* could explain the findings reported in Frenck-Mestre and Pynte (1997, Experiment 2) was given. In this same study, Frenck-Mestre and Pynte (Experiment 1) showed that under some circumstances, the L2 parser initially favors *Late Closure*, another structure-based parsing principle (Frazier, 1979, 1987). In Experiment 1, using an eye-tracking device, the authors investigated the way in which advanced English-speaking learners of French and native French speakers resolved attachment ambiguities involving prepositional phrases. The results showed L2 speakers encounter more difficulty than native speakers when processing verb phrase attachment of prepositional phrases in constructions comparable to (9):

(9) *He rejected the manuscript on purpose because he hated its author.*

(10) *He rejected the manuscript on horses because he hated its author*

On the other hand, when parsing sentences like (10) which required the prepositional phrase to be attached to the noun phrase immediately preceding it, the same L2 speakers did not experience any difficulty. The reading patterns obtained suggest that bilingual speakers appear to initially favor attaching the ambiguous prepositional phrases low when processing such constructions, which illustrates the application of late closure, a structurally-based parsing principle.

Given the contradictory findings in the studies reported above, it is evident that additional research is required in order to further assess whether proficient L2 learners

consistently behave differently from native speakers and primarily rely on lexical-semantic information to parse sentences. In addition, because the argument in favor of the shallow structure hypothesis is based on the examination of a limited number of structures, it remains unclear whether it is a general property of the way in which L2 speakers parse L2 input or whether it is specific to the cases examined in the literature. Investigating whether L2 speakers use structure-based parsing principles during L2 sentence comprehension is the second goal of the experiments reported in this dissertation.

2.5 Research questions and predictions

One of the objectives of the proposed experiments in this dissertation is to investigate whether proficient L2 speakers employ structure-based parsing principles when processing ambiguous structures in the first and second language. The second objective is to determine whether a speaker's immersion experience in the second language affects the processing of argument phrases in their first language. Specifically, the experiments reported in this dissertation are designed to answer two research questions.

(1) Do bilinguals parse object/ subject ambiguities following the same structure-based parsing principles that have been argued to be operative during monolingual sentence parsing?

(2) What is the role of immersion experience in the processing of arguments when bilinguals read in their first and second language? Does the number of years of *immersion* in the L2 have an impact on how bilinguals parse argument phrases in their L1?

The structure that will be examined to answer these questions concerns the so-called object/subject ambiguities, illustrated in example (11):

(11) *When the naïve explorer lands the damaged helicopter stops in a chaotic manner.*

This structure has been chosen for two reasons. First, because the syntactic ambiguity involves the interpretation of a post-verbal noun phrase as a direct object (an argument) or as the subject of a following clause (another argument), it allows for the examination of the role of immersion experience in the processing of verbal arguments. Second, given that the ambiguity can be temporarily resolved by selecting a simpler syntactic structure (i.e., the direct object structure) or more complex structure (i.e., the embedded clause structure), it is possible to examine the extent to which structure-based principles such as Minimal Attachment guide parsing decisions in bilingual speakers.

2.5.1 Monolingual English group

In line with previous findings (Frazier 1979; Frazier & Rayner, 1982), if monolingual English speakers obey Minimal Attachment, they are expected to experience difficulty reading the disambiguating region, underlined in (11) above. That is, minimal attachment should direct the parser to interpret the ambiguous noun phrase *the damaged helicopter* as the direct object of *lands*. This analysis, which should be favored over the embedded subject analysis on the grounds that it requires the postulation of fewer

syntactic nodes, will be abandoned only if readers encounter information indicating that it is incorrect. Because *lands* can function as a transitive verb in English, readers will maintain the direct-object analysis until they reach the second verb *stops*. Inability to integrate *the damaged helicopter* into the current syntactic frame will trigger reanalysis of *lands* as an intransitive verb and of the ambiguous noun phrase as the subject of the second clause, resulting in an increase in reading times.

Minimal attachment also predicts that participants will experience processing difficulties in the control condition (e.g., *When the naïve explorer panics the damaged helicopter stops in a chaotic manner.*), albeit in a different region in the sentence. As in the previous case, the parser should initially interpret the ambiguous noun phrase as the direct object of the verb *panics*, thereby ignoring momentarily its intransitive property. However, as processing unfolds and information about the transitivity of *panics* becomes available, reanalysis of the noun phrase as the subject of the second clause is expected. Given that transitivity information becomes available very quickly during sentence processing, participants are expected to show increased reading times at some point during the processing of the ambiguous noun phrase (Frenck-Mestre & Pynte, 1997). Therefore, for the intransitive condition, there is a predicted increase in reading times not on the disambiguating region, but on the ambiguous noun phrase.

2.5.2 Monolingual French group

The group of monolingual French speakers is not expected to show any differences in reading times for either sentence type in French, as both contain verbs used intransitively in the adjunct clause. Hence, due to the nature of the materials, the

application of Minimal Attachment is not expected to produce longer reading times in one construction type versus the other.

2.5.3 English-French bilinguals

Moving to the prediction for the English-French bilinguals, given that these speakers are immersed in both English and French, a general prediction is that they should parse English sentences as English monolinguals do, and French sentences as French monolinguals do. Specifically, for the English constructions, if these speakers use Minimal Attachment, they should initially interpret the ambiguous noun phrase as the object of the preceding verb, just like the monolingual English speakers. Upon reaching the main verb, the inability to integrate it into the syntactic frame should initiate a revision process, which should lead to longer reading times at the disambiguating region. However, if instead these bilingual speakers prioritize lexical-semantic information and verb argument structure information during L2 sentences processing, as suggested in Clahsen and Felser (2006), the bilinguals should not experience a “garden-path” because the adverbial adjunct clause contains a verb that is most likely intransitive. Regardless of whether the Minimal Attachment account or the lexical-semantic account is correct, the French constructions should not present differences in reading times, given that the verb in the adjunct clauses for the two types of sentences is used intransitively.

2.5.4 French-English bilinguals

The final set of predictions concerns the French-English bilinguals. As discussed earlier, current literature in L2 syntactic ambiguity resolution suggests that immersion in

a linguistic environment affects parsing preferences (Dussias, 2003; Dussias & Sagarra, 2007). Thus, Dussias and Sagarra (2007) showed that when bilingual speakers were immersed in the L2 environment, processing of the L1 was influenced by information from the L2. This is most likely because L2 information is readily available to the speaker by virtue of the participants being immersed in an L2 context. Conversely, when bilinguals were immersed in the L1 environment, processing of the L1 remained unaffected by knowledge of the L2. In the context of the present experiment, one might predict that when reading English, the French-English bilinguals should exhibit the same type of processing difficulties as the monolingual English speakers. A finding such as this would also indicate that the bilinguals are initially using principle-based processing strategies to parse the L2. On the other hand, if verb subcategorization information plays an initial role, we would expect the processing patterns of English monolinguals and the French-English bilinguals to be different (as outlined above). Finally, if immersion in the second language environment influences the processing of arguments in the L1, parsing in the L1 French is expected to be different from that of monolingual French speakers.

Chapter 3: EXPERIMENTAL DESIGN

3.1 Overview of Experimental Approach

In this chapter, I provide a description of the method and design used in the self-paced reading experiment on which this dissertation is based, the working memory, as well as the English and French proficiency tests given to the participants. The goal of the research to be reported is to examine how L2 learners comprehend and process sentences in cases where the lexical constraints of verbs are at odds with each other in the first and second language. More specifically, I attempt to examine how the ambiguity resolution strategies employed by bilinguals to process argument structures are influenced by exposure to a second language. It is crucial to comprehend the role of variables such as the amount of exposure to the L2, global linguistic competence, and the cognitive abilities of bilinguals in order to determine which individual characteristics have the greatest influence on parsing. A detailed description of all the tasks assigned as well as of the participants is essential not only to better understand how individual variables may modulate sentence processing, but also to allow for comparison across sentence processing studies with participants having comparable linguistic backgrounds (e.g., amount of exposure to an L2, level of proficiency, age of L2 acquisition) (Grosjean, 1998, 2004).

To this end, all the participants performed an on-line self-paced reading experiment and were also administered a battery of individual tests measuring L1 and L2 proficiency level and working memory capacity in their first language. Performance on the experimental tasks was then subjected to repeated measures (ANOVA) to analyze the results of the main experiment. In addition, various *t*-tests were performed to determine whether the two groups of bilinguals were comparable in terms of individual characteristics and whether processing is modulated by individual differences.

3.1.1 General Method

This section will describe the various groups of participants in the study, the materials, and the general procedures for conducting the experiments. In order to obtain preliminary information to screen participants and ensure they fit the age and linguistic requirements, a self-assessment language history questionnaire (see Appendix A) was sent electronically to potential participants. The two groups of bilinguals had to be fluent in both languages, whereas the two monolingual groups were unable to function in any foreign language. In addition, to be considered for the study the participants had to be under the age of 35. This limit was established to reduce additional variation in terms of individual characteristics.

3.1.1.1 Participants

The participants were recruited in various ways: via informational emails sent to a group listserv, as well as with the help of flyers, and through word of mouth. Participants were tested individually in different labs at Penn State, Temple University, Concordia University (SAGE laboratory), l'Université de Montréal, and at l'Université de Québec in

Trois Rivières. The interactions between the experimenter and the participants always took place in the participants' first language.

For the purposes of this dissertation, four groups of participants were recruited; two groups of bilingual³ participants: (1) 40 English-French bilinguals who had been living in a francophone environment for an extended period of time and (2) 39 French-English bilinguals who had been living in an anglophone environment for periods of time ranging from 1 year to 20 years. There were also two groups of monolingual subjects: (1) 40 English monolinguals and (2) 29 functionally monolingual French speakers. All the participants were enrolled in an American or Canadian university, and the mean age range was from 21-26. A language history questionnaire was used to assess the linguistic abilities of all the participants in the first and second language. This questionnaire was designed not only to assess their functional proficiency in both languages, but also to compile more detailed information regarding the participants' experiences with languages. The questionnaire allowed us to determine many characteristics of the participants, such as language dominance, level of proficiency, the number of years the L2 was studied, and the number of years the bilinguals had spent in immersion, as well as the context of L2 use. Part of this assessment was based on self-ratings of L1 and L2 proficiency in reading, writing, listening and speaking. The self-rated measurement was based on a 10-point scale with 1 being the lowest score and 10 the highest. Biographical data gathered for the four groups of participants is summarized in Table 3-1.

³ Note that in the present research, the term 'bilingual' is used to refer to individuals who actively use two languages.

Table 3-1: Summary of the four groups of participants' biographical-data

Participants' Biographical data		Age	AOA	Average # years in immersed in the L2 speaking environment
29 French monolinguals	Mean	22.55	Birth	From birth
	SD	3.23	N/A	N/A
	Range	19-32	N/A	N/A
40 English Monolinguals	Mean	21.95	birth	From birth
	SD	3.93	N/A	N/A
	Range	18-35	N/A	N/A
39 FR-ENG Bilinguals	Mean	26.12	10.41	4.8
	SD	4.21	4.1	4.2
	Range	19-35	0-18	1-20
40 ENG-FR Bilinguals	Mean	23.95	4.73	13.11
	SD	3.82	3.63	8.1
	Range	19-35	Birth-13	2-26

The questionnaire indicates that the group of English-French bilinguals, recruited in Montreal, Canada, had lived for over 13 years in the L2 environment. Most had started learning their second language between the ages of 5 and 6. At the time of data collection, they were all enrolled in anglophone university, and had completed an average of 8 years of formal instruction in French. The questionnaire also reveals that English was chosen by these participants as the language most frequently used in daily interactions. However, most of these speakers also reported having easy access to French-language press and media, and frequently engaged in formal and informal interaction in their L2 with friends and colleagues. As Table 3-2 shows, these bilinguals consistently rated their L1 proficiency in reading, writing, speaking and listening, higher in English than in French. *t*-tests revealed that the difference in ratings is statistically significant.

Table 3-2: *English-French bilinguals' proficiency self-ratings in L1 and L2*

English-French Bilinguals	Means for English (L1)	Standard Deviation	Means for French (L2)	Standard Deviation	<i>p</i> value t-test
Reading	9.6	0.63	7.9	1.52	<.05
Writing	9.2	1.23	7.0	1.60	<.05
Speaking	9.8	0.59	7.6	1.71	<.05
Listening	9.7	0.58	8.1	1.55	<.05

The French-English bilinguals were enrolled in a large university in the Northeast of the United States. Most of the French-English participants were pursuing graduate studies in a variety of academic fields. Their ages ranged from 19 to 35, and the average age for this group was just over 26 years. The bilinguals reported the onset of L2 acquisition at around the age of 10, in a formal classroom setting. They also reported using French during phone and internet interactions with friends and family, and using English primarily for academic and professional purposes, and daily activities. Prior to participating in the experiment, all the bilinguals had been living in the L2 environment for at least 2 years, but some of them had spent up to 20 years in the United States. Despite the extensive immersion experience of some French-English bilinguals and the fact that they reported feeling integrated in the L2 environment, they all considered French to be their dominant language. As Table 3-3 shows, these participants rated their L1 proficiency in reading, writing, speaking and listening consistently higher in French than in English. They also rated their English abilities high as well, which was not surprising given the fact that they are successful at using the L2 for intellectual and professional advancement. Reading and listening abilities appear to be the language skills that they have mastered the best in the L2 ($M= 8.4$).

Table 3-3: *French-English bilinguals' proficiency self-ratings in L1 and L2*

French-English Bilinguals	Means for French (L1)	Standard Deviation	Means for English (L2)	Standard Deviation	<i>p</i> value t-test
Reading	9.7	0.47	8.4	1.4	<.05
Writing	9.2	1.2	7.9	1.6	<.05
Speaking	9.6	0.8	8.1	1.8	<.05
Listening	9.8	0.4	8.4	1.3	<.05

The group of monolingual English speakers were also recruited from a large Northeastern University and served as control group. These monolinguals were on average the youngest group of participants in this study ($M= 21.95$). The self-reported questionnaire revealed that none of them indicated functional proficiency in a second language. They had all received some instruction in a foreign language, but limited in average to 2 years and they had never experienced living in an L2 environment. Finally, a group of monolingual French-speaking university students who were functionally monolingual were recruited from L'Université de Montréal in Montreal, Canada and from l'Université de Québec in Trois Rivières. These speakers were on average 22 years of age, and had also received a few years of English instruction. However, the questionnaire indicated that they could not function in this other language and that they rarely had to interact with English speakers.

To summarize the self-assessed proficiency results in French (see Figure 3-1), the questionnaire data indicate that the French-English bilinguals rated their French linguistic abilities in a way that is very close to the French monolingual group. On the other hand, the English-French bilinguals considered their abilities in reading, writing, speaking and

listening in French lower than both the monolingual French speakers and French-English bilinguals.

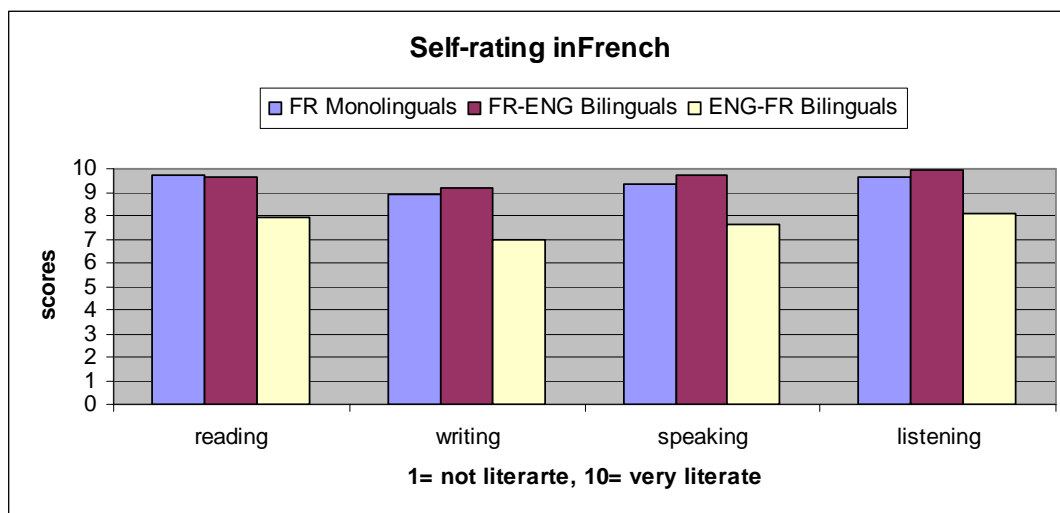


Figure 3-1: *Self-ratings in French in the four language areas*

The findings of the English self-ratings (summarized in Figure 3-2) show that the English-French bilinguals rated their English language skills similarly to monolingual English speakers in their four language areas. Finally, the French-English bilinguals rated their English abilities lower than the monolingual speakers and the English-French bilinguals.

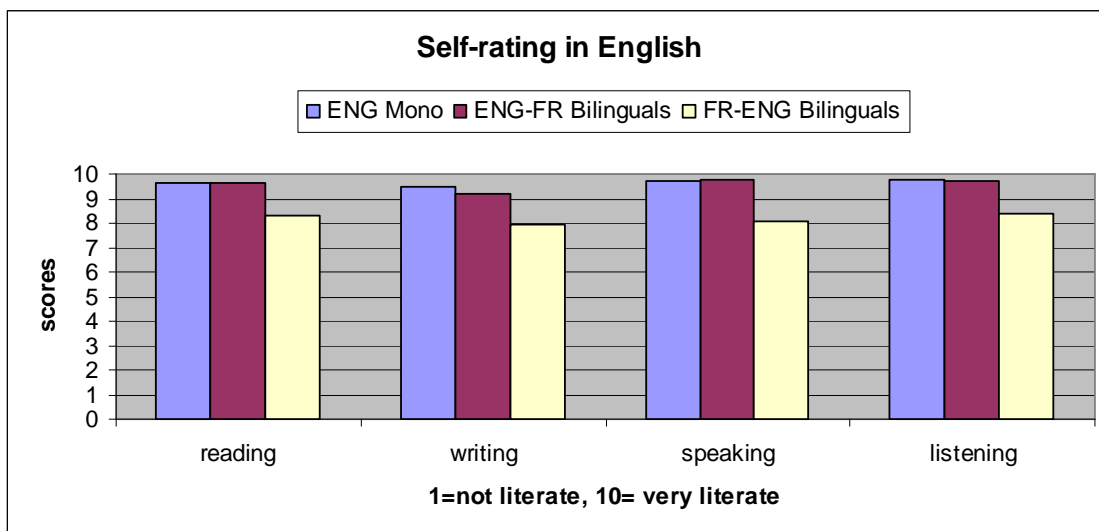


Figure 3-2: *Self-ratings in English in the four language areas*

3.1.1.2 Standardized Test of Language Proficiency

Two additional language tasks were used in order to assess the L2 proficiency level of the participants in the best way possible. These were the Test d'Evaluation de Français (TEF) (see Appendix B) and the Michigan English Language Institute College English Test (MELICET), which is a retired version of the Michigan test for English as a Second Language (MELAB) (see Appendix C). These additional measures of linguistic attainment were used because assessing proficiency is difficult as a construct and researchers do not agree on the best way to determine L2 abilities. Therefore, the best way to do so is to find converging measures, such as the ones selected in this dissertation.

3.1.1.2.1 French proficiency test

The TEF was developed by 'La Chambre de Commerce et d'Industrie de Paris' in 1998. This test is a fast and reliable measure of L2 French proficiency, as La Chambre de Commerce et d'Industrie reports that one of the characteristics of the original test is that the pedagogical evaluation is precise and individualized. The TEF is composed of a series of tasks to assess the French proficiency of the bilingual participants in a way that is similar to the MELICET, which was used to test English proficiency. Only two sections of the compulsory tasks of the TEF exam (written comprehension and structure/vocabulary) were given to the participants in this study. The original number of items composing the TEF was considerably too large for the purposes of this study, and was therefore reduced to make more effective use of the participants' time spent in the laboratory. A native speaker subjectively rated the level of difficulty of the items from 1 to 10, and the most difficult ones were included in the test version given. The rationale behind the inclusion of the most difficult items was to avoid a ceiling effect in the test scores. All of the questions selected were multiple choice, with four possible responses. The version of this test was entirely selected from a practice test booklet (La Chambre de Commerce et d'Industrie de Paris, 2001). Questions in each section of the test are based on various communicative activities.

The first part of this test assesses written comprehension: This first section (A) consists of a series of four authentic texts (signs, classified ads, postcards) that the participants must identify. The second section (B) deals with understanding details in six documents, such as newspaper articles or professional letters. The third section of the

written comprehension (C) contains five questions that test the understanding of the general meaning of given sentences. In the final section of this first part the participants had to read another five sentences and select the best reformulation among the four proposed, as illustrated in (1) below:

- (1) *Au cours de leurs recherches, les archéologues ont mis au jour une statue.*
- a. Les archéologues ont reconstitué une statue.
 - b. Les archéologues ont découvert une statue.
 - c. Les archéologues ont exposé une statue.
 - d. Les archéologues ont placé une statue en plein soleil.

The second part of the TEF focuses on structure and lexicon and is composed of four subsections: In the first section (A), the participants are required to show their lexical knowledge and sentence comprehension in French, as in the following example:

- (2) *On sera sûr de trouver du fil, des boutons et des aiguilles dans une ...*
- a. blanchisserie
 - b. droguerie
 - c. quincaillerie
 - d. mercerie

The second section (B) focuses on semantics and is presented in a cloze test form. The cloze items are deletions from a text. Section (C) assesses several grammatical concepts such as tense concordance as illustrated in example (3).

- (3) *Auriez-vous une cravate qui ... avec ce costume et cette chemise ?*
- a. aille

- b. ira
- c. va
- d. allait

The last section (D) tests more general grammatical knowledge; as in the following example. Examinees are asked to identify an error in one of the underlined words:

(4) *Le patient avait perdu les siens en 1996, lorsque l'explosion d'une fusée artisanale.*

A B C D

3.1.1.2.1.1 Procedure

The participants were seated at a desk and given the paper and pencil test. They simply had to circle the correct answer for each of the questions. When they finished answering all the items, they handed in their test to the experimenter who corrected them later and assigned a score rating their ability in the target language. The possible scores range from a minimum of 0 points to a perfect score of 45 points.

3.1.1.2.1.2 Scoring

In the official TEF test each candidate is usually evaluated on a seven- point scale, ranging from 0+ (elementary abilities) to level 6 (mastery of the language). The scoring procedures are as follows: points are awarded for each question according to the following schema, which penalizes the test-taker for guessing: correct answer: +3 points, no answer: 0 points, incorrect answer: -1 points. The details of the official scoring are not

accessible; therefore, the actual scoring of the TEF in this dissertation has been simplified. Each question was worth one point, for a possible total of 45.

3.1.1.2.1.3 Results

The French monolingual participants obtained an average of 84% correct answers ($M = 37.63$). They scored almost equally well in the written comprehension (84% accuracy), the vocabulary and the grammar section of the TEF (83% accuracy). The French-English bilinguals obtained an overall score higher (92% accuracy) than the French monolingual group. Finally, the English-French speakers had the most difficulty with this proficiency test, answering correctly on average 69% of the questions presented. The detailed results indicated that the vocabulary and grammar section caused extensive problems to the English-French group, who averaged a score of 62% of correct answers on this section. They had less difficulty with the written comprehension portion, scoring on average 78%. These results showing such a difference between the two groups of native speakers were somewhat puzzling and may be a function of the proficiency measure, rather than a true representation of the participants' knowledge of the language. It is important to note that there are disparities between the types of French spoken in France and in Canada, especially in terms of vocabulary. Therefore, the TEF, which is a French-made linguistic assessment, appears to be the cause for such lower performance from both the French monolingual Canadians and the Canadian English-French bilinguals in comparison to the French-English group, which was composed essentially of people from France.

3.1.1.2.2 English proficiency test

In order to assess the linguistic abilities of the participants in English, the MELICET-Grammar, Cloze, Vocabulary and Reading (GCVR) was administered. The original MELICET-GCVR is a 100-item, multiple choice test designed to provide information about the English language competence of adult non-native speakers of English who have high-intermediate to advanced level English skills. It contains questions which are based on grammatical and lexical knowledge and are presented in a cloze test and in reading comprehension tasks. In a comparable way to the TEF, the original MELICET-GCVR test was reduced in size for practical reasons. This allowed the participants to complete this task in a reasonable amount of time, approximately 30 minutes.

In the grammar section, each item represents a short (two-line) conversational exchange. An underlined blank appears in the second speaker's response. Each item has four options for a response. Only one of the choices correctly completes the second speaker's utterance, as in (5):

(5) “*May I bring you a cup of tea?*”

“*I prefer coffee _____ tea.*”

- a. to
- b. than
- c. rather
- d. instead

Item specifications require that the question use relatively high frequency vocabulary that is appropriate for a spoken register but is neither idiomatic nor complicated or lengthy. Distracters are not wrong simply because of orthography or punctuation (e.g., “it’s vs. its), and test items do not test prescriptive usage distinctions in English or usage distinctions variable in native speakers of English (e.g., “have got” vs. “have gotten”); however, the distracters (wrong answers) may be grammatical deviations similar to the example below:

(6) *Color is such a constant part of our environment that we tend to ignore its messages. Many people with perfect vision suffer _____ a sort of cultural color blindness.*

- a. of
- b. from
- c. such
- d. like

The cloze test items attempt to measure a participant’s understanding of organizational features of texts, i.e. cohesion and coherence features, as well as grammatical knowledge. They also measure the learner’s pragmatic knowledge, particularly knowledge of expected vocabulary in certain written contexts. The cloze items are deletions from a single passage of text. Items deleted in cloze passages vary with respect to form, class, and discourse function. Items targeted came from closed (prepositions, pronouns, determiners) as well as open classes (nouns, adjectives, main verbs and adverbs). Distracters may vary in syntactic category from the correct response.

In the vocabulary section, items measure the participant's understanding of specific words. The vocabulary tasks are of two types: synonym and word-meaning-in-context completion. The synonym-type item appears as a single, relatively short sentence with the word to be tested underlined. The given context is minimal. Examinees must select a synonym for the underlined word from four options. The answer choices are all words that could fit the context of the sentence; however, only one is a synonym for the underlined word, as illustrated in the following example:

(7) *We didn't think it would endure.*

- a. last
- b. increase
- c. happen
- d. change

The second vocabulary based task consists of completion-type items. The participants see a sentence with a blank slot which is followed by four multiple-choice options, only one of which fits appropriately into the sentence. In this section more information about the context is provided than in the synonym-type vocabulary items, as shown in the next example:

(8) *George gave Martha a diamond ring as _____ of his love for her.*

- a. a token
- b. a caress
- c. a signature
- d. an utterance

All the possible answers in the completion-type items are real words and are at approximately the same frequency level. The distracters are predominantly of three types, any of which may occur in any item: words with some phonetic or orthographic similarity to the correct answer, words with semantic similarity to the correct answer, and apparently irrelevant distracters that have been selected because they were offered as correct answer attempts by non-native speakers of English. A small portion of the items (10%-15%) are idiomatic phrases and expressions. The inclusion of such expressions is an attempt to measure the more colloquial language typically encountered in lectures, oral presentations, and some social-academic situations.

3.1.1.2.2.1 Procedure

Similarly to the French proficiency test, the participants were given a printed version of the MELICET and were asked to circle the correct answer for each of the sections and items. They were not allowed to speak with the experimenter or ask questions during the test. They had no time limitation and handed in their test when they were finished, after approximately 30 minutes. Later, the experimenter corrected and assigned a score ranging from a minimum score of 0 to a maximum score of 43 points.

3.1.1.2.2.2 Scoring

The official standardized test is corrected by counting the number of incorrect answers, then subtracting the total number of incorrect answers from 100. This gives the total number of correct answers, or the raw score. Then the raw score is converted to scaled scores. For the sake of simplicity and practicality, the scoring system of the

MELICET was simplified. It consisted of adding the total number of correct answers, which were all worth one point, with a potential perfect score of 43 points.

3.1.1.2.2.3 Results

The monolingual English speakers obtained an average composite score of 41 points out of a total of 43 points ($M = 41.17$). Their average score on the grammar and vocabulary sections was 98% and 99%, respectively. These speakers appear to have had more difficulty with the cloze test section, where they obtained an average score of 89%. The English-French group performed in a way that was comparable to that of the monolinguals. Their average composite score was also 41 points ($M = 41.13$), but were slightly less accurate than the monolingual speakers on the cloze section (92%). Finally, the composite score of the French-English bilinguals was 35 ($M=35.24$). Unlike the English-French bilinguals, these L2 learners showed more difficulty in the vocabulary section, where the average number of correct answers was 79%. The average scores on the grammar section and the cloze section were 83% and 84% respectively. Table 3-4 provides an overview of the scores obtained in the two proficiency measures for the four groups of subjects.

Table 3-4: Proficiency test results

Learners' proficiency data		MELICET (out of 43)	TEF (out of 45)
40 English-French Bilinguals	Mean	41.23 – 96%	30.71 – 69%
	SD	1.9	5.4
	Range	35-43	20-42
	Mode	41	33
39 French-English Bilinguals	Mean	35.24 – 74%	41.48 – 92%
	SD	6.18	4.06
	Range	21-43	26-45
	Mode	42	42
40 English Monolinguals	Mean	41.17 – 96%	N/A
	SD	1.47	N/A
	Range	38-43	N/A
	Mode	42	N/A
29 French monolinguals	Mean	N/A	36.96 – 84%
	SD	N/A	3.77
	Range	N/A	30-42
	mode	N/A	41

As Table 3-4 shows, the monolingual English group obtained a higher overall score in the proficiency measure, than the French monolingual participants. This suggests that the French proficiency tests may have been more difficult than the English proficiency test for the French speakers for the reasons mentioned above (e.g., discrepancies between French Canadian vocabulary and French from France). Table 3-4 also shows that each of the bilingual groups performed better in their first language than in their L2. The scores of the English-French group were virtually identical to those of the English monolingual group and were slightly lower than the scores obtained by the French monolinguals. This indicates that the English-French speakers were proficient in

both of their languages. Similarly, the French-English bilinguals scored high on the TEF (even higher than the French monolingual speakers), and were also accurate in the English test. This suggests that the two groups of bilinguals were highly proficient in their L2.

3.1.1.3 Working memory test

In the monolingual literature, working memory has been identified to modulate the way readers with different resources process sentences (Ardila, 2003; Daneman & Carpenter 1980; Gordon & Levine 2002; MacDonald, Just, & Carpenter 1992; Miyake, Just, & Carpenter 1994). As noted in Chapter 2, bilingual sentence processing research has failed to find a correlation between working memory capacity and L2 sentence processing (Juffs, 2004, 2005, 2006; Omaki, 2005). However, current evidence also indicates that a higher volume of brain activity is observed when speakers process language in their L2 (Hasegawa, Carpenter and Just, 2002), suggesting that processing a second language is a demanding task. It is possible, then, that the lack of a correlation reported in the literature may be related to the measures that have been used to assess cognitive resources. For example, the Daneman and Carpenter (1980) reading span test, used in Juffs (2004, 2005, 2006), requires participants to read sentences aloud while remembering the last word of each sentence for a subsequent recall task. Because reading aloud does not guarantee that participants process sentences for meaning, it has been argued that the processing component of working memory is not taxed in the manner that it normally is during language comprehension (Waters & Caplan, 1996). In this dissertation, working memory capacity will be assessed using the Waters & Caplan

(1996) test, which in addition to having a reading and recall component, it also incorporates a processing component, by asking participants to judge the semantic plausibility of the stimulus sentences.

The version of the Waters and Caplan (1996) tests used here consisted of 80 experimental sentences and nine practice sentences (see Appendix F for the English version of the test and Appendix G for the French version). In the practice session, participants saw 3 different sets of sentences. The first set only contained two sentences, the following set had three sentences, and the final practice trial consisted of four sentences. The 80 test sentences were divided among 20 blocks that ranged in length from two sentences to a maximum of six sentences. The blocks were of unknown length to the subjects. Following the last sentence of each block, the word “RECALL” (and SOUVENEZ-VOUS in the French version) appeared on the screen. This signaled to the participant that it was time write down the final words from that block that he or she could recall. In addition to the recall task, participants were also asked to provide a plausibility judgment for each of the sentences. Half of the sentences were plausible as in (9) and the other half were implausible (10):

- (9) a. *It was the employee that wanted the **raise**.*
b. *C'était l'employé qui voulait une **augmentation**.*
- (10) a. *It was the story that told the **librarian**.*
b. *C'était l'histoire qui raconta le **libraire**.*

3.1.1.3.1 Procedure

The participants were seated in front of a computer screen in the testing room and they read the instructions presented on the screen. This task began with three practice trials, during which the experimenter remained in the room to ensure the participant fully understood the procedure. At the end of the training blocks, the experimenter answered any questions that the participants had. Each trial began with a fixation point (+) that was presented for 300 ms, followed by the display of the sentences. Each sentence remained on the screen for 5000 ms or until the participant pressed the 'Yes' button (to indicate a plausible judgment) or the 'No' (to indicate an implausible judgment) button. Following the last sentence of each block, the word "RECALL" was displayed on the screen, and participants wrote down the words that they remembered in a booklet provided by the experimenter. The participants then pressed the spacebar to proceed to the following block. Reading times, and accuracy data for the plausibility judgments, were recorded.

3.1.1.3.2 Scoring

For each participant, a reading span score was calculated. A maximum score of 80 points was possible. In order to receive one point, it was necessary to have made a correct plausibility judgment and to have also correctly recalled the last word of the same sentence. Trials for which a plausibility judgment was not provided within the time limit were considered incorrect.

3.1.1.3.3 Results

Overall, the four groups of participants appear to be similar in terms of span scores. The French monolingual group obtained the lowest average on the working

memory task ($M= 44.24$), followed by the English-French group who scored ($M= 49.07$). The English monolinguals reached the mid fifties ($M= 56.12$) and the group of French-English bilinguals obtained the highest average ($M= 58.57$).

3.1.2 Tasks and Materials

In this dissertation, experimental data was collected using a reading moving window paradigm (Just, Carpenter & Wooley, 1982). Sentences were presented in a non-cumulative word-by-word fashion; that is, the reader pressed the spacebar of a computer keyboard to see each successive word in a sentence, and the previous word was removed when a new word appears. Consequently, participants are unable to go back and reread words that have been presented earlier in the sentence (Hoover & Dwivedi, 1998; Marinis 2003). A number of drawbacks have been associated with the moving-window paradigm. For instance, the time between successive presses required in a moving window paradigm does not necessarily reflect the time spent processing the word that just appeared on the screen (Frenck-Mestre, 2005; Garnsey et al. 1997; Just, Carpenter, Wooley, 1982; Rayner & Clifton, 2002). Garnsey et al. (1997), as well as Frenck-Mestre (2002, 2005), also point out that the self-paced reading technique allows researchers to track on-line reading, but it does not allow for the differentiation between first or second pass readings. In addition, the slowness associated with finger response and the moving display may allow readers enough time to integrate information coming from multiple sources (lexical, syntactic, pragmatic, etc.), making the methodology less than ideal for the study of initial parsing decisions. Despite these disadvantages, the moving-window technique produces on-line reading times data with many characteristics of naturally occurring eye-fixation data and

provides a record of participants' reading performance during sentence processing (Garnsey et al, 1997; Frenck-Mestre, 2005). In addition, the methodology is also less expensive and easier to administer than other more sophisticated methodology. Because of this, it was chosen as the data collection methodology for the experiments conducted in this dissertation.

3.1.2.1 Materials

Sixty-four experimental sentences were constructed. Thirty-two sentences were used in the English experiment and the remaining thirty-two--which were French translation equivalents of the English sentences--were used in the French experiment. All experimental sentences contained a main clause preceded by an adjunct clause. The sentences for the English experiment were constructed by manipulating the transitivity properties of the verb in the adjunct clause. Accordingly, in sixteen of the thirty-two sentences, the verb in the adjunct clause was optionally transitive. In the remaining sixteen, the verb was intransitive. This created two conditions, exemplified below:

Condition 1 *When the naïve explorer lands the damaged helicopter stops in a chaotic manner.*

Condition 2 *When the naïve explorer panics the damaged helicopter stops in a chaotic manner.*

A consequence of the verbal manipulation is that Condition 1 is structurally ambiguous, whereas Condition 2 is not. The ambiguity in Condition 1 arises because the noun phrase *the damaged helicopter* can be interpreted either as the direct object of the verb in the adjunct clause (e.g., *lands*) or as the subject of the main clause. If the

transitive reading is chosen, the noun phrase is interpreted as its direct object. When the reader reaches the verb *stops*, the sentence becomes difficult to interpret and the reader is forced to reanalyze the ambiguous noun phrase as the subject of the main verb. On the other hand, the construction in Condition 2 is not structurally ambiguous because the verb in the adjunct clause (e.g., *panics*) is intransitive.

Crucial to the experimental manipulation, the French translation equivalents of the English adjunct verbs were always intransitive. Hence, the French sentences did not exhibit any structural ambiguity. A sample of the French conditions is provided below:

Condition 1 *Quand l'explorateur naïf atterrit son hélicoptère abimé s'arrête de façon chaotique.*

Condition 2 *Quand l'explorateur naïf panique son hélicoptère abimé s'arrête de façon chaotique.*

In each of the experiments, the verbs in the adjunct clause were matched for frequency in the two conditions using Kučera & Francis (1982) for English verbs ($t = .194, p > 0.05$) and Trésor de la langue Française (1971) for French verbs ($t = 1.040, p > 0.05$). In a similar vein, care was taken to match the verbs in the main clause for the two conditions ($t = 1.757, p > 0.05$, for the English main verbs and $t = 1.839, p > 0.05$, for the French main verbs).

In addition to each of the thirty-two experimental sentences in each experiment, 176 filler sentences including various syntactic structures were added. Some included agreement violations, simple declarative sentences and two types of ambiguous relative clauses. An example of each is provided below (a complete list of the materials used in

the English experiment is given in Appendix D. The list of materials used in the French experiment is provided in Appendix E):

- (11) *The slogan on the posters was designed to get attention of the consumers.*
Le slogan des posters était conçu pour attirer l'attention des consommateurs.
- (12) *The publisher read the romance novel with great interest for the entire day.*
L'éditeur lit le roman avec grand intérêt toute la journée.
- (13) *The thief attacked the daughter of the man who worked as a waiter.*
Le voleur attaqua la fille de l'homme qui travaillait comme serveur.
- (14) *The senator talked to the brother of the actress who wanted to become a monk.*
Le sénateur parla au frère de l'actrice qui voulait devenir moine.

Finally, ten practice items were added at the beginning of the experiment to familiarize participants with the requirements of the task and the type of stimuli. All experimental items, filler sentences and practice items were followed by comprehension questions that required understanding the sentences without calling attention to the experimental manipulations. Thus, for example, a sentence like in (14) was followed by the question *Does the brother want to become a nurse?* Half of the questions required a “yes” answer and the other half a “no” answer.

Four 218-item lists were created, two for the English experiment and another two for the French experiment. Each list had 32 experimental items (16 in each condition), 176 fillers and the 10 practice sentences. Each list contained exactly one version of each experimental sentence (i.e., one version of a sentence within a sentence pair). The experimental sentences and the fillers were pseudo-randomly interleaved; this resulted in

the items being presented in a different order to each subject, yet the items in each stimulus type were evenly distributed throughout the duration of the experiment.

3.1.2.2 Procedure

The method used for data collection was a non-cumulative moving-window task and was run using E-Prime software (Schneider, Eschman, Zuccolotti, 2002). Data was collected in two sessions. During the first session, monolingual and bilingual subjects performed the moving window experiment in the native language to rule out the possibility in the bilingual results that any effects of the L2 on L1 processing could be caused by the order in which the subjects performed the experiments. After participating in the experiment, subjects were also administered the working memory test, the language proficiency test and the language background questionnaire, again in their native language. Approximately four weeks later, the bilingual groups participated in the second session, during which they completed the experiment and the proficiency test in their second language.

Before beginning each testing session, participants were provided with an informed consent form which explained their rights as participants. After signing the form, they were seated in front of a computer. Testing was done individually, in a quiet room. The testing session began with the self-paced moving window task. Participants were informed that the reading of each sentence began with a series of dashes marking the length and position of the words in the sentences. After reading the final word of each item, they were told that a comprehension question would follow. Their task was to

answer the question by pressing either a “yes” button or a “no” button on the computer keyboard. Both accuracy and speed were emphasized in the instructions. Participants were asked to read sentences as naturally as possible. The trial began with the ten practice items. In addition, the participants were asked whether they had any additional questions regarding the experiment. The display of the experimental items began once all questions were answered.

Monolingual participants were debriefed at the end of the first experimental session. Bilingual participants were debriefed at the end of the second experimental session. Each experimental session lasted approximately 70 minutes (between 55-80 minutes). Participants were either paid \$15 for completing each session or received course credit for their participation.

Chapter 4: RESULTS

4.1 Criteria for subject inclusion

Participants that scored less than 80% in their first language and 75% in their second language on comprehension questions were excluded from the analysis. This led to the exclusion of 2 French-English participants and 2 English-French bilinguals.

4.2 Data trimming

As it is customary with this type of study, any words that were read by participants faster than 200 ms or slower than 2000 ms were excluded from the analysis. This resulted in the loss of approximately 3 % of the data. Finally, as is standard procedure for ‘moving window’ experiments, reading times followed by incorrect responses to the comprehension questions were also excluded from the statistical analysis. This resulted in the loss of approximately 2% of the data. No additional trimming was conducted.

4.3 General procedure for data analysis

All comparisons involved the examination of experimental sentences containing two clauses. The verb in the adjunct clause was either optionally transitive in English and intransitive in French (Condition 1) or intransitive in both English and French (Condition 2). An example of each condition is repeated below for ease of exposition:

English Experiment

Condition 1 *When the naïve explorer lands the damaged helicopter stops in a chaotic manner.*

Condition 2 *When the naïve explorer panics the damaged helicopter stops in a chaotic manner.*

French Experiment

Condition 1 *Quand l'explorateur naïf atterrit son hélicoptère abimé s'arrête de façon chaotique.*

Condition 2 *Quand l'explorateur naïf panique son hélicoptère abimé s'arrête de façon chaotique.*

Analyses were run in the following regions. The subordinate verb (word 5), the following determiner (word 6) and accompanying adjective, (word 7), the noun (word 8) and the disambiguating region of the sentences--i.e., the verb of the second clause-- (word 9). The subordinate verb (word 5) is of critical interest because it is at this point that the bilinguals' two languages differ in terms of the lexical constraints associated with

the verb subcategorization information. Hence, we might observe an increase in reading times at this region, owing to the subcategorization frame differences of the two languages. The noun phrase (determiner + adjective + noun) is also an area of interest, as it is at this point that parsing decisions are made about the ambiguous noun phrase, and revisions may take place based on information that becomes available as the processing of the verb and noun phrase unfold (e.g., Clifton & Mitchell, 1994; Mitchell, 1989). The final point of interest is the main verb (word 9), as it disambiguates the syntactic role of the ambiguous noun phrase toward a subject interpretation. In other words, it is at this region that participants confirm or disconfirm their initial analysis concerning the post-verbal noun phrase.

One-way ANOVAs with verb type (optionally transitive or intransitive) as a within-subjects variable and groups (monolinguals vs. bilinguals) as the between subject variable were performed. The monolingual English results are reported first, followed by the results for the monolingual French group. Subsequently, the results for the two bilingual groups are reported. The English-French bilinguals are presented first (those immersed in French and English in Canada), followed by the results of the French-English speakers (i.e., those living in their L2 English environment). Additional ANOVAs to determine the effects of working memory capacity and language proficiency on reading patterns are also provided. For each group of participants, analyses by subjects (F1) and by items (F2) are reported.

4.3.1 Monolinguals English speakers

4.3.1.1 Reading times

The percentage of correct responses to the comprehension questions was calculated. The English monolingual group had an overall mean accuracy score of 94.5%, indicating that they were very accurate in answering the comprehension questions. Results of the word-by-word reading times for both sentence types are provided in Figure 4-1.

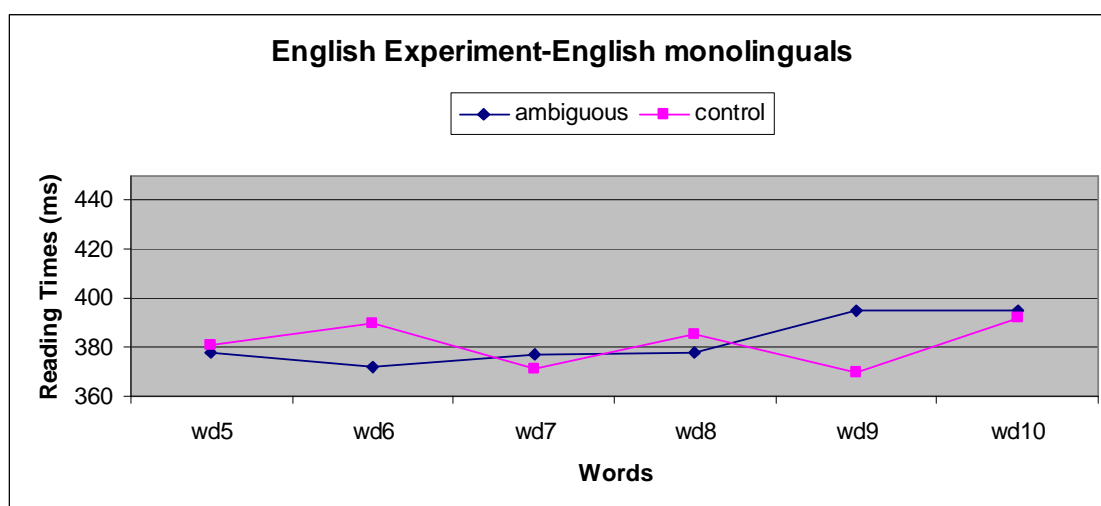


Figure 4-1: Reading patterns for the English monolinguals

Subject and item analyses conducted on words 5, 7 and 8 indicate that there are no reliable differences between Condition 1 and Condition 2 [for Word 5 $F_1(1,49) = .148$, $MSE = 2188.358$, $p > 0.05$ and $F_2(1,31) = .174$, $MSE = 1965.439$, $p > 0.05$]; for Word 7 $F_1(1,49) = .292$, $MSE = 2760.000$, $p > 0.05$ and $F_2(1,31) = .6686$, $MSE = 7280.135$, $p > 0.05$]; for Word 8 $F_1(1,49) = .697$, $MSE = 2053.063$, $p > 0.05$ and $F_2(1,31) = .189$, MSE

=3608.291, $p > 0.05$). These results are not surprising given that there is no particular reason why these words in the sentences should cause difficulty.

At word 6, monolinguals were slower to read the determiner when it followed an intransitive verb than a transitive one ($M = 390$ ms vs. $M = 372$ ms, respectively). This difference was statistically significant by subjects ($F_1(1,49) = 4.792$, $p < 0.05$) and marginally significant by items ($F_2(1,31) = 3.646$, $MSE = 1338.639$, $p = .065$). At word 9, English monolinguals took longer to process the disambiguating region when the verb of the adjunct clause was optional transitive than when it was intransitive ($M=395$ ms vs. $M=370$ ms, respectively). The differences were statistically reliable by subjects ($F_1(1,49) = 5.410$, $MSE = 501.50$, $p < 0.05$) and by items ($F_2(1,31) = 11.223$, $MSE = 1858.595$, $p < 0.01$).

These results suggest that the monolingual English readers incorrectly interpreted the ambiguous noun phrase as a direct object regardless of whether the verb in the first clause was optionally transitive or intransitive. In the optionally transitive case, the direct-object analysis was maintained because it did not conflict with the subcategorization information provided by the verb. At word 9, inability to integrate the second verb into the available syntactic frame initiated the reanalysis process, causing an increase in reading times in this region.

In cases where the verb was intransitive, the results are somewhat different. Although readers also incorrectly interpreted the ambiguous noun phrase as the direct object of the verb, they abandoned the interpretation early in the sentence, while processing the ambiguous noun phrase. These results replicate previous findings in the

literature. For example, in a seminal study, Mitchell (1987) showed that participants reading sentences containing intransitive verbs like *sneezed* or optionally transitive verbs like *visited* (*After the child had sneezed (visited) the doctor prescribed a course of injections*) experienced difficulty at the noun phrase when it immediately followed an intransitive verb. Mitchell interpreted the results as indicating that participants initially treated the ambiguous noun phrase *the doctor* as the direct-object of *sneezed* and subsequently realized that this analysis was untenable. In a recent eye-tracking study, vanGompel & Pickering (2001) demonstrated that readers experience more difficulty at the ambiguous noun phrase after intransitive verbs than after transitive verbs, replicating the results reported in Mitchell's study.

4.3.2 Monolingual French speakers

4.3.2.1 Reading times

The mean accuracy for the French monolingual group in the comprehension questions was 95.2%, which indicates that they were very accurate in answering the questions and remained on task for the duration of the experiment. Moving to the reading time data, subject and item analyses showed no reliable differences at any of the five regions of interest [for Word 5 $F_1(1,28) = .100$, $MSE = 1255.900$, $p > 0.05$ and $F_2(1,31) = 1.220$, $MSE = 9700.560$, $p > 0.05$; for word 6 $F_1(1,28) = .096$, $MSE = 4139.960$, $p > 0.05$ and $F_2(1,31) = .157$, $MSE = 6004.600$, $p > 0.05$; for Word 7 $F_1(1,28) = 1.021$, $MSE = 1474.618$, $p > 0.05$ and $F_2(1,31) = 2.387$, $MSE = 3993.443$, $p = .133$; for Word 8 $F_1(1,28) = .120$, $MSE = 2050.035$, $p > 0.05$ and $F_2(1,31) = 1.215$, $MSE = 4713.834$, $p > 0.05$) In particular, at word 9, there were no significant differences in reading times between

the two sentence types in French, ($M = 423$ ms vs. $M = 438$ ms; $F_1(1,28) = .178$, $MSE = 1892,243$, $p > 0.05$ and $F_2(1,31) = .935$, $MSE = 4097.661$, $p > 0.05$). Figure 4-2 illustrates the reading times for both condition 1 and 2 in the five regions that were analyzed. This was expected because the French sentences only contained intransitive verbs in the adjunct clause; hence, the strategies used by the participants to parse the noun phrase following the adjunct verbs should not be different in the two conditions.

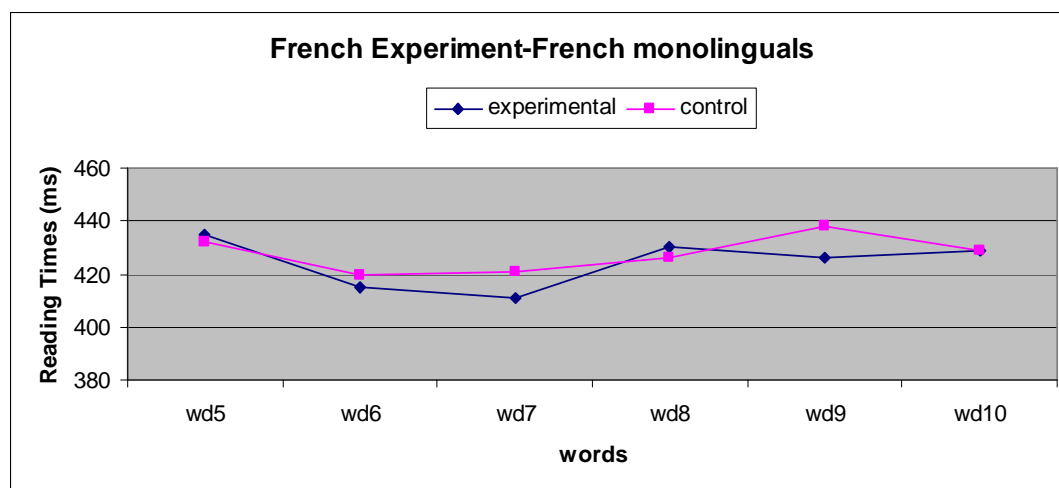


Figure: 4-2: Reading patterns for the French monolinguals

The lack of a significant difference in processing routines between the two French conditions replicates the findings reported in Frenck-Mestre & Pynte (1997), with one minor caveat. These authors found that monolingual French speakers took longer to read the adjunct verb (word 5) in Condition 1 vis-à-vis Condition 2, a finding that was only expected for the bilingual groups due to the purported differences between the lexical properties of the adjunct verb in the bilinguals' two languages. A closer examination of the materials used in their study revealed that some of the adjunct verbs in Condition 1

could often be followed by an indirect object –for example, *téléphoner* is often followed by an indirect object, as illustrated in *Je téléphone à mon ami* / I phone my friend.

Frenck-Mestre and Pynte suggested that the multiple structural options made available by some of the adjunct verbs may have caused the unexpected increase in reading times at word 5. The materials employed in the experiment reported here did not include verbs like *téléphoner*, which explains the discrepancy between the French results in Frenck-Mestre study and the results in the present dissertation.

4.3.3 English-French bilingual speakers

Mean accuracy score for the comprehension questions in English was 94.7%. In French, the average accuracy score was 92.1%. The results of the comprehension questions confirm that the English-French bilinguals were highly proficient in both their first and second languages. For the reading time data, the results of the English experiment are presented first, followed by the results of the French experiment.

4.3.3.1 English Experiment

4.3.3.1.1 Reading times

Comparisons of the reading times between the English-French bilinguals and the monolingual English speakers revealed a main effect of verb at word 6 ($F_1(1,88) = 8.608$, $MSE = 1393.240$, $p < 0.05$) and word 9 ($F_1(1,88) = 9.521$, $MSE = 2477.315$, $p < 0.05$), and no interaction effects between verb and group at either of these two sites (for word 6 $F_1(1,88) = .063$, $MSE = 1393.240$, $p > 0.05$; for word 9 $F_1(1,88) = 9.521$, $MSE = 2477.315$, $p > 0.05$). This finding indicates that the bilingual speakers behaved similarly

to the monolingual English group when processing ambiguous structures in their first language.

A look at the reading times for English-French bilinguals in the two experimental conditions revealed that at word 6, the bilingual speakers took longer to read the determiner when it appeared after an intransitive verb ($M = 348$ ms) than when it followed an optionally transitive verb ($M = 333$ ms). The difference was reliable by subjects ($F_1(1,39) = 4.259$, $MSE = 1060.55$, $p < 0.05$) and by items ($F_2(1,31) = 4.035$, $MSE = 1542.616$, $p < 0.05$). Longer reading times were also observed at the adjective in the intransitive condition ($M = 346$ ms) compared to the optionally transitive one ($M = 328$ ms). As in the previous case, the difference was statistically significant by subjects ($F_1(1,39) = 5.393$, $MSE = 1184.06$, $p < 0.05$) and marginally significant by items $F_2(1,31) = 3.346$, $MSE = 1287.092$, $p = .075$). Taken together, these results suggest that the bilinguals momentarily entertained the possibility that the ambiguous noun phrase functioned as the direct object of the adjunct verb, even when this analysis is illicit following intransitive verbs. The findings replicate the results obtained for the monolingual English speakers discussed above, as well as those reported in previous literature (Mitchell, 1987; vanGompel & Pickering, 2001).

At word 9, there was an increase in reading times at the verb in the main clause for sentences with optional transitive adjunct verbs compared to sentences with intransitive adjunct verbs ($M = 366$ ms vs. $M = 345$ ms, respectively). The difference was significant by subjects ($F_1(1,39) = 4.524$, $MSE = 1967.01$, $p < 0.05$) and by items ($F_2(1,31) = 4.437$, $MSE = 936.090$, $p < 0.05$). The results suggest that the English-French

bilinguals attached the ambiguous noun phrase to verb in the adjunct clause (as predicted by Minimal Attachment), and maintained that analysis until they encountered the main verb. At this time, a revision process was initiated and reanalysis of the ambiguous noun phrase as the subject of the main clause occurred. Finally, there were no significant differences in reading times at any of the remaining word positions, indicating that both monolingual group and the English-French bilinguals processed the syntactic ambiguity in a similar way (at word 5 and word 8 between Condition 1 and Condition 2 was observed ($F_1(1,39) = .459, MSE = 3251,295, p > 0.05$, and $F_2(1,31) = 1.276, MSE = 2702.433, p > 0.05$ for word 5, and $F_1(1,39) = 2.918, MSE = 1617,567, p > 0.05$ and $F_2(1,31) = 2.415, MSE = 2809.046, p > 0.05$ for word 8). Figure 4-3 shows the reading patterns for the English monolinguals and the English-French bilingual:

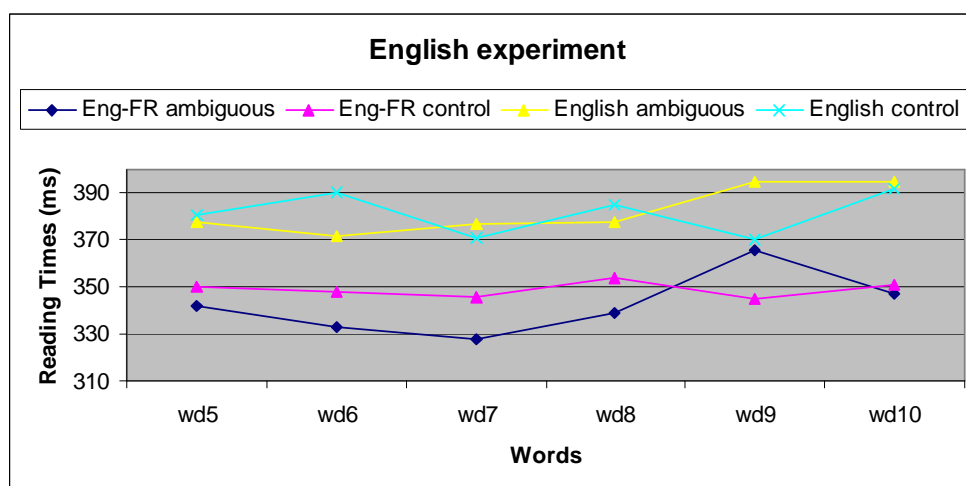


Figure: 4-3: Reading patterns for the English-French bilinguals and the English monolinguals

In all, the results indicate that the English-French bilinguals reading patterns and the English monolingual speakers were similarly sensitive to the syntactic ambiguity, as the two groups of readers demonstrated remarkably similar processing patterns at points in the sentence where the ambiguity arose and was resolved.

4.3.3.1.2 Additional Individual Difference Measures

4.3.3.1.2.1 Working Memory

As previously discussed, in monolingual research, working memory capacity has been identified to play an important role in the comprehension of sentences. Studies in which participants have been divided into high and low working memory have reported differences in processing speed between these two groups, suggesting that the high span readers are able to entertain more syntactic information in comparison to the low span readers.

To investigate whether working memory capacity impacts ambiguity resolution, the English-French bilingual group was divided into high working memory capacity and low working memory capacity, based on the score obtained in the English version of the Waters and Caplan (1996) working memory test. Using a median split procedure, twenty participants fell in the high working memory group and 20 in the low working memory group. A one-way ANOVA with verb (optionally transitive vs. intransitive) as a within-subjects variable and working memory score (high and low) as a between-subjects variable was performed at words 6 and word 7 (the ambiguous noun phrase) and word 9 (the disambiguating region). The analysis revealed no interaction effects between verb type and working memory score at any of the critical regions examined (for word 6 (F_1

(1,38) = .065, $MSE = 70.095$, $p > 0.05$; for word 7 ($F_1(1,38) = .264$, $MSE = 319.072$, $p > 0.05$ and for word 9 ($F_1(1,38) = .161$, $MSE = 322.940$, $p > 0.05$), suggesting that working memory does not modulate the processing of the ambiguous constructions studied here. These results replicate other findings in the bilingual literature (Juffs, 2004, 2005, 2006; Omaki, 2005), which failed to find any significant interaction between memory span and L2 sentence comprehension.

4.3.3.1.2.2 Language Proficiency

To determine whether differences in proficiency level play a role during sentence processing, the English-French bilingual were divided into two groups, using the composite scores of the MELICET. Following a median-split procedure, twenty participants were allocated to the high proficiency group and 20 in the lower proficiency group. A one-way ANOVA with verb type as a within-subjects variable and English proficiency (higher and lower) as a between-subjects variable was performed at words 6, (the beginning of the noun phrase) and word 9 (the disambiguating main verb). The analyses revealed no interaction effects between the verb type and proficiency score at any of the critical regions examined (for word 6 $F_1(1,38) = 1.02$, $MSE = 1060.00$, $p > 0.05$; for word 9 $F_1(1,38) = .980$, $MSE = 1968.01$, $p > 0.05$). This result indicates that proficiency does not modulate the processing of object/subject ambiguities for this group of speakers.

4.3.3.2 French Experiment

4.3.3.2.1 Reading times

Comparison of the reading times between the English-French monolinguals and the monolingual French speakers for the French stimuli revealed no main effect of verb at word 6 ($F_1(1,67) = .102, MSE = 3470.519, p > 0.05$) and word 9 ($F_1(1,67) = 2.759, MSE = 3470.519, p > 0.05$), and no interaction effects between verb and group at either of these two sites (for word 6 $F_1(1,67) = .694, MSE = 3470.519, p > 0.05$; for word 9 $F_1(1,67) = 0.35, MSE = 3470.519, p > 0.05$). This finding indicates that the bilingual speakers behaved similarly to the monolingual French speakers when processing ambiguous structures in their second language. The pattern of reading times for the French monolinguals and the English-French bilinguals is provided in Table 4-4.

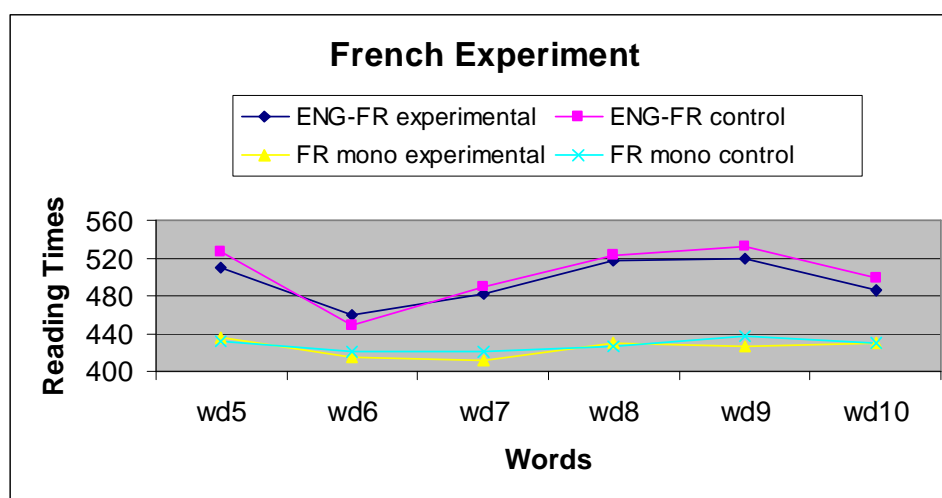


Figure: 4-4: Reading patterns for the English-French bilinguals and the French monolinguals

A comparison of the reading times for the English-French bilinguals in the two conditions showed no statistical differences between experimental and the control structures at any of the regions examined (for word 5 $F_1(1,39) = 1.312, MSE = 3664.598, p > 0.05$ and $F_2(1,31) = .663, MSE = 8089.248, p > 0.05$; for word 6 $F_1(1,39) = .916,$

$MSE = 2989.895, p > 0.05$ and $F_2(1,31) = .020, MSE = 3836.567, p > 0.05$; for word 7 $F_1(1,39) = .196, MSE = 5051.698, p > 0.05$ and $F_2(1,31) = .316, MSE = 3715.370, p > 0.05$; for word 8 $F_1(1,39) = .110, MSE = 2957.597, p > 0.05$ and $F_2(1,31) = .300, MSE = 6832.773, p > 0.05$, and for word 9 $F_1(1,39) = 1.109, MSE = 2857.720, p > 0.05$ and $F_2(1,31) = .150, MSE = 8553.291, p > 0.05$).

To summarize the results, when reading in their second language, the English-French bilinguals showed reading patterns that were much like the monolingual French speakers. This indicates that the bilingual speakers were not transferring verbal information from their first language while reading constructions in their second language. If the reverse had been the case, we would have observed increased reading times at the disambiguating region for Condition 1, compared to Condition 2. The fact that no garden-path effect was apparent suggests, instead, that the bilingual speakers were sensitive to verbal information specific to their L2 French.

4.3.3.2.2 Additional Individual Difference Measures

4.3.3.2.2.1 Working Memory

A one-way ANOVA with verb type as a within-subjects variable and working memory score as a between-subjects variable was performed word 9 produced no interaction effect between verb type and memory capacity at word 6 and word 9 (for word 6 $F_1(1,38) = .165, MSE, p > 0.05$; for word 9 $F_1(1,38) = .110, MSE = 321.029, p > 0.05$). This result is expected because the French sentences are not structurally different from one another, and so working memory capacity should not have a differential effect.

4.3.3.2.2 Language Proficiency

To assess whether proficiency level influences L2 ambiguity resolution, we divided the English-French participants, using the proficiency scores of the TEF, into higher and lower proficient groups. As in the English experiment, twenty participants fell in the high proficiency group and 20 in the lower proficiency group. At word 9, the analysis revealed no interaction effects between verb type and French proficiency score ($F_1(1,38) = .608, MSE = 1756.33, p > 0.05$). The results showed that the proficiency level, as measured by the TEF, did not affect the reading patterns obtained for both conditions.

4.3.4 French-English bilinguals

The French-English participants were also highly proficient in both languages. Their mean accuracy on the comprehension questions in their L1 French was 95.1% and 91.3% in their L2 English. I now turn to the results of the English experiment and follow with the findings for the French experiment.

4.3.4.1 English Experiment

4.3.4.1.1 Reading time data

Comparisons of the reading times between the French-English bilinguals and the monolingual English speakers revealed was no main effect of verb type ($F_1(1,66) = .188, MSE = 397.405, p > 0.05$), but there was a significant interaction between verb type and group by subjects ($F_1(1,87) = 3.880, MSE = 11278.30, p < 0.05$) and by items ($F_2(1, 87) = 25.372, MSE = 73745.71, p < 0.01$), suggesting that the processing routines of the

monolingual English speakers were different from those of the French-English bilinguals. To better understand this interaction effect, I will focus on the bilingual group.

For the bilinguals, a comparison between the reading times for the sentences containing the optionally transitive verb and the intransitive verb did not reveal any statistical differences between the two conditions at any of the critical regions (for word 5 $F_1(1,38) = .092$, $MSE = 3286.312$, $p > 0.05$ and $F_2(1,31) = .336$, $MSE = 3952.203$, $p > 0.05$; for word 6 $F_1(1,38) = .017$, $MSE = 1395.028$, $p > 0.05$ and $F_2(1,31) = .505$, $MSE = 8331.658$, $p > 0.05$; for word 7 $F_1(1,38) = .361$, $MSE = 3689.828$, $p > 0.05$ and $F_2(1,31) = .033$, $MSE = 6197.492$, $p > 0.05$; for word 8 $F_1(1,38) = .072$, $MSE = 3412.759$, $p > 0.05$ and $F_2(1,31) = .990$, $MSE = 2154.119$, $p > 0.05$; finally for word 9 $F_1(1,38) = .971$, $MSE = 1655.955$, $p > 0.05$ and Word 9 ($F_2(1,31) = .709$, $MSE = 3961.848$, $p > 0.05$)

It is possible that the lack of a significant effect between the two conditions for the French-English group might be related to immersion experience. As discussed in Chapter 3, the French-English participants differed considerably in the years of L2 immersion experience. Some had lived in the L2 environment for a little over a year, whereas others had been immersed in the L2 environment for almost 20 years. Given that years of immersion in the L2 environment has been shown to impact sentence processing strategies (Dussias & Sagarra, 2007), one may speculate that participants with lower immersion experience transferred their processing strategies from the L1 (cf. French-Mestre, 1997), and the participants with higher immersion experience processed the ambiguous construction much in the same way as English monolingual speakers did. This, in turn, could have resulted in the null result that we observed in the reading times

between the two conditions. To investigate this hypothesis further, the bilingual group was divided into high immersion and low immersion subgroups using a median-split procedure. Based on the information provided by the participants in the Language History Questionnaire, twenty participants fell in the high immersion group and 19 in the low immersion group. Participants in the high immersion group had been living in the L2 environment on average 7 years, and the ones in the low immersion group had been immersed in the L2 for a little over two years. The difference in years between the two immersion groups was statistically significant ($t = 4.68$, $df = 37$, $p < 0.01$). The questionnaire also revealed that the participants in the high immersion group had scored their reading, writing, listening and speaking abilities in English significantly higher than the subjects in the low immersion group. Mean scores for the two groups in the four language areas are provided in Table 4-1. *T*-tests revealed that the English proficiency ratings provided by the high immersion group and the low immersion group were statistically significant. Conversely, ratings for ability in the four language areas in French showed no statistical significance between the two groups.

Table: **4-1**: *Self-ratings in English and French of the high and low immersion group*

FRENCH- ENG Bilinguals	ENG reading	ENG writing	ENG speaking	ENG listening	FR reading	FR writing	FR speaking	FR listening
20 high immersion	9.1*	8.7*	8.9*	9.2*	9.95	9.45	9.8	9.95
19 low immersion	7.8*	7.2*	7.5*	8.2*	10	8.95	9.5	9.74

*= $p < 0.05$

Analyses were re-run comparing reading times for the ambiguous and control conditions in the high immersion group first, and in the low immersion group next. Results for the high-immersion group revealed no significant differences at word 5 ($F_1(1,19) = .671, MSE = 2140.054, p > 0.05$). At word 6, there was a very slight delay reading the determiner when it followed an intransitive verb compared to when it appeared after an optionally transitive verb ($M = 410$ ms and $M = 419$ ms, respectively). However, the means between the two conditions was not statistically significant ($F_1(1,19) = .221, MSE = 1838.473, p > 0.05$). At word 9, the high immersion group was significantly slower reading the disambiguating region when the adjunct verb was optionally transitive ($M = 438$ ms) compared to when it was intransitive ($M = 408$ ms), and this difference was statistically significant ($F_1(1,19) = 4.408, MSE = 2047.68, p < 0.05$). No other significant differences were obtained in any of the remaining regions examined (for word 7 ($F_1(1,19) = .501, MSE = 2055.065, p > 0.05$) and word 8 ($F_1(1,19) = .319, MSE = 3121.746, p > 0.05$)).

The garden-path effect evidenced at word 9 suggests that the high immersion group experienced some of the same difficulties that were evidenced in the monolingual English data. Aside from the lack of a difference in reading times at word 6, reading patterns for the high immersion bilinguals and the English monolinguals (Figure 4-5) are virtually identical to one another. The fact that reading times for both groups reached their highest peak at word 9 confirms the assumption that these two groups of participants incorrectly interpreted the ambiguous noun phrase in the adjunct clause as the verb's

direct object, and revised the analysis once additional information indicated that the analysis was no longer tenable.

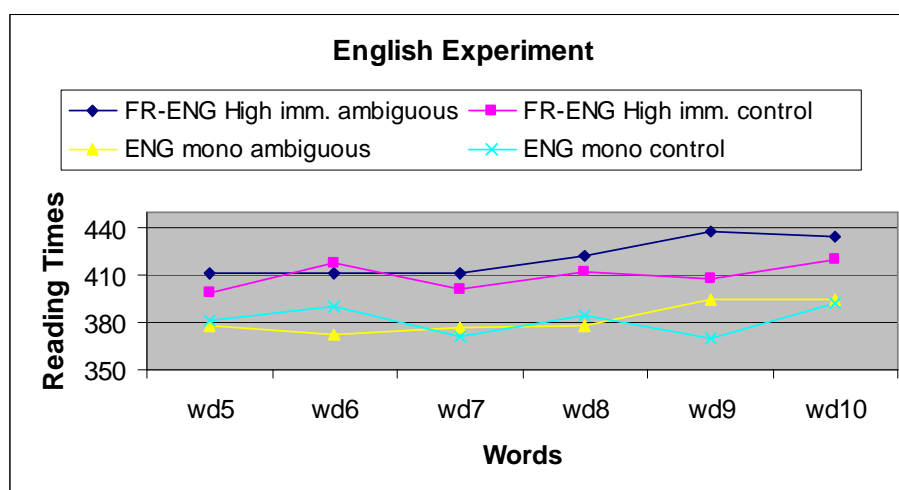


Figure: 4-5: Reading patterns for the high immersion group and the English monolingual speakers

Unlike the high immersion group, the low immersion group showed no significant differences in reading times at any of the five word positions when reading in English (for word 5 $F_1(1,18) = .926$, $MSE = 4390.42$, $p > 0.05$; for word 6 $F_1(1,18) = .810$, $MSE = 9401.764$, $p > 0.05$; for word 7 $F_1(1,18) = .067$, $MSE = 5616.360$, $p > 0.05$; for word 8 $F_1(1,18) = .811$, $MSE = 3701.12$, $p > 0.05$ and for word 9 $F_1(1,18) = 1.924$, $MSE = 833.269$, $p > 0.05$). An examination of the word-by-word reading patterns for the low immersion group and the English monolingual group (Figure 4-6) shows that the two groups are quite different at word 9. Whereas reading times for the ambiguous sentence peaks for the English monolinguals, there is no such change observed in the low

immersion group. This suggests that the low immersion group may have transferred lexical information from their L1 French to process English.

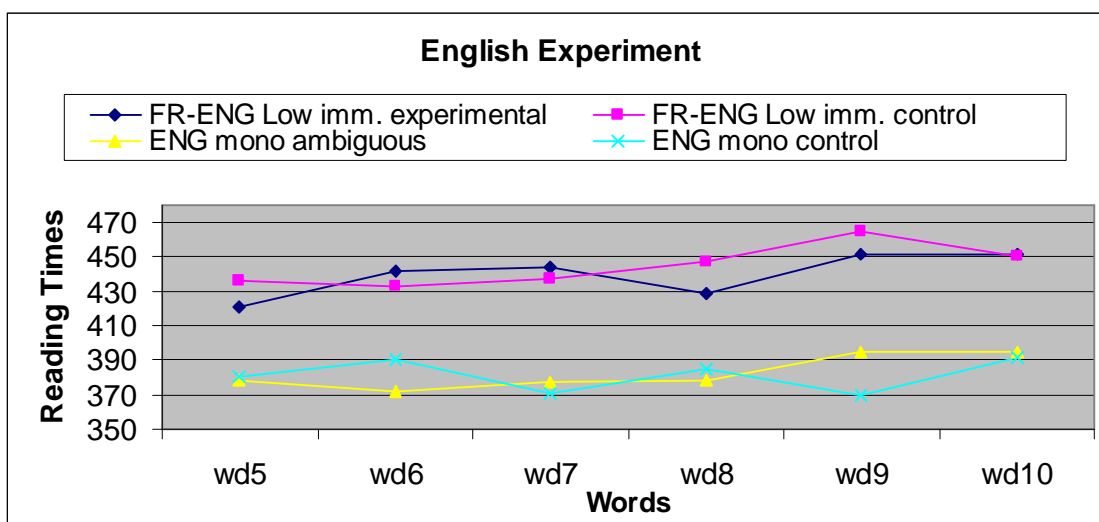


Figure: 4-6: Reading patterns for the low immersion group and the English monolingual speakers

To summarize, the results for the French-English bilinguals suggest that immersion in the L2 environment has impacted their parsing procedures. This is evident in the high immersion group, who had been living in an English environment for a little over 7 years. These speakers exhibited processing delays when reading English and French sentences at word 9 that closely resembled the delays evidenced in the English monolinguals data. On the other hand, the low immersion bilinguals appear to have relied on the lexical information of their first language to process the ambiguous constructions.

4.3.4.1.2 Additional Individual Difference Measures

4.3.4.1.2.1 Working Memory

The French-English bilinguals were split into two groups: 20 were classified as high working memory capacity and 20 as low working memory. A one-way ANOVA was conducted with verb type as a within-subjects variable and working memory capacity as a between-subjects variable. The findings revealed no interaction between verb-type and working memory at word 6 ($F_1(1,37) = .005$, $MSE = 6.552$, $p > 0.05$) or word 9 ($F_1(1,37) = .077$, $MSE = 129.918$, $p > 0.05$). The lack of an effect observed in the results suggests that bilinguals' working memories do not differentially affect the reading performance in the two conditions.

4.3.4.1.2.2 Language Proficiency

To determine whether differences in proficiency level affected parsing routines, the more highly proficient French-English speakers were placed in one group and the less proficient into another group. Twenty participants fell into the first group and 19 in the second group. A one-way ANOVA with verb type as a within-subjects variable and proficiency level as a between-subjects variable resulted in no interaction effects at word 6 or at word 9 (for word 6, $F_1(1,37) = 3.238$, $MSE = 1317.441$, $p > 0.05$; for word 9 $F_1(1,37) = 2.512$, $MSE = 1592.584$, $p > 0.05$). Once again, the results suggest that language proficiency does not modulate the parsing decisions of French-English bilinguals when they process object/subject ambiguities of the type studied here.

4.3.4.2 French Experiment

4.3.4.2.1 Reading Times

Comparisons of the reading times between the French-English bilinguals and the monolingual French speakers revealed there was no main effect of verb type ($F_1(1, 66) = .188, MSE = 397.405, p > 0.05$). However, there was an interaction effect between verb type and group that was significant by subjects ($F_1(1,66) = 3.913, MSE = 8291.309, p < 0.05$) but only marginally significant by items ($F_2(1,55) = 3.626, MSE = 4413.946, p = 0.062$). This indicates that the processing routines of the monolingual French speakers were different from those of the French-English bilinguals. Looking in more detail at the bilingual group, a comparison between the reading times in Conditions 1 and Condition 2 did not reveal statistical differences at any of the five critical regions (for word 5 $F_1(1,38) = .072, MSE = 4622.200, p > 0.05$ and $F_2(1,31) = .071, MSE = 3865.766, p > 0.05$; for word 6 $F_1(1,38) = .935, MSE = 2860.485, p > 0.05$ and $F_2(1,31) = 2.015, MSE = 1570.860, p > 0.05$; for word 7 $F_1(1,38) = .911, MSE = 1875.510, p > 0.05$ and $F_2(1,31) = .039, MSE = 3873.736, p > 0.05$; for word 8 $F_1(1,38) = .297, MSE = 2889.087, p > 0.05$ and $F_2(1,31) = .966, MSE = 4326.579, p > 0.05$; for word 9 $F_1(1,38) = 1.276, MSE = 2323.682, p > 0.05$ and $F_2(1,31) = .020, MSE = 5339.872, p > 0.05$).

As in the previous case, to explore the results of the French-English bilinguals in more detail, two groups were created using the immersion information gathered from the Language History Questionnaire. A one-way ANOVA with verb type as a within-subjects variable and immersion (high or low) as a between-subjects variable showed that the high immersion French-English bilinguals exhibited more processing difficulty when reading

Condition 1 ($M = 438$ ms) as compared to Condition 2 ($M = 408$ ms), despite the fact that the two conditions were structurally unambiguous in French. The difference between the means was statistically significant ($F_1(1,19) = 5.538$, $MSE = 10113.763$, $p < 0.05$). No other significant effects were observed in the remaining regions (for word 5 $F_1(1,19) = .001$, $MSE = 6556.68$, $p > 0.05$; word 6 $F_1(1,19) = .130$, $MSE = 4292.423$, $p > 0.05$; word 7 $F_1(1,19) = 1.930$, $MSE = 1220.265$, $p > 0.05$; word 8 $F_1(1,19) = .025$, $MSE = 3285.874$, $p > 0.05$). As Figure 4-7 shows, word-by-word reading patterns for the French monolingual speakers is practically flat, whereas for the high immersion group there is a peak happening at word 9.

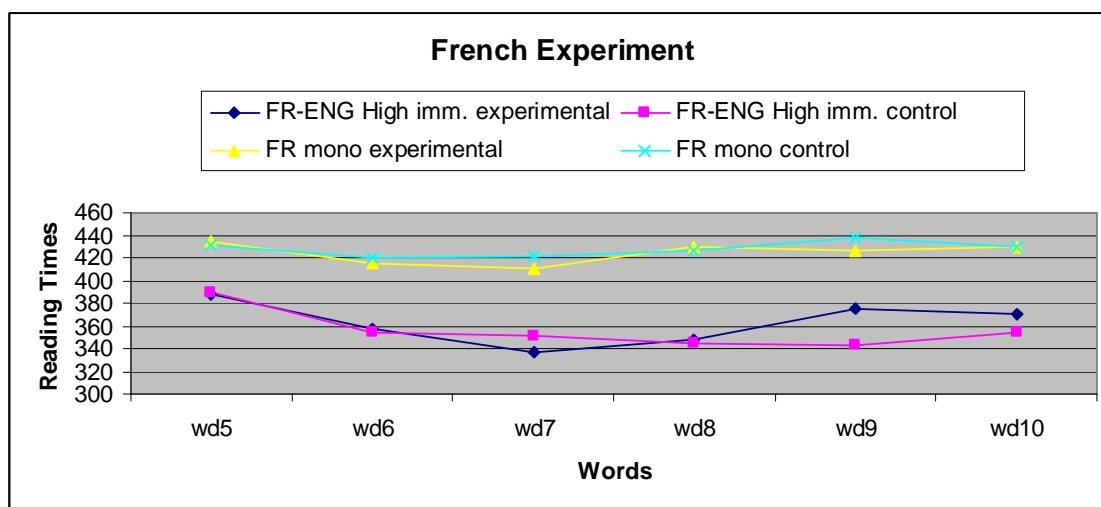


Figure 4-7: Reading patterns for the high immersion French-English bilinguals and the French monolinguals

One might speculate that due to the extensive exposure to the L2, lexical-semantic information from English has influenced the processing of French constructions. I take up this issue in more detail in the Discussion chapter.

Turning now to the final group, French-English bilinguals who had been living in an L2 environment for a limited amount of time were very similar to the French monolingual speakers when reading in their native language (i.e., French). Reading times at the regions of interest did not reveal any statistical differences between the two conditions (for word 5 $F_1(1,38) = .072$, $MSE = 4622.200$, $p > 0.05$; for word 6 $F_1(1,38) = .935$, $MSE = 2860,485$, $p > 0.05$; for word 7 $F_1(1,38) = .911$, $MSE = 1875.510$, $p > 0.05$; for word 8 $F_1(1,38) = .297$, $MSE = 2889.087$, $p > 0.05$; and for word 9 $F_1(1,38) = 1.276$, $MSE = 2323.682$, $p > 0.05$). The similarity in responses between the two groups is evidenced in Figure 4-8, where the reading patterns are rather flat from one word to the next.

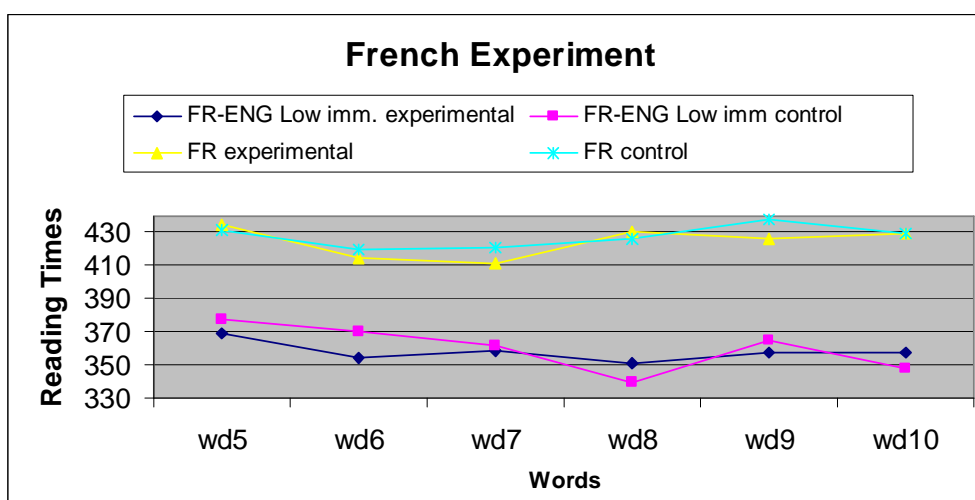


Figure 4-8: Reading patterns for the low immersion French-English bilinguals and the French monolinguals

The overall results of the low immersion group suggest are better explained if one assumes that L1 information is transferred from the L1 to the L2 (i.e., forward transfer).

4.3.4.2.2 Additional Individual Difference Measures

4.3.4.2.2.1 Working Memory

Participants were divided into two groups according to their working memory span scores in French. Twenty participants were placed in the high span group and 19 in the low span group. An ANOVA with verb type as a within-subjects variable and span size as a between-subjects variable did not show any interaction effects at word 6 ($F_1(1,37) = .486, MSE = 2899.696, p > 0.05$) and word 9 ($F_1(1,37) = .083, MSE = 193.377, p > 0.05$). This finding suggests that working memory capacity did not play an important role in modulating the parsing strategies used by the bilingual speakers when reading the temporarily ambiguous sentences.

4.3.4.2.2.2 Proficiency

To examine the effect of proficiency, the proficiency-level split procedure described above was also performed here as well. An ANOVA with verb type as a within-subjects variable and proficiency as a between-subjects variable did not show a significant interaction effect between verb type and French proficiency score at word 6 ($F_1(1,37) = .823, MSE = 2873.83, p > 0.05$) and at word 9 ($F_1(1,37) = .185, MSE = 374.63, p > 0.05$). This result was not surprising as the French-English bilinguals are

reading in their native language and that both conditions contain intransitive verbs in the adjunct clause.

Chapter 5: GENERAL DISCUSSION

Past research on bilingual sentence processing has focused on examining whether the parsing strategies adopted during L2 sentence comprehension differ from those employed when reading in the L1. Various linguistic (e.g., verbal information, structure-based principles) and individual variables (e.g., working memory, proficiency level and immersion) have been shown to influence the parsing of different ambiguous syntactic constructions. Studies have provided evidence suggesting that L2 learners primarily rely on verbal information (e.g. Clahsen & Felser, 2006; Juffs, 1998b) whereas others indicate that L2 readers initially rely on structure-based principle (e.g., Frenck-Mestre & Pynte, 1997). The lack of strong evidence that L2 learners initially make use of a particular types of information (i.e., structural vs. lexical) during sentence comprehension has open the door for additional research to further investigate the claim that L2 speakers never adopt structure-based parsing principles, but instead rely on lexical information to parse sentences in the L2. One of the goals of the present research was to determine whether highly fluent L2 speakers employ structure-based parsing principles in a way that is comparable to monolingual speakers when resolving structurally ambiguous constructions in both their languages. In addition, recent evidence has indicated that individual characteristics, such as years of immersion experience in a second language, affect the processing of modifiers. One important question is whether the processing of other types of phrases is equally susceptible to the linguistic experiences available in the environmental setting. Hence, the second objective of the present dissertation was to

identify whether amount of immersion experience in a second language modulated the parsing of argument phrases, such as objects and subjects.

To address these questions, a moving-window experiment was conducted comparing the reading performance of English and French monolinguals with that of French-English bilinguals and English-French bilinguals with different years of immersion in the L2 environment. The structure investigated was structurally ambiguous in that the post-verbal noun phrase in an adjunct clause could be interpreted as a direct object (an argument) or as a sentential subject (another argument).

In this chapter, a summary of the major findings in the English and the French experiments is presented, followed by a discussion of the role of immersion experiment during L2 sentence processing. The implications of the findings for the *Shallow Structure Hypothesis* of Clahsen and Felser are also discussed. The chapter ends with a discussion of the implications of the findings obtained here for a working definition of proficiency.

5.1 Summary of Major Findings

The present dissertation examined the parsing of structurally ambiguous English and French sentences by non-native and native readers. These two languages present cross-linguistic disparities in the type of verbal information they convey. In English, a sentence like *When the naïve explorer lands the damaged helicopter stops in a chaotic manner* contains an ambiguous noun phrase that can either be interpreted as the direct object of the adjunct verb *lands* (an optionally transitive verb) or as the subject of the following clause, which is the intended interpretation for this sentence. In addition, the

participants also read unambiguous control sentences, in which the verb of the adjunct clause was intransitive (i.e., *panics*). In the French experiment, both types of sentences read did not present any structural ambiguity, as they contained verbs that were used intransitively (e.g., as in *Quand l'explorateur naïf atterrit son hélicoptère abîmé s'arrête de façon chaotique*). In the case of the English sentences, the nature of the ambiguity is expected to cause reading difficulties. Because the French sentences lack structural ambiguity, they are not predicted to cause difficulty for the readers.

The data show that the monolingual English participants experienced processing difficulties during the comprehension of both sentence types. The reading patterns obtained in the sentence containing an optionally transitive adjunct verb suggest that the monolingual group initially interpreted the ambiguous noun phrase (e.g., *the damaged helicopter*) as the direct object of the verb in the adjunct clause. As a result, elevated reading times were observed when reaching the disambiguating region (word 9), because it is here that the subjects realized that the ambiguous noun phrase should have been treated as the subject of the main clause. When reading the sentences containing an intransitive adjunct verb, the reading patterns obtained at word 6 indicated that the English monolinguals also incorrectly interpreted the post-verbal noun phrase as the direct object of the adjunct verb. Once verbal information about the intransitivity of the verb was accessed, a reanalysis process was initiated. In this condition, the lack of longer reading times at word 9 suggests that the English monolinguals evaluated the feasibility of the post-verbal noun phrase as the direct object of the adjunct verb, rejected it based on the latter's subcategorization information, and rapidly initiated the reanalysis process.

The results of the monolingual French group did not reveal significant differences in reading patterns for the two structures examined. A parsimonious explanation of this finding is that the monolingual French speakers also initially assigned the role of direct object to the post-verbal noun phrase in the adjunct clause. In the experimental and control sentences, then, the parser initiated a revision process once transitivity information of the adjunct verb is accessed. Behaviorally, however, it is not possible to observe the expected increase in reading times linked to a revision process because, in both conditions, the adjunct verbs were used intransitively. However, the fact that the monolingual French group was slower than the two bilingual groups to read the experimental stimuli provides some evidence that the sentences were difficult for these participants.

The reading patterns obtained for the group of English-French bilinguals, who lived in a bilingual environment in Montreal, indicated that these participants were able to process both their languages in a way that was comparable to the English and French monolingual groups. This finding highlights one important point: that these speakers are not transferring information from their first language when processing sentences in their second language, but rather they are parsing the second language using information particular to that language.

Finally, the high-immersion French-English bilinguals showed evidence of parsing sentences in their L2 much in the same way as native English speakers. The reading patterns obtained in the English experiment indicated that these bilinguals experienced difficulty when reaching the disambiguating region in the experimental

condition, indicating that they interpreted the ambiguous noun phrase as a direct object. Contrary to the monolingual English speakers, no significant differences in reading times were observed when they processed the post-verbal noun phrase in sentences with an intransitive adjunct verb. The reading patterns obtained in French suggest that they parsed the structures in their first language unlike French monolingual speakers. In fact, there was an increase in reading times at word 9, which is comparable to that observed in the English experiment, suggesting that these participants are applying the same parsing routines that they used in English. In contrast, French-English bilinguals with limited immersion experience showed evidence of transferring L1 information when computing syntactic structure in their L2 (i.e., *forward* transfer).

To conclude, proficiency level, as assessed by the MELICET in English and the TEF in French, did not affect the parsing of object/subject ambiguous constructions. Similarly, working memory capacity, as measured with the Waters and Caplan (1996), did not modulate the reading patterns for the constructions under investigation.

5.2 The role of immersion experience

I suggested earlier that the findings for the monolingual English speakers and the English-French bilinguals reading in English provide evidence in favor of structure-based accounts of parsing, such as the Garden Path Model, that initially favor syntactically simple structures (i.e., structures with the fewest possible number of syntactic nodes). Thus, if faced with a choice of parsing a noun phrase as a direct object or as a sentential subject, the Garden Path Model predicts that the parser will favor the former over the

latter. In this study, both the monolingual English speakers and the English-French bilinguals showed evidence of having done precisely this. That is, these readers parsed the post-verbal noun phrase as a direct object regardless of whether the adjunct verb was optionally transitive or intransitive. In the optionally transitive condition, reanalysis of the ambiguous noun phrase from the object of the adjunct verb to the subject of the main clause is responsible for the increased reading times. In addition, because the Garden Path Model stipulates that structure based-parsing principles apply before the parser can consider other sources of potentially useful information, such as verb subcategorization, selectional information or argument structure, it makes the strong prediction that a noun phrase following an intransitive verb should also be initially interpreted as its direct object. Once again, this prediction is borne out in the results. Both the monolingual English speakers and the English-French bilingual group showed increased reading times at the post verbal noun phrase when the verb in the adjunct clause was intransitive. This finding is explained away if one assumes that the parser initially assigned the role of direct object to the noun phrase, and only later abandoned it, when the incompatibility of the subcategorization frame of the verb became available. This initiated a re-analysis process (resulting in the increased reading times), which was completed while the participants were still processing the post-verbal noun phrase. Despite the adequacy of the Garden Path Model in accounting for these findings, it is unlikely to provide a complete explanation of the results obtained in this dissertation. In particular, the model is limited because it does not take into account how exposure to language input influences parsing decision. In this respect, a more suitable explanation is one such as

Linguistic Tuning, which postulates that cross-linguistic variation or even individual differences in parsing preferences may be linked to different learning histories and to exposure to particular linguistic patterns.

Support for Linguistic Tuning comes from the results of the high-immersion French-English participants. Their intense contact with their L2 English, and concomitant decreased exposure to French, appears to have made the English verbal information more accessible than the information in the L1, thereby affecting the processing of their native language. That is, when reading the French sentence *Quand l'explorateur naïf atterrit son hélicoptère abimé s'arrête de façon chaotique*, these bilinguals accepted the noun phrase *son hélicoptère* as the direct object of *atterrit*, and committed to this interpretation despite the fact that the verb argument structure of the French verb *atterrir* does not allow for a direct object to follow it. The resulting garden-path was identified by the processor when it encountered the disambiguating region, and the misanalyzed phrase was reanalyzed as a subject. Given that in English, the translation equivalent of *atterrir* (*to land*) accepts a noun phrase object, and that the results of the high immersion French-English bilingual in the English experiment also showed the garden-path effect, a likely explanation for the French result is that these bilinguals transferred information from the L2 to the L1 (*backward* transfer). This finding is consistent with those reported in other studies investigating the processing of syntactically ambiguous constructions in the L2. For example, the evidence presented in Dussias & Sagarra (2007) and Fernández (2003) demonstrates that bilingual speakers sometimes resolve structural ambiguity when parsing their first language using strategies

directly derived from their second language. In these studies, years of L2 immersion experience was identified as the source of the changes in parsing routines.

In discussing the occurrence of the 'erosion' of the L1 system, it seems important to know whether there has been a change in the participants' L1 knowledge (the tacit linguistic information, be it syntactic, semantic, pragmatic, etc. that resides in the speaker's mind) or whether there has been a change in the participant's control of that knowledge (the on-line access mechanisms that the speaker draws upon to deploy that knowledge during real-time processing) (Sharwood Smith & Van Buren, 1991). Until we have a refined theory of how syntactic parsing and linguistic knowledge interact, we will not be able to provide an unequivocal answer to this question. Therefore, the attempt in this discussion to disentangle knowledge from the on-line performance mechanisms that are responsible for accessing and using knowledge is rather speculative.

To begin with, let's take the task of the parser to be that of assigning a syntactically licit structure to an incoming string of words for subsequent interpretation (Fodor, 1998a). Given that for a syntactic parse to take place, the parser must apply the facts of the available grammar, we might propose as a working hypothesis that difficulty at the level of retrieval and integration of information (i.e., control) would manifest itself in terms of dysfluent reading (i.e., significantly longer reading times by L2 speakers compared to those observed for monolingual readers). The fact that reading times in the French experiment were similar for the monolingual French speakers and for the high-immersion French-English bilinguals does not suggest a loss of fluent access on the part of the latter group of participants. Rather, it seems to be the case that for these bilinguals,

the change has occurred at the source of knowledge that guides monolingual French speakers to reject attachment of the post-verbal noun phrase as the direct object. The results also suggest that the sources of information that guide attachment processes of constituents that hold tighter syntactic relations, as are those between verbs and their core arguments, are permeable to intrusion from other linguistic systems (see Prince, 1992; Silva-Corvalán, 1996 for additional evidence indicating the permeability of linguistic systems at the discourse-pragmatic level). This finding is significant because it adds to the growing body of evidence suggesting that the putatively stable L1 system is changeable and open to influence from the second language (Fishman, 1972).

The housing of two linguistic systems in one mind will not, of course, inevitably lead to the information of one system permeating into the other system. The evidence gathered from the English-French bilinguals, for example, is compatible with the view that they processed their first language like monolingual English speakers and their second language like monolingual French speakers. Several explanations could account for the 'monolingual-like' behavior of the English-French bilinguals and the process of backward transfer observed in the French-English bilinguals. One is proficiency level. That is, it is possible that the English-French bilinguals were equally proficient in their two languages and that the French-English bilinguals were more proficient in their L2 English, and that this influenced how they read in their two languages. This explanation is unlikely, though, when considering the results of the proficiency tests. The Language History Questionnaire indicates that English-French bilinguals clearly considered their language abilities in English significantly better than in French. Results of the

standardized test scores in English were also higher than the scores obtained in the French test. Hence, their performance on the English and French experiments is doubtfully linked to their level of proficiency in the two languages. A similar argument can be made for the French-English bilinguals. That is, the French-English bilinguals rated their language abilities in French significantly higher than in English. The composite score on the French language test was also higher than the score on the English test. For the French-English bilinguals, then, it also seems unlikely that level of proficiency is responsible for the result.

As suggested at the beginning of this section, a more likely explanation is that immersion in a bilingual environment for the English-French bilinguals and in a predominantly English environment for the French-English bilinguals impacts their language dominance. The English-French bilinguals are dominant in both their languages most likely because of the constant flux of input in their environment. For the high-immersion French-English bilinguals, the prolonged residence in an English environment has impacted the L1 linguistic system. As suggested by Fishman (1972), the bilinguals' two languages compete with one another for processing space and processing resources. If the linguistic context is favorable (e.g., when there is diminished input in one of the two languages), patterns of dominance for one or other language may be established (Porte, 1999). A change in the pattern of dominance, then, could explain why the high-immersion French-English bilinguals parsed their first language using information from the second language. In a similar vein, the "stable dominance" of the English-French

bilinguals, promoted by the central role of the two languages in these bilinguals lives, explains their “monolingual-like” behavior.

5.3 The Shallow Structure Hypothesis

As stated in Chapter 2, Clahsen and his colleagues have argued that the structure-building processes during online L2 sentence comprehension are fundamentally different from the representations built by native speakers (or native readers) of the target language. According to a recent proposal, the *Shallow Structure Hypothesis* (Clahsen and Felser, 2006), native readers are said to employ principle-based parsing strategies as well as lexical-semantic information when computing a syntactic structure for a temporarily ambiguous string of words. Non-native readers, on the other hand, are said to lack the ability to use structure-based parsing principles during L2 sentence comprehension. Ambiguity resolution in these speakers is said to rely primarily on information provided by the lexical-semantics of verbs. The findings of the high immersion French-English speakers offer some support for this hypothesis.

This bilingual group clearly showed that they were able to parse ambiguous input in their second language, that they were successful at comprehending such input, and that their processing output (i.e., word-by-word reading pattern) was very similar to that produced by monolingual English speakers. At first glance, these results would indicate that the high-immersion French-English group and the monolingual English participants constructed very similar syntactic structures. However, the fact that the locus of processing difficulty for the native English readers (i.e., the monolingual English

speakers and the English-French bilinguals) and non-native readers (i.e., the high-immersion French-English bilinguals) manifested itself at difference points in the sentence, suggests that the non-native readers did not build the same structure as the native readers. The monolingual English speakers and the English-French bilinguals alike exhibited difficulty early in the sentence, at the ambiguous noun phrase when the verb in the adjunct clause was intransitive, as well as later during processing (at the disambiguating region) when optionally transitive verbs appeared in the adjunct clause. The French-English bilinguals, on the other hand, only experienced difficulty at the disambiguating region. The presence of an intransitive verb in the adjunct clause did not cause any disruptions during reading.

As discussed earlier, the results for the native readers can be explained if one assumes that they initially apply structure-based parsing principles. However, the results of the French-English bilinguals suggest that they did not initially attach the ambiguous noun phrase to the adjunct verb, as predicted by Minimal Attachment. If they had done so, we would have observed the same increase in reading times at the ambiguous noun phrase in the intransitive condition that was observed for the two groups of native English readers. The results of these French-English bilinguals, then, are better explained by postulating that they ‘waited’ until lexical semantic information was available to make an attachment decision. That is, at the point they reach the adjunct verb, the bilinguals access its subcategorization frame but delay attachment decisions until they reach a noun phrase that can potentially fill the verbs’ thematic roles. Presumably, upon encountering the post-verbal noun phrase, an evaluation process is initiated to determine its plausibility

as a direct object. If the noun phrase is plausible, bilinguals attach it to the verb; if it is not, they continue the search until another potential noun phrase is encountered (cf. Juffs & Harrington, 1996). On this account, an increase in reading times is expected only at the disambiguating region for optionally transitive, when it becomes evident that the post-verbal noun phrase occupies a sentential subject position. And this is what we find. The results for the high-immersion group, then, are most compatible with an account that capitalizes on the primacy of lexical-semantic information during L2 sentence processing, such as the Shallow Processing Hypothesis.

5.4 L1 transfer

Adult L2 learners embark of the task of L2 acquisition with a fully developed language system. Consequently, an important issue in the second language acquisition literature concerns the impact that the native language has on the acquisition and processing of the second language. In this study, the reading patterns of the low-immersion French-English bilingual group suggest that these participants transferred information associated with their L1 French, during the processing of English sentences. Scores on the MELICET for this group of speakers were rather high. Yet, despite the high level of L2 proficiency, the low-immersion French-English bilinguals parsed the L2 input using information from their L1. This suggests that standardized tests of language proficiency do not adequately capture the nuances of linguistic performance that characterize fluent native use. Congruent with second language curriculum, language tests have traditionally emphasized the assessment of the degree of competence or

mastery that an individual possesses in language areas such as reading, writing, listening, speaking, grammar and vocabulary. Specifically, L2 proficiency assessment tools are typically designed to reveal the extent to which an individual is able to understand and use the second language for communicative and academic purposes. Although proficiency tests reveal valuable information about L2 learners' knowledge and use of the target language, the need for a reevaluation of how the concepts of proficiency is operationalized is underscored by the fact that the low-immersion French-English speakers, who are competent users of the L2, who obtained high scores on standardized tests in the L2 proficiency, and who are able to successfully function on an L2 academic setting, still used L1 information to process the second language.

There is a need to re-evaluate how the concept of proficiency is defined. Generally, standardized tests assess linguistic competence (reading, writing, listening and speaking) and ignore other important aspects of language abilities, such as processing, which is an inherent part of fully mastering a language.

5.5 Conclusions and Future Directions

The experiment reported here indicates that immersion experience does influence the processing of arguments. The data show that extensive exposure to the L2 is capable of influencing the processing of object/subject constructions in an L1, suggesting that the primary language system of bilinguals is susceptible to change. On the other hand, English-French bilingual speakers who are exposed to both languages in their daily lives

in various situations did not show signs of transfer regarding verbal information from their first language while reading constructions in their first or second language.

Based on the pattern derived from these results, we have argued that a variable such as immersion is essential to better understand how bilinguals process sentences in two languages.

From a theoretical perspective, the findings of this dissertation do not support parsing theories (*e.g.*, Construal) that postulate differences in the processing of different constructions such as adjunct and argument phrases. Both types of phrases appear to be sensitive to the influence of external factors such as the linguistic environment in which they evolve. The results of the present experiment exhibited that certain bilinguals appear to be able to parse argument constructions using structure-based principles in a way that is comparable to native speakers, whereas others may rely on lexical-semantic information, as suggested by the Shallow Structure Hypothesis (Clahsen & Felser, 2006)

However, as mentioned in chapter 4, the adjunct verbs in the French experiment are of the same nature; therefore it is not possible to identify whether readers apply minimal attachment or rely on lexical information in this language and whether monolinguals and bilinguals use similar parsing principles. In order to address this limitation, it would be necessary to add a condition in French which contains an optionally transitive verb, allowing for the distinction in the application of parsing principles, as exemplified below:

1. *Juste avant que la fille mange la pizza commandée arrive du restaurant local.*
2. *Juste avant que la fille parte la pizza commandée arrive du restaurant local.*

In the case that readers apply structure-based principles such as minimal attachment they should interpret the NPs (*la pizza*) in sentences as (1) as the direct object, resulting in elevated reading times when readers encounter the verb of the second clause (*arrive*). In addition, as observed in the present experiment, elevated reading times at the beginning of the ambiguous noun phrase are also expected in sentences containing intransitive verbs as in (2). Readers may also incorrectly interpret the ambiguous noun phrase as the direct object of the verb, but rapidly abandoned the interpretation early in the sentence, while processing the same ambiguous noun phrase.

Although plausibility was not manipulated in the present Experiment, it is a valuable variable to further assess the parsing principles favored by readers and to also examine in more details the Shallow Structure Hypothesis.

3. *Whenever the naïf explorer lands his body shakes with fear.*

Adding a condition containing an implausible noun phrase as in (3) will allow us to observe whether readers initially pay attention to plausibility information as different reading patterns would be observed depending on the type of information considered first by the readers. Additional investigation will reveal valuable information on how the knowledge of two languages interacts with one another and provide critical information for models of bilingual sentence processing.

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Appendix A: LANGUAGE HISTORY QUESTIONNAIRE

Language History Questionnaire		For office use only	
Pennsylvania State University		Participant number	
University Park, PA 16802		File	
<p>This questionnaire is designed to give us a better understanding of your experience learning a second language. We ask that you be as accurate and thorough as possible when answering the following questions. Once you have finished the questionnaire, please chose <i>file</i>, then <i>save</i> as and change the file name to "language history questionnaire_Last name_First name". Then, please email the completed questionnaire to the experimenter for scheduling (gab182@psu.edu). Thank you for your participation in this study!</p>		Date	
Last Name			
First Name			
Phone Number (with area code)			
Email Address			
Sex (M/F)			
Age (in years)			
Native Country			
Number of years spent in the U.S.			
Number of years spent in U.S. schools/university			
Do you have any known visual or hearing problems (corrected or uncorrected)?			
What is(are) your first language(s) (i.e. language first spoken)? If more than one, please briefly describe the situations in which each language was used.			
Please list any language(s) you consider to be your second language(s) excluding those in question 11.			
What languages were spoken in your home while you were a child and by whom?			
Please list the language(s) the following people speak to you now :			
(a) Mother			
(b) Father			
(c) Closest friend			
<p>List below, from most fluent to least fluent, <u>all</u> of the languages you have had experience with. Also, please specify the age in years at which you began to learn the language, the total number of years you used the language and the context(s) in which you used it. For example, "English, birth, 21, home and school". Include <u>all</u> languages to which you have been exposed, even if you never had formal training in the language or cannot read, speak or write the language. Please remember to list your native language!</p>			
Language	Age at which you started learning	Total number of years used	Learning Situation(s)

Please answer the following four questions (16a-d) according to the ONE language that you consider to be your "most native" language. Please write that language here.	
---	--

(a) Please rate your first language reading proficiency on a ten point scale (1 = not literate, 10 = very literate)	
--	--

(b) Please rate your first language writing proficiency on a ten point scale (1 = not literate, 10 = very literate)	
--	--

(c) Please rate your first language conversational fluency proficiency on a ten point scale (1 = not literate, 10 = very literate)	
---	--

(d) Please rate your first language listening proficiency on a ten point scale (1 = not literate, 10 = very literate)	
--	--

If you are currently enrolled in any language courses, please list them.	
--	--

**At this time, if you do not have a second language, you have completed the questionnaire.
Thank you! If you do have a second language, please answer the remaining questions.**

For each language you consider to be a second language, how many years have you studied each language? Also, please indicate the setting(s) in which you have had experience with the language(s) (i.e. classroom, with friends, foreign country...)	
--	--

What languages other than your native or second language do you speak fluently?	
--	--

What languages other than your native or second language do you read fluently?	
---	--

What languages other than your native or second language do you write fluently?	
--	--

What languages other than your native or second language do you understand when they are spoken?	
--	--

Please answer the following questions according to the ONE language that you consider to be your second language. Please write that language here.	
---	--

(a) Please rate your second language reading proficiency on a ten point scale (1 = not literate, 10 = very literate)	
---	--

(b) Please rate your second language writing proficiency on a ten point scale (1 = not literate, 10 = very literate)	
---	--

(c) Please rate your second language conversational fluency proficiency on a ten point scale (1 = not literate, 10 = very literate)	
--	--

(d) Please rate your second language listening proficiency on a ten point scale (1 = not literate, 10 = very literate)	
---	--

Thank you for participating in our survey!

Appendix B

FRENCH PROFICIENCY TEST

TEF

Date: _____

Participant #: _____

Compréhension écrite :

Section A :

Dans cette section, vous prendrez connaissance de deux documents et vous répondrez aux questions correspondantes.

Pour chaque question, entourez la lettre correspondant à la bonne réponse sur la feuille.

<p>Honfleur 8'272 habitants, située sur l'estuaire de la Seine aux portes du pays d'Auge et de la côte fleurie, offre une grande séduction avec son vieux bassin, l'église Sainte Catherine, ses rues pittoresques et son port. Durée de la visite : 2 heures 1/2</p>

Question 1

Quelle est la nature de ce document ?

- A. Le résultat d'une enquête sociologique.
- B. Une publicité sur une région.
- C. Une information touristique.
- D. Un article sur les loisirs.

Question 2

Où se situe la ville dont parle le document ?

- A. Au bord de la mer
- B. A la montagne
- C. A la campagne
- D. Sur une île

Votre énergie retrouvée vous fera reprendre le chemin du succès. Restez ferme en ce qui concerne les affaires professionnelles. Les affaires de cœur passeront au second plan. Si vous décidez de faire de gros achats, regardez d'abord votre compte en banque et ne vous laissez pas influencer. Vous serez appelé à beaucoup voyager pour votre plaisir.

Question 3

Sous quelle rubrique de journal, peut-on lire cet article ?

- A. Faits divers
- B. Horoscope
- C. Santé
- D. Loisirs

Question 4

Quel sujet n'est pas évoqué dans le texte ?

- A. La vie sentimentale.
- B. L'argent.
- C. La vie sociale.
- D. Le travail.

Section B

Dans cette section, vous prendrez connaissance des quatre documents suivants et répondez aux questions correspondantes

Pour chaque question, entourez la lettre correspondant à la bonne réponse sur la feuille.

Le saviez-vous ?

Les historiens se sont toujours servis de l'œuf – qualifié de « viande du pauvre » - comme d'un repère pour définir le coût de la vie. Premier producteur européen, la France arrive en troisième position de la consommation mondiale, avec deux cent soixante œufs par an et par habitant. La palme appartient aux Israéliens, avec plus de quatre cents unités. Quatre-vingt-dix pour cent des œufs français sont produits dans des élevages spécialisés. Le reste provient de poules élevées selon d'autres critères. Le consommateur est concerné par la catégorie A, dans laquelle on trouve les œufs extra-frais et frais. Dans le réfrigérateur, il faut placer les œufs sur la pointe, éliminer ceux qui pourraient être fêlés et surtout ne jamais les laver pour ne pas détruire la protection de la coquille.

Question 5

Les Israéliens

- A. sont les premiers producteurs d'œufs au monde.
- B. consomment autant d'œufs que les Français.
- C. possèdent le plus grand nombre d'unités de production au monde.
- D. sont les premiers mangeurs d'œufs au monde.

Questions 6

Entrent dans la catégorie A

- A. les œufs extra-frais et frais.
- B. les œufs produits en élevage spécialisé.
- C. les œufs de poules élevées en milieu naturel.
- D. les œufs importés en France.

Question 7

Pour la conservation des œufs, il est recommandé

- A. de les laisser à l'air libre.
- B. de les laisser à la lumière du jour.
- C. de les laver avant de les mettre dans le réfrigérateur.
- D. de les placer directement au frais.

Deux vitrines brisées : Les auteurs interpellés

De nouvelles dégradations ont été commises, au cours de la soirée de mercredi, dans le centre-ville de Saint-Jean. Entre 21 heures et 22 heures, un groupe de jeunes passablement éméchés a brisé la vitrine de la Banque Royale et la porte de la pharmacie, rue de Nice. Appelés aussitôt par des témoins, les gendarmes ont interpellé les auteurs en flagrant délit : trois jeunes de la ville et des environs, âgés d'une vingtaine d'années. Ils ont été placés en garde à vue à la gendarmerie, où l'enquête se poursuit, car il semble que ces nouvelles dégradations se situent dans le prolongement des vols et dégradations effectués ces dernières semaines.

D'après La Nouvelle République

Question 8

Les auteurs du délit ont été

- A. arrêtés sur les lieux du délit.
- B. libérés.
- C. arrêtés chez eux.
- D. blessés.

Question 9

Ils étaient tous originaires

- A. de Nice.
- B. de la même région.
- C. de Saint-Jean.
- D. d'une région différente.

Question 10

L'enquête se poursuit parce que

- A. d'autres coupables sont recherchés.
- B. le montant des dégâts n'est pas connu.
- C. ce ne sont pas les premières dégradations commises.
- D. des témoins manquent à l'appel.

Section C

Dans le texte ci-dessous, cinq phrases ont été supprimées. Retrouvez chacune d'elles parmi les quatre phrases qui vous sont proposées et entourez la lettre correspondant à la bonne réponse sur la feuille.

Des Femmes « accros » à leur voiture-bulle

Une étude de presse dresse le portrait de ces irréductibles.

Proposez-leur un arrêt de bus à leur porte, sur une ligne desservie fréquemment par un matériel spacieux et non polluant :(19).... Accros du volant, éprises du sentiment de « liberté » que semble leur donner leur automobile, ainsi sont les femmes « pro-voitures » ... (20)... La psychosociologue C. Espinasse a présenté les résultats d'une étude qualitative sur « les besoins et les stratégies des femmes pro-voitures ». Celle-ci a été réalisée avec P. Buhagiar à Rennes et à Nanterre, au cours du premier semestre 1999, auprès de ces irréductibles qui préfèrent la voiture pour se rendre au travail. ... (21)... Parce que leur voiture, c'est leur monde, un lieu privé, un sas de décompression. « C'est une loge dont les hommes sont exclus » note la psychosociologue, où elles se sentent chez elles, écoutent la radio, chantent à tue-tête, se maquillent, boivent et mangent avec un plaisir sans bornes. ... (22) ... A contrario, les transports en commun empêchent l'ouverture de cette petite fenêtre de liberté. « Ils obligent les femmes à attendre. ... (23)... . Ils sont associés à la confrontation à l'autre, particulièrement pénible le matin. »

D'après Libération

Question 11

- A. elles y monteront tout de suite.
- B. elles n'en voudront pas.
- C. elles hésiteront à y monter.
- D. elles renonceront à leur voiture.

Question 12

- A. Elles amusent les professionnels des transports en commun.
- B. Les professionnels des transports en communs les approuvent.
- C. Les professionnels des transports en commun ne désespèrent pas de les faire changer d'attitude.
- D. Elles font le désespoir des professionnels des transports publics.

Question 13

- A. Normal, leur quartier n'est pas bien desservi par les transports en commun.
- B. Pourtant, elles considèrent leur quartier plutôt bien desservi par les transports en commun.
- C. Logique, puisque les transports en commun sont rarement à l'heure.
- D. Essentiellement parce que les transports en commun sont trop lents.

Question 14

- A. Plaisir encore plus grand quand elles sont en présence de leur conjoint ou de leur enfants.
- B. Plaisir d'autant plus grand que c'est interdit.
- C. Plaisir d'autant plus grand qu'elles ne pouvaient pas le faire chez elles.
- D. Plaisir d'autant plus grand qu'elles ne sont accompagnées ni de leur conjoint, ni de leurs enfants.

Question 15

- A. Ils les contraignent aussi à laisser leur voiture au garage.
- B. Ils les forcent aussi à supporter les embouteillages.
- C. Ils les forcent ensuite à voyager debout pendant des heures.
- D. Ils les contraignent également à choisir un trajet.

Section D

Dans cette section, cinq phrases sont proposées et, pour chacune d'elles, quatre reformulations. Pour chaque question, choisissez la reformulation qui a le sens le plus proche de la phrase originale. Entourez la lettre correspondant à la bonne réponse sur la feuille.

Question 16

Au cours de leurs recherches, les archéologues ont mis au jour une statue.

- A. Les archéologues ont reconstitué une statue.
- B. Les archéologues ont découvert une statue.
- C. Les archéologues ont exposé une statue.
- D. Les archéologues ont placé une statue en plein soleil.

Question 17

Nous aurions pu réussir l'examen si nous avions travaillé davantage.

- A. Nous n'aurions pas pu réussir l'examen sans travailler.
- B. Nous aurions dû travailler plus pour réussir l'examen.

- C. Nous aurions pu réussir l'examen en travaillant moins.
- D. Nous n'aurions pas réussi l'examen, même en travaillant plus.

Questions 18

Je ne saurais vous dire le nombre exact de manifestants.

- A. Je ne pourrais pas compter les manifestants, il y en a trop.
- B. Je ne peux pas dire si les manifestants sont nombreux.
- C. Je n'arriverais pas à vous dire tous les noms des manifestants.
- D. Je ne pourrais pas vous donner le compte exact des manifestants.

Questions 19

Un petit repas dans ce restaurant, ça te dirait ?

- A. Que veux-tu dire au sujet de ce restaurant ?
- B. Ne devait-on pas manger dans ce restaurant ?
- C. Ne m'as-tu pas dit que tu mangerais dans ce restaurant ?
- D. Ça te ferait plaisir de manger dans ce restaurant ?

Question 20

Il est resté de glace en apprenant la nouvelle.

- A. La nouvelle l'a apparemment laissé insensible.
- B. Il s'est ému en apprenant la nouvelle.
- C. La nouvelle ne l'a pas vraiment étonné.
- D. Il a mal réagi à l'annonce de la nouvelle.

Lexique/ Structure

Section A

Entourez la lettre correspondant à la bonne réponse sur la feuille.

Question 21

Envoyez votre règlement avant le 31 mars, le de la poste faisant foi.

- A. bureau
- B. cachet
- C. facteur
- D. guichet

Question 22

On sera sûr de trouver du fil, des boutons et des aiguilles dans une

- A. blanchisserie
- B. droguerie
- C. quincaillerie
- D. mercerie

Question 23

Dans ce guide touristique, vous trouverez une sélection d'hôtels de bon confort..... sur tout le territoire.

- A. disposés
- B. échelonnés
- C. répartis
- D. partagés

Question 24

La réussite de Jacques est plus surprenante qu'il n'avait révisé !

- A. d'autant
- B. pour autant
- C. autant
- D. autant de

Question 25

Afin d'utiliser cet appareil dans les meilleures conditions, lisez attentivement

- A. l'avis
- B. le formulaire
- C. la notice
- D. le procédé

Section B

Dans le texte suivant, choisissez le mot ou groupe de mots qui a le sens le plus proche du mot ou groupe de mots souligné. Entourez la lettre correspondant à la bonne réponse sur la feuille.

L'agriculture biologique

L'idée d'agriculture biologique voit le jour en Europe, dans les années 1920, sous l'impulsion (26) d'un philosophe allemand, Rudolph Steiner.

Il s'agit d'une agriculture exempte (27) d'engrais chimiques, de pesticides ou d'herbicides de synthèse, basée sur le respect des saisons et des écosystèmes. Grâce à des techniques à la fois très anciennes et sophistiquées (28), elle préserve (29) l'équilibre entre les organismes vivants qui habitent les sols et les arbres et les ressources naturelles. En France, en 1980, l'Etat a reconnu officiellement l'agriculture biologique et ses produits et a créé, huit ans plus tard, le label « AB » (30).

Question 26

- A. la découverte
- B. l'expérience
- C. l'influence
- D. le raisonnement

Question 27

- A. dépourvue
- B. enrichie
- C. fertilisée
- D. recyclée

Question 28

- A. complexes
- B. innovantes
- C. naturelles
- D. rudimentaires

Question 29

- A. obtient
- B. protège
- C. recherche
- D. retrouve

Questions 30

- A. l'enseigne
- B. le logo
- C. la norme
- D. la règle

Section C

Entourez la lettre correspondant à la bonne réponse sur la feuille.

Question 31

Le directeur est en mission vendredi 10 mai.

- A. déjà
- B. jusqu'au
- C. pendant
- D. pour

Question 32

J'ai acheté les chaussures j'avais envie.

- A. que
- B. dont
- C. auxquelles
- D. desquelles

Question 33

Des amis m'ont invitée dans l'appartement ils ont emménagé depuis peu.

- A. auquel
- B. dont
- C. où
- D. qu'

Question 34

.... Prend des cours de piano, il a fait de réels progrès.

- A. Dès qu'il
- B. Pendant qu'il
- C. Quand il
- D. Depuis qu'il

Question 35

Ce serait possible mardi après-midi, un autre jour ne vous convienne mieux.

- A. à moins qu'
- B. alors qu'
- C. pourvu qu'
- D. soit qu'

Question 36

Paul ne sait pas encore la nouvelle. Je vais annoncer.

- A. l'y
- B. lui l'
- C. la lui
- D. lui en

Question 37

Auriez-vous une cravate qui avec ce costume et cette chemise ?

- A. aille
- B. ira
- C. va
- D. allait

Question 38

Il y avait longtemps que nous d'aller nous installer à la campagne

- A. aurons décidé
- B. avions décidé
- C. avons décidé
- D. sommes décidés

Questions 39

Le code d'entrée, tu souviendras ?

- A. te le
- B. t'en
- C. t'y
- D. le te

Question 40

Quand le coureur la ligne d'arrivée, le public l'a acclamé.

- A. a passé
- B. passe
- C. passerait
- D. est passé

Section D

Dans certaines phrases du texte suivant, des parties (A, B, C, D) ont été soulignées. L'une de ces parties est incorrecte. Entourez la lettre correspondant à la bonne réponse sur la feuille.

Greffe : Les mains d'un autre

Exemple :

Depuis janvier 2000, en France, un jeune peintre en bâtiment de trente-trois ans vit avec
 une partie des avant-bras et les mains d'un autre homme, récemment décédés.
 A B
 C D

Dans cette première phrase, il faut entouré « D » car la formulation correcte est « décédé ».

Question 41

Le patient avait perdu les siens en 1996, lorsque l'explosion d'une fusée artisanale.
 A B C D

Question 42

L'opération a duré dix-sept heures ; elle a mobilisé une équipe internationale de
 chirurgiens, spécialistes en transplantation, orthopédie et micro-chirurgie, soient un total
 de cinquante participants.
 A B C D

Question 43

Après la polémique suscitée pour sa précédente intervention – la première greffe de main
 en septembre 1998- le chirurgien a consulté un groupe d'experts.
 A B C D

Question 44

Ces spécialistes l'ont autorisé à pratiquer cinq doubles greffes, estimants, que le bénéfice
 serait supérieur chez les personnes privées de leurs deux mains.
 A B C D

Question 45

Des nouvelles tentatives sont d'ores et déjà prévues pour les prochains mois : les
 chirurgiens espèrent ainsi pouvoir redonner un peu de liberté aux personnes amputées
 bilatéralement et aux enfants nés sans mains.
 A B C D

Appendix C

ENGLISH PROFICIENCY TEST

MELICET-GCVR

Date: _____

Participant #: _____

Grammar

Choose the word or phrase that best completes the conversation.

Question 1

“What’s the matter?”

“I feel _____ out.”

- A. tire
- B. tiring
- C. tired
- D. being tired

Question 2

“May I bring you a cup of tea?”

“I prefer coffee _____ tea.”

- A. to
- B. than
- C. rather
- D. instead

Question 3

“Have you ever gone to Tahiti?”

“No, but I have _____ for a long time.”

- A. wanted
- B. been wanted
- C. wanting to
- D. been wanting to

Question 4

“What do you think of American football?”

“I think it’s _____ sport.”

- A. very dangerous
- B. very dangerous a
- C. too dangerous a
- D. too dangerous

Question 5

“What shall we do about this problem?”

“John suggests _____ a meeting.”

- A. of calling
- B. that call
- C. that will call
- D. calling

Question 6

“Why did John refuse to pay for his dinner?”

“Because _____ two hours by the time he was served.”

- A. he’s been waiting
- B. he’s been waited
- C. he’d been waiting
- D. he’d been waited

Question 7

“Does John have a lot of accidents at work?”

“Yes. He isn’t _____ he should be.”

- A. as careful work
- B. as careful as a worker
- C. as careful worker as
- D. as careful a worker as

Question 8

“Did David enter the writing contest?”

“Yes, he thinks he has _____.”

- A. a chance to win
- B. a chance of win
- C. a chance win
- D. the chance to win

Question 9

“Does Barbara have a difficult job?”

“Yes. She is responsible _____ many important decisions.”

- A. her making
- B. for making
- C. to make
- D. of making

Question 10

“Will Bill’s report be ready by Friday?”

“No, I don’t think he _____ it by then.”

- A. has finished
- B. will have finished
- C. finishes
- D. will be finished

Question 11

“When will this paint be dry?”

“Not long. This is very _____ paint.”

- A. fast to dry
- B. fast drying
- C. dry fast
- D. fast dry

Question 12

“Do Mary’s children help with the housework?”

“Yes, if she asks _____.”

- A. it them
- B. them to do
- C. them to
- D. them for

Question 13

“Where’s the box I asked for?”

“Over there, _____ on the table.”

- A. seated
- B. sitting
- C. sat
- D. seating

Question 14

“Let’s plan a picnic for Saturday.”

“_____ it rains?”

- A. What if
- B. Nevertheless
- C. Except
- D. In spite of

Question 15

“That movie isn’t very good.”

“Just wait. The best part _____.”

- A. has come yet.
- B. is yet coming
- C. is yet to come
- D. come yet

Cloze

Read the passage, then select the word which best fills the blank in both grammar and meaning.

Color is such a constant part of our environment that we tend to ignore its messages. Many people with perfect vision suffer (16) a sort of cultural color blindness. But (17) unnoticed color influences feelings as well. (18) of experiments with both infants and (19) indicate that blue light tends to (20) activity and produce a state of restfulness. (21) more tense a person is, the (22) blue will act as a tranquilizer. Red, (23) the contrary, excites the nervous system, (24) that if this page were printed (25) red paper, electrodes attached to your skin (26) show a definite increase in muscle (27), restlessness, and eye movements compared with (28) reactions to the white page.

Question 16

- A. of
- B. from
- C. such
- D. like

Question 17

- A. that
- B. other
- C. even
- D. have

Question 18

- A. Many
- B. Some
- C. Lot
- D. Reports

Question 19

- A. colors
- B. adults
- C. also
- D. muscles

Question 20

- A. lessen
- B. create
- C. release
- D. increase

Question 21

- A. Even
- B. But
- C. As
- D. The

Question 22

- A. more
- B. color
- C. light
- D. worse

Question 23

- A. in
- B. is
- C. on
- D. affects

Question 24

- A. and
- B. so
- C. suppose
- D. imagine

Question 25

- A. with
- B. on
- C. as
- D. in

Question 26

- A. would
- B. will
- C. and
- D. to

Question 27

- A. intensity
- B. system
- C. naturally
- D. tension

Question 28

- A. eye
- B. its
- C. your
- D. their

Vocabulary

There are two kinds of vocabulary problems. In one kind (29-36), you should choose the word or phrase that means the same thing as the underlined word or phrase. In the other kind (37-43), you should choose the word or phrase that most appropriately completes the sentence.

Question 29

We didn't think it would endure.

- A. last
- B. increase
- C. happen
- D. change
- E.

Question 30

Martha often flies off the handle.

- A. travels
- B. gets lost
- C. spends money
- D. becomes angry

Question 31

They dozed in the study.

- A. played
- B. worked
- C. slept
- D. ate

Question 32

David likes to go sailing now and then.

- A. rarely
- B. sometimes
- C. often
- D. always

Question 33

Ken didn't notice the flaw.

- A. smell
- B. message
- C. time
- D. fault

Question 34

That is a very cunning animal.

- A. dangerous
- B. rare
- C. small
- D. smart

Question 35

Bill finally threw in the towel.

- A. gave up
- B. arrived
- C. cleaned up
- D. began

Question 36

This kind of book is scarce.

- A. not common
- B. very expensive
- C. useful
- D. frightening

Question 37

He didn't know the answer to this question, so he silently _____ his shoulders.

- A. transferred
- B. shrugged
- C. wrinkled
- D. disturbed

Question 38

George gave Martha a diamond ring as _____ of his love for her.

- A. a token
- B. a caress
- C. a signature
- D. an utterance

Question 39

Maria _____ her voice by singing too loudly and too long.

- A. pitched
- B. strained
- C. yelled
- D. groaned

Question 40

A lot of heavy books were _____ one on top of the other, and when I walked by them, they all fell down.

- A. constructed
- B. erected
- C. stacked
- D. posed

Question 41

I don't have enough time to read through this book carefully, so I'll just _____ it quickly.

- A. skim
- B. gaze
- C. span
- D. flap

Question 42

Working hard at three jobs and going to school became too much of a _____ for John.

- A. bridle
- B. tackle
- C. time
- D. burden

Question 43

Warren dropped the glass bottle, and it _____.

- A. withered
- B. shattered
- C. crumbled
- D. abolished

Appendix D

EXPERIMENTAL AND FILLER SENTENCES IN ENGLISH

44 Experimental Sentences

- 1a. Whenever the young girl walks (shouts) her tiny dogs follow her quietly.
Does the young girl have pets? C
- 1aa. Whenever the Chinese nurse walks (shouts) her docile Labrador follows her obediently. Does the nurse have pets? C
- 2a. Each time the child pedals (falls) his yellow bicycle squeaks loudly.
Does the child have a bicycle? C
- 2aa. Whenever the obese boy pedals (falls) his rusty bike squeaks for awhile. Does the boy have a bicycle? C
- 3a. When the poor man begs (trips) the rich executive ignores him all the time.
Does the executive usually help the poor man? N
- 3aa. Each time the alcoholic begs (trips) the friendly tourists ignore him.
Do the tourists help the alcoholic? N
- 4a. When the trained chef cooks (works) the glazed chicken becomes the most ordered dish. Does the chef serve poultry in this restaurant? C
- 4aa. Whenever the café owner cooks (works) the spicy rabbit becomes a popular dish.
Does the café owner serve rabbit? C
- 5a. When the lean athlete rows (coughs) the wooden boat advances with difficulty on the lake. Is the sportsman fat? N
- 5aa. Whenever the amateur competitor rows (coughs) the heavy dinghy advances slowly. Is the competitor a professional? N

- 6a. When the cleaning lady runs (chats) the dusty vacuum remains unplugged for awhile. Is the vacuum plugged in? N
- 6aa. Whenever the young maid runs (chats) the efficient washer remains unused until her return. Is the washer running? N
- 7a. When the talented florist works (perseveres) the flower garden becomes more beautiful. Is the garden in good condition? C
- 7aa. Whenever the skilled farmer works (perseveres) the vegetable patch becomes more productive. Is the vegetable patch productive? C
- 8a. When the strong athletes swim (perspire) Lake Michigan's waters shine in the moonlight. Do the athletes swim during the day? N
- 8aa. Whenever the team members swim (perspire) Lake Ontario's stream shines in the sunlight. Do the team members swim at night? N
- 9a. When the old men fish (dive) the clean river reflects the bright sun.
Do the men dive at night? N
- 9aa. Whenever the young boys fish (dive) the calm pond reflects the sunlight.
Do the young boys fish at night? N
- 10a. When the young man skis (falls) the flat slopes prove very difficult.
Are the slopes easy? N
- 10aa. Whenever the insecure boy skis (falls) the smooth hills prove demanding and tricky. Are the slopes easy? N
- 11a. When the young pilot flies (daydreams) the damaged airplane descends very rapidly. Is the descent slow? N
- 11aa. Whenever the skilled aviator flies (daydreams) the army jet descends smoothly on the ground. Is the descent abrupt? N
- 12a. When the naïve explorer lands (panics) the damaged helicopter stops in a chaotic manner. Does the helicopter stop smoothly? N

- 12aa. Whenever the British aviator lands (panics) the fighter jet stops quickly and smoothly. Does the plane stop slowly? N
- 13a. Whenever the curious tourist climbs (camps) the impressive mountain remains challenging. Is the mountain small? N
- 13aa. Whenever the equipped hiker climbs (camps) the steep peak remains difficult. Is the peak small? N
- 14a. When the bright students sweat (panic) the language assignment proves very difficult. Is the assignment difficult? C
- 14aa. Whenever the smart students sweat (panic) the biology test proves extremely hard. Is the test difficult? C
- 15a. While the talented child skates (shivers) the frozen pond shines in the sun. Is the pond shining? C
- 15aa. While the gracious athlete skates (shivers) the frozen lake shines intensely. Is the lake frozen? C
- 16a. When the dishonest players cheat (lie) their male partners refuse to trust them. Are the players honest? N
- 16aa. Whenever the corrupt contestants cheat (lie) their honest opponents refuse to continue the game. Are the contestants honest? N

22 Fillers Agreement Sentences (grammatical)

1. The slogan on the posters was designed to get attention.
Was the slogan designed to get attention? C
2. The picture on the postcards was of a village church in the south of France.
Was the church in Italy? N
3. The mistake in the programs was disastrous for the small software company.
Was the mistake disastrous? C
4. The label on the bottles was a warning about the toxic effects of the drug.
Was the label an advertisement? N

5. The problem in the schools was solved by firing the superintendent.
Was the problem solved? C
6. The name on the billboards was of a prominent local politician.
Was the name an athlete's? N
7. The crime in the cities was a reflection of the violence in today's society.
Was the crime urban? C
8. The defect in the cars was unknown to consumers and government regulators.
Was the defect in a truck? N
9. The cover of the books was really colorful and pretty.
Was the cover white? N
10. The head of the dolls was broken and looked miserable.
Was the head in good shape? N
11. The main road to the stores was under construction until the end of the year.
Was the road in bad condition? C
12. The drink sold by the kids was not fresh and tasted awful.
Was the drink refreshing? N
13. The score of the students was extremely good and encouraging.
Was the score good? C
14. The advertisement for the latest French movies was very attractive.
Was the ad attractive? C
15. The bookshelf that displayed the books was about to fall apart.
Was the bookshelf in good condition? N
16. The animal that is covered with fleas looks really dirty.
Is the animal dirty? C
17. The computer with the viruses was not working too well.
Was the computer functioning well? N

18. The abandoned garden with the rotten vegetables was filled with weeds.
Was the garden well tended? N
19. The gerbil with long teeth was running on his small wheel.
Was the gerbil exercising in his wheel? C
20. The fingerprint at both crime scenes was left by the same person.
Was the fingerprint the same at both scenes? C
21. The architect of the modern office buildings was extremely famous.
Was the architect unknown? N
22. The author of the novels was working on a new political book.
Is the author retired? N

22 Fillers Agreement Sentences (ungrammatical)

1. The author of the novels were working on a new political book.
Is the author retired? N
2. The main road to the stores were under construction until the end of the year.
Was the road in bad condition? C
3. The score of the students were extremely good and encouraging.
Was the result good? C
4. The advertisement for the latest French movies were very attractive.
Was the ad attractive? C
5. The bookshelf that displayed the books were about to fall apart.
Was the bookshelf in good condition? N
6. The animal that is covered with fleas look really dirty.
Is the animal dirty? C
7. The computer with the viruses were not working too well.

- Was the computer functioning well? N
8. The abandoned garden with the rotten vegetables were filled with weeds.
Was the garden well tended? N
9. The gerbil with long teeth were running on his small wheel.
Was the gerbil exercising in his wheel? C
10. The fingerprint at both crime scenes were left by the same person.
Was the fingerprint the same at both scenes? C
11. The architect of the modern office buildings were extremely famous.
Was the architect unknown? N
12. The drink sold by the kids were not fresh and tasted awful.
Was the drink refreshing? N
13. The slogan on the posters were designed to get attention.
Was the slogan designed to get attention? C
14. The picture on the postcards were of a village church in the south of France.
Was the church in Italy? N
15. The mistake in the programs were disastrous for the small software company.
Was the mistake disastrous? C
16. The label on the bottles were a warning about the toxic effects of the drug.
Was the label an advertisement? N
17. The problem in the schools were solved by firing the superintendent.
Was the problem solved? C
18. The name on the billboards were of a prominent local politician.
Was the name an athlete's? N
19. The crime in the cities were a reflection of the violence in today's society.
Was the crime urban? C
20. The defect in the cars were unknown to consumers and government regulators.

Was the defect in a truck? N

21. The cover of the books were really colorful and pretty.
Was the cover white? N
22. The head of the dolls were broken and looked miserable.
Was the head in good shape? N

44 Fillers Declarative Sentences

1. The publisher read the romance novel with great interest for the entire day.
Did the romance novel keep the publisher's interest? C
2. The patients from the clinic recognized their doctor in the supermarket.
Did the patients notice the doctor? C
3. Sharon repeated the phone number to herself so she wouldn't forget it.
Was Sharon trying to forget the number? N
4. The frightened boys reported the homicide at the police station.
Were the boys scared? C
5. Douglas revealed the surprise party when he accidentally spilled the beans.
Did Douglas keep the party a secret? N
6. The teacher from the university taught the lesson very thoroughly.
Did the teacher do a careful job? C
7. John's mother anticipated the flimsy excuse right when he opened his mouth.
Was John able to fool his mother with the excuse? N
8. The truck driver concealed the weapons behind the seat when he saw the officer.
Did the trucker hide the weapons? C
9. The professional movers disputed the legitimacy of their client's claim.
Did the movers feel the claim was legitimate? N
10. Yesterday Caroline's veterinarian forgot his scheduled appointment in the afternoon. Did the veterinarian remember the appointment? N

11. The cookies that were wrapped in cellophane had been made for the party.
Were the cookies baked for the party? C
12. The books that were left on the table had been forgotten by the students.
Had the books been forgotten by a librarian? N
13. The townhouses that were lined up on the avenue could not be sold.
Were they having a hard time selling the townhouses? C
14. The wild cats that were found on the farm had become the children's pets.
Did the cats stay abandoned? N
15. The willow tree that was shaded by the oak hadn't grown in a while.
Had the willow tree stopped growing? C
16. The teachers at the private school were trying out a progressive new method.
Were the classes taught using a traditional method? N
17. The paintings at the art museum were in storage for several years.
Were the paintings being shown? N
18. The professional chefs at the bakery were becoming upset about the low wages. Were the chefs getting paid too little? C
19. The bankers in the downtown branches were noticing that business was slow.
Was business at the downtown branches doing well? N
20. The ball player from the club were volunteering to teach little league.
Were the ball players teaching kids? C
21. The skilled doctor examined the woman with a cerebral tumor.
Does the woman have a tumor? C
22. The experienced woman goes down the steep slopes with ease.
Are the slopes steep? C
23. Mary sang a country song in the talent show that took place last night.
Did Mary sing last week? N

24. The dogs were happily running in the meadow until they heard a loud noise.
Were the dogs walking slowly? N
25. The sports car in the banker's garage costs a fortune.
Is the car expensive? C
26. My friend Ann always spends one month at the beach in the summer.
Does Ann go to the beach in the summer? C
27. When it is sunny many birds sing under my windows.
Do the birds sing? C
28. Every time my sister eats strawberries she gets an allergic reaction.
Is my sister allergic to raspberries? N
29. It has been five years today since my favorite singer died.
Is my favorite singer alive? N
30. In the winter it snows a lot in the north of the United States.
Does it snow a lot in the south of the US? N
31. The black horse was wandering in the green meadow all afternoon.
Was the horse in a meadow? C
32. The scalding hot coffee is burning the back of my mouth.
Is the coffee hot? C
33. On the way to school the boy met his best friend.
Did the boy meet his mother? N
34. Melissa's dog never walks on the leash without pulling and panting away.
Is Melissa's dog well behaved? N
35. The distracted chemist dropped the glass beaker and broke it.
Did the chemist break something? C
36. The powerful microwave burned the frozen dish that John was trying to defrost.
Did the dish burn? C

37. The green garden snake curled up on the warm rock.
Was the snake black? N
38. The small calculator that the student was using started acting weirdly.
Was the calculator functioning well? N
39. The London police identified the DNA of the notorious serial killer.
Did the police find evidence at the scene? C
40. The opera singer was very nervous before her important performance at Carnegie Hall. Was the singer nervous? C
41. France is a beautiful country that is visited by many tourists every year.
Is France a popular destination? C
42. When the teacher speaks the unruly students do not pay attention.
Do all the students listen to the teacher? N
43. Each time there is a fight at a hockey game the spectators cheer.
Do the spectators like fights? C
44. Every time the bell rings the school kids run in the playground.
Do the kids walk outside? N

44 Fillers Garden Path Sentences

1. When the young girl eats good food gets wasted for no reason.
Is the girl young? C
2. The nice nurse gave the child the dog bit a band aid.
Was the dog nice and friendly? N
3. The new kindergarten teacher convinced her children are noisy leaves the room.
Are the children quiet? N
4. The important politician is expecting tomorrow to be a bad day.
Is the politician important? C
5. The singer knows the words to that song do not rhyme.
Do the words rhyme? N

6. My mother told me a little white lie will come back to haunt me.
Can lying haunt you? C
7. Until the police arrest the drug dealers control the streets.
Are the drug dealers powerful? C
8. The nice dog that I had really loved to chew on bones.
Was the dog nice? C
9. The old man who whistles tunes pianos in the neighborhood.
Does the old man tune violins? N
10. The cotton clothing is made of grows in the south of Mississippi.
Does the cotton grow in Florida? N
11. Have the students who failed the exam take the make-up.
Have all the students passed the exam? N
12. Every woman that admires a man that paints likes Monet.
Do some men paint like Monet? C
13. The fast horse raced past the large barn fell down.
Was the horse racing? C
14. The old yellow raft floated down the large river sank.
Was the raft orange? N
15. The new homeowners painted the white wall with large cracks.
Did the homeowners do some painting? C
16. The tycoon sold the offshore oil tracts for money needed to kill JR.
Was JR a murder target? C
17. The old rich man who hunts ducks out on weekends.
Does the man hunt? C
18. The young blond boy rang the door bell sounded loudly.
Is the door bell quiet? N

19. The young blind girl told the long sad story cried.
Did the girl tell a funny story? N
20. While Philip was washing the dishes crashed on the floor.
Did dishes fall on the floor? C
21. The complex houses married and single students and their families.
Is the complex only for single students? N
22. The student forgot the solution was in the back of the book.
Is the solution in the back of the book? C
23. While Agnes dressed the baby spit up on the bed.
Did the baby spit on the floor? N
24. Had the old man escaped this battle might have ended differently.
Is the man young? N
25. The serious judge believed the defendant was clearly lying under oath.
Did the judge believe the defendant? N
26. The curious traveler saw the small island was deserted and peaceful.
Was the traveler disinterested? N
27. The smart secretary understood the joke was completely inappropriate in the workplace. Was the secretary stupid? N
28. The important scientist heard several excellent solutions were possible to the problem. Is the scientist important? C
29. The famous and rich editor forgot the manuscript was lost.
Is the editor well-known? C
30. After the teacher left the class broke the blackboard and the door.
Did the students behave well? N
31. After the tall clown tripped the blond woman laughed loudly.
Was the woman blond? C
32. The criminal murdered a student and his poor parents became crazy.

- Did the criminal murder a student? C
33. Madonna joked with the players and the media were all over the place.
Did Madonna joke with the media? N
34. The actress flirted with photographers and the writer became really angry and jealous. Was the writer happy? N
35. Sandra bumped into the boy and the waiter told her to be careful.
Did Sandra bump into a girl? N
36. James idolized the scientist and his teacher was really impressed.
Did James like the scientist? C
37. Pamela hit the fireman and the policeman had to restrain her.
Was Pamela aggressive? C
38. While the pretty actress watched her new television exploded unexpectedly.
Did the television explode? C
39. While the soldiers fought the intense battle ended in defeat.
Was the battle successful? N
40. After the fire burned the experienced ranger surveyed the extensive damage. Was the damage extensive? C
41. After the old janitor dusted the clock fell off the shelf.
Was the janitor sweeping the floor? N
42. After the agents stopped the red sports car disappeared into the darkness. Was the car green? N
43. While the priest hid the young fugitive emptied his fridge.
Was the fugitive young? C
44. While the aggressive passengers pushed the bus driver told them to sit down.
Were the passengers friendly? N

Fillers High Attachment Sentences

1. The bank robbers killed the niece of the man who was a nun.
Was the niece a nun? C
2. The senator talked to the brother of the actress who wanted to become a monk.
Does the brother want to become a nurse? N
3. The nurse saw the aunt of the man who works as a seamstress.
Is the aunt a nurse? N
4. We learned that Paul killed the brother of the woman who married an actress.
Is the brother married? C
5. The children kissed the grandmother of the man who married a duke.
Does the child kiss the grandfather? N
6. The girls spoke with the brother of the lady who became a priest.
Is the brother a fireman? N
7. The waitress saw the mistress of the guy who was a Chippendale dancer.
Is the guy working as an accountant? N
8. The police called the aunt of the actor who divorced a prince.
Was the aunt married to a prince? C
9. The reporter photographed the sister of the man who became a ballerina.
Did the photographer take any pictures? C
10. Janet knows the brother of the girl who studied opera to become a tenor.
Is the brother studying music? C
11. The terrorists tortured the nephew of the woman who was engaged to an Italian woman. Is the nephew single? N
12. Peter met the niece of the count who always wears bright red lipstick.
Did Peter meet the count? N
13. The bullfighter saw the bride of the football player who was leaving a beauty shop. Did the bride marry a football player? C

14. The family ate with the stepfather of the stewardess who was a professional rugby player. Does the stepfather work for an airline? N
15. Sarah met the uncle of her girlfriend who had a long white beard. Does the uncle have a beard? C
16. Mary danced with the boyfriend of the French woman who had black sideburns. Did Mary dance with the French woman's boyfriend? C
17. The scientist spoke to the wife of the duke who wore a lot of make-up. Did the duke speak to the scientist? N
18. Chris congratulated the sister of the truck driver who received an engagement ring. Did Chris talk to the sister? C
19. The customer talked to the sister of the bachelor who was wearing a padded bra. Did the customer talk to the bachelor? N
20. The reporter interviewed the niece of the priest who was wearing a bikini. Did the reporter interview a girl? C
21. Tracy talked to the daughter of the pilot who had breast implants. Did Tracy talk to the pilot? N
22. Jason met the niece of the tenor who always wears dresses. Does the niece often wear shorts? N

22 Fillers Low Attachment Sentences

1. The singer was attracted to the son of the maid who always wore pearl earrings. Does the maid have a son? C
2. The nurse met the husband of the pregnant woman who went to the gynecologist. Did the woman go to a specialist? C
3. The doctor examined the wife of the man who had prostate cancer. Did the woman go to the doctor? C
4. The teacher spoke with the father of the girl who was wearing pigtails. Was the girl wearing a bun? N

5. The newspaper published a story about the granddaughter of the milkman who was a gentleman. Did the milkman publish a story about his granddaughter? N
6. The students stared at the wife of the waiter who always wears ties. Does the waiter wear ties? C
7. The journalist interviewed the bodyguard of the princess who sunbathed topless on a private beach. Did the journalist interview the princess? N
8. The mayor talked to the widow of the fisherman who had a red mustache. Did the fisherman have a red mustache? C
9. The dog followed the son of the landlady who was wearing a black skirt. Was the lady wearing a green skirt? N
10. The lawyer saw the son of the madwoman who was testing blush in the shop. Did the lawyer see the madwoman? N
11. An explosion killed the niece of the man who is a fireman. Was the niece killed in an explosion? C
12. The audience praised the nephew of the lady who is a ballerina. Does the lady dance? C
13. The detective arrested the son of the woman who was a waitress. Was the son arrested? C
14. When my sister sees the aunt of the man who is a salesman she smiles. Is the sister a saleswoman? N
15. The doctor received a gift from the agent of the actress who had an abortion. Did the actress have a baby? N
16. The dentist sent a gift to the brother of the actress who gave birth yesterday. Did the actress receive a present? N
17. The terrorists killed the tailor of the rich woman who was pregnant. Did the terrorists kill the tailor? C
18. The architect had dinner with the brother of the lady who was a saleswoman.

Is the lady an actress? N

19. The butcher met the grand-mother of the boxer who fought in Las Vegas last night. Did the boxer fight in New York? N
20. The neighbors called the sister of the actor who married the English queen. Did the neighbors make a phone call? C
21. The thief attacked the daughter of the guy who worked as a waiter. Did the thief attack a man? N
22. The history professor taught the son of the castafiore who grew up in a convent. Did the professor teach history? C

Appendix E

EXPERIMENTAL AND FILLER SENTENCES IN FRENCH

32 Experimental Sentences

- 1a. Quand la jeune fille marche (crie) ses beaux chiens suivent docilement leur maîtresse. Est-ce que la jeune fille a des animaux? C⁴
- 1aa. Quand le serveur chinois marche (crie) ses gros labradors suivent sagement leur maître. Est-ce que le serveur a des animaux? C
- 2a. Quand la jeune fillette pédale (tombe) son vélo rouge grince bruyamment. Est-ce que l'enfant a un vélo? C
- 2aa. Quand le garçon obèse pédale (tombe) sa bicyclette orange grince tout le temps. Est-ce que l'enfant a un vélo? C
- 3a. Lorsque le pauvre clochard mendie (trébuche) le directeur fortuné l'ignore tout le temps. Est-ce que le directeur aide le clochard? N⁵
- 3aa. Lorsque le vieil alcoolique mendie (trébuche) le touriste stressé l'ignore et poursuit son chemin. Est-ce que le touriste aide l'alcoolique? N
- 4a. Quand le cuisinier expérimenté cuisine (travaille) le poulet rôti devient le plat le plus commandé. Est-ce que le cuisinier sert de la volaille? C
- 4aa. Lorsque le restaurateur talentueux cuisine (travaille) le lapin succulent devient un repas très apprécié. Est-ce que le restaurateur sert du lapin? C
- 5a. Quand le petit homme rame (tousse) le gros bateau avance difficilement sur le lac. Est-ce que l'homme est grand? N
- 5aa. Lorsque le jeune amateur rame (tousse) le canot énorme avance lentement.

⁴ C indicates that the answer to this comprehension question was 'yes' and the participants had to press the keyboard key 'C'

⁵ N indicates that the answer to this comprehension question was 'no' and the participants had to press the keyboard key 'N'

Est-ce que l'amateur est vieux? N

- 6a. Quand la servante sportive court (discute) son vieil aspirateur reste débranché pendant un moment. Est-ce que l'aspirateur est allumé? N
- 6aa. Lorsque la serveuse active court (discute) sa nouvelle cafetière reste éteinte jusqu'à son retour. Est-ce que la cafetière est allumée? N
- 7a. Quand le jardinier talentueux travaille (persiste) le jardin potager devient toujours plus beau. Est-ce que le jardin est en bonne condition? C
- 7aa. Lorsque le fleuriste adroit travaille (persiste) la roseraie fleurie devient encore plus productive. Est-ce que les fleurs poussent bien? C
- 8a. Quand le nageur expérimenté nage (sue) le beau lac brille au coucher de lune. Est-ce que l'athlète nage pendant la journée? N
- 8aa. Pendant que l'athlète musclé nage (sue) le grand lac brille intensément sous le soleil. Est-ce que l'athlète nage la nuit? N
- 9a. Quand les hommes âgés pêchent (plongent) le lac bleu reflète les rayons du soleil. Est-ce que les hommes plongent la nuit? N
- 9aa. Quand les garçons sportifs pêchent (plongent) la grande rivière reflète le coucher du soleil. Est-ce que les garçons pêchent la nuit? N
- 10a. Quand le jeune débutant skie (tombe) les pistes plates semblent très difficiles. Est-ce que les pistes sont faciles? N
- 10aa. Quand le garçon inquiet skie (tombe) les pentes enneigées semblent dangereuses. Est-ce que les pistes sont faciles? N
- 11a. Lorsque le pilote amateur vole (rêvasse) son vieil avion descend très rapidement. Est-ce que la descente est lente? N
- 11aa. Quand un aviateur sérieux vole (rêvasse) son bel appareil descend en douceur. Est-ce que la descente est rapide? N
- 12a. Quand l'explorateur naïf atterrit (hurle) son hélicoptère abîmé s'arrête de façon chaotique. Est-ce que l'hélicoptère s'arrête gentiment? N
- 12aa. Quand un pilote stressé atterrit (hurle) son avion privé s'arrête abruptement. Est-ce que l'avion s'arrête lentement? N

- 13a. Quand un touriste curieux grimpe (campe) les hautes montagnes restent toujours impressionnantes. Est-ce que les montagnes sont petites? N
- 13aa. Quand un randonneur équipé grimpe (campe) les sommets abrupts restent difficiles à escalader. Est-ce que les sommets sont plats? N
- 14a. Quand le mauvais étudiant transpire (panique) son examen écrit semble très difficile. Est-ce que l'étudiant est intelligent? C
- 14aa. Quand un élève brillant transpire (panique) son devoir d'anglais semble interminable et laborieux. Est-ce que l'élève est intelligent? C
- 15a. Quand la patineuse professionnelle patine (grelotte) le lac gelé ressemble à une vraie patinoire. Est-ce que la sportive est une professionnelle? C
- 15aa. Quand un athlète gracieux patine (grelotte) le grand étang ressemble à une piste de danse. Est-ce que l'athlète est gracieux? C
- 16a. Quand le joueur malhonnête triche (ment) ses meilleurs amis refusent de lui faire confiance. Est-ce que le joueur est honnête? N
- 16aa. Lorsque le participant corrompu triche (ment) ses adversaires honnêtes refusent de continuer la partie. Est-ce que le participant est honnête? N

22 Fillers Agreement Sentences (grammatical)⁶

1. Le slogan des posters était conçu pour attirer l'attention des consommateurs.
Est-ce que le slogan était conçu pour attirer l'attention? C
2. L'image des cartes postales était de l'église du village en France.
Est-ce que l'église est en Italie? N
3. L'erreur des logiciels informatiques était désastreuse pour la petite entreprise.
Est-ce que l'erreur était désastreuse? C
4. L'étiquette des bouteilles était une prévention contre l'effet toxique de la drogue.
Est-ce que l'étiquette était une publicité? N

⁶ These types of filler are grammatical sentences that present potential complexities in terms of NP and verbal agreement

5. Le problème des écoles fut résolu en licenciant le ministre de l'éducation.
Est-ce que le problème fut résolu? C
6. Le nom sur les panneaux était celui d'un politicien important.
Est-ce que le nom était celui d'un sportif? N
7. La criminalité des villes est un résultat de la violence de notre société.
Est-ce que la criminalité est un résultat de la violence? C
8. Le défaut de construction des voitures n'était pas connu des possesseurs.
Est-ce que le défaut a été trouvé sur des camions? N
9. La tête des poupées était cassée et avait l'air misérable.
Est-ce que la poupée est en bon état? N
10. L'écrivain anglais de ces romans travaillait sur de nouveaux livres.
Est-ce que l'écrivain est américain? N
11. La couverture des livres pour enfants était très colorée et jolie.
Est-ce que les livres sont pour adultes? N
12. La rue principale des magasins est en construction pendant six mois encore.
Est-ce que la rue principale est en construction pendant 1 mois? N
13. La boisson des enfants n'était pas fraîche et avait un goût bizarre.
Est-ce que la boisson des enfants était fraîche? N
14. Le résultat en maths des étudiants était très bon et encourageant.
Est-ce que les étudiants ont eu de bons résultats en maths? C
15. La bande annonce des derniers films français était très attirante.
Est-ce que la bande annonce est attirante? C
16. La limousine des acteurs les plus célèbres arrive toujours en retard au festival de Cannes. Est-ce que la limousine est toujours à l'heure? N
17. Le problème majeur des pays africains est la malnutrition et les maladies infectieuses. Est-ce que les maladies infectieuses sont courantes en Afrique? C

18. L'effort physique des athlètes olympiques des jeux d'Athènes était incroyable à voir. Est-ce que les athlètes olympiques ont fait des efforts physiques? C
19. L'expression du visage des enfants de l'orphelinat de Mère Térésa en Inde est troublante. Est-ce que l'orphelinat est en Inde? C
20. L'espion chinois des films de ce cinéaste est toujours effrayant et très malin. Est-ce que l'espion est chinois? C
21. La nourriture des boîtes de conserves n'est pas toujours très bonne. Est-ce que la nourriture en conserve est toujours bonne? N
22. Le bureau des lycéens est souvent en désordre et très sale. Est-ce que le bureau est mal rangé? C

22 Fillers Agreement Sentences (ungrammatical)

1. La rue principale des magasins sont en construction pendant six mois encore. Est-ce que la rue principale est en construction pendant 1 mois? N
2. La boisson des enfants n'étaient pas fraîches et avaient un goût bizarre. Est-ce que la boisson des enfants était fraîche? N
3. Le résultat en maths des étudiants étaient très bons et encourageants. Est-ce que les étudiants ont eu de bons résultats en maths? C
4. La bande annonce des derniers films français étaient très attirants. Est-ce que la bande annonce est attirante? C
5. La limousine des acteurs les plus célèbres arrivent toujours en retard au festival de Cannes. Est-ce que la limousine est toujours à l'heure? N
6. Le problème majeur des pays africains sont la malnutrition et les maladies infectieuses. Est-ce que les maladies infectieuses sont courantes en Afrique? C
7. L'effort physique des athlètes olympiques des jeux d'Athènes était incroyable à voir. Est-ce que les athlètes olympiques ont fait des efforts physiques? C

8. L'expression du visage des enfants de l'orphelinat de Mère Térésa en Inde sont troublants. Est-ce que l'orphelinat est en Inde? C
9. L'espion chinois des films de ce cinéaste sont toujours effrayants et très malins. Est-ce que l'espion est chinois? C
10. La nourriture des boîtes de conserves ne sont pas toujours très bonnes. Est-ce que la nourriture en conserve est toujours bonne? N
11. Le bureau des lycéens sont souvent en désordre et très sales. Est-ce que le bureau est mal rangé? C
12. Le slogan des posters étaient conçus pour attirer l'attention des consommateurs. Est-ce que le slogan était conçu pour attirer l'attention? C
13. L'image des cartes postales étaient de l'église du village en France. Est-ce que l'église est en Italie? N
14. L'erreur des logiciels informatiques étaient désastreux pour la petite entreprise. Est-ce que l'erreur était désastreuse? C
15. L'étiquette des bouteilles étaient une prévention contre l'effet toxique de la drogue. Est-ce que l'étiquette était une publicité? N
16. Le problème des écoles furent résolues en licenciant le ministre de l'éducation. Est-ce que le problème fut résolu? C
17. Le nom sur les panneaux étaient celui d'un politicien important. Est-ce que le nom était celui d'un sportif? N
18. La criminalité des villes sont un résultat de la violence de notre société. Est-ce que la criminalité est une réflexion de la violence? C
19. Le défaut de construction des voitures n'étaient pas connues des possesseurs. Est-ce que le défaut a été trouvé sur des camions? N
20. La couverture des livres pour enfants étaient très colorés et jolis. Est-ce que les livres sont pour les adultes? N
21. La tête des poupées étaient cassées et avaient l'air misérable. Est-ce que la poupée est en bon état? N

22. L'écrivain anglais de ces romans travaillaient sur de nouveaux livres.
Est-ce que l'écrivain est américain? N

44 Fillers Declarative Sentences⁷

1. L'éditeur lit le roman avec grand intérêt toute la journée.
Est-ce que l'éditeur lit un roman? C
2. Les patients de la clinique ont reconnu leur docteur au supermarché.
Est-ce que les patients ont vu une infirmière? N
3. Sandra se répéta le numéro de téléphone pour ne pas l'oublier.
Est-ce que Sandra se répète un numéro de compte bancaire? N
4. Les garçons apeurés ont signalé un meurtre à la police.
Est-ce que les garçons étaient apeurés? C
5. Paul a préparé une surprise party pour le départ de son ami.
Est-ce que Paul a préparé une fête? C
6. Le professeur enseigna un cours de chimie avancée aux nouveaux étudiants.
Est-ce que d'anciens étudiants suivirent le cours de chimie? N
7. La mère de Marc cuisina un bon plat pour son anniversaire.
Est-ce que le père de Marc fit la cuisine? N
8. Le camionneur cachait des armes à feu derrière son siège.
Est-ce que les armes étaient derrière le siège? C
9. Les déménageurs professionnels ont travaillé sous un soleil intense hier après-midi. Est-ce que les déménageurs ont travaillé sous la pluie? N
10. Le vétérinaire de Caroline a oublié son rendez-vous de ce matin.
Est-ce que le vétérinaire a oublié le rendez-vous de cet après-midi? N
11. Le gâteau qui est emballé a été fait pour la fête de ce soir.
Est-ce que le gâteau était emballé? C

⁷ These filler sentences are non ambiguous declaratives

12. Le livre qui est resté sur la table avait été oublié par un étudiant.
Est-ce qu'un étudiant a oublié son cahier? N
13. Les chats sauvages ont été adoptés par les enfants du village.
Est-ce que les enfants ont adopté un chien? N
14. La maison blanche près de la forêt n'a pas été vendue.
Est-ce que la maison est bleue? N
15. Les chiens couraient joyeusement dans la prairie jusqu'au coucher du soleil.
Est-ce que les chiens ont couru toute la nuit? N
16. Marie a chanté une vieille chanson au concours de chant du village.
Est-ce que Marie a chanté une vieille chanson? C
17. Les professeurs de cette école privée sont particulièrement bien payés pour leur travail. Est-ce que les profs sont bien payés? C
18. Le docteur a examiné une nouvelle patiente qui avait un cancer des poumons.
Est-ce que la patiente a un cancer? C
19. Le skieur professionnel descend les pistes noires avec une élégance impressionnante. Est-ce que le skieur descend des pistes noires? C
20. Les pêcheurs anglais adorent prendre leur déjeuner avant d'embarquer sur leur bateau. Est-ce que les hommes pêchent le ventre vide? N
21. Les tableaux du musée d'art de Londres sont très colorés.
Est-ce que les tableaux sont ternes? N
22. Le grand arbre du jardin public va être coupé la semaine prochaine.
Est-ce que l'arbre va être coupé demain? N
23. Les étudiants français font souvent la grève parce qu'ils ne sont pas contents.
Est-ce que les étudiants français sont heureux? N
24. La voiture de sport rouge exposée chez ce garagiste coûte une fortune.
Est-ce que la voiture est chère? C
25. Les enfants qui sont impolis se font punir par leur maîtresse.
Est-ce que les enfants impolis sont punis? C

26. Quand j'étais jeune je faisais beaucoup d'équitation en été et de ski en hiver.
Est-ce que je faisais de la pêche étant jeune? N
27. Chaque fois que ma sœur mange des fraises elle attrape des boutons.
Est-ce que ma sœur est allergique aux fraises? C
28. Lorsque le soleil brille les oiseaux chantent intensément sous mes fenêtres.
Est-ce que les oiseaux chantent? C
29. Il y a maintenant plusieurs années que mon chanteur préféré est décédé.
Est-ce que mon chanteur préféré est mort? C
30. Pendant les vacances ma famille passe un mois au bord de la mer.
Est-ce que ma famille va à la mer? C
31. Sur le chemin de l'école Marc rencontre son meilleur ami et ils marchent ensemble. Est-ce que Marc va seul à l'école? N
32. Le chien de mon professeur n'aime pas se promener en laisse.
Est-ce que mon professeur a un chien? C
33. Le chimiste distrait a laissé tomber une fiole remplie d'un liquide dangereux.
Est-ce que la fiole contenait un liquide inoffensif? N
34. Le four a brûlé le plat surgelé que John voulait manger.
Est-ce que John mange des plats surgelés? C
35. La calculatrice de l'étudiant en maths est tombée en panne pendant l'examen.
Est-ce que la calculatrice fonctionne bien? N
36. Ce matin mon café était tellement chaud que je me suis brûlé la langue.
Est-ce que le café était tiède? N
37. Le cheval noir a brouté dans la prairie toute la journée.
Est-ce que le cheval a mangé toute la journée? C
38. Chaque fois que mon chat sort dans le jardin il attrape un oiseau.
Est-ce que le chat attrape souvent des oiseaux? C

39. Quand le professeur explique une règle de grammaire les élèves dissipés n'écoutent pas. Est-ce que tous les élèves écoutent le professeur? N
40. Hier la police Londonienne a identifié l'ADN du récent tueur en série. Est-ce que la police a identifié l'ADN du tueur? C
41. Quand une bagarre commence pendant un match de hockey les spectateurs applaudissent par plaisir. Est-ce que les spectateurs aiment les bagarres? C
42. Le petit garçon blond porte souvent une casquette rouge et jaune. Est-ce que le garçon porte une casquette bleue? N
43. La statue en bois du musée d'art date du dix-neuvième siècle. Est-ce que la statue est en pierre? N
44. Le petit chien se gratte les oreilles et se lèche souvent les pattes. Est-ce que le chien se lèche les pattes? C

44 Filler Garden Path Sentences⁸

1. Le vieux policier a vu l'espion russe avec ses jumelles. Est-ce que le policier est jeune? N
2. Hier quand Clara chantait sa chanson préférée est passée à la radio. Est-ce que Clara chante? C
3. Hier soir quand l'enfant mangeait un morceau de poulet s'est coincé entre ses dents. Est-ce que l'enfant a mangé du poulet hier soir? C
4. L'autre jour quand je buvais un verre s'est cassé dans les mains de Marie. Est-ce qu'une assiette s'est cassée? N
5. En voiture lorsque mon père anticipe ses virages deviennent plus subtils. Est-ce que mon père conduit? C
6. Quand le professeur a recommencé à danser le tango n'était plus à la mode. Est-ce que le tango était démodé? C

⁸ These fillers are ambiguous garden path sentences

7. Le dimanche lorsque je joue un match de foot passe toujours à la télévision.
Est-ce qu'il y a du foot à la télé? C
8. Le samedi quand ma sœur nettoie sa chambre redevient extrêmement propre.
Est-ce que la fille nettoie sa chambre 2 fois par semaine? N
9. Lorsque ma meilleure amie range ses affaires importantes réapparaissent subitement. Est-ce que mon amie a perdu des affaires? C
10. Quand ma mère étudiait la linguistique était une nouvelle science.
Est-ce que ma mère a fait des études? C
11. Quand un sportif court un marathon paraît être si facile.
Est-ce qu'un marathon semble facile pour un athlète? C
12. Lorsque l'étudiant lit une page défile devant ses yeux fatigués.
Est-ce que l'étudiant est fatigué ? C
13. Quand mes sœurs nagent le crawl est leur nage préférée.
Est-ce que mes sœurs savent nager? C
14. Quand mes cousins baratinent leurs parents ne sont pas contents.
Est-ce que mes cousins racontent des histoires à leurs parents? C
15. Lorsque le garçon timide balbutie des mots dénués de sens sortent de sa bouche.
Est-ce que le garçon est extroverti? N
16. Quand mon frère conduit sa voiture tombe toujours en panne.
Est-ce qu'on peut compter sur la voiture de mon frère? N
17. Quand le célèbre romancier écrira un nouveau livre sera bientôt vendu.
Est-ce que le romancier est célèbre? C
18. Lorsque l'étudiant stressé bégaye une longue phrase inaudible est prononcée.
Est-ce que l'étudiant est calme et reposé? N
19. Quand les vaches suisses broutent l'herbe disparaît rapidement des prés.
Est-ce que les vaches sont italiennes? N
20. Lorsque les abeilles butinent les fleurs rouges se multiplient à vue d'œil.
Est-ce que les fleurs sont bleues? N

21. Quand l'entrepreneur construit une maison apparaît au bout de quelques mois.
Est-ce que l'entrepreneur met des années à construire une maison? N
22. Quand le bel homme drague sa voisine jalouse se fâche.
Est-ce que la voisine est jalouse? C
23. Quand la femme de ménage nettoie le sol brille toujours plus.
Est-ce que la femme de ménage fait bien son travail? C
24. Quand un jeune chien renifle une trace l'amène toujours à un animal mort.
Est-ce que le chien est jeune? C
25. Quand Mme Smith engraisse ses enfants sont tristes et déçus.
Est-ce que les enfants de Mme Smith sont contents quand elle grossit? N
26. Quand le célèbre cameraman français filme les acteurs travaillent sérieusement.
Est-ce que le cameraman est belge? N
27. Quand le bon président gouverne son pays devient plus puissant et le peuple est content. Est-ce que le peuple est content avec un bon président? C
28. Quand les hamsters gourmands grignotent des carottes sont rongées rapidement.
Est-ce que les hamsters mangent du chocolat? N
29. Lorsque le joueur de tennis argentin gagne un match supplémentaire est mis à son actif. Est-ce que le joueur est brésilien? N
30. Lorsque le vieil homme fume une cigarette se consomme rapidement.
Est ce que l'homme est jeune? N
31. Quand l'enfant fâché grommèle des mots peu plaisants sortent de sa bouche. Est-ce que l'enfant parle de façon aimable? N
32. Chaque fois que l'assureur négocie un contrat est signé le jour même.
Est-ce que l'assureur négocie des contrats? C
33. Chaque fois que l'enfant malade avale sa salive lui fait mal à la gorge.
Est-ce que l'enfant est en pleine forme? N
34. Chaque fois que le tueur à gage assassine une personne importante est éliminée.
Est-ce une personne insignifiante est tuée? N
35. Chaque fois que le jeune cambrioleur vole des bijoux disparaissent d'une maison.
Est-ce que le cambrioleur est vieux? N

36. Lorsque le nouveau né bouge ses membres paraissent faibles et dénués de tout pouvoir. Est-ce que le bébé bouge ses bras et ses jambes? C
37. Chaque fois qu'un étudiant en doctorat défend sa thèse est enfin terminée. Est-ce que l'étudiant est au lycée? C
38. Lorsque ma grand-mère maternelle tricote un pull supplémentaire s'accumule dans mon armoire. Est-ce que ma grand-mère paternelle tricote? N
39. Quand le patient se gratte assidûment le visage du docteur se crispe anxieusement. Est-ce que le docteur est inquiet? C
40. Chaque fois que le lion du zoo dévore son repas disparaît en quelques secondes. Est-ce que le lion mange rapidement? C
41. Chaque fois que le sportif talentueux surfe les vagues sont énormes et difficiles à gérer. Est-ce que les vagues sont grosses? C
42. Quand un nouvel auteur talentueux publie un bon livre peut s'acheter dans les grandes surfaces. Est-ce que le livre est disponible en grandes surfaces? C
43. Après que l'artiste suisse a exposé ses sculptures se sont vendues très rapidement. Est-ce que l'artiste a exposé ses peintures? N
44. Lorsque le gros chien féroce mord le facteur part en courant. Est-ce que le chien est féroce? C

22 Fillers Low Attachment Sentences⁹

1. Les voisins appelèrent la sœur de l'acteur qui s'est marié avec la femme anglaise. Est-ce que les voisins passent un coup de fil? C
2. Le voleur attaqua la fille de l'homme qui travaillait comme serveur. Est-ce que le voleur attaqua un homme? N
3. Pierre fait du shopping avec le père de sa copine qui porte des dessous sexy. Est-ce que Pierre a fait du shopping? C
4. Le gérant du magasin rencontra la sœur du propriétaire qui était stérile.

⁹ These fillers are relative clauses which are attached to the second NP (low attachment)

- Est-ce que le propriétaire a une sœur? C
5. La chanteuse était attirée par le fils de la servante qui portait des boucles d'oreilles. Est-ce que la servante a un fils? C
 6. L'infirmière rencontra le mari de la femme enceinte qui avait été chez le gynécologue. Est-ce que la femme a vu un spécialiste? C
 7. Le docteur examina la femme de l'homme qui avait le cancer du sein. Est-ce que la femme a vu un docteur? C
 8. Le professeur parla au père de la fille qui avait des tresses. Est-ce que la fille portait une queue de cheval? N
 9. Le journal a publié un article sur la petite-fille du laitier qui est un gentleman. Est-ce que le laitier a écrit un article sur sa petite-fille? N
 10. Les étudiants regardèrent la femme du doyen qui portait toujours une cravate. Est-ce que le doyen porte des cravates? C
 11. Le journaliste interviewa le garde du corps de la princesse qui se bronzaient en monokini. Est-ce que le journaliste parla avec la princesse? N
 12. Le maire a parlé avec la veuve du pêcheur qui avait une moustache rousse. Est-ce que le pêcheur avait une moustache rousse? C
 13. Le chien a suivi le fils de la propriétaire qui porte souvent une jupe rouge. Est-ce que la femme porte fréquemment une jupe verte? N
 14. L'avocat a vu le fils de la chanteuse qui essayait du maquillage dans la parfumerie. Est-ce que l'avocat a vu la chanteuse? N
 15. Une explosion tua la sœur de l'homme qui est pompier. Est-ce que la sœur fut tuée dans une explosion? C
 16. Le public admira le neveu de la femme qui est ballerine. Est-ce que la femme danse professionnellement? C
 17. Le détective arrêta le fils de la femme qui était serveuse. Est-ce que le fils s'est fait arrêter? C

18. Quand ma sœur voit la tante de l'homme qui est vendeur elle sourit.
Est-ce que la sœur est vendeuse? N
19. Le dentiste envoya un cadeau au frère de l'actrice qui accoucha hier.
Est-ce que l'actrice a reçu un cadeau? N
20. Les terroristes ont tué le fils de la femme riche qui était enceinte.
Est-ce que les terroristes ont tué un homme? C
21. L'architecte a dîné avec le frère de la femme qui était vendeuse.
Est-ce que la femme est actrice? N
22. Le boucher a rencontré le boxeur qui a combattu à Las Vegas.
Est-ce que le boxeur a combattu à Los Angeles? N

22 Fillers High Attachment Sentences¹⁰

1. Les voleurs tuèrent la nièce de l'homme qui était nonne.
Est-ce que les voleurs sont des assassins? C
2. Le sénateur parla au frère de l'actrice qui a le cancer de la prostate.
Est-ce que l'actrice est malade? N
3. L'infirmière a rencontré la tante de l'homme qui travaille comme couturière.
Est-ce que la tante est infirmière? N
4. Nous avons appris que Paul tua le frère de la femme qui était marié.
Est-ce que le frère est marié? C
5. Les enfants embrassent la grand-mère de l'homme qui est mariée avec un duc.
Est-ce que les enfants embrassent le grand-père? N
6. Les filles parlèrent au frère de la femme qui est prêtre.
Est-ce que le frère est pompier? N

¹⁰ These fillers are relative clauses which are attached to the first NP (high attachment)

7. La police téléphona à la tante de l'acteur qui divorça d'un sultan.
Est-ce que la tante était mariée? C
8. Le journaliste photographia la sœur de l'homme qui est devenue princesse.
Est-ce que la sœur est princesse? C
9. Janet connaît le frère de la fille qui a étudié le chant pour devenir ténor.
Est-ce que le frère étudie le chant? C
10. Les terroristes torturèrent le neveu de la femme qui s'est fiancé à une Italienne.
Est-ce que le neveu est célibataire? N
11. Pierre a rencontré la nièce du comte qui porte toujours du rouge à lèvres.
Est-ce que Pierre a rencontré le comte? N
12. Les acteurs ont vu la fiancée du footballeur qui sortait d'un salon de beauté.
Est-ce que la femme va se marier avec un footballeur? C
13. La famille mangea avec le beau-père de l'hôtesse de l'air qui était joueur de rugby.
Est-ce que le beau-père travaille pour une compagnie aérienne? N
14. Marie rencontra l'oncle de sa copine qui avait une longue barbe blanche.
Est-ce que l'oncle a une barbe? C
15. Laura a dansé avec le copain de la femme française qui a des favoris noirs.
Est-ce que Laura dansa avec l'ami de la femme française? C
16. Le chercheur parla à la femme du duc qui portait beaucoup de fond de teint.
Est-ce que le duc parla au chercheur? N
17. Chris félicita la sœur du camionneur qui a reçu une bague de fiançailles.
Est-ce que Chris parla à la sœur? C
18. Le client parla avec la sœur du célibataire qui portait un soutien-gorge rembourré.
Est-ce que le client parla au célibataire? N
19. Le journaliste interviewa la nièce du prêtre qui portait un bikini.
Est-ce que le journaliste interviewa une fille? C
20. Anne parla à la fille du pilote qui avait des implants en silicone.
Est-ce qu'Anne parla au pilote? N

21. L'athlète regarda le cousin de sa copine italienne qui portait un speedo.
Est-ce que la copine de l'athlète est russe? N

22. Un homme tua la servante de l'acteur qui était dans le jardin avec son mari.
Est-ce que la servante était dans le jardin? C

Appendix F

SENTENCES USED IN THE MEMORY SPAN TASK (ENGLISH)

Set 1

1. It was the employee that wanted the **raise**.¹¹
2. It was the story that told the **librarian***.¹²

Set 2

3. The parent hugged the child that made the birthday **card**.
4. The man attacked the burglar that sneaked into his **house**.
5. The spectators applauded the goal that scored the **player**.*
6. The teacher rewarded the question that answered the **student**.*

Set 3

7. The car in which the president rode was designed for an **actress**.
8. The restaurant who performed in the opera that Jenny saw was at the **singer**.*
9. It was a turnip and not a recipe that was called for in the **carrot**.*
10. It was the player in the red shorts who broke his **arm**.
11. The murder mystery was so engrossing that Maria forgot about her **meeting**.

Set 4

12. It was the garbage collector that the trash can **emptied**.*
13. It was the robbery that the police officer **prevented**.
14. It was the child that the multiplication tables **learned**.*

¹¹ The final words are bolded here to emphasize what is the final word the participants had to recall. In the experiment these words were not bolded.

¹²* indicates implausible sentences.

Set 5

15. It was the party that Julia hosted that woke the **neighbors**.
16. It was the boy with the sprained thumb that sat on the big **chair**.
17. The red barn jumped the fence besides the **horses**.*
18. It was the child with a foreign stamp that intrigued the **letter**.*
19. The long test given at school was assumed to measure **intelligence**.
20. It was the sleeping couple that woke the loud **noise**.*

Set 6

21. It was the President that the crime bill **vetoed**.*
22. It was the soap opera that the housekeeper **watched**.
23. It was the actor that the Academy Award **won**.*

Set 7

24. The woman met the author that wrote the **novel**.
25. The car followed the man that stole the **detective**.*
26. The evaluation that the student wrote pleased the **professor**.
27. The comedian that the joke told amused the **audience**.*

Set 8

28. It was the hallway the swept the **janitor**.*
29. It was the doctor that wrote the **prescription**.

Set 9

30. The insects that the girl collected disgusted her **mother**.
31. The doctor that the diagnosis gave upset the **patient**.*
32. The plan that the politician advocated interested the **voter**.
33. It was the tornado reported on the news that destroyed the **village**.
34. The psychologist that the advice gave puzzled the **client**.*

Set 10

35. It was the fisherman that caught the **trout**.
36. It was the Gatorade that drank the **athletes**.*

Set 11

37. It was the chicken that the chef **fried**.
38. It was the mansion that the fire **consumed**.
39. It was the boy that the thunder **heard**.*

Set 12

40. The scary dog bit the child that pulled its **tail**.
41. The cook that the soup prepared tasted **good**.*
42. The house that Jack built burned **down**.
43. The politician that the article read angered **him**.*
44. The food that Nathan prepared poisoned **Susan**.
45. The plumber that the sink installed fell **apart**.*

Set 13

46. The firefighter rescued the boy that was trapped in the **apartment**.
47. The killer kidnapped the murder that witnessed the **man**.*
48. The woman thanked the girl that found the **wallet**.
49. The speech introduced the celebrity that gave the **host**.*

Set 14

50. It was the neighbor that destroyed the **garden**.
51. It was the document that shredded the angry **cats**.*
52. It was the student by Chomsky that the book **read**.*
53. It was the poisonous plant that the child **ate**.
54. It was the secretary that took the **message**.
55. It was the heartburn that gave the man **chili**.*

Set 15

56. It was the bodybuilder that lifted the **barbell**.

57. It was the purse that snatched the **thief**.*

Set 16

58. It was the cookie who ate the youngest **child**.*
 59. It was the computer with the broken hard drive that sat on the **table**.
 60. The students in the conservative newspaper infuriated the **editorial**.*
 61. The lawyer with the good reputation was hired by the **criminals**.
 62. It was the teacher that had to be graded by the last set of **papers**.*

Set 17

63. It was the talent contest that entered the **dancers**.*
 64. It was the plumber that unclogged the **drain**.
 65. It was the washing machine that the repairman **fixed**.

Set 18

66. The dog bit the house that robbed the **intruders**.*
 67. The woman who knew Sam well thought he was a good **cook**.
 68. The man loved the deep purple irises that were **growing**
 69. The paper used the blue pencil only to revise the **editor**.*
 70. The school musical made an excellent prop in the feathery **hat**.*

Set 19

71. It was the newspaper article that angered the murder **suspect**.
 72. It was the egg that laid the **chicken**.*
 73. The pool dove in to the careless swimmer that was **empty**.*
 74. The angry woman slapped the man that touched her **leg**..
 75. The tennis player hit the ball that was out of **bounds**.
 76. The bowl ate the food that was in the **kitten**.

Set 20

77. The cereal box that the prize contained disappointed the **children**.*
 78. The guests that the band played entertained the **music**.*
 79. The instruction that the boss gave confused the **secretary**.
 80. The package that the driver delivered thrilled the **recipient**.

Appendix G

SENTENCES USED IN THE MEMORY SPAN TASK (FRENCH)

Set 1

1. C'était l'employé qui voulait une **augmentation**.
2. C'était l'histoire qui raconta le **libraire**.*

Set 2

3. Les parents embrassèrent l'enfant qui écrivit la carte **d'anniversaire**.
4. L'homme attaqua le cambrioleur qui s'introduisit dans sa **maison**.
5. Les spectateurs applaudirent le but qui marqua le **joueur**.*
6. Le professeur récompensa la question qui répondit **l'étudiant**.*

Set 3

7. La voiture dans laquelle le président conduit était conçue pour une **actrice**.
8. Le restaurant qui joua dans l'opéra que Jenny vit était au **chanteur**.*
9. C'était le navet et non pas la recette qui demanda une **carotte**.*
10. C'était le joueur au short rouge qui se cassa le **bras**.
11. Le mystère du meurtre était si absorbant que Marie oublia sa **réunion**.

Set 4

12. C'étaient les éboueurs que la poubelle **vida**.*
13. C'était le vol que l'officier de police **évita**.
14. C'était l'enfant que la table de multiplication a **apprise**.*

Set 5

15. C'était la fête que Julie fit qui réveilla les **voisins**.
16. C'était le garçon avec une entorse au pouce qui était assis dans le grand **fauteuil**.
17. La ferme rouge sauta par-dessus la barrière à côté des **chevaux**.*

18. C'était l'enfant avec un timbre étranger qui intrigua la **lettre**.*
19. Le long test donné à l'école était censé mesurer **l'intelligence**.
20. C'était le couple endormi qui réveilla le **bruit**.*

Set 6

21. C'était le président que le projet de loi exerça son droit de **véto**.*
22. C'était le feuilleton télévisé que la femme au foyer **regardait**.
23. C'était l'acteur que le César **gagna**.*

Set 7

24. La femme rencontra l'auteur qui écrivit ce **roman**.
25. La voiture suivit l'homme qui vola le **détective**.*
26. L'évaluation que l'étudiant écrivit plut au **professeur**.
27. Le comédien que la blague raconta amusa les **spectateurs**.*

Set 8

28. C'était le couloir qui balaya le **concierge**.*
29. C'était le docteur qui écrivit **l'ordonnance**.

Set 9

30. Les insectes que la fille collectionnait dégoûtaient sa **mère**.
31. Le docteur que le diagnostic donna perturba le **patient**.*
32. Le plan que le politicien soutenait intéressa les **citoyens**.
33. C'était la tornade annoncée aux informations qui détruisit le **village**.
34. Le psychologue que le conseil donna perturba le **client**.*

Set 10

35. C'était le pêcheur qui attrapa une **truite**.
36. C'était du Gatorade qui buvait les **athlètes**.*

Set 11

37. C'était le poulet que le cuisinier **frit**.

38. C'était la maison que le feu **consuma**.
 39. C'était le garçon que le tonnerre **entendit**.*

Set 12

40. Le chien effrayant mordit l'enfant qui tirait sa **queue**.
 41. Le cuisinier que la soupe prépara avait bon **goût**.*
 42. La maison que Jacques construisit **brûla**.
 43. Le politicien que l'article lut **l'énerva**.*
 44. La nourriture que Paul prépara empoisonna **Suzanne**.
 45. Le plombier que l'évier installa tomba en **morceau**.*

Set 13

46. Le pompier sauva l'enfant qui était coincé dans **l'appartement**.
 47. Le tueur kidnappa le meurtre qui témoigna **l'homme**.*
 48. La femme remercia la fille qui trouva le **sac**.
 49. Le discours introduisit la personne célèbre qui donna le **présentateur**.*

Set 14

50. C'était le voisin qui détruisit le **jardin**.
 51. C'était le document qui déchira les chats **énervés**.*
 52. C'était l'étudiant de Chomsky que le livre **lu**.*
 53. C'était la plante vénéneuse que l'enfant **mangea**.
 54. C'était le secrétaire qui prit le message.
 55. C'était la brûlure d'estomac qui donna à l'homme le **chili**.*

Set 15

56. C'était le culturiste qui souleva les **poids**.
 57. C'était le sac à main qui arracha le **voleur**.*

Set 16

58. C'était le biscuit qui mangea le jeune **enfant**.*
 59. C'était l'ordinateur avec le disque dur endommagé qui était sur la **table**.
 60. Les étudiants dans le journal conservateur énervèrent **l'article**.*
 61. L'avocat à la bonne réputation fut embauché par les **criminels**.
 62. C'était le professeur qui devait être noté par les derniers **papiers**.*

Set 17

- 63. C'était le concours de talent qui entra les **danseurs**.*
- 64. C'était le plombier qui déboucha le **tuyau**.
- 65. C'était la machine à laver que le réparateur **répara**.

Set 18

- 66. Le chien mordit la maison qui vola les **cambricoleurs**.*
- 67. La femme qui connaissait bien Sam pensa qu'il était un bon **cuisinier**.
- 68. L'homme aimait les grands iris violets qui poussaient dans son **jardin**.
- 69. Le papier utilisa le crayon bleu seulement pour réviser **l'éditeur**.*
- 70. Le spectacle de l'école fit un excellent costume de chapeau à **plume**.*

Set 19

- 71. C'était l'article de journal qui énerva le suspect du **meurtre**.
- 72. C'était l'œuf qui pondit le **poulet**.*
- 73. La piscine plongea dans le nageur insouciant qui était **vide**.*
- 74. La femme fâchée gifla l'homme qui toucha sa **jambe**.
- 75. Le joueur de tennis frappa la balle qui était **sortie**.
- 76. Le bol mangea la nourriture qui était dans le **chaton**.*

Set 20

- 77. La boîte de céréales que le prix contenait déçut les **enfants**.*
- 78. Les invités que le groupe jouèrent distrayèrent la **musique**.*
- 79. Les instructions que le chef donna embrouillèrent la **secrétaire**.
- 80. Le paquet que le livreur amena réjouit les **destinataires**.

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Publications

Kinginger, C. & Blattner, G. (In press). Assessing the Development of Sociolinguistic Awareness in Study Abroad: Colloquial French. In L. Ortega & H. Byrnes (Eds.), *The Longitudinal Study of Advanced L2 Capacities*. Mahwah, NJ: Lawrence Erlbaum.

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Presentations

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Blattner, G., Dussias, P.E., & Cramer, T.R. Bilingual syntactic processing: differences in the interpretation of verb subcategorization frames may be attributable to cognitive variations. Paper presented at the Sixth International Symposium on Bilingualism (ISB6), Hamburg, Germany, May 2007.

Awards

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