PLAUSIBILITY AND STRUCTURAL REANALYSIS

IN ONLINE L1 AND L2 SENTENCE PROCESSING

by

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ABSTRACT

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This study examines whether highly proficient comprehenders of English with different language learning profiles -- English native speakers (NSs, *N*=40), late (Korean-English) learners (LLs, *N*=32), and early bilinguals (EBs, *N*=28) -- make comparable use of plausibility information in the online processing of structurally complex sentences. Two sentence types involving temporarily ambiguous structural configurations, subordinate-clause (SC) ambiguity sentences and split/non-split phrasal verb (PV) constructions, were tested using self-paced reading. In SC ambiguity sentences, the pattern of reading times indicated that all three groups were able to use plausibility information to recover from initial structural misanalysis. NSs and EBs were also able to use this information to facilitate syntactic and semantic reanalysis in sentences involving split PVs. LLs, however, showed persistent processing difficulty for these PV sentences, regardless of the plausibility of the initial analysis. These results indicate that

highly proficient comprehenders of English -- whether NSs, LLs, or EBs -- are able to use plausibility to facilitate structural processing, even in sentences that require major syntactic reanalysis (contra Roberts & Felser, 2011). The only clear limit on LLs' ability to use this information related to lexico-syntactic/semantic processing difficulty, in that they appeared to be unable to use this information to recover from misanalysis associated with the idiosyncratic structural properties of English PVs. Finally, in both sentence types, EBs appeared to make particularly efficient use of plausibility information for structural reanalysis, which might be attributed to a bilingual cognitive advantage.

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Chapter 1

Introduction

The aim of numerous psycholinguistic studies is to understand how people comprehend sentences. Although sentence comprehension may seem simple or automatic, it is a complex process in which a number of constituent sub-processes are involved. In order for this process to occur smoothly and without error, multiple sources of information must be processed rapidly and integrated efficiently. For instance, during sentence comprehension, the comprehender not only analyzes the auditory or visual stimuli (e.g., characters, words), but also integrates these elements together to form the appropriate syntactic structure and to interpret the meaning of the sentence. Although such processes cannot be observed directly, it is possible to examine these comprehension mechanisms indirectly by providing input stimuli to comprehenders and examining their responses.

Structural ambiguity is a useful phenomenon because it can be employed to understand the mental processes involved in sentence comprehension. This ambiguity occurs when a string of words happens to be compatible with more than one syntactic structure. In some cases, a whole sentence can be ambiguous (*global ambiguity*). In other cases, ambiguity may occur temporarily, which is then resolved by words later in the sentence (*temporary ambiguity*). In temporarily ambiguous sentences, if a word is not grammatically compatible with

the syntactic structure that is currently being parsed, the comprehender will be forced to reanalyze the initial, incorrect syntactic analysis, yielding what is called a "garden path effect". This effect refers to the extra processing costs that are incurred when the parser detects the incompatibility with the preferred structure and revises the initial misanalysis. It is important to note that despite these garden path effects, individuals are often unaware of the presence of ambiguity in sentences because they are resolved so quickly.

Much of the research in first language (L1) and second language (L2) sentence processing has focused on examining the kinds of strategies and the types of information that comprehenders with different language backgrounds use to resolve structural ambiguities in globally or temporarily ambiguous constructions (see e.g., Dussias, 2003; Dussias et al., 2008; Felser et al., 2003; Frenck-Mestre & Pynte, 1997; Frazier & Rayner, 1982; MacDonald et al., 1994; Juffs, 1998a; Papadopoulou & Clahsen, 2003; Witzel, Witzel, & Nicol, 2012). Factors such as lexical frequency, plausibility of events, discourse information, knowledge of the world, and prosodic information have been found to influence the resolution process to a greater or lesser extent.

Of particular interest in this project are studies that have shown that plausibility affects the recovery process from syntactic misanalysis in "garden-path" (GP) sentences in both L1 and L2 (Pickering & Traxler, 1998; Juffs & Harrington, 1996; Williams et al. 2001; Williams, 2006; Roberts & Felser, 2011).

Although these studies have shown that both native and nonnative readers are highly sensitive to plausibility when constructing and revising syntactic analyses, there is some evidence to suggest that there are limits to L2 learners' ability to use this information source during structural processing. Specifically, it has been argued that L2 learners might not be able to use plausibility in order to facilitate reanalysis in sentences that involve especially complex structural processing (Roberts & Felser, 2011). Further examination of this issue is necessary in order to determine whether this is the case with different groups of L2 comprehenders.

More generally, the goal of this dissertation is to investigate the role of plausibility information in the structural ambiguity resolution process, and whether the use of this source of information is influenced by comprehenders' language learning backgrounds. More specifically, this dissertation explores whether comprehenders with different language profiles -- native speakers (NSs), early bilinguals (EBs), and late (Korean-English) learners (LLs) -- are able to make comparable use of plausibility information to avoid or recover from an initial misanalysis in the online processing of structurally complex sentences. To this end, two sentence types involving temporarily ambiguous structural configurations were tested using self-paced reading: subordinate-clause (SC) ambiguity sentences (e.g., *While Emma played (drank) the song about true love amused all the customers at the club*.) and phrasal verb (PV) constructions (e.g.,

Mary ran over the fox that crossed the road when it jumped in front of her car. vs. *Mary ran the fox that crossed the road over when it jumped in front of her car*.)

This issue is particularly important in relation to L2 sentence comprehension, much of which has focused (i) whether the L1 affects L2 sentence processing and (ii) whether structural computation in the L2 is characterized by the same depth and detail as in the L1. Specifically, this examination into whether and how L2 learners (in this case, the LL participant group) use plausibility information during the online sentence comprehension of structurally challenging sentence types can shed light on core issues related to the depth of L2 syntactic processing. Furthermore, by comparing the processing patterns of EBs with monolingual NSs, it should be possible to examine whether the bilingual cognitive advantage (Bialystok, Craik, Klein, & Viswanathan, 2004; Bialystok, Craik, & Luk, 2008; Costa et al., 2008, 2009) extends to coordinating multiple sources of information during online sentence processing. If that is the case, EBs might make particularly effective and efficient use of plausibility information to recover from initial structural misanalysis.

With regard to the processing characteristics of this EB group, it has been argued that bilinguals have a unique cognitive profile as a result of their language background (Bialystok, 2006; Prior & MacWhinney, 2010). That is, bilingual speakers enjoy some cognitive advantages in domains such as *conflict resolution, multi-tasking,* and *working memory* relative to their monolingual peers (Bialystok,

Craik, Klein, & Viswanathan, 2004; Bialystok, Craik, & Luk, 2008; Costa et al., 2008, 2009). This might be because bilingual speakers need to continuously control their two languages. For example, they not only have to focus on the relevant linguistic information, but also need to avoid interference from their other (non-intended) language (Costa, La Heij, & Navarrete, 2006; Costa & Santesteban, 2004; Costa, Santesteban, & Ivanova, 2006; Finkbeiner, Almeida, Janssen, & Caramazza, 2006; Finkbeiner, Gollan, & Caramazza, 2006; Green, 1998; La Heij, 2005; Meuter & Allport, 1999; Philipp, Gade, & Koch, 2007). Investigations into whether EBs process the target language in the same way as NSs during sentence comprehension may thus shed light on the role of cognitive control in online language processing, and more broadly on the interaction of language and cognition.

The dissertation is structured as follows. In Chapter 2, the L1/L2 psycholinguistics literature on the processing of ambiguous SC constructions constitutes the beginning of the chapter, followed by the description, design, and analysis of the experiment related to this sentence type. Chapter 3 discusses how PVs have been studied in the L1/L2 psycholinguistics literature and then presents the experiment related to the PV construction. Chapter 4 provides a summary of the results presented in Chapter 2 and 3 and presents conclusions, together with the limitations of this work and possible avenues for future research.

Chapter 2

Subordinate-Clause (SC) Ambiguity

One widely investigated construction in studies of syntactic ambiguity resolution involves the subordinate-clause (SC) ambiguity in sentences like the following: *As the woman edited the magazine about fishing amused all the reporters*. A number of studies have shown that comprehenders initially interpret the noun phrase (NP) *the magazine* as the direct object (DO) of the preceding subordinate-clause verb (*edited*), only to revise this analysis when they encounter the disambiguating verb (*amused*) in the main clause (see e.g., Ferreira & Henderson, 1991; Juffs & Harrington, 1996; Juffs, 1998b, 2004; Pickering & Traxler, 1998; Felser & Roberts, 2004; Roberts & Felser, 2011). For NSs, Pickering & Traxler (1998) found that the process of recovery in these sentences is influenced by the plausibility of the ambiguous NP as a DO of the preceding verb. More specifically, at this NP, readers initially found locally implausible sentences (e.g., #*As the woman sailed the magazine about fishing amused all the reporters*.) more difficult to process than locally plausible sentences (e.g., *As the woman edited the magazine about fishing amused all the reporters*.). That is, they found a clear plausibility effect at this point. However, at the disambiguating region (*amused*), there was more processing difficulty for plausible sentences than for implausible sentences – or a reverse plausibility effect. This pattern of results was taken to indicate that readers were strongly committed to the initial

misanalysis in the plausible condition and thus that it was harder to reanalyze these sentences to the correct parse.

Interestingly, there is evidence suggesting that non-native speakers (NNSs) are not able to use plausibility comparably to recover from misanalysis in these sentences. Specifically, although Roberts and Felser (2011) found that NNSs were sensitive to plausibility information during the reanalysis of weak GP sentences involving complement clause constructions (e.g., *The inspector warned the boss (crimes) would destroy very many lives*.), such effects were not observed during the processing of strong GP constructions involving SC ambiguity (e.g., *While the band played the song (beer) pleased all the customers*.). It is important to point out that these SC ambiguity sentences force comprehenders to detach a structural ambiguous NP from the subordinate-clause verb phrase (VP) and reanalyze it as a main-clause subject. Due to the structural processing difficulty involved in this sentence type, Roberts and Felser argued that L2 learners might not be able to use plausibility information effectively during reanalysis.

Further examination of this argument is important because it has clear implications for theoretical proposals related to the "depth" of L2 sentence processing. Specifically, with regard to the processing of syntactic structure, Clahsen and Felser (2006) argue that L2 sentence processing is fundamentally different from the processing of sentences in a native language. According to their *Shallow Structure Hypothesis* (SSH), NNSs do not make use of syntactic or

structural information in the same way as NSs when parsing sentences in the target language. Rather, they argue that NNSs construct shallow syntactic representations and rely more heavily on lexical, semantic, and pragmatic information in order to compensate for a relative lack of access to grammatical knowledge. The finding that NNSs appear to be unable to use plausibility information to facilitate especially complex structural processing/reanalysis has been taken as consistent with this hypothesis (Roberts & Felser, 2011). That is, it has been interpreted as a further indication that NNSs' structural processing abilities are less automatic or reduced as compared to NSs. Further investigation of sentences involving this type of "radical structural reorganization" (Roberts & Felser, 2011: 325) might thus provide a clear idea of how plausibility is used to recover from misanalysis in L2 syntactic processing.

In addition, this SC ambiguity construction provides a good testing ground for an examination into whether the cognitive benefits of bilingualism extend to coordinating multiple sources of information during real-time sentence processing. In SC ambiguity sentences, we understand that comprehenders are more likely to attach the ambiguous NP as the DO of the subordinating verb. Upon encountering the main verb, readers need to reanalyze the sentence to appropriately attach this NP as the subject of the main clause. In this way, these sentences yield conflicting analyses because the preferred syntactic structure (the DO analysis) needs to be abandoned to arrive at the correct interpretation. It is thus likely the case that

recovery from this garden path involves cognitive control as well as conflict resolution. And it is possible that early bilinguals who have an advantage in these cognitive domains may be able to better recover from this misanalysis, particularly in cases where plausibility information offers an additional cue to the correct interpretation.

Although many researchers have examined whether bilinguals' continuous involvement of control mechanisms influences other cognitive capacities relative to their monolingual peers (Bialystok, Craik, Klein, & Viswanathan, 2004; Bialystok, Craik, & Luk, 2008; Costa et al., 2008, 2009; Hernandez and Li, 2007; Martin-Rhee & Bialystok, 2008; Hilchey & Klein, 2011; Sebastian-Galles, 2008), few studies have investigated the possible role of this heightened cognitive control during online sentence processing. In fact, Gutiérrez (2013) is the only study to date that has attempted to address this issue in the bilingual literature. Using pupillometry, this study examined whether bilinguals' cognitive abilities extend to online sentence processing by testing two groups of early bilinguals. The participants included sequential Spanish-English bilinguals (who were first exposed to English at approximately age 5), simultaneous Spanish-English bilinguals (who were exposed to both Spanish and English from birth), and English monolinguals as the control group. One of the sentence types that was tested involved locally plausible/implausible SC ambiguity. This study, however, yielded inconclusive result, in that while neither the sequential bilingual group nor

the monolinguals showed plausibility effects, the simultaneous bilingual group revealed both plausibility and reverse plausibility effects. Thus, based on this study alone, it is not yet clear whether early bilinguals' cognitive abilities can be transferred directly to sentence processing. Further research into this issue is thus necessary in order to understand the nature of cognitive benefits associated with bilingualism and, more generally, the interaction of language and cognition.

In the following section, I review some of the previous L1 and L2 sentence processing studies that motivate the SC ambiguity experiment detailed below. Then, the SC experiment is introduced in Section 2.2. In Section 2.3, the methodology for the experiment is described in detail. Section 2.4 discusses the results of the experiment, followed by a summary of the findings in Section 2.5.

2.1 Theoretical Motivation

2.1.1 Theoretical Motivation for the Investigation of the LL group

A number of studies have investigated the L2 processing of structurally ambiguous sentences. Several of these studies have indicated that NNSs are sensitive to plausibility and can use this information during the online comprehension of these sentences. For instance, Williams, Möbius, and Kim (2001) investigated whether L2 learners of English (Chinese, Korean, and German) would show sensitivity to plausibility information in the online processing of temporarily ambiguous *wh*-questions. Participants read sentences

containing either a plausible or implausible filler noun as the direct object of the main verb (e.g., *Which girl (river) did the man push the bike into late last night?*). In this task, they read sentences one word at a time, and were asked to indicate the point at which they thought the sentence no longer made sense. The results showed that both NSs and NNSs made more stop-making-sense decisions at the verb in the implausible condition (# *Which river did the man push…?*) than in the plausible condition (*Which girl did the man push...?*). This finding suggests that all participant groups analyzed the filler as the DO of the verb (*push*) and computed the plausibility of the filler as this DO. Interestingly, in the post-verbal disambiguating region (*the bike*), the implausible NP condition was read faster than the plausible NP condition for both the NS and NNS groups. However, NSs showed an immediate reverse plausibility effect at this region, whereas NNSs showed a delayed effect, suggesting that NSs initiated reanalysis earlier when they found the initial analysis was implausible. In addition, the results from an off-line plausibility judgment task showed that NNSs judged the plausible NP items as unacceptable more often than the implausible items, whereas NSs showed no differences in acceptability ratings for the two sentence types. This was taken to suggest that NNSs had more difficulty than NSs recovering from syntactic misanalysis.

With regard to the delayed reverse plausibility effects for NNSs, Williams et. al (2001) argued that this processing difficulty might be due to "argument

competition" rather than syntactic revisions (Williams, 2006:73) since NNSs showed no such effects until the post-verbal noun. Williams (2006) thus conducted a follow-up study to further examine NSs and NNSs' reverse plausibility effects in the post-verbal region by increasing the number of words prior to the noun (e.g., *Which machine (friend) did the mechanic fix the very noisy motorbike with two weeks ago?*). He hypothesized that NNSs would show reverse plausibility effects prior to the noun (*motorbike*) if there is merely a delay in employing plausibility information. However, if NNSs' delayed reverse plausibility effects reflect thematic level processes (e.g., substituting the post-verbal noun for the filler as the theme in the verb's argument structure), these effects should be obtained only at and after the post-verbal noun. Overall, the results showed that both NSs and NNSs initially interpreted the filler as the DO of the verb (*fix*) in both the plausible and implausible conditions, suggesting that both groups processed plausibility information incrementally. More specifically, there were more stop-making-sense decisions at and immediately following the verb in the implausible condition for both NSs and NNSs. For the plausible condition, both groups of participants also made more stop-making-sense decisions and showed slower reading times in the immediate post-verbal region, and crucially prior to the post-verbal noun. This finding suggests that NSs and NNSs did not have to wait until there was overt argument competition at the post-verbal noun, but rather used the *det-int-adj* sequence (*the very noisy*) to trigger

reanalysis. The results from Williams et al. (2001) and Williams (2006) thus indicate that both NSs and NNSs use plausibility information to recover from syntactic misanalysis, suggesting that like L1 readers, L2 learners build syntactic and semantic/conceptual representations incrementally during online language comprehension.

Although the results of these studies indicate that NNSs are sensitive to plausibility information in the reanalysis of GP sentences, a recent study by Roberts and Felser (2011) has suggested that this sensitivity might depend on sentence type. Specifically, they examined the effect of plausibility on Greek L2 learners' online processing of GP sentences using a self-paced reading task. Two different types of GP sentences were tested -- "weak" GP-complement clause sentences and "strong" GP-SC ambiguity sentences. For the weak GP sentences (e.g., *The inspector warned the boss (crimes) would destroy very many lives*.), NNSs showed an immediate and prolonged plausibility effect at and after the ambiguous NP in the implausible condition (*crimes*), whereas NSs showed only a delayed effect. During the processing of the disambiguating region, both NSs and NNSs showed reverse plausibility effects, suggesting that both groups now found the plausible DO condition (*warned the boss*) more difficult to process than the implausible DO condition (# *warned the crimes*). For the strong GP sentences (e.g., *While the band played the song (beer) pleased all the customers*.), on the other hand, the results showed that implausible DOs (*beer*) led to longer RTs than

plausible ones (*song*) only for the L2 learners. There were also no statistically reliable reverse plausibility effects at or after the disambiguating main-clause verb (*pleased*) for either NSs or NNSs.

In order to account for the different pattern of results for these sentence types, Roberts and Felser pointed out that reanalysis in weak GP sentences may involve relatively little computational effort compared to strong GP sentences (Gorrell, 1995; Pritchett, 1992; Weinberg, 1999). Specifically, in weak GP-complement clause sentences, although reanalysis involves adding a clause boundary as well as revising case and thematic role assignments for the NP (*the boss*), it seems that all of these adjustments can take place within the current thematic processing domain, as shown in (1) below:

(1)

a. The inspector [$_{VP}$ [$_{V'}$ warned [$_{NP}$ the boss]]]….

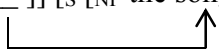
b. The inspector [$_{VP}$ [$_{V'}$ warned [$_{S}$ [$_{NP}$ the boss] [$_{VP}$ would destroy…]]]]

(*adapted from Roberts & Felser (2011:325)*)

Even though the NP *the boss* is reanalyzed as a subject of an embedded clause, it remains part of the complement of the verb *warned*. Under such conditions, it may not be particularly difficult for NNSs to recover from an initial misanalysis.

On the other hand, for the strong GP-SC ambiguity sentences, the ambiguous NP (*the song*) is initially analyzed as the DO of the subordinate-clause verb and is then reanalyzed as the subject of a main clause, as shown in (2) below:

(2) [$_S$ While the band [$_{VP}$ played ___]] [$_S$ [$_{NP}$ the song] [$_{VP}$ pleased everyone]]



Since this syntactic restructuring process involves both a break in the current thematic domain and the creation of a new domain, Roberts and Felser argue that even highly proficient L2 learners might not be able to revise their initial misanalysis during the processing of these sentences. In this way, the lack of a reverse plausibility effect in the disambiguating regions of these sentences was attributed to NNSs' reduced ability to use structural information in online sentence comprehension. Roberts and Felser point out that these results match well with findings from previous L2 processing studies suggesting that NNSs' structural processing abilities might be slow and less automatic compared to NSs' (Felser & Roberts, 2007; Felser, Roberts, Gross, & Marinis, 2003; Hahne & Friederici, 2001; Marinis, Roberts, Felser, & Clahsen, 2005; Papadopoulou & Clahsen, 2003).

Although these findings are interesting and appear to have important implications for L2 sentence processing models, more research is necessary in order to understand the influence of plausibility information during online L2 sentence comprehension. Specifically, further examination of sentences involving SC ambiguity is necessary to investigate whether other groups of L2 learners would show a comparable inability to use plausibility to facilitate reanalysis in this sentence type.

Such examinations would seem to be particularly necessary in light of some discrepancies between the findings from Roberts and Felser (2011) and those of Pickering and Traxler (1998), which examined comparable sentence types. Specifically, Pickering and Traxler (1998) used eye tracking to investigate plausibility effects on NSs' processing of similar weak/strong GP sentences (i.e., complement clause ambiguity; *The criminal confessed his sins (gang) which upset kids harmed too many people* vs. SC ambiguity; *As the woman edited (sailed) the magazine about fishing amused all the reporters*). In both sentence types, readers showed plausibility effects at the ambiguous NP (*gang/magazine*) and reverse plausibility effects at and after the disambiguating verb (*harmed/amused*). The results for the SC ambiguity sentences were therefore quite different than those reported in Roberts and Felser. Recall that for the NS in that study, there were no plausibility effects at the ambiguous NP and no reverse plausibility effects at the disambiguating verb in these sentences. (Note also that in Roberts and Felser, a post hoc speed analysis revealed that only slow readers showed plausibility effects in the weak GP sentences.)

With regard to NSs' insensitivity to plausibility information in SC ambiguity sentences, Roberts and Felser argue that this might be due to modifications of their experimental sentences. For the SC ambiguity sentences in Pickering and Traxler, the head of the ambiguous phrase (*magazine*) was separated from the disambiguating word (*amused*) by intervening material (e.g.,

As the woman edited (sailed) the magazine about fishing amused all the reporters.). Previous research has shown that when there is structural distance between the ambiguous NP and the disambiguating element, reanalysis becomes more difficult for comprehenders (e.g., Christianson, Hollingworth, Halliwell, & Ferreira, 2001; Ferreira & Henderson, 1991). Roberts and Felser, however, deliberately kept their sentences simple (e.g., *While the band played the song pleased all the customers*.) in order to make them easier for L2 learners to comprehend. In these sentences, since the ambiguous NP (*song*) appeared immediately before the disambiguating verb (*pleased*), Roberts and Felser contend that it is possible that commitment to the initial misanalysis would have been relatively short. For this reason, NSs might not have experienced reanalysis difficulty and may have been able to revise any possible misinterpretations too quickly to show any measurable plausibility effects. However, it is difficult to conclude that NSs and NNSs showed different processing patterns on these sentence types if the items were incapable of eliciting the relevant processing costs. Therefore, a L1/L2 study using the same materials as in Pickering and Traxler (*As the woman edited the magazine about fishing amused* . . .) is necessary in order to allow for a more straightforward examination into whether/how NSs and NNSs are influenced by plausibility information in this sentence type.

In addition to this structural distance issue, Roberts and Felser also did not include the relevant control conditions (e.g., unambiguous controls) for SC ambiguity sentences. This again differed from the earlier study by Pickering and Traxler, which provided participants with unambiguous controls (e.g., *As the woman edited (sailed), the magazine about fishing amused all the reporters*.). In these control sentences, a comma after the subordinate verb unambiguously indicated the structural properties of the immediately following NP. Since no misanalysis is expected in these controls, inclusion of these sentences can provide a clear indication of reanalysis costs. In light of these issues, a replication study with a more careful research design should be conducted for more accurate understanding of these sentence types.

2.1.2 Theoretical Motivation for the Investigation of the EB group

An investigation of these sentence types with early bilinguals might also shed light on the possible connection between bilingual cognitive advantages and online language processing. Specifically, these sentences would seem to allow for an examination into whether early bilinguals are able to use plausibility information to efficiently resolve conflicting information during online sentence comprehension. As discussed above, in these sentences, readers are more likely to attach the ambiguous NP as the DO of the subordinating verb. According to the Garden Path Account proposed by Frazier (1979), this initial misanalysis is driven

by the simplest syntactic attachment (so called “minimal attachment”), which is the DO analysis, relative to the correct interpretation -- attaching the NP as the subject of the main clause. Upon encountering the main verb, however, readers need to reanalyze the sentence to appropriately attach this NP as the main-clause subject. In this way, these sentences yield conflicting analyses because the preferred syntactic structure needs to be abandoned to arrive at the correct interpretation. It is therefore likely that recovery from this garden path involves cognitive control as well as conflict resolution. And it is possible that early bilinguals who have an advantage in these domains may be better equipped to recover from this misanalysis, particularly in cases where plausibility information offers an additional cue to the correct interpretation.

Indeed, bilinguals have been shown to have unique cognitive profile as a result of their language background (Bialystok, 2006; Prior & MacWhinney, 2010). For instance, a number of studies have found that bilingual speakers enjoy cognitive advantages in areas such as conflict resolution, multi-tasking, working memory relative to their monolingual peers (Bialystok, Craik, Klein, & Viswanathan, 2004; Bialystok, Craik, & Luk, 2008; Costa et al., 2008, 2009). This might be because bilingual speakers need to continuously control their two languages. For example, they not only have to focus on the relevant linguistic information, but also need to avoid interference from their other language (Costa, La Heij, & Navarrete, 2006; Costa & Santesteban, 2004; Costa, Santesteban, &

Ivanova, 2006; Finkbeiner, Almeida, Janssen, & Caramazza, 2006; Finkbeiner, Gollan, & Caramazza, 2006; Green, 1998; La Heij, 2005; Meuter & Allport, 1999; Philipp, Gade, & Koch, 2007). In particular, Michael and Gollan (2005) argued that because bilinguals' management of two language systems requires inhibition of one system while the other language is being used, they may exhibit more efficient working memory abilities than monolinguals. In this sense, bilingual language use may help to develop cognitive skills such as extensive manipulation and control of working memory resources, thereby enhancing the use of those resources for other cognitive tasks.

To date most of the research that has examined whether the continuous involvement of control mechanisms in bilinguals has an impact on their cognitive performance relative to their monolingual peers (see e.g., Bialystok, Craik, Klein, & Viswanathan, 2004; Bialystok, Craik, & Luk, 2008; Costa et al., 2008, 2009; Hernandez and Li, 2007; Martin-Rhee & Bialystok, 2008; Hilchey & Klein, 2011; Sebastian-Galles, 2008) has done so through tasks that involve ignoring conflicting information (i.e., Simon task, flanker task). For instance, Bialystok et al. (2004) used the Simon task, in which participants have to respond according to a dimension of the target stimulus (color) while ignoring an irrelevant one (position on the screen). They found that responses were slower for incongruent than for congruent trials (the conflict effect) and that this effect was larger for monolinguals than for bilinguals. In other words, monolinguals spent more time

resolving conflicting information compared to bilinguals. This finding suggests that bilinguals are better at resolving distracting or conflicting information (e.g., Bialystock et al., 2004; Bialystok et al., 2008; Costa et al., 2008).

Another study by Costa et al. (2008) asked both monolinguals and bilinguals to perform the flanker test. In this task, participants simply indicated whether a central arrow displayed on the screen was pointing to the right or to the left. This arrow was presented along with flanker arrows pointing in the same direction (congruent trials) or in the opposite direction (incongruent trials). Similar to the findings in Bialystok et al (2004), this study found that the conflict produced by incongruent distracters was smaller for bilinguals than for monolinguals. Interestingly, it also appeared that bilinguals were overall faster than monolinguals in performing tasks involving conflict resolution. In line with these studies, Hilchey and Klein (2011) have claimed that bilinguals are more adept at monitoring potentially conflicting material. That is, when bilinguals identify incoming conflicting information, they seem more efficient at allocating cognitive recourses to resolving the conflict.

Interestingly, very few studies have examined the role of such cognitive advantages during online sentence processing in early bilinguals. In fact, Gutiérrez (2013) is the only study to date that has attempted to investigate this issue. This study used pupillometry, which is sensitive to cognitive workload or processing demands, to compare monolinguals' as well as simultaneous and

sequential bilinguals' language processing during online (aural) sentence comprehension. Three sentence types involving SC ambiguity, reflexive pronoun-anaphor gender agreement, and filler-gap dependencies were tested. The participants included sequential Spanish-English bilinguals (who were first exposed to English at approximately age 5), simultaneous Spanish-English bilinguals (who were exposed to both Spanish and English from birth), and English monolinguals as the control group.

One of the sentence types of interest in this study was SC ambiguity sentences in which the ambiguous NP was a plausible or implausible DO. The results revealed both plausibility and reverse plausibility effects only for the simultaneous bilingual group. For the monolingual and sequential bilingual groups, on the other hand, no plausibility effects were observed at the ambiguous NP in the implausible DO condition. Rather, the opposite effect was found that both groups showed an increase in pupil size at/after the ambiguous NP in the plausible DO condition relative to the implausible DO condition.

With regard to the unexpected results for the monolingual and the sequential bilingual groups, it was argued that the immediate increase in pupil diameter in the plausible DO condition might be attributed to elevated processing costs from conflicting prosodic and syntactic information. That is, both monolinguals and sequential bilinguals may have used prosodic information to help parse the sentences because they were presented aurally with the natural

intonation. It is possible that these participants could hear the intonation pattern indicating the correct analysis of the ambiguous NP (*the song* or *the beer*). For the plausible DO condition (*play the song*), the prosodic information indicates that the NP *the song* should be the interpreted as subject of a main clause, yet this also can be a DO of *played*. Thus, this conflicting information may have caused immediate processing costs as reflected in the larger pupil dilations in the plausible DO condition. For the implausible DO condition (*play the beer*), on the other hand, the ambiguous NP is not a good thematic fit as the DO of *played*, and this is confirmed by the prosodic information indicating that it should be interpreted as the subject in the main clause. Thus, this congruency might have yielded lower processing demands and smaller pupillary changes.

As mentioned above, unlike the sequential bilingual and monolingual groups, the simultaneous bilingual group showed an immediate plausibility effect, suggesting that there was a larger processing load for the implausible DO condition (*played the beer*) relative to the plausible DO condition (*played the song*). Interestingly, Gutiérrez (2013) did not interpret this result to indicate that these bilinguals were particularly attuned to plausibility. Rather, with reference to explanation of the results for the monolingual and sequential bilingual groups, this finding was taken to suggest that these simultaneous bilinguals were relatively insensitive to potentially disambiguating prosodic information. That is, they seemed to rely more on syntactic information and plausibility information, as

revealed by the immediate effect of plausibility and the reverse plausibility effect. Gutiérrez contends that this might be because simultaneous bilinguals have been exposed to a larger variety of prosodic information due to having been exposed to multiple languages from birth. For this reason, prosodic cues might have carried less weight in the initial interpretation for simultaneous bilinguals. For sequential bilinguals, on the other hand, since they were monolinguals for the first five years of their lives before they were exposed to the second language, it is possible that they might have showed an elevated sensitivity to prosodic information.

The findings from the other two sentence types also did not provide clear indications that bilinguals' enhanced cognitive abilities influenced online sentence processing. Indeed, the two experiments yielded mixed results in that while both the monolingual and simultaneous groups revealed a similar pattern of results on the reflexive pronoun-anaphor gender agreement, both the simultaneous and sequential bilinguals showed a similar pattern of results on the filler-gap dependency constructions. On the basis of these results, Gutiérrez argues that the cognitive advantages do not appear to penetrate language processing for the sequential bilingual group because this group showed pupillary responses that resemble those of the monolingual group in one sentence type (SC ambiguity) but not in other sentence types. Therefore, with regard to the interaction between language and cognition, Gutiérrez concluded that there was no evidence to

indicate that the bilinguals' cognitive skills affected language processing, although more work is required.

However, it is hard to conclude that bilinguals' cognitive skills have no effect on sentence processing based on the results of this study alone. Thus, further examination into whether early bilinguals' cognitive advantages can extend to online sentence processing is necessary in order to gain a clear idea about interplay of language and cognition. This is particularly true again in light of several methodological limitations of the Gutiérrez's (2013) investigation into this SC ambiguity sentence type. First and foremost, it is important to emphasize that the SC ambiguity items in this study were not fully ambiguous because they were presented with appropriate prosodic cues. As indicated above, although this might allow for an investigation into how different information sources are "weighted" by comprehenders from different language backgrounds, the results from such sentences are difficult to interpret in terms of how plausibility information is used during online ambiguity resolution processes. It thus seems necessary to investigate this issue with fully (locally) ambiguous and unambiguous sentences in order to examine whether bilinguals are sensitive to plausibility information during these reanalysis processes. In addition, as in Roberts and Felser's (2011) study, the test sentences in Gutiérrez (2013) were presented without any intervening material between the ambiguous NP and disambiguating verb. As in this previous study, this property of the test sentences

might have led to reduced plausibility/reverse plausibility effects, particularly for the monolinguals and sequential bilinguals. Lastly, it might be helpful to test these sentences with a technique that is potentially more sensitive to word-by-word changes in processing time differences -- self-paced reading.

2.2 The Experiment: sample items and predictions

2.2.1 Sample Test Sentences

In this experiment, participants' processing of SC ambiguity sentences was tested to examine whether and how comprehenders with different language profiles are influenced by plausibility information during online sentence comprehension. This sentence type was examined using a self-paced "moving window" reading task, and reading times (RTs) per word were measured. Specifically, by adapting materials from Pickering and Traxler (1998), the effect of plausibility was investigated in sentences involving SC ambiguity and their unambiguous controls, as in sentences (3a)-(d) below:

(3) Subordinate-clause (SC) ambiguity sentences

a. Implausible/ambiguous (no comma)
While Emma drank the song about true love amused all the customers at the club.

b. Implausible/unambiguous (comma)
While Emma drank, the song about true love amused all the customers at the club.

c. Plausible/ambiguous (no comma)
While Emma played the song about true love amused all the customers at the club.

d. Plausible/unambiguous (comma)
While Emma played, the song about true love amused all the customers at the club.

In sentences such as (3a) and (3c), the temporary ambiguity is due to the fact that the ambiguous NP *the song* might be temporarily misinterpreted as a DO of the preceding verb (*drank, played*). However, in sentences such as (3b) and (3d), no such misinterpretations are expected since the subordinate clause is disambiguated by the comma. Also, in ambiguous sentences, while *the song* is an implausible DO for the verb *drank* in (3a), it is a plausible DO for the verb *played* in (3c). For the analysis of SC ambiguity items, the critical word for assessing sensitivity to plausibility is the head noun of the ambiguous/unambiguous NP (*song*); for ambiguity resolution, the critical word is the matrix verb (*amused*).

2.2.2 Predictions

It was predicted that if readers are sensitive to plausibility information and initially adopt the DO analysis in ambiguous sentences (i.e., (3a) and (3c)), they should find the implausible condition more difficult to process than the plausible condition at and immediately after the head noun of the ambiguous NP (i.e., # *Emma drank the song* > *Emma played the song*). On the other hand, a comparable

difference should not be observed in unambiguous control sentences. Figure 2.1 shows an idealized pattern of results that is consistent with these predictions.

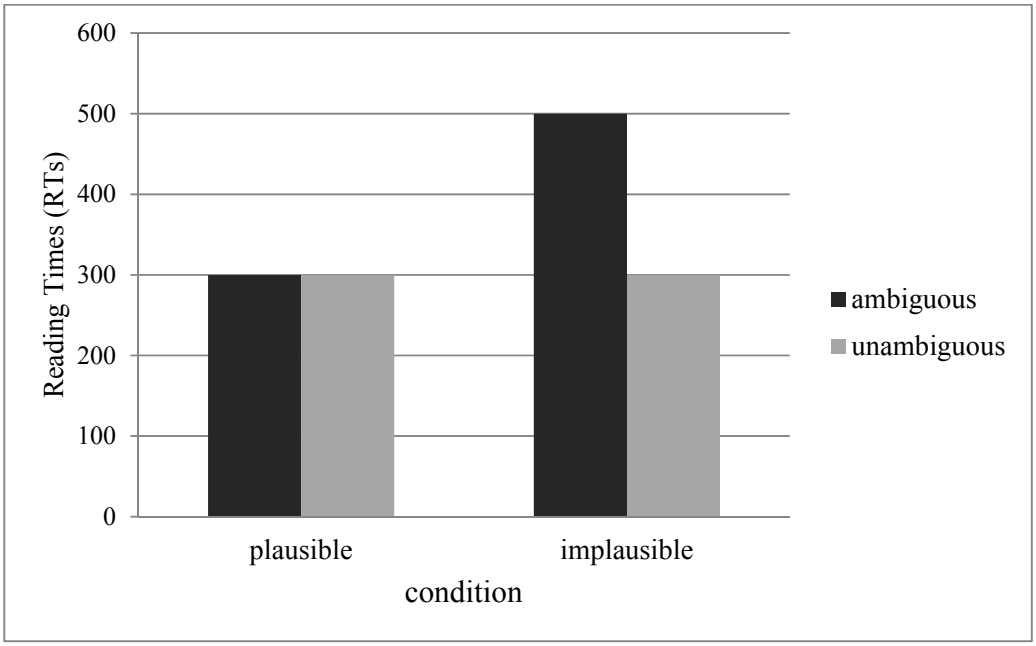


Figure 2.1 Predicted reading times (RTs) at the head noun of the matrix clause

At and immediately after the disambiguating verb (*amused*), if readers are able to use plausibility information to revise the initial misanalysis, then they should show more processing difficulty for ambiguous sentences in the plausible condition (3c) than in the implausible condition (3a). As discussed above, this is because readers would find it harder to recover from an initially plausible misanalysis and switch to the correct analysis. Figure 2.2 shows an idealized pattern of results at the disambiguating verb when plausibility information is used.

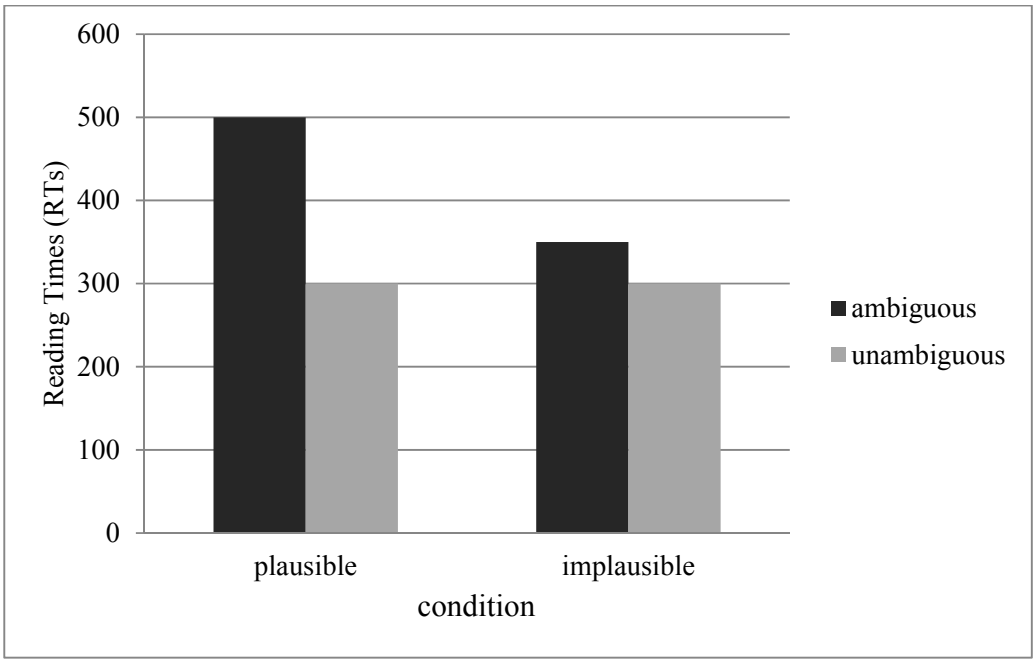


Figure 2.2 Predicted reading times (RTs) at the matrix verb when using plausibility information

However, there is also the possibility that readers -- and LLs in particular -- might not be able to use plausibility information to recover from misanalysis due to the structural difficulties involved in this sentence type, as discussed in the findings from Roberts and Felser (2011). In this case, reverse plausibility effects should not be observed at or after the disambiguating verb. Figure 2.3 shows an idealized pattern of results at the disambiguating verb when plausibility information is not used.

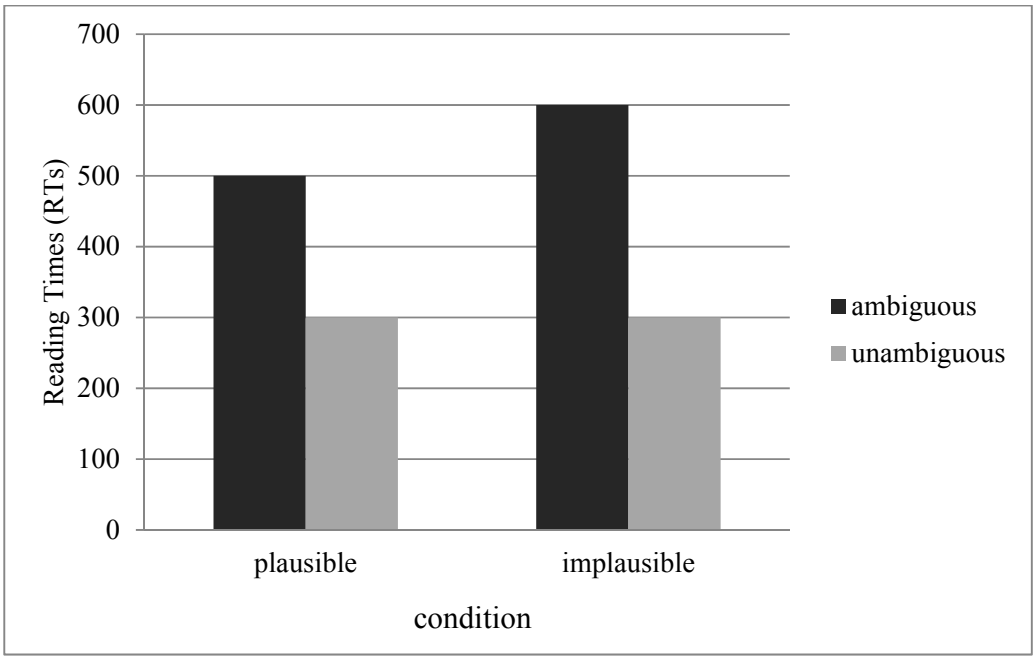


Figure 2.3 Predicted reading times (RTs) at the matrix verb when not using plausibility information

As discussed above, the present study tested native speakers (NSs), late (Korean-English) learners (LLs), and early bilinguals (EBs) on these sentence types. If LLs are able to use plausibility information to recover from initial misanalysis in the same way as NSs, it could be taken as evidence of L2 learners' ability to compute deep and detailed syntactic representations during online sentence comprehension. On the other hand, if these language learners are not able to use plausibility information to resolve structural ambiguities in these sentences, this pattern of results might be taken as support for the SSH (Clahsen & Felser, 2006) which suggests that NNSs construct shallow syntactic

representation in their L2. With respect to the influence of early bilingualism, it was further predicted that the EB group would use plausibility information particularly efficient to recover from syntactic misanalysis if the cognitive advantages of bilingualism -- particularly in terms of cognitive control and conflict resolution -- extend to online sentence processing.

2.3 Methodology

2.3.1 Participants

Three groups of participants were tested -- 43 native speakers of English (NSs), 45 late learners (LLs), and 29 early bilinguals (EBs). The participants in the NS and EB groups were undergraduate students at the University of Texas at Arlington who participated in the experiment for course credit. According to a questionnaire administered just prior to the experiment, all participants in the NS group indicated that English was their first and dominant language. Participants in the EB group also indicated that English was their dominant language, but that they had acquired English simultaneously with or in early childhood with another language (Amharic: 1; Arabic: 2; Burmese: 1; Igbo: 1; Malayalam: 2; Marathi: 1; Punjabi: 1; Spanish: 10; Tagalog: 1; Tigrinya: 2; Urdu: 4; Vietnamese: 3). Participants in the LL group were proficient Korean learners of English who had completed undergraduate or graduate degrees in the U.S. or who were studying in degree-granting undergraduate or graduate programs in the U.S. at the time of the

experiment. As discussed below, the data from 13 of these LL participants were eliminated due to high error rates on comprehension questions during the reading experiment and/or a phrasal verb multiple choice test. The LL participants were asked to complete a language history questionnaire, which asked questions about language dominance, self-rated level of proficiency in their first and second languages (with 1 being the lowest score and 10 being the highest score), length of stay in a country where the second language was spoken, and so forth. The language background information for the participants whose data were included in the analyses is provided in Table 2.1.

Table 2.1 Biographical data for the (Korean-English) late learners

	LoR (yrs.)	AoA (yrs.)	AoF (yrs.)	Self-rated speaking English	Self-rated listening English	Self-rated reading English	Self-rated speaking Korean	Self-rated listening Korean	Self-rated reading Korean
Mean	7.68	10.65	19.06	7.57	7.85	7.90	9.74	9.71	9.71
SD	4.21	4.48	6.37	1.70	1.31	1.27	0.63	0.69	0.59

(*Note: LoR=Length of residence; AoA=Age of Acquisition (English); AoF=Age of Fluency; Self-rated level of proficiency in the three language areas (with 1 being the lowest score and 10 being the highest score)*

2.3.2 Materials and Design

The materials for this portion of the experiment consisted of 40 sets of four sentences (as in (3) above) in a 2X2 factorial design that manipulated plausibility (plausible vs. implausible) and ambiguity (ambiguous vs.

unambiguous). (See Appendix A for the complete set of items.) Plausibility was manipulated by pairing the second NP in each sentence with two different subordinate verbs. Each subordinate verb appeared in two sets of items, once in the plausible conditions and once in the implausible conditions. This was done to control for irrelevant effects related to the processing of particular verbs. Each experimental item was followed by a yes/no comprehension question, with an equal number of correct "yes" and "no" answers in each condition (e.g., *While Emma played the song about true love amused all the customers at the club. / Did the song amuse all the customers?*).

In addition to these experimental items, 32 fillers of different structural types were created. (See Appendix C for the complete set of filler items.) These filler items were matched in length and complexity with the experimental items and were included to distract participants from the purpose of the experiment. This experiment was also interleaved with the experiment that targeted phrasal verbs (PVs), which is discussed separately in Chapter 3. This experiment involved 72 items. (See Chapter 3 for the details related to these items.) Altogether, there were 144 sentences in the experiment, which were organized into counterbalanced lists. (See the *Procedure* section below).

2.3.3 Plausibility Norming Experiment

In order to ensure that the plausibility manipulation worked as intended in SC ambiguity items, 28 native English speakers from the University of Texas at Arlington, who did not take part in the main experiment, participated in an online plausibility judgment task. Specifically, they were asked to judge the plausibility of the beginning portions of the experimental sentences. This plausibility judgment task was conducted online, using the web-based implementation of the DMDX software package (Forster & Forster, 2003; Witzel, Cornelius, Witzel, Forster, & Forster, 2013). Participants were presented with sentences consisting of each pairing of the verb and the potential DO (e.g., *Emma played the song* and *Emma drank the song*), and they were asked to rate the plausibility of each sentence (or indicate how much sense each sentence made) on a scale from 1 (completely implausible) to 5 (completely plausible). The test items were counterbalanced and presented to each participant in a different random order. Eight practice items were included at the beginning of the experiment.

As illustrated in Figure 2.4 below, implausible sentences were rated lower than their plausible counterparts (plausible: $M = 4.82$, $SD = 0.24$ vs. implausible: $M = 1.67$, $SD = 0.57$). In order to determine whether this difference was statistically significant, analyses of variance (ANOVA) both by subjects ($F1$) and items ($F2$) were conducted on the mean plausibility rating, with sentence condition (plausible, implausible) as a repeated measure and list as a grouping

factor. There was a significant effect of sentence condition in both the subject and item analyses ($F1$ (1, 26) = 740.46, $p < .001$, $F2$ (1, 38) = 1071.44, $p < .001$). This analysis indicates that the plausible items were indeed considered more plausible than the implausible items, confirming that the experimental manipulation worked as intended.

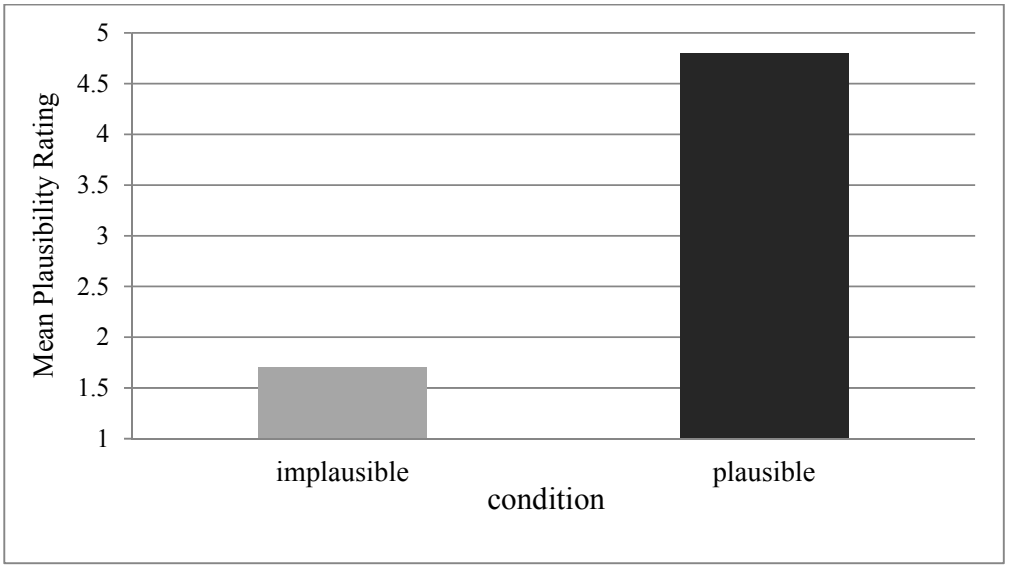


Figure 2.4 Mean plausibility ratings for SC ambiguity items

2.3.4 Procedure

Prior to taking the main experiment, all participants filled out a language background questionnaire. The findings from this questionnaire are reported in the *Participant*s section above. The experiment employed a word-by-word, self-paced, non-cumulative moving-window reading task (Just et al., 1982), which was run on desktop computers using DMDX software (Forster & Forster, 2003). In

this task, participants read each sentence one word at a time. For each item, the initial display was a string of dashes. The participant then pressed the button on a game controller to reveal the first word of the sentence. After reading this word, the participant again pressed the button. The first word then disappeared, and the next word was presented. The participant continued through the remaining words of the sentence in the same manner. At the end of each sentence, a yes/no question appeared on the computer screen, which the participant answered by pressing one of two buttons on the game controller. After answering this question, the participant received feedback ("correct" / "wrong"), and the next trial began automatically. All sentences and accompanying questions were presented on a single line in the center of the computer screen. Participants were instructed to read as quickly as possible, but carefully enough to respond accurately to comprehension questions. Items were presented in a different random order for each participant, in eight blocks, each consisting of 18 sentences. At the beginning of the task, participants read a set of instructions and were given eight practice items. Immediately after completing the reading task, participants in the LL group took a multiple-choice test to assess their knowledge of English PVs. This test was not directly relevant to the sentences under investigation in this experiment. It will be discussed in more detail in Chapter 3.

2.3.5 Data Analysis

For the NS and EB groups, the data from participants with error rates (ERs) of 20% or greater on the complete set of comprehension questions (i.e., on the questions for filler and experimental items) were eliminated from the analysis. Based on this criterion, the data from three NS participants and one EB participant (a Spanish-English bilingual) were excluded. For the LL group, the data from participants (a) with ERs of 25% or greater on the complete set of comprehension questions or (b) with ERs of 20% or greater on the PV multiple choice test were eliminated from the analysis. This led to the exclusion of datasets from 13 LL participants -- six were excluded based on comprehension question accuracy; two were excluded based on PV multiple choice test accuracy; five were excluded because they did not meet either of these criteria. Thus, 40 NSs, 32 LLs, and 28 EBs and were included in the data analysis. Items on which participants made 100% errors in one of the conditions were also eliminated from the analysis. For SC ambiguity sentences, one item was eliminated for NSs, and four items were eliminated for LLs. The overall comprehension accuracy rate was high for both NS and EB groups (89.52% (*SD* = 4.66), 88.89% (*SD* = 4.26), respectively), whereas for LLs it was 83.06% (*SD* = 3.23).

RT data were analyzed only for trials on which the participant correctly answered the comprehension question. Prior to the analysis of these data, values that were two standard deviations above or below a participant's mean for a given

region were replaced with the value two standard deviations above or below this mean. The statistical analyses of the ER and RT data are presented by group (NS, LL, EB) below.

2.4 Results

2.4.1 Native Speakers

In the statistical analyses for this sentence type, both subjects and items were treated as random factors. These by-subjects ($F1$) and by-items ($F2$) analyses consisted of 2x2x4 ANOVAs, with plausibility (*implausible, plausible*) and ambiguity (*ambiguous, unambiguous*) as repeated measures, and list/item group as a non-repeated factor. These analyses were followed up with tests of the simple effects of (i) ambiguity (ambiguous vs. unambiguous) in both plausible and implausible sentences, and (ii) plausibility (plausible vs. implausible) in both ambiguous and unambiguous sentences. For the RT analyses, because the experimental conditions were identical up to the embedded-clause verb, only the results at and after that region (Region 3) are reported.

The NSs' mean ERs on the comprehension questions for the four experimental sentence types and results of the analyses of variance are presented in Table 2.2 below. For the NS group, this analysis revealed reliably higher ERs for plausible sentences ($F1$ (1, 36) = 15.89, $p < .001$; $F2$ (1, 35) = 5.80, $p < .05$) and a non-statistically reliable trend suggesting generally higher ERs for

ambiguous sentences ($F1$ (1, 36) = 6.50, $p < .05$; $F2$ (1, 35) = 1.59; plausibility x ambiguity interaction: both F's < 1). Under planned comparisons, there was a marginal effect suggesting higher ERs for ambiguous sentences under both the implausible and plausible conditions (implausible: $F1$ (1, 36) = 5.06, $p < .05$; $F2$ < 1; plausible: $F1$ (1, 36) = 4.61, $p < .05$; $F2$ (1, 35) = 1.36). In addition, there was a marginal effect suggesting higher ERs for plausible sentences under both the ambiguous and unambiguous conditions (ambiguous: $F1$ (1, 36) = 11.18, $p < .01$; $F2$ (1, 35) = 2.16; unambiguous: $F1$ (1, 36) = 8.83, $p < .01$; $F2$ (1, 35) = 1.98).

Table 2.2 NSs' mean ERs (in percentages) on the comprehension questions and results of the analyses of variance

	Mean Error Rates	
implausible/ambiguous	13.69	
implausible/unambiguous	9.81	
plausible/ambiguous	20.78	
plausible/unambiguous	15.17	
	F1(1,36)	F2(1,35)
plausibility	15.89***	5.80*
ambiguity	6.50*	1.59
interaction	< 1	< 1
implausible (amb vs. unamb)	5.06*	< 1
plausible (amb vs. unamb)	4.61*	1.36
ambiguous (pl vs. impl)	11.18**	2.16
unambiguous (pl vs. impl)	8.83**	1.98
**p < .05. **p < .01. ***p < .001*		

The RT patterns for the NS group on the four experimental conditions are illustrated in Figure 2.5. The mean RTs for this group in each region are presented in Table 2.3, along with the results of the associated ANOVAs.

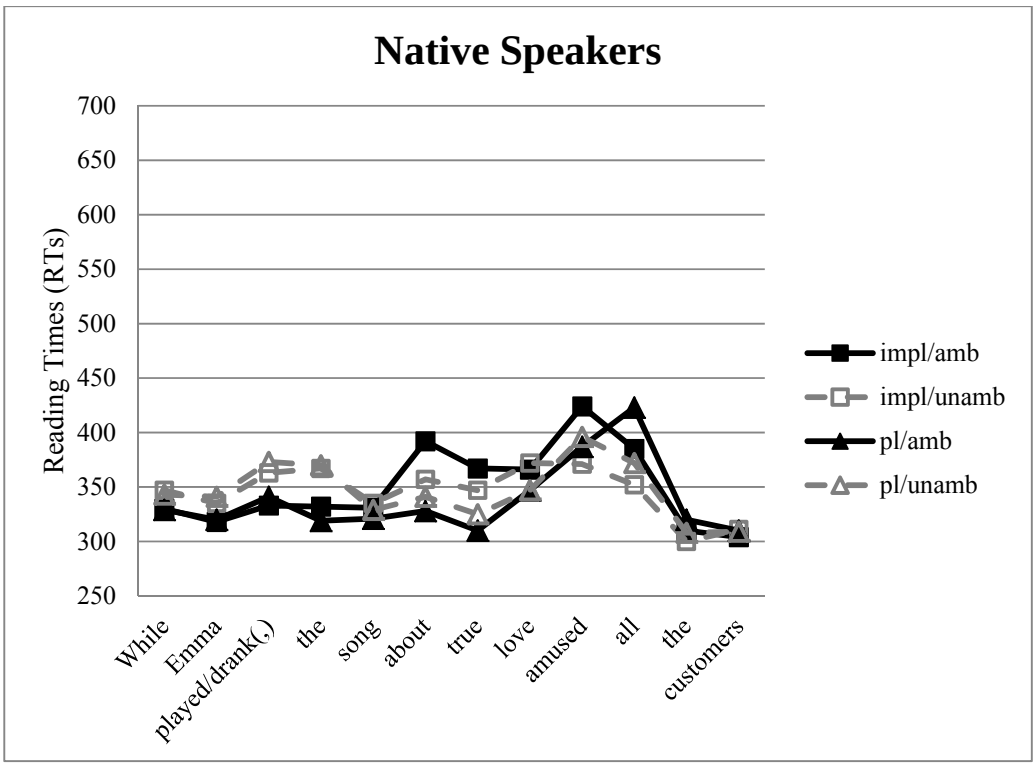


Figure 2.5 NSs' mean word by word reading times (ms) for SC ambiguity item

Table 2.3 NSs' mean RTs and results of the analyses of variance for SC ambiguity sentences

	Region 3 (played/drank)		**Region 4 (the)**		**Region 5 (song)**		**Region 6 (about)**		**Region 7 (true)**	
implausible/ambiguous	333		332		331		392		367	
implausible/unambiguous	363		367		335		357		347	
plausible/ambiguous	341		319		321		328		310	
plausible/unambiguous	373		370		329		341		325	
	F1(1,36)	F2(1,35)	F1(1,36)	F2(1,35)	F1(1,36)	F2(1,35)	F1(1,36)	F2(1,35)	F1(1,36)	F2(1,35)
plausibility	1.11	< 1	< 1	< 1	1.03	1.52	11.68**	13.58***	18.55***	30.43***
ambiguity	10.06**	9.73**	24.15***	49.69***	< 1	2.98	1.59	1.76	< 1	< 1
interaction	< 1	< 1	1.49	1.19	< 1	< 1	7.36*	8.96**	3.39	8.28**
implausible (amb vs. unamb)	6.08*	6.31*	10.34**	12.03**	< 1	< 1	5.96*	5.82*	2.19	3.11
plausible (amb vs. unamb)	5.14*	4.41*	21.12***	30.26***	< 1	2.26	1.62	3.16	2.52	2.50
ambiguous (pl vs. impl)	< 1	< 1	2.21	1.70	< 1	1.51	13.42***	17.74***	18.17***	33.50***
unambiguous (pl vs. impl)	< 1	< 1	< 1	< 1	< 1	< 1	2.06	1.42	3.24	5.93*
	Region 8 (love)		**Region 9 (amused)**		**Region 10 (all)**		**Region 11 (the)**		**Region 12 (customers)**	
implausible/ambiguous	366		424		385		310		304	
implausible/unambiguous	372		371		352		300		311	
plausible/ambiguous	347		387		423		320		310	
plausible/unambiguous	347		396		372		308		309	
	F1(1,36)	F2(1,35)	F1(1,36)	F2(1,35)	F1(1,36)	F2(1,35)	F1(1,36)	F2(1,35)	F1(1,36)	F2(1,35)
plausibility	7.75**	3.21	< 1	< 1	5.76*	5.98*	3.16	< 1	< 1	< 1
ambiguity	< 1	< 1	2.53	2.18	8.12**	15.44***	3.99	4.14*	< 1	< 1
interaction	< 1	< 1	5.43*	9.77**	< 1	< 1	< 1	< 1	< 1	< 1
implausible (amb vs. unamb)	< 1	< 1	8.33**	11.95**	6.49*	6.68*	2.22	2.50	< 1	< 1
plausible (amb vs. unamb)	< 1	< 1	< 1	< 1	5.87*	7.50**	3.11	2.39	< 1	< 1
ambiguous (pl vs. impl)	3.38	2.39	3.34	4.88*	4.06	4.24*	1.39	< 1	< 1	< 1
unambiguous (pl vs. impl)	4.18*	2.20	1.90	3.93	3.56	1.97	2.50	< 1	< 1	< 1

**p < .05. **p < .01. ***p < .001*

For the NS group, there was a clear clause boundary (or comma) effect beginning at Region 3 (*played*/*drank*). In this region, the main effect of plausibility and the interaction of plausibility and ambiguity were not significant either by subjects or by items (plausibility: $F1$ (1, 36) = 1.11; $F2 < 1$; interaction: both F's < 1). However, there was a significant main effect of ambiguity ($F1$ (1, 36) = 10.06, $p < .01$; $F2$ (1, 35) = 9.73, $p < .01$), indicating that unambiguous sentences -- i.e., sentences with a comma in this region -- were read significantly longer than ambiguous sentences. Under planned comparisons, there were also statistically reliably longer RTs for unambiguous sentences under both the plausible and implausible conditions. For implausible sentences, the simple effect of ambiguity was significant both by subjects and by items ($F1$ (1, 36) = 6.08, $p < .05$; $F2$ (1, 35) = 6.31, $p < .05$). For plausible sentences, the simple effect of ambiguity was also significant in both analyses ($F1$ (1, 36) = 5.14, $p < .05$; $F2$ (1, 35) = 4.41, $p < .05$).

This comma effect was also pronounced in the immediately following region, Region 4 (*the*). In this region, there was again a significant main effect of ambiguity ($F1$ (1, 36) = 24.15, $p < .001$; $F2$ (1, 35) = 49.69, $p < .001$), with longer RTs for unambiguous sentences. In addition, tests of the simple effect of ambiguity were again significant for both implausible and plausible sentences (implausible: $F1$ (1, 36) =10.34, $p < .01$; $F2$ (1, 35) = 12.03, $p < .01$; plausible: $F1$ (1, 36) = 21.12, $p < .001$; $F2$ (1, 35) = 30.26, $p < .001$). In these sentences, the

comma in Region 3 provides the first indication of a clause break. The inflated RTs for unambiguous sentences at and immediately after this region might thus be taken to reflect processing costs associated structure-building operations involved in closing off the embedded clause.

For Region 5 (*song*), where the head noun of the ambiguous NP was presented, there were no statistically reliable differences among the test sentences (plausibility: $F1$ (1, 36) = 1.03; $F2$ (1, 35) = 1.52; ambiguity: $F1 < 1$; $F2$ (1, 35) = 2.98; interaction: both F's <1). However, NSs showed a slightly delayed plausibility effect, beginning at Region 6 and continuing into the following region, Region 7. In Region 6 (*about*), although the main effect of ambiguity was not significant either by subjects or by items ($F1$ (1, 36) = 1.59; $F2$ (1, 35) = 1.76), the main effect of plausibility was significant in both analyses ($F1$ (1, 36) = 11.68, $p < .01$; $F2$ (1, 35) = 13.58, $p < .001$). Crucially, the interaction of plausibility and ambiguity was also significant in both analyses ($F1$ (1, 36) = 7.36, $p < .05$; $F2$ (1, 35) = 8.96, $p < .01$), indicating particularly long RTs for implausible ambiguous sentences. Indeed, for implausible sentences, the simple effect of ambiguity was significant in both analyses ($F1$ (1, 36) = 5.96, $p < .05$; $F2$ (1, 35) = 5.82, $p < .05$), with implausible ambiguous sentences taking significantly longer than implausible unambiguous sentences (392 ms vs. 357ms). In addition, the simple effect of plausibility was significant in both analyses for ambiguous sentences ($F1$ (1, 36) = 13.42, $p < .001$; $F2$ (1, 35) = 17.74, $p < .001$), with implausible

ambiguous sentences taking significantly longer than plausible ambiguous sentences (392 ms vs. 328ms).

For Region 7 (*true*), the main effect of plausibility was again significant ($F1$ (1, 36) = 18.55, $p < .001$; $F2$ (1, 35) = 30.43, $p < .001$). The interaction observed in the previous region was significant by items ($F2$ (1, 35) = 8.28, $p < .01$) and approached significance by subjects ($F1$ (1, 36) = 3.39, $p = .07$). In addition, the simple effect of plausibility was significant in both analyses for ambiguous sentences ($F1$ (1, 36) = 18.17, $p < .001$; $F2$ (1, 35) = 33.50, $p < .001$), with implausible ambiguous sentences taking significantly longer than plausible ambiguous sentences (367 ms vs. 310 ms). For Region 8 (*love*), neither the main effects nor the interaction was significant (all F's < 1).

At the disambiguating verb in Region 9 (*amused*), there were no significant main effects of plausibility or ambiguity either by subjects or by items (plausibility: both F's < 1; ambiguity: $F1$ (1, 36) = 2.53; $F2$ (1, 35) = 2.18). However, the interaction was significant in both analyses ($F1$ (1, 36) = 5.43, $p < .05$; $F2$ (1, 35) = 9.77, $p < .01$), indicating particularly long RTs for implausible ambiguous sentences. In addition, the simple effect of ambiguity was significant for implausible sentences ($F1$ (1, 36) = 8.33, $p < .01$; $F2$ (1, 35) = 11.95, $p < .01$), with implausible ambiguous sentences taking significantly longer than implausible unambiguous sentences.

A different pattern of results was found at the immediately following word, Region 10 (*all*). In this region, the main effects of plausibility and ambiguity were significant both by subjects and by items (plausibility: $F1$ (1, 36) = 5.76, $p < .05$; $F2$ (1, 35) = 5.98, $p < .05$; ambiguity: $F1$ (1, 36) = 8.12, $p < .01$; $F2$ (1, 35) = 15.44, $p < .001$; interaction: F's < 1). The simple effect of ambiguity was also significant for both implausible and plausible sentences (implausible: $F1$ (1, 36) = 6.49, $p < .05$; $F2$ (1, 35) = 6.68, $p < .05$; plausible: $F1$ (1, 36) = 5.87, $p < .05$; $F2$ (1, 35) = 7.50, $p < .01$), indicating clear garden-path effects for both sentence types. However, the simple effect of plausibility was significant for ambiguous sentences by items ($F2$ (1, 35) = 4.24, $p < .05$) and approached significance by subjects ($F1$ (1, 36) = 4.06, $p = .05$), indicating that plausible ambiguous sentences took longer to read than implausible ambiguous sentences (423 ms vs. 385ms). This suggests that sentences with plausible object analyses caused greater disruption after disambiguation than did sentences with implausible object analyses. In Regions 11 and 12, there were no statistically reliable results (see Table 2.3).

Clearer indications of reverse plausibility effects were found in analyses that combined the data from the spill-over regions after the disambiguating verb (Regions 10-12) in order to capture distributed indications of processing difficulty. Table 2.4 provides mean per-word RTs in a combined spill-over region, again along with the results of the associated statistical tests.

Table 2.4 NSs' mean RTs and results of the analyses of variance in combined spill-over regions for SC ambiguity sentences

	Regions 10-12	
implausible/ambiguous	337	
implausible/unambiguous	323	
plausible/ambiguous	356	
plausible/unambiguous	333	
	F1(1,36)	F2(1,35)
plausibility	7.50**	2.80
ambiguity	6.35*	10.74**
interaction	< 1	< 1
implausible (amb vs. unamb)	2.91	5.96*
plausible (amb vs. unamb)	6.71*	5.23*
ambiguous (pl vs. impl)	5.71*	2.51
unambiguous (pl vs. impl)	3.04	1.01
**p < .05. **p < .01. ***p < .001*		

In this region, although the interaction was not significant either by subjects or by items (both *F*'s < 1), the main effect of ambiguity was significant both by subjects and items ($F1$ (1, 36) = 6.35, $p < .05$; $F2$ (1, 35) = 10.74, $p < .01$). There was also a marginal main effect of plausibility suggesting longer RTs for plausible sentences ($F1$ (1, 36) = 7.50, $p < .01$; $F2$ (1, 35) = 2.80). Under planned comparisons, the simple effect of ambiguity was significant only under the plausible condition (implausible: $F1$ (1, 36) = 2.91; $F2$ (1, 35) = 5.96, $p < .05$; plausible: $F1$ (1, 36) = 6.71, $p < .05$; $F2$ (1, 35) = 5.23, $p < .05$), indicating that only plausible ambiguous sentences had significantly longer RTs than their unambiguous counterparts. In addition, there was a marginal simple effect for

ambiguous sentences ($F1$ (1, 36) = 5.71, $p < .05$; $F2$ (1, 35) = 2.51), suggesting that plausible ambiguous sentences had longer RTs than implausible ambiguous sentences.

2.4.2 Late Learners

The LLs' mean ERs on the comprehension questions for the four experimental sentence types and results of the analyses of variance are presented in Table 2.5. For the LL group, this analysis of the ER data for the four conditions revealed non-statistically reliable trends suggesting generally higher ERs for implausible sentences ($F1$ (1, 28) = 1.09; $F2$ (1, 32) = 4.45, $p < .05$) and for ambiguous sentences ($F1$ (1, 28) = 7.62, $p < .05$; $F2$ (1, 32) = 1.60). Although there was no interaction between plausibility and ambiguity (both F's < 1), under planned comparisons, there was a marginal effect suggesting higher ERs for ambiguous sentences only under the plausible condition ($F1$ (1, 28) = 7.39, $p < .05$; $F2$ (1, 32) = 2.93; implausible/ambiguous vs. implausible/unambiguous: $F1$ (1, 28) = 3.18; $F2 < 1$), suggesting that LLs answered plausible ambiguous items less accurately than plausible unambiguous items.

Table 2.5 LLs' mean ERs (in percentages) on the comprehension questions and results of the analyses of variance

	Mean Error Rates	
implausible/ambiguous	24.77	
implausible/unambiguous	17.72	
plausible/ambiguous	22.49	
plausible/unambiguous	15.72	
	F1(1,28)	F2(1,32)
plausibility	1.09	4.45*
ambiguity	7.62*	1.60
interaction	< 1	< 1
implausible (amb vs. unamb)	3.18	< 1
plausible (amb vs. unamb)	7.39*	2.93
ambiguous (pl vs. impl)	< 1	1.42
unambiguous (pl vs. impl)	< 1	3.60
**p < .05. **p < .01. ***p < .001*		

The RT patterns for the LL group on the four experimental conditions are illustrated in Figure 2.6. The mean RTs for this group in each region are presented in Table 2.6, along with the results of the associated ANOVAs.

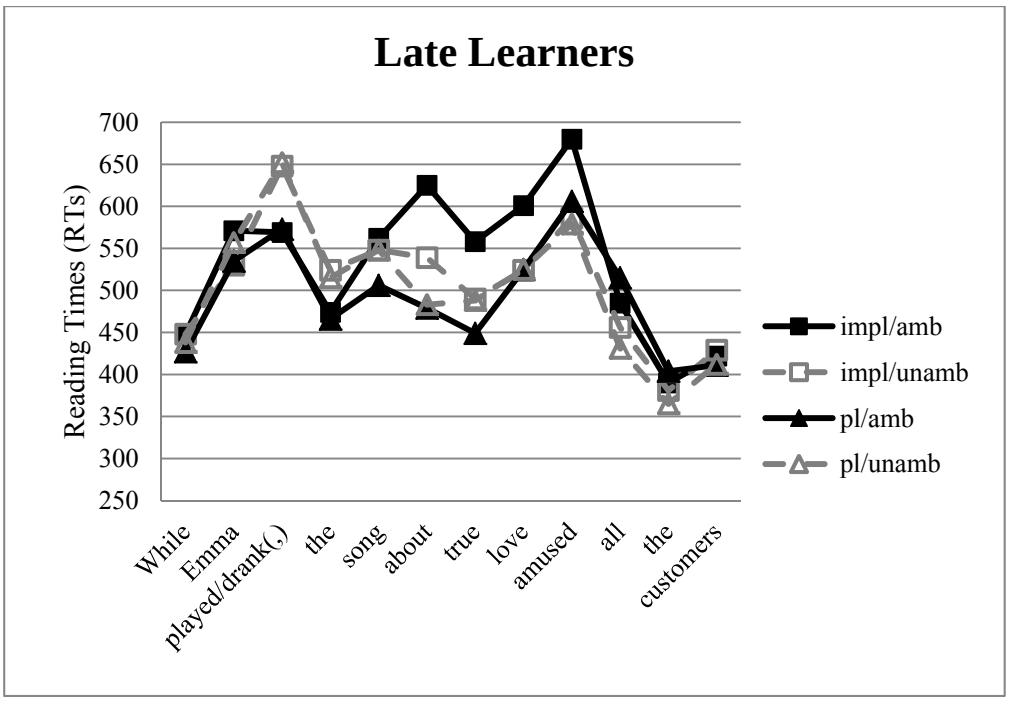


Figure 2.6 LL's mean word by word reading times (ms) for SC ambiguity item

Table 2.6 LLs' mean RTs and results of the analyses of variance for SC ambiguity sentences

	Region 3 (played/drank)		**Region 4 (the)**		**Region 5 (song)**		**Region 6 (about)**		**Region 7 (true)**	
implausible/ambiguous	569		474		562		625		558	
implausible/unambiguous	648		524		548		539		490	
plausible/ambiguous	573		466		506		479		449	
plausible/unambiguous	652		515		548		483		488	
	F1(1,28)	F2(1,32)	F1(1,28)	F2(1,32)	F1(1,28)	F2(1,32)	F1(1,28)	F2(1,32)	F1(1,28)	F2(1,32)
plausibility	< 1	1.20	< 1	1.58	2.47	2.72	18.82***	27.81***	11.61**	13.70***
ambiguity	12.19**	14.05***	10.61**	7.83**	< 1	< 1	4.17	3.75	1.18	< 1
interaction	< 1	< 1	< 1	< 1	1.32	2.37	6.41*	3.98	9.40**	12.35**
implausible (amb vs. unamb)	5.43*	4.56*	6.97*	5.75*	< 1	< 1	7.01*	4.61*	9.21**	6.95*
plausible (amb vs. unamb)	4.44*	12.77**	7.18*	4.57*	2.20	3.85	< 1	< 1	3.30	5.38*
ambiguous (pl vs. impl)	< 1	< 1	< 1	< 1	5.52*	3.02	17.96***	20.81***	15.98***	22.81***
unambiguous (pl vs. impl)	< 1	< 1	< 1	< 1	< 1	< 1	5.78*	6.42*	< 1	< 1
	Region 8 (love)		**Region 9 (amused)**		**Region 10 (all)**		**Region 11 (the)**		**Region 12 (customers)**	
implausible/ambiguous	601		680		485		390		422	
implausible/unambiguous	524		586		456		381		429	
plausible/ambiguous	525		606		515		404		411	
plausible/unambiguous	525		579		431		365		412	
	F1(1,28)	F2(1,32)	F1(1,28)	F2(1,32)	F1(1,28)	F2(1,32)	F1(1,28)	F2(1,32)	F1(1,28)	F2(1,32)
plausibility	4.75*	7.78**	2.13	6.91*	< 1	< 1	< 1	< 1	2.99	1.93
ambiguity	5.31*	2.91	9.91**	4.68*	8.74**	17.79***	6.06*	14.85***	< 1	< 1
interaction	3.38	5.10*	3.79	2.47	3.05	1.02	4.44*	1.62	< 1	< 1
implausible (amb vs. unamb)	7.86**	6.40*	8.61**	9.77**	5.90*	4.09	< 1	3.40	< 1	< 1
plausible (amb vs. unamb)	< 1	< 1	2.34	< 1	6.54*	12.16**	7.57*	9.52**	< 1	< 1
ambiguous (pl vs. impl)	6.98*	8.85**	3.41	7.48*	1.22	< 1	1.14	< 1	< 1	< 1
unambiguous (pl vs. impl)	< 1	< 1	< 1	< 1	3.49	3.49	3.02	3.80	1.51	< 1
**p < .05. **p < .01. ***p < .001*										

For the LL group, there was a comma effect beginning at Region 3 (*played*/*drank*). Similar to the NS group, the main effect of plausibility and the interaction of plausibility and ambiguity were not significant either by subjects or by items (plausibility: $F1 < 1$; $F2$ (1, 32) = 1.20; interaction: both F's < 1). However, the main effect of ambiguity was significant ($F1$ (1, 28) = 12.19, $p < .01$; $F2$ (1, 32) = 14.05, $p < .001$), indicating that unambiguous sentences took significantly longer to read than ambiguous sentences. Under planned comparisons, the simple effect of ambiguity was significant for both implausible and plausible sentences (implausible: $F1$ (1, 28) = 5.43, $p < .05$; $F2$ (1, 32) = 4.56, $p < .05$; plausible: $F1$ (1, 28) = 4.44, $p < .05$; $F2$ (1, 32) = 12.77, $p < .01$), indicating that LLs also experienced processing difficulty when there were additional processing costs for building a new clause.

This comma effect carried over to the following region, Region 4 (*the*). Again, there was a significant main effect of ambiguity ($F1$ (1, 28) = 10.61, $p < .01$; $F2$ (1, 32) = 7.83, $p < .01$). Under planned comparisons, significant simple effects of ambiguity were also found for both implausible and plausible sentences (implausible: $F1$ (1, 28) = 6.97, $p < .05$, $F2$ (1, 32) = 5.75, $p < .05$; plausible: $F1$ (1, 28) = 7.18, $p < .05$, $F2$ (1, 32) = 4.57, $p < .05$).

For Region 5 (*song*), there were no statistically reliable differences among test sentences (plausibility: $F1$ (1, 28) = 2.47; $F2$ (1, 32) = 2.72; ambiguity: both F's < 1; interaction: $F1$ (1, 28) = 1.32; $F2$ (1, 32) = 2.37). However, the LL group showed prolonged plausibility effects after this word, in Regions 6 through 9. For Region 6 (*about*), the main effect of plausibility

was significant both by subjects and by items ($F1$ (1, 28) = 18.82, $p < .001$; $F2$ (1, 32) = 27.81, $p < .001$). Although the main effect of ambiguity was not significant ($F1$ (1, 28) = 4.17; $F2$ (1, 32) = 3.75), there was a marginal interaction of plausibility and ambiguity ($F1$ (1, 28) = 6.41, $p < .05$; $F2$ (1, 32) = 3.98). Under planned comparisons, there was a significant simple effect of ambiguity only for implausible sentences ($F1$ (1, 28) = 7.01, $p < .05$; $F2$ (1, 32) = 4.61, $p < .05$), indicating that only implausible ambiguous sentences took significantly longer to read than their unambiguous counterparts. In addition, the simple effect of plausibility was significant for ambiguous sentences ($F1$ (1, 28) = 17.96, $p < .001$; $F2$ (1, 32) = 20.81, $p < .001$), indicating that implausible ambiguous sentences were read significantly longer than plausible ambiguous sentences. Interestingly, the simple effect of plausibility was also significant for unambiguous sentences ($F1$ (1, 28) = 5.78, $p < .05$; $F2$ (1, 32) = 6.42, $p < .05$), indicating that implausible unambiguous sentences took significantly longer than plausible unambiguous counterparts.

This plausibility effect carried over into Region 7 (*true*). Although the main effect of ambiguity was not significant either by subjects or by items ($F1$ (1, 28) = 1.18; $F2 < 1$), the main effect of plausibility was significant ($F1$ (1, 28) = 11.61, $p < .01$; $F2$ (1, 32) = 13.70, $p < .001$). Crucially, the interaction was also significant both by subjects and by items ($F1$ (1, 28) = 9.40, $p < .01$; $F2$ (1, 32) = 12.35, $p < .01$). Under planned comparisons, the simple effect of ambiguity was significant only for implausible sentences ($F1$ (1, 28) = 9.21, $p < .01$; $F2$ (1, 32) = 6.95, $p < .05$), indicating that implausible ambiguous

sentences took significantly longer than implausible unambiguous sentences. The simple effect of plausibility was also significant for ambiguous sentences ($F1$ (1, 28) = 15.98, $p < .001$; $F2$ (1, 32) = 22.81, $p < .001$), indicating that implausible ambiguous sentences took significantly longer than plausible ambiguous sentences.

For Region 8 (*love*), again the main effect of plausibility was significant both by subjects and by items ($F1$ (1, 28) = 4.75, $p < .05$; $F2$ (1, 32) = 7.78, $p < .01$). There was also marginal main effect of ambiguity and a marginal interaction (ambiguity: $F1$ (1, 28) = 5.31, $p < .05$; $F2$ (1, 32) = 2.91; interaction: $F1$ (1, 28) = 3.38; $F2$ (1, 32) = 5.10, $p < .05$). Under planned comparisons, the simple effect of ambiguity was significant only for implausible sentences ($F1$ (1, 28) = 7.86, $p < .01$; $F2$ (1, 32) = 6.40, $p < .05$), indicating that implausible ambiguous sentences were read significantly longer than implausible unambiguous sentences. In addition, the simple effect of plausibility was significant only for ambiguous sentences ($F1$ (1, 28) = 6.98, $p < .05$; $F2$ (1, 32) = 8.85, $p < .01$), indicating that implausible ambiguous sentences took significantly longer than plausible ambiguous sentences.

At the disambiguating verb in Region 9 (*amused*), although there was no statistically reliable interaction between plausibility and ambiguity ($F1$ (1, 28) = 3.79; $F2$ (1, 32) = 2.47), the main effect of ambiguity was significant both by subjects and by items ($F1$ (1, 28) = 9.91, $p < .01$; $F2$ (1, 32) = 4.68, p < .05). Under planned comparisons, the simple effect of ambiguity was significant only for implausible sentences ($F1$ (1, 28) = 8.61, $p < .01$; $F2$ (1,

32) = 9.77, $p < .01$), indicating that implausible ambiguous sentences took significantly longer than their unambiguous counterparts.

However, a different pattern of results was found at the immediately following word, Region 10 (*all*). In this region, although the main effect of plausibility and interaction were not significant either by subjects or by items (plausibility: both F's < 1; interaction: $F1$ (1, 28) = 3.05; $F2$ (1, 32) = 1.02), the main effect of ambiguity was significant ($F1$ (1, 28) = 8.74, $p < .01$; $F2$ (1, 32) = 17.79, $p < .001$). Under planned comparisons, the simple effect of ambiguity was significant only for plausible sentences ($F1$ (1, 28) = 6.54, $p < .05$; $F2$ (1, 32) = 12.16, $p < .01$), indicating that plausible ambiguous sentences were read significantly longer than plausible unambiguous sentences. For implausible sentences, on the other hand, the simple effect of ambiguity was significant by subjects ($F1$ (1, 28) = 5.90, $p < .05$), but only approached significance by items ($F2$ (1, 32) = 4.09, p =.05).

For Region 11 (*the*), again the main effect of ambiguity was significant both by subjects and by items ($F1$ (1, 28) = 6.06, $p < .05$; $F2$ (1, 32) = 14.85, $p < .001$). There was also a marginal interaction ($F1$ (1, 28) = 4.44, $p < .05$; $F2$ (1, 32) = 1.62). Under planned comparisons, the simple effect of ambiguity was not significant either by subjects or by items for implausible sentences ($F1 < 1$; $F2$ (1, 32) = 3.40). For plausible sentences, on the other hand, the simple effect of ambiguity was significant both by subjects and by items ($F1$ (1, 28) = 7.57, $p < .05$; $F2$ (1, 32) = 9.52, $p < .01$), indicating that plausible ambiguous sentences were read significantly longer than plausible

unambiguous sentences. For Region 12 (*customers*), no statistically reliable results were found (see Table 2.6).

Clear indications of reverse plausibility effects were also found in analyses that combined the data from the spill-over regions after the disambiguating verb (Regions 10-12) in order to capture distributed indications of processing difficulty. Table 2.7 provides mean per-word RTs in a spill-over region, again along with the results of the associated statistical tests.

Table 2.7 LLs' mean RTs and results of the analyses of variance in combined spill-over regions for SC ambiguity sentences

	Region 10-12	
implausible/ambiguous	435	
implausible/unambiguous	428	
plausible/ambiguous	454	
plausible/unambiguous	407	
	F1(1,28)	F2(1,32)
plausibility	< 1	1.17
ambiguity	6.54*	11.55**
interaction	4.01	2.10
implausible (amb vs. unamb)	< 1	1.69
plausible (amb vs. unamb)	6.91*	10.64**
ambiguous (pl vs. impl)	1.51	< 1
unambiguous (pl vs. impl)	4.16	4.87*
**p < .05. **p < .01. ***p < .001*		

In this region, although there was no significant interaction between plausibility and ambiguity ($F1$ (1, 28) = 4.01; $F2$ (1, 32) = 2.10), the main effect of ambiguity was significant both by subjects and by items ($F1$ (1, 28) = 6.54, $p < .05$; $F2$ (1, 32) = 11.55, $p < .01$). However, the simple effect of

ambiguity was significant only under the plausible condition ($F1$ (1, 28) = 6.91, $p < .05$; $F2$ (1, 32) = 10.64, $p < .01$), indicating that only plausible ambiguous sentences had significantly longer RTs than their unambiguous counterparts.

2.4.3 Early Bilinguals

The EBs' mean ERs on the comprehension questions for the four experimental sentence types and results of the analyses of variance are presented in Table 2.8 below. For this group, this analysis revealed no statistically reliable differences for among the sentence types (plausibility: $F1$ (1, 24) = 3.51; $F2 < 1$; ambiguity: $F1$ (1, 24) = 1.89; $F2 < 1$; interaction: $F1 < 1$; $F2$ (1, 36) = 2.96). In addition, no significant simple effects of ambiguity or plausibility were found under planned comparisons.

Table 2.8 EBs' mean ERs (in percentages) on the comprehension questions and results of the analyses of variance

	Mean Error Rates	
implausible/ambiguous	16.07	
implausible/unambiguous	15.00	
plausible/ambiguous	21.07	
plausible/unambiguous	17.14	
	F1(1,24)	F2(1,36)
plausibility	3.51	< 1
ambiguity	1.89	< 1
interaction	< 1	2.96
implausible (amb vs. unamb)	< 1	2.07
plausible (amb vs. unamb)	2.17	< 1
ambiguous (pl vs. impl)	3.95	< 1
unambiguous (pl vs. impl)	< 1	2.11
**p < .05. **p < .01. ***p < .001*		

The RT patterns for the EB group on the four experimental conditions are illustrated in Figure 2.7. The mean RTs for this group in each region are presented Table 2.9, along with the results of the associated ANOVAs.

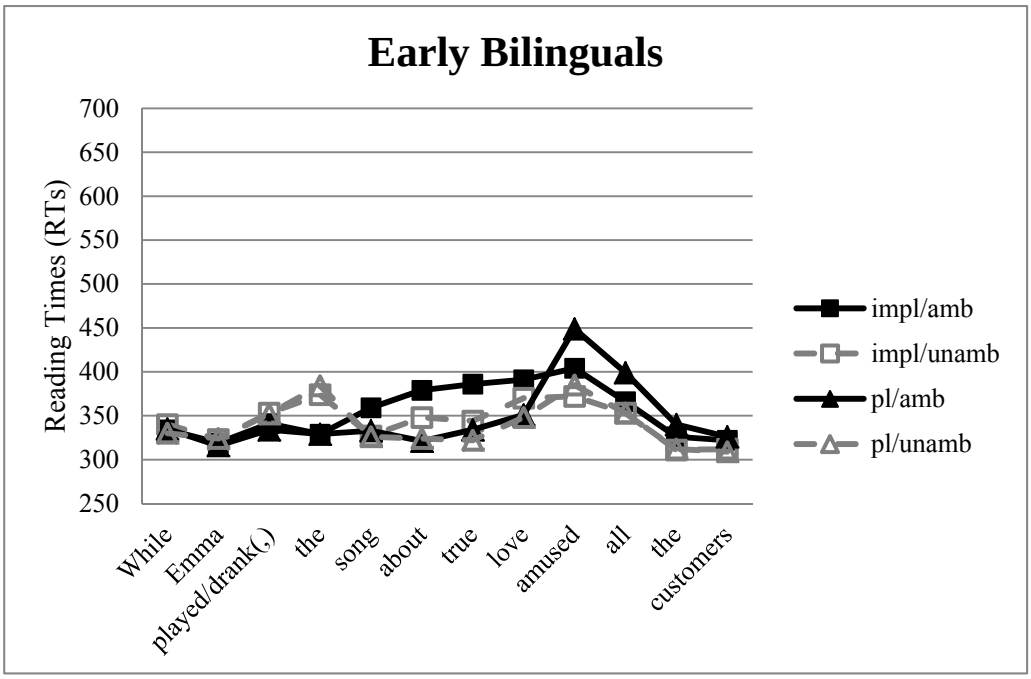


Figure 2.7 EBs' mean word by word reading times (ms) for SC ambiguity items.

Table 2.9 EBs' mean RTs and results of the analyses of variance for SC ambiguity sentences

	Region 3 (played/drank)		**Region 4 (the)**		**Region 5 (song)**		**Region 6 (about)**		**Region 7 (true)**	
implausible/ambiguous	341		329		359		379		386	
implausible/unambiguous	353		374		327		348		344	
plausible/ambiguous	334		329		333		321		334	
plausible/unambiguous	352		382		326		324		322	
	F1(1,24)	F2(1,36)	F1(1,24)	F2(1,36)	F1(1,24)	F2(1,36)	F1(1,24)	F2(1,36)	F1(1,24)	F2(1,36)
plausibility	< 1	1.29	< 1	< 1	3.16	1.76	13.78**	24.11***	20.63***	9.35**
ambiguity	1.76	4.35*	17.86***	19.84***	1.79	1.12	1.60	< 1	4.54*	1.93
interaction	< 1	< 1	< 1	1.14	4.00	2.78	2.19	3.66	3.45	4.11
implausible (amb vs. unamb)	< 1	1.13	6.71*	7.05*	2.88	3.77	2.82	2.48	6.76*	6.52*
plausible (amb vs. unamb)	1.67	3.52	9.95**	14.37***	< 1	< 1	< 1	< 1	< 1	< 1
ambiguous (pl vs. impl)	< 1	1.97	< 1	1.13	6.53*	3.53	11.08**	21.99***	16.49***	13.04***
unambiguous (pl vs. impl)	< 1	< 1	< 1	< 1	< 1	< 1	2.70	6.54*	4.77*	< 1
	Region 8 (love)		**Region 9 (amused)**		**Region 10 (all)**		**Region 11 (the)**		**Region 12 (customers)**	
implausible/ambiguous	391		404		366		326		322	
implausible/unambiguous	370		372		353		311		312	
plausible/ambiguous	351		449		399		340		326	
plausible/unambiguous	348		385		353		312		309	
	F1(1,24)	F2(1,36)	F1(1,24)	F2(1,36)	F1(1,24)	F2(1,36)	F1(1,24)	F2(1,36)	F1(1,24)	F2(1,36)
plausibility	9.30**	9.83**	2.41	< 1	2.22	1.73	< 1	< 1	< 1	< 1
ambiguity	< 1	< 1	2.90	8.31**	8.19**	6.34*	4.72*	5.01*	2.34	1.41
interaction	< 1	< 1	< 1	< 1	3.31	2.80	< 1	< 1	< 1	< 1
implausible (amb vs. unamb)	1.40	< 1	3.96	1.75	1.62	< 1	2.82	2.41	1.82	1.22
plausible (amb vs. unamb)	< 1	< 1	1.76	5.03*	7.81*	7.60**	3.52	3.07	< 1	< 1
ambiguous (pl vs. impl)	9.00**	6.59*	1.65	1.17	4.37*	4.70*	1.29	< 1	< 1	< 1
unambiguous (pl vs. impl)	2.04	4.14*	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

**p < .05. **p < .01. ***p < .001*

For Region 3 (*played*/*drank*), there were no statistically reliable effects (plausibility: $F1 < 1$; $F2$ (1, 36) = 1.29; ambiguity: $F1$ (1, 24) = 1.76; $F2$ (1, 36) = 4.35, $p < .01$; interaction: both F's < 1). However, there was a significant main effect of ambiguity beginning at Region 4 (*the*; $F1$ (1, 24) = 17.86, $p < .001$; $F2$ (1, 36) = 19.84, $p < .001$), indicating that unambiguous sentences took significantly longer to read than ambiguous sentences. In addition, the simple effect of ambiguity was significant under both the implausible and plausible conditions (implausible: $F1$ (1, 24) = 6.71, $p < .05$; $F2$ (1, 36) = 7.05, $p < .05$; plausible: $F1$ (1, 24) = 9.95, $p <. 01$; $F2$ (1, 36) = 14.37, $p < .001$). These results indicate a slightly delayed comma effect, whereby unambiguous sentences with commas had longer processing times than ambiguous sentences without commas.

For Region 5 (*song*), where the head noun of the ambiguous NP was presented, there were no statistically reliable differences among test sentences (plausibility: $F1$ (1, 24) = 3.16; $F2$ (1, 36) = 1.76; ambiguity: $F1$ (1, 24) = 1.79; $F2$ (1, 36) = 1.12; interaction: $F1$ (1, 24) = 4.00; $F2$ (1, 36) = 2.78). Plausibility effects were however revealed at the immediately following word, in Region 6 (*about*). In this region, although the main effect of ambiguity and the interaction of plausibility and ambiguity were not significant either by subjects or by items (ambiguity: $F1$ (1, 24) = 1.60; $F2 < 1$; interaction: $F1$ (1, 24) = 2.19; $F2$ (1, 36) = 3.66), the main effect of plausibility was significant under both analyses ($F1$ (1, 24) = 13.78, $p < .01$; $F2$ (1, 36) = 24.11, $p < .001$), indicating that implausible sentences took significantly longer to read than

plausible sentences. This effect appeared to be driven in large part by particularly long RTs for implausible ambiguous sentences. This was indicated by a significant simple effect of plausibility for ambiguous sentences ($F1$ (1, 24) = 11.08, $p < .01$; $F2$ (1, 36) = 21.99, $p < .001$), indicating that implausible ambiguous sentences had reliably longer RTs than plausible ambiguous sentences.

This plausibility effect continued into the following two regions (Region 7 & Region 8). For Region 7 (*true*), again the main effect of plausibility was significant ($F1$ (1, 24) = 20.63, $p < .001$; $F2$ (1, 36) = 9.35, $p < .01$; ambiguity: $F1$ (1, 24) = 4.54, $p < .05$; $F2$ (1, 36) = 1.93; interaction: $F1$ (1, 24) = 3.45; $F2$ (1, 36) = 4.11). Under planned comparisons, the simple effect of ambiguity was significant both by subjects and items for implausible sentences ($F1$ (1, 24) = 6.76, $p < .05$; $F2$ (1, 36) = 6.52, $p < .05$), indicating that implausible ambiguous sentences took significantly longer to read than implausible unambiguous sentences. For plausible sentences, on the other hand, the simple effect of ambiguity was not significant either by subjects or items (both F's < 1). In addition, the simple effect of plausibility was significant for ambiguous sentences ($F1$ (1, 24) = 16.49, $p < .001$; $F2$ (1, 36) = 13.04, $p < .001$), indicating implausible ambiguous sentences took significantly longer than plausible ambiguous sentences.

For Region 8 (*love*), although the main effect of ambiguity and the interaction of plausibility and ambiguity were not significant (all F's < 1), the main effect of plausibility was significant both by subjects and by items ($F1$ (1,

24) = 9.30, $p < .01$; $F2$ (1, 36) = 9.83, $p < .01$). The simple effect of ambiguity was not significant under either the implausible or plausible condition (implausible: $F1$ (1, 24) = 1.40; $F2 < 1$; plausible: both F's < 1). However, the simple effect of plausibility was significant for ambiguous sentences ($F1$ (1, 24) = 9.00, $p < .01$; $F2$ (1, 36) = 6.59, $p < .05$), indicating that implausible ambiguous sentences again took significantly longer to read than plausible ambiguous sentences.

At the disambiguating verb in Region 9 (*amused*), although the main effect of plausibility and interaction were not significant (plausibility: $F1$ (1, 24) = 2.41; $F2 < 1$; interaction: both F's < 1), there was a marginal main effect of ambiguity ($F1$ (1, 24) = 2.90; $F2$ (1, 36) = 8.31, $p < .01$). There was also a marginal simple effect of ambiguity for plausible sentences ($F1$ (1, 24) = 1.76; $F2$ (1, 36) = 5.03, $p < .05$), suggesting that plausible ambiguous sentences had longer RTs than their unambiguous counterparts.

In Region 10 (*all*), clearer indications of reverse plausibility effects were observed for this group. Although the interaction was not significant ($F1$ (1, 24) = 3.31; $F2$ (1, 36) = 2.80), the main effect of ambiguity was significant ($F1$ (1, 24) = 8.19, $p < .01$; $F2$ (1, 36) = 6.34, $p < .05$). Under planned comparisons, a significant simple effect of ambiguity was found only for plausible sentences ($F1$ (1, 24) = 7.81, $p < .05$; $F2$ (1, 36) = 7.60, $p < .01$), indicating that plausible ambiguous sentences were read significantly longer than their plausible unambiguous controls. However, the simple effect of ambiguity was not significant for implausible sentences ($F1$ (1, 24) = 1.62; $F2$

< 1). In addition, the simple effect of plausibility was significant only for ambiguous sentences ($F1$ (1, 24) = 4.37, $p < .05$; $F2$ (1, 36) = 4.70, $p < .05$), indicating that plausible ambiguous sentences took significantly longer than implausible ambiguous sentences.

For Region 11 (*the*), although the main effect of ambiguity was significant in both analyses ($F1$ (1, 24) = 4.72, $p < .05$; $F2$ (1, 36) = 5.01, $p < .05$), no significant simple effects of ambiguity were found under either the implausible or plausible conditions. For Region 12 (*customers*), there were no reliable effects (plausibility: both F's < 1; ambiguity: $F1$ (1, 24) = 2.34; $F2$ (1, 36) = 1.41; interaction: both F's < 1).

Clear indications of reverse plausibility effects were also found in analyses that combined the data from the spill-over regions after the disambiguating verb (Regions 10-12) in order to capture distributed indications of processing difficulty. Table 2.10 provides mean per-word RTs in a spill-over region, again along with the results of the associated statistical tests.

Table 2.10 EBs' mean RTs and results of the analyses of variance in a combined spill-over region

	Region 10-12	
implausible/ambiguous	335	
implausible/unambiguous	319	
plausible/ambiguous	354	
plausible/unambiguous	324	
	F1(1,24)	F2(1,36)
plausibility	2.11	< 1
ambiguity	9.16**	5.74*
interaction	1.22	< 1
implausible (amb vs. unamb)	3.75	2.59
plausible (amb vs. unamb)	7.05*	4.49*
ambiguous (pl vs. impl)	2.75	1.11
unambiguous (pl vs. impl)	< 1	< 1
**p < .05. **p < .01. ***p < .001*		

In this region, the main effect of ambiguity was significant both by subjects and by items ($F1$ (1, 24) = 9.16, $p < .01$; $F2$ (1, 36) = 5.74, $p < .05$). However, the simple effect of ambiguity was significant only under the plausible condition ($F1$ (1, 24) = 7.05, $p < .05$; $F2$ (1, 36) = 4.49, $p < .05$), indicating that only plausible ambiguous sentences were read significantly longer than their plausible unambiguous counterparts.

2.5 Discussion

2.5.1 Native Speakers

First of all, NSs showed an immediate comma effect beginning at the embedded verb and continuing into the following region. Indeed, this effect was more pronounced at the article. As mentioned earlier in the chapter, the comma after the embedded verb in unambiguous sentences is the first point that signals to the comprehender to begin another new clause. Thus, the inflated RTs in this region for unambiguous sentences can be taken to reflect the processing difficulty associated with this structure-building operation.

In addition, they showed a slightly delayed plausibility effect right after the ambiguous NP (*song*), which continued until the following region. This finding is different from the results of Roberts and Felser (2011) in that they did not find such plausibility effects for the native speakers. One possible explanation for this plausibility effect is that it was due to the intervening material between the head noun of the ambiguous NP and the disambiguating verb. The structural distance between the ambiguous NP and the disambiguating element might have allowed the plausibility effect to be observed in these regions.

Lastly, delayed reverse plausibility effects were observed in the disambiguation region. Although NSs experienced processing difficulty with both of ambiguous sentences after the disambiguating verb, the results for the combined spill-over region (Regions 10-12) revealed that only plausible ambiguous sentences had significantly longer RTs than their unambiguous

counterparts, indicating that the processing difficulty with ambiguous sentences lasted longer only for plausible ambiguous sentences. Although reverse plausibility effects were observed only in the combined spill-over region, this finding suggests that the NS group used the plausibility information to recover from their initial misanalysis and found it difficult to switch to the correct analysis.

2.5.2 Late Learners

Similar to the NS group, LLs showed the immediate ambiguity effect at the embedded verb and this effect carried over to the following region. Also, the LL group showed slightly delayed plausibility effects right after the ambiguous NP and continuing into the following three regions (Region 7 through Region 9). Interestingly, LLs showed an indication of immediate plausibility effect in Region 5 (*song*). Specifically, there was a trend toward longer RTs for implausible ambiguous sentences, suggesting that LLs read implausible ambiguous sentences significantly longer than plausible ambiguous sentences. Indeed, there was elevated RTs for the implausible ambiguous sentences (562 ms) as compared to the plausible ambiguous sentences (506 ms).

In addition, it is important to note that LLs showed a prolonged plausibility effect beginning at Region 6 (*about*) and continuing into the disambiguating verb (*amused*). This finding is consistent with previous findings in Roberts and Felser's study that the Greek L2 learners also showed

prolonged plausibility effects, indicating that the implausible DO condition caused significantly higher RTs than the plausible DO condition.

Finally, delayed reverse plausibility effects were obtained two regions after the disambiguating verb. Similar to the NS group, there were statistically reliable differences between the ambiguous and unambiguous sentences under both the implausible and plausible condition after the disambiguating verb, suggesting that LLs also had processing difficulty with both of the ambiguous sentences. However, the processing difficulty with plausible ambiguous sentences appeared to have lasted longer-- until the following region. The clear pattern of reverse plausibility effects was also observed in the results of combined spill-over regions that plausible ambiguous sentences had significantly longer RTs than their unambiguous counterparts. This finding suggests that LLs were also able to use plausibility information to recover from their initial misanalysis, which is different from the result of Roberts and Felser (2011). In their study, L2 learners were not able use the plausibility information to reanalyze due to the structural difficulties involved in this sentence type. Thus, the findings from the LL group cast some doubt on the SSH, which claims that NNSs do not fully process the syntactic information as NSs do.

2.5.3 Early Bilinguals

For the EB group, there was a comma effect beginning at the article (*the*). However, this effect was a slightly delayed as compared to the NS and

LL groups. The EB group also showed a slightly delayed plausibility effect after the ambiguous NP. Like the LL group, there was also an early indication of the immediate plausibility effect at the ambiguous NP (*song*).

In addition, unlike the other two groups, it is important to note that reverse plausibility effects were observed right after the disambiguating verb. There were statistically reliable differences between the ambiguous and unambiguous conditions only for plausible sentences, indicating that plausible ambiguous sentences were read significantly longer than plausible unambiguous controls (399 ms vs. 353 ms). Another indication of reverse plausibility effects was found that there were also statistically reliable differences between the implausible and plausible conditions only for ambiguous sentences. This finding indicates that plausible ambiguous sentences took significantly longer than implausible ambiguous sentences (399 ms vs. 365 ms). Because the EBs show reliable indications of processing difficulty only for plausible ambiguous sentences, this finding suggests that the EB group used plausibility information more efficiently to recover from initial misanalysis as compared to other two previous groups.

2.5.4 Conclusion

Taken together, for SC ambiguity sentences, all three groups of comprehenders showed both plausibility effects and reverse plausibility effects, indicating that they were able to use plausibility information to recover from structural misanalysis. Although NSs in Roberts and Felser's (2011) study did

not show any significant reading time differences between plausible and implausible sentences, the NSs in the current study showed both plausibility effects and reverse plausibility effects. Since the present study used materials comparable to those in Pickering and Traxler (1998), which provided structural distance between the ambiguous NP and the disambiguating verb, this might have allowed their recovery processes to be affected by plausibility information.

It is also noteworthy that unlike the findings in Roberts and Felser's study, LLs showed reverse plausibility effects in the disambiguation region, indicating that they were also able to use the plausibility information to recover from initial misanalysis. It is thus hard to conclude that L2 learners could not use this "high level" semantic information during online sentence comprehension due to structural difficulties involved in this sentence type. The findings in our study suggest that like NSs, they were able to compute plausibility information as they process syntactically challenging sentences.

Importantly also, the EB group appeared to be more adept at using plausibility information to facilitate their recovery process in this sentence type, suggesting that the cognitive advantages of early bilingualism related to resolving the conflicting information might extend to online sentence processing. As mentioned earlier in this chapter, garden-path sentences like SC ambiguity sentences yield conflicting analyses because the preferred DO analysis should be abandoned to arrive at the correct interpretation. The results of the present study suggest that the EBs were particularly effective at

allocating cognitive resources to resolving the conflicting information, suggesting that EBs' cognitive skills can extend to ambiguity resolution during online sentence processing.

Chapter 3

Phrasal Verb (PV) Construction

The other sentence type of interest in this dissertation involves phrasal verb (PV) constructions. PVs are multi-word verbs that consist of a verb followed by an adverbial particle (i.e., *run over, bring up, take out, etc.*) (Biber, Johansson, Leech, Conrad, & Finegan, 1999). The structural processing of PVs is particularly interesting because many of these constructions allow the verb and particle to be separated by intervening material, usually a direct object (e.g., *Mary ran over the fox that crossed the road when it ran in front of her car*. vs. *Mary ran the fox that crossed the road over when it ran in front of her car*.). Due to the peculiarity of this syntactic alternation (split vs. non-split), PVs present interesting problems for the language processor. Indeed, it is as yet unclear what happens when the particle (*over*) is split from the verb (*ran*) during online sentence comprehension. In L2 English, it is possible that structural processing difficulty involved in the comprehension of these split PVs can account in part for L2 learners' avoidance of these verbs. Systematic examinations into this structure can thus shed light on potential structural processing difficulties related to PVs as well as on why these verbs appear to pose particular problems for NNSs.

In terms of the main goals of this dissertation, it also important to emphasize that split PV constructions allow for another test of the interaction between plausibility and structural processing. This is because the PV might

be temporarily misinterpreted as a regular (i.e., non-PV or lexical) verb before its particle becomes available. For instance, in a sentence such as *Jess brought the winnings from his Las Vegas vacation up during dinner*, readers might initially link with the NP *the winnings* as the direct object (DO) of the verb *brought* without projecting the additional structure necessary to create a PV. Later in the sentence, when the particle *up* appears, this initial misanalysis would have to be revised, which might induce processing difficulty. It is important to note that during this process, semantic revision as well as structural reanalysis is often necessary in order for readers to select the correct meaning for the PV. For instance, with reference to the example above, it is not clear that the PV *bring up* should be interpreted as *to mention* until the particle *up* is encountered.

The scenario might be different with sentences like *Mary ran the fox that crossed the road over….* In this sentence, comprehenders might initially find *the fo*x implausible as the DO of the verb (*ran*) and experience processing difficulty at this point. However, this sentence might be easier to process at the disambiguating region (*over*) because the readers might not be strongly committed to the initial misanalysis. In this way, in line with SC ambiguity sentences, split PVs provide an opportunity to examine how comprehenders deal with misanalysis and use plausibility information to reanalyze syntactically complex sentences.

It is thus important to consider (i) whether these idiosyncratic properties of split PVs lead to parsing problems during the online

comprehension for all three groups of comprehenders that are of interest in the present study -- NSs, LLs, and EBs -- and (ii) whether they are able to use plausibility information in the recovery process. Unlike other two groups, it is expected that L2 comprehenders might show especially large processing costs during the comprehension of split PV constructions. If L2 comprehenders have a particular processing difficulty with these sentences, it is possible that they might not be able to use plausibility information to recover from initial syntactic misanalysis due to structural difficulties involved in split PV sentences. If that is the case, this could be taken as additional evidence that the syntactic characteristics of PVs cause particular processing difficulty for L2 comprehenders and thus might lead to avoidance of these verbs.

This split PV construction is also useful for another examination into whether the cognitive advantages of early bilingualism extend to the coordination of multiple sources of information during sentence processing. In particular, if such early bilingual comprehenders are able to use cognitive advantages such as *conflict resolution, multi-tasking, working memory* (Bialystok, Craik, Klein, & Viswanathan, 2004; Bialystok, Craik, & Luk, 2008; Costa et al., 2008, 2009) in the domain of online sentence processing, it is expected that such participants will be able to use plausibility information more efficiently to resolve the temporary ambiguity in this sentence type as compared to the monolingual NS group.

In the following section, I review some of the previous second language acquisition (SLA) and sentence processing studies that motivate the

PV experiment. Then, the PV experiment is introduced in Section 3.2. In Section 3.3, the methodology for the experiment is described in detail. Section 3.4 discusses the results, followed by a summary of findings in Section 3.5.

3.1 Theoretical Motivation

According to Celce-Murcia and Larsen-Freeman (1999), PVs are known to be notoriously difficult for learners of English, and especially for EFL learners whose native languages do not have PVs (i.e., Chinese, Korean, Japanese, etc.). One strategy that learners appear to use to deal with PV difficulty is avoidance. When L2 learners perceive that it is difficult to produce a given form or structure when using the target language, avoidance is one of the strategies they can use to deal with that difficulty (Kleinmann, 1978). In Schachter's (1974) study on avoidance behaviors in L2 acquisition, she argued that it is very likely that students will avoid using a particular construction in the target language if they find it difficult to understand. Although a number of SLA studies to date have shown that L2 learners tend to avoid using PVs and to prefer their one-word equivalents (Dagut & Laufer, 1985; Hulstijn & Marchena, 1989; Liao & Fukuya, 2004; see below for more on these studies), the sources of difficulty that give rise to this strategy have not yet been identified.

There are several reasons why PVs might be especially difficult for English language learners. According to Cornell (1985), there are at least 3,000 established PVs in English, and about 700 of them appear to be used in

daily communication. Due to the large number of PVs that are used regularly, English language learners often feel pressured to learn them all at once, which can be overwhelming.

Moreover, various aspects of the meanings of PVs can confuse learners and make it difficult for them to understand these verbs. For example, there are many PVs whose meaning cannot be deduced directly from their semantic components. Some examples of English verb-particle combinations are presented in (4).

(4) PV sentence examples

a. He put a hand over hers on the table but quickly **took** it **away** again. " (FIC/Bk: DarknessBound 2012)

b. I was told he was on the list. Maybe his car **broke down** on the way over. (SPOK/Fox_Five 2012)

c. She picked up the bag again and **went back** to work, too antsy to stand still and chat. (FIC/Bk:Sugar Rush 2012)

d. She became bitterly jealous of Camilla and might have **called** the wedding **off**, but there was a problem. (SPOK/NBC_Dateline 2007)

(*Examples taken from COCA (Davies, 2008*)

Semantically, the meaning of the PV may be quite literal, as in (4a) and (4c), but it is also often non-literal or idiomatic, as in (4b) and (4d), in which case its meaning cannot be deduced directly from its semantic components. Research on L2 learners' avoidance of PVs shows some evidence that L2 speakers tend to use literal PVs more than idiomatic ones, suggesting that semantic difficulties of idiomatic PVs may aggravate learners' avoidance of

these verbs (Dagut & Laufer, 1985; Hulstijn & Marchena, 1989; Liao & Fukuya, 2004).

L1-L2 structural differences might also contribute to the avoidance of PVs by L2 English learners. One of the unique grammatical characteristics of PVs is that they often permit particle movement. That is, when the PV has a DO, the adverb particle can often be separated from the verb, as exemplified in (5):

(5) Syntactic Alternation in PV

a. While you're in town, can you PICK UP my trousers from the dry cleaner?

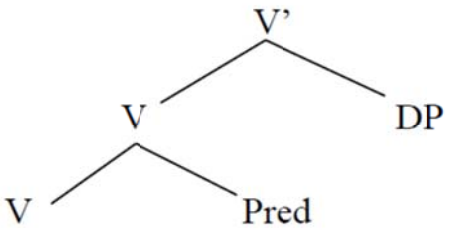
b. While you're in town, can you PICK my trousers UP from the dry cleaner?

As shown in this example, the direct object of the verb-particle construction may occur immediately following the particle as in (5a) or before the particle as in (5b). Henceforth, sentences as in (5a) will be referred to as non-split PV constructions, while those in (5b) will be referred to as split PV constructions. The word order alternation illustrated in (5) is available to a predominant number of English PV constructions. However, there appears to be no clear meaning (or semantic) difference between the two word orders, suggesting that the choice between the two orders is largely optional.

There are a number of syntactic accounts for this alternation (Neeleman, 1994; Kayne, 1985; Guéron, 1990; Den Dikken, 1995; Svenonius, 1996a; Radford, 1997; Harley & Noyer, 1998; Ramchand & Svenonius, 2002).

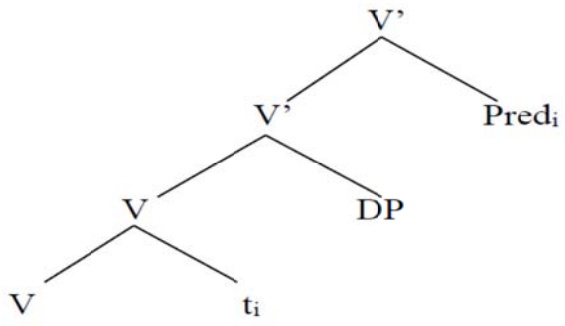
Although the specifics of these accounts differ, all of them posit more complex syntactic structure for PVs than for lexical verbs and more complex syntactic structure for split PVs than for their non-split counterparts. For instance, Neeleman (1994) argues that English PVs are complex verbs (or complex predicates) that take the direct object as their complement. Under this account, the particle is analyzed as a non-verbal predicate (Pred) as shown in (6):

(6)



He further argues that the split PV construction (e.g., V-DO-Prt) is derived by particle extraction from the complex verb as illustrated in (7):

(7)



The split PV construction in (7) is thus more structurally complex than the non-split PV construction in (6) because a new syntactic node needs to be built for particle extraction.

It is important to note that this split PV construction also involves structural ambiguity. For example, with reference to example (5b), the reader might initially interpret the verb *pick* as a lexical verb, only to revise this analysis (and build the more complex split PV structure) upon encountering *up* later in the sentence. As mentioned earlier, resolving this structural ambiguity often also requires semantic revision of the PV. For instance, while *pick* might initially be interpreted as meaning something like *choose*, upon encountering the particle *up*, it becomes clear that it is in fact part of a PV meaning roughly *collect and bring back.*

These properties of split PVs suggest a number of interesting questions related to language processing. Specifically, it is important to consider (i) whether these properties lead to parsing problems during the online comprehension of split PV sentences and (ii), if so, whether these processing costs are comparable for all three groups of comprehenders examined in the present study. As suggested above, an answer to the latter question in particular might help us to better understand L2 learners' avoidance of PVs. Indeed, if the structural processing difficulty related to PVs contributes to the problems these verbs pose for second language learners, LLs might show especially large processing costs during the comprehension of split PV constructions. To date, only one study has examined the structural processing

of PVs during real-time language processing (Konopka & Bock, 2009). This study, however, only investigated the production of these sentences by NSs. Further investigation into these sentence types is therefore necessary to better understand how PVs are processed during online sentence comprehension by both NSs and NNSs.

These PV constructions also allow for another test of whether/how plausibility information influences readers' recovery from structural misanalysis. As mentioned earlier, in sentences with a locally implausible DO like *Mary ran the fox that crossed the road over when it ran in front of her car*, readers might initially link the verb *ran* with the implausible DO *the fox* and find it difficult to process at this point. However, if readers are able to use this plausibility information to recover from this initial misinterpretation, it might be easier for them to project the additional syntactic structure necessary to comprehend these split PV sentences. In this way, the split PV construction provides a good testing ground for investigations of the interaction between structural processing and plausibility.

3.1.1 Avoidance of PVs by L2 Learners

As mentioned above, English PVs have been known to be difficult for L2 learners, and especially for learners whose their native languages do not contain this construction. For this reason, they are structures that might be avoided by L2 learners. Several studies have examined whether this is the case and if so what these avoidance patterns can tell us about the nature of the

difficulty for PVs (Dagut & Laufer, 1985; Hulstijn & Marchena, 1989; Liao & Fukuya, 2004).

Dagut & Laufer (1985) examined Hebrew-speaking English learners' avoidance of English PVs. Specifically, they tested learners' active use of three PV types: *literal* (*go out*, *take away*), *figurative* (*let down*, *turn over*), and *completive* (*cut off*, *burn down*) in a multiple-choice test, a memorization test, and a translation test. In the multiple-choice cloze task, participants had to fill in a missing blank with either a PV or a one-word verb. In the memorization task, participants were first asked to memorize sentences with PVs or one-word verbs (distractors), and fill in blanks with either form later. The translation task asked participants to translate the missing word from their own language into English. The results showed that learners avoided using PVs in general and preferred single verbs over PVs. Also, this avoidance occurred more often with figurative PVs than literal ones. The researchers argued that the absence of a PV equivalent in Hebrew may have contributed to these learners' avoidance of English PVs.

A follow-up study by Hulstijn and Marchena (1989) was conducted with Dutch ESL learners. Despite the fact that these learners had PVs in their native language (L1), they hypothesized that Dutch learners would still avoid PVs, not for structural reasons (L1-L2 structural differences), as the Hebrew learners did, but for more semantic reasons. The same methodology (three elicitation tests) used in Dagut & Laufer (1985) was used in their study, with different PVs. The results were similar to those of Dagut and Laufer in that the

Dutch ESL learners also preferred using one-word verbs over PVs. Interestingly, this avoidance tendency was more pronounced in intermediate Dutch ESL learners than in advanced Dutch ESL learners. In addition, they also argued that Dutch learners appeared to adopt a "play-it-safe" strategy, preferring one-word verbs with general meanings (*disappoint*) over PVs with more specialized or idiomatic meanings (*let down*). Their findings suggest that regardless of the first language, ESL learners tend to avoid using a PV when there is an equivalent one-word expression available to them.

In line with these two studies, Liao & Fukuya (2004) examined the avoidance of PVs by Chinese L2 learners of English, who do not have the PV structure in their native language. As in the previous studies, they assumed that L1-L2 structural differences and semantic difficulty might be reasons for Chinese learners' avoidance of English PVs. Therefore, they tested two types of PVs (literal vs. figurative) in three types of tests (multiple choice, translation, and memorization) with two proficiency levels (intermediate and advanced). The overall results showed that proficiency level, PV type, and test type affected learners' avoidance of PVs. With regard to proficiency level, they found that the intermediate Chinese ESL learners produced PVs much less frequently than both advanced learners and NSs. In terms of PV type, the results showed that both learner groups (intermediate and advanced) produced more literal PVs than figurative PVs, which is consistent with the findings from Dagut & Laufer (1985) and Hulstijn and Marchena (1989). This avoidance was particularly evident in the translation test. This might be

because this test offered the weakest elicitation context for PV responses, as neither PVs nor their one-word equivalents were explicitly available, unlike in the memorization or multiple-choice tests.

To summarize, the findings of the three studies on the avoidance of PVs by L2 English learners suggest that, regardless of whether the learners have PVs in their L1, they prefer to use one-word verbs (*disappoint, confuse*) over equivalent PVs (*let down, mix up*). This avoidance tendency was more evident in intermediate learners of English than advanced learners. Also, both intermediate and advanced learners showed a similar tendency to use fewer figurative PVs than literal PVs. In light of these findings, it appears that a key reason for L2 English learners' avoidance with PVs relates to difficulties with their semantics. Because figurative PVs often take an idiomatic meaning which departs from its individual components, learners might find it difficult to map their meanings with their forms. On the other hand, for literal PVs, it might be relatively easy to get the meaning since it is a straightforward product of their semantic components.

With respect to this potential source of PV processing difficulty, a number of studies have addressed the issue of how literal and idiomatic meanings are accessed and retrieved from semantic memory. To date, however, only a few psycholinguistic studies have investigated idiom or PV comprehension in L2 sentence processing (McPartland-Fairman, 1989; Matlock & Heredia, 2002; Cieślicka, 2006), even though a large number of studies have examined L1 idiom processing (Cacciari & Tabossi, 1988;

Swiney & Cutler, 1979; Titone & Connine, 1994; Tabossi et al, 2005). In the following section, the relevant literature on L1 and L2 idiom/PV comprehension in sentence processing will be reviewed to better understand how idioms and PVs are represented and accessed by both groups of comprehenders.

3.1.2 Idiom/PV Processing in L1/L2 Sentence Comprehension

Previous SLA studies have shown that L2 learners tend to avoid PVs and use one-word equivalents. In addition, they tend to show more difficulty with figurative PVs than literal PVs (Dagut & Laufer, 1985; Hulstijn & Marchena, 1989; Liao & Fukuya, 2004). It is therefore important to examine how the meanings of idioms/PVs are accessed and processed by L1 and L2 comprehenders during online comprehension. Interestingly, studies in this area have shown that that NSs seem to activate idiomatic meanings more quickly than literal meanings (Cacciari & Tabossi ,1988; Swiney & Cutler, 1979; Titone & Connine, 1994; Tabossi et al, 2005). The evidence for L2 processing is a bit more mixed, however, with some studies indicating delayed access to idiomatic meanings (Cieślicka, 2006), while others have shown relatively fast, automatic access to these meanings (Matlock & Heredia, 2002; McPartland-Fairman, 1989).

In one such study, Swinney and Cutler (1979) compared the subjects' reaction times for idioms (*spill the beans*) and matched control phrases (*cook the beans*) using a *Phrase Classification Task*. In this task, participants had to

decide whether a word string was an acceptable English phrase. The results showed that participants responded significantly faster to idioms than to their controls (literal phrases). This was taken to suggest that the figurative interpretation usually "wins" the race because it benefits from the activation of both literal and nonliteral interpretations.

Cacciari & Tabossi (1988) examined how idiomatic expressions are processed during sentence comprehension by NSs of English. They used a cross-modal lexical priming task where participants listened to idiomatic expressions (e.g., *After the excellent performance, the tennis player was in seventh heaven.*) and responded to visually presented target words that were related to the idiomatic meaning (*happy*) or the literal meaning (*stars*) (compared with unrelated controls (*respect*)). The results showed that when the idiomatic string was predictable, subjects' response rates were significantly faster to idiomatically related targets than to literally related targets. However, when the word string was not recognizable as idiomatic until its completion (*hit the nail on the head*- unpredictable until *head*), subjects were faster on targets that were literally related to the last word.

As an extension study of Cacciari & Tabossi (1988), Titone & Connine (1994) examined the influence of *predictability* on idiom comprehension by native English speakers in three cross-modal lexical priming experiments. They found that when the visual targets were presented at the idiom offset, both high- and low-predictable idioms showed priming of the idiom-related meaning. However, when the visual target was presented prior to idiom offset,

more priming was observed for high-predictable idioms (e.g., *George wanted to bury the hatchet soon after Susan left.*) than for low-predictable idioms (e.g., *Fred wanted to hit the sack after his long day hiking.*).

Tabossi et al. (2005) also investigated recognition of spoken idioms by Italian speakers in cross-modal priming experiments. Since they were particularly interested in the activation point for idiomatic expressions, visual targets were presented in one of four positions: (1) before the idiom (e.g., *Christina had the habit* of pulling water to her mill* (meaning "pursuing her interests").), (2) after the first content word (e.g., *Christina had the habit of pulling water* to her mill*.), (3) at the idiom offset (e.g., *Christina had the habit of pulling water to her mill**.), and (4) at the literal offset (e.g., *Christina had the habit of pulling water to her neighbor**.). The results showed that for predictable idioms, priming effects were observed as early as the first content word following the idiom verb. However, for non-predictable idioms, priming effects appeared at the end of the idiom (at the idiom offset position).

The findings from these L1 studies of idiom processing indicate that NSs activate the idiomatic interpretations quite quickly -- and indeed, faster than the literal interpretations, especially when the idioms are predictable. The same, however, might not be true of L2 comprehenders. For instance, Cieślicka (2006) examined activation of literal and nonliteral meanings in a neutral sentence in a cross-modal lexical priming experiment with advanced Polish learners of English. After participants listened to a target sentence (e.g., *Peter was planning to tie the knot later that month*.), they responded to

visually presented literal targets (*rope*), idiomatic targets (*marry*), and unrelated controls. More priming was observed for visual targets related to literal meanings than for targets related to idiomatic meanings. Thus, the literal interpretation appeared to be more active or more salient than the idiomatic interpretation of the idiom, which was taken to suggest that activation of the literal interpretation of the idiom is obligatory and automatic for bilingual speakers (Giora, 1999; 2002). A possible reason for this could be that unlike NSs, idiomatic interpretations are not readily accessible from semantic memory for L2 learners.

Contrary to the findings of Cieślicka (2006), however, a study by McPartland-Fairman (1989) indicated that the activation of idiomatic meanings is not delayed, but rather occurs simultaneously with the activation of literal meanings in PV processing for L2 learners. This study examined the online processing of PVs by both bilingual and monolingual English speakers. This was done using a cross-modal lexical priming experiment in which participants listened to PVs such as *break in* preceded by contextual information that was either biased towards the literal interpretation of the PV (e.g., *Peter shocked everyone at the party.→ It was an expensive antique lamp that he broke in a million pieces.*) or biased towards the idiomatic interpretation (e.g., *The criminal trained a monkey to enter and steal money. → It was during his vacation that he broke in, a policeman said.*). After listening to the last word of the PV, participants responded to visually presented target words: literal targets (*crack*), nonliteral or idiomatic targets

(*robbery*), or unrelated controls (*smart* and *martial*). The results showed that the bilingual speakers activated both the literal and non-literal meaning of the PV regardless of the preceding contextually biasing information. Thus, the findings from PVs are not consistent with the results from idioms in Cieślicka's (2006) study.

Another study by Matlock and Heredia (2002) investigated whether monolingual English speakers and bilinguals (both early and late) would read a sentence with a PV (e.g., *Paul* ***went over*** *the exam with his students*) more quickly than they would a sentence with an identical verb + preposition (e.g., *Paul went* ***over*** *the bridge with his bicycle*). The results showed that both monolinguals and early bilinguals read sentences with PVs more quickly (4312 ms; 4140 ms, respectively) than the sentences with ambiguous verb-preposition combinations. (4635 ms; 4354 ms, respectively). However, this was not the case for late bilinguals (even with high proficiency in English; 6882 ms for PVs; 7053 ms for VPs). Matlock and Heredia interpreted the results to indicate that for monolingual and early bilingual speakers, the figurative meaning is always activated first before the literal meaning. For instance, when reading *go over* as in *Paul* ***went over*** *the exam with his students*, it was argued that monolinguals and early bilinguals activate the meaning of *go over* as a lexical unit, not the meaning of *go* and *over* separately.

Taken together, findings from the previous L1 idiom processing studies provide robust evidence that NSs activate idiomatic meanings quickly and automatically -- and, in fact, in some cases, faster than literal meanings.

On the other hand, L2 idiom/PV processing studies have yielded mixed results related to whether L2 learners readily access idiomatic meanings. These mixed results are somewhat unexpected if the core reason for PV processing difficulty related to problems with idiomatic meaning processing. In particular, the evidence in McPartland-Fairman's (1989) study casts doubt on the idea that PV difficulty stems primarily from difficulty accessing idiomatic meanings and suggests that there might be something other than semantic difficulty that can cause avoidance of PVs by L2 learners. It is important to note that neither this study nor Matlock and Heredia's study addressed another possible difficulty with PVs in L2 sentence comprehension -- structural processing difficulty. In fact, one study to date has examined the structural processing of PVs (Konopka & Bock, 2009).

3.1.3 Structural Processing of PVs

As noted above, structural difficulty might be another factor that can cause avoidance of PVs by L2 learners because many of these constructions allow the verb and particle to be separated by intervening material. This is a somewhat unusual property, which according to the *Lexical Integrity Principle* (Chomsky, 1970), should not be possible if PVs are thought of as single words. Along these lines, it is also important to emphasize the peculiarity of split PV constructions from the perspective of structural processing. Indeed, it is as yet unclear what happens when the particle is split from the verb during online sentence comprehension.

Until now, only one study (Konopka & Bock, 2009) has investigated structural processing patterns for split and non-split PVs. Specifically, this study examined whether verb-particle constructions are more word-like or phrase-like by using the psycholinguistic technique of syntactic priming. Of particular interest was whether split and non-split PV constructions can be structurally primed for English NSs. This was done by testing whether the syntactic structure of PVs (i.e., particle placement) can be primed in the rapid serial visual presentation (RSVP) task where participants silently read a sentence on a computer screen, and then recalled the sentence aloud. Experimental sentences included non-split PV constructions (e.g., *A celebrity threw in the first ball*.) and split PV constructions (e.g., *A celebrity threw the first ball in.*). The results showed that verb-particle structure can be primed when target sentences are reconstructed, with more non-split sentences following non-split primes, and more split sentences following split primes. In their second and third experiments, Konopka and Bock also showed that these priming effects were comparable (i.e., not reliably different) for idiomatic and non-idiomatic PVs.

Although this study provides some evidence for more structure-based accounts of PV processing, further investigations are needed to better understand how PVs are parsed during online sentence comprehension. Indeed, this is the only study to date that has attempted to investigate the structural processing of PV constructions. However, it only examined native English speakers' syntactic priming of these constructions during production. We

therefore still know relatively little about the moment-by-moment mental processes involved in the L1 and L2 comprehension of PVs.

As mentioned above, the structural processing of PVs is particularly interesting because many of these constructions allow the verb and particle to be separated by intervening material. Due to this syntactic alternation in PVs (split vs. non-split), it is possible that L2 learners' avoidance of these verbs can be attributed to structural processing difficulty for PVs in general and split PV constructions in particular. Specifically, the question that needs to be addressed is whether comprehenders with different language learning profiles show comparable patterns of processing difficulty in sentences involving split PV constructions (e.g., *Mary ran the fox that crossed the road over when it ran in front of her car*.).

Furthermore, another way of looking at structural processing difficulty with PVs is to examine whether comprehenders use plausibility information in online processing of PV sentences. If comprehenders, and L2 learners in particular, are able to use plausibility information in their recovery process in this sentence type, this could be taken as additional evidence that they can compute deep syntactic representations, contrary to *shallow structure hypothesis* (SSH). However, if they are not able to use plausibility information to recover from initial misanalysis in these sentences, this might be taken as evidence that idiosyncratic characteristics of split PVs cause particular processing difficulty for L2 comprehenders during online sentence comprehension.

The structural processing of split PV is also useful for investigations into whether early bilinguals' cognitive advantages can extend to resolving the syntactic ambiguity during online sentence comprehension. If these advantages can be transferred to online sentence processing, it is expected that such bilinguals should be more adept at using plausibility information in their recovery process of this sentence type as compared to monolinguals and late learners.

3.2 The Experiment: sample items and predictions

3.2.1 Sample Test Sentences

In this experiment, participants' processing of PV sentences were tested to investigate (a) whether all three groups of comprehenders show comparable patterns of processing difficulties in split PV sentences, and (b) whether they are influenced by plausibility information when processing these sentences. Thus, syntactic alternation (split vs. non-split) and plausibility of DO (implausible, plausible, plausible/no semantic reanalysis) were manipulated in the experimental sentences as in (8) below:

(8) PV sample sentences

a. Implausible/split

Mary ran the fox that crossed the road over when it jumped in front of her car.

b. Implausible/non-split

Mary ran over the fox that crossed the road over when it jumped in front of her car.

c. Plausible/split

Andy turned the key for his new office in and then left to catch the train.

d. Plausible/non-split

Andy turned in the key for his new office and then left to catch the train.

e. Plausible-no semantic reanalysis(nsr)/split

Albert called the family who visited his church up after he talked to his pastor.

f. Plausible-no semantic reanalysis(nsr)/non-split

Albert called up the family who visited his church after he talked to his pastor.

As can be seen in the examples above, there were three PV sentence types of interest: implausible, plausible, and plausible-no semantic reanalysis (nsr). Each of these sentence types were presented in both split and non-split conditions. For implausible sentences, the NP immediately following the verb (*ran*) in the split condition cannot act as a plausible DO. The particle in this sentence type would also seem to require syntactic reanalysis and semantic revision as well. However, these processes might be influenced by earlier indications of implausibility.

For plausible sentences, there are two sentence types: (i) sentences that require semantic revision, and (ii) sentences that do not require semantic revision. In plausible-nsr sentences, the NP immediately following the verb (*called*) in the split PV condition can act as a plausible DO. Upon encountering the particle (*up*) in these sentences, although there might be

syntactic reanalysis, little (if any) semantic revision would be required (i.e., *call* and *call up* mean roughly the same thing). In plausible sentences, the NP immediately following the verb (*turned*) in the split PV condition can again act as a plausible DO. In these sentences, however, the particle would seem to trigger both syntactic reanalysis and semantic revision (i.e., the meaning assigned to *turned* would have to be revised when *in* is encountered).

For the analysis of the reading time data, the critical word for plausibility effects is the DO (*fox, key, family*). The critical words for reanalysis are the particle (*over, in, up*) and the remaining constituents of the matrix clause, which will be referred to as the "spill-over region". Also, note that the particle in the split conditions is compared with the particle in the non-split conditions.

3.2.2 Predictions

If readers use the plausibility information as soon as the DO is encountered in the split condition, it was predicted that they would show evidence of a plausibility effect, reflected as inflated RTs at the DO in implausible/split sentences (*fox*). However, for both plausible and plausible-nsr sentences, it is predicted that no processing difficulty would be observed when encountering these DOs (*key, family*, respectively). Thus, there should be significant reading time differences between the split and non-split condition only for implausible sentences. Figure 3.1 shows an idealized pattern of results that is consistent with these predictions.

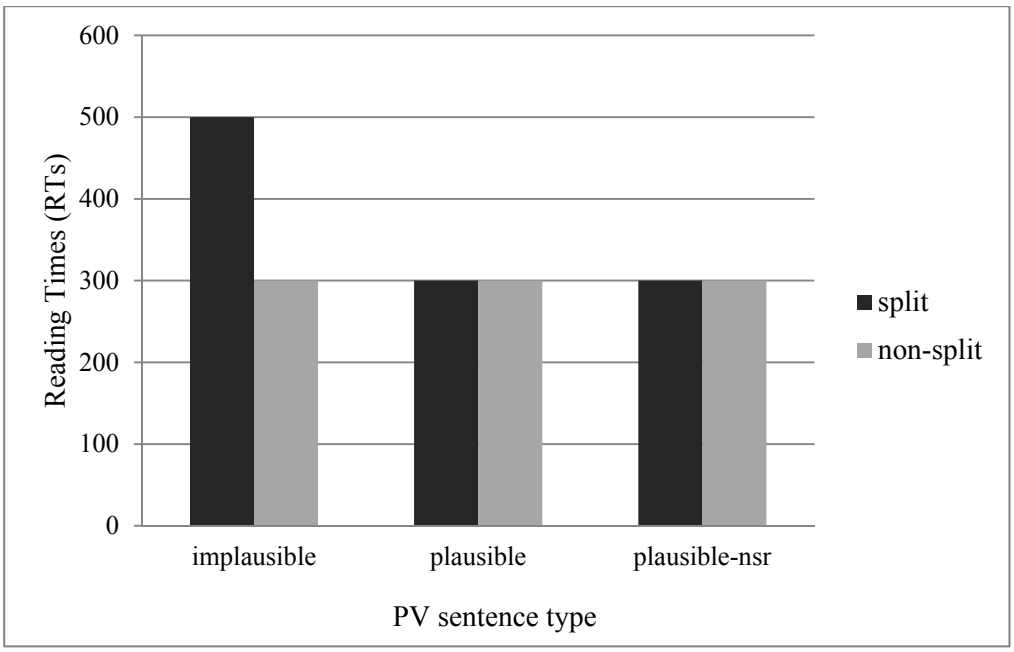


Figure 3.1 Predicted reading times (RTs) at the direct object (DO)

At the disambiguating region (at/after the particle), there are several possible predictions. First, assuming that measurable processing costs occur only when there is both syntactic and semantic reanalysis, if readers use plausibility information to project PVs, it is predicted that they will experience processing difficulty only for the plausible/split sentences (*turned the key…in*). Thus, the prediction is that the reading time difference between the split and non-split conditions in the plausible sentences should be greater than in the implausible sentences or the plausible-nsr sentences. Figure 3.2 below shows an idealized pattern of results when plausibility information is used.

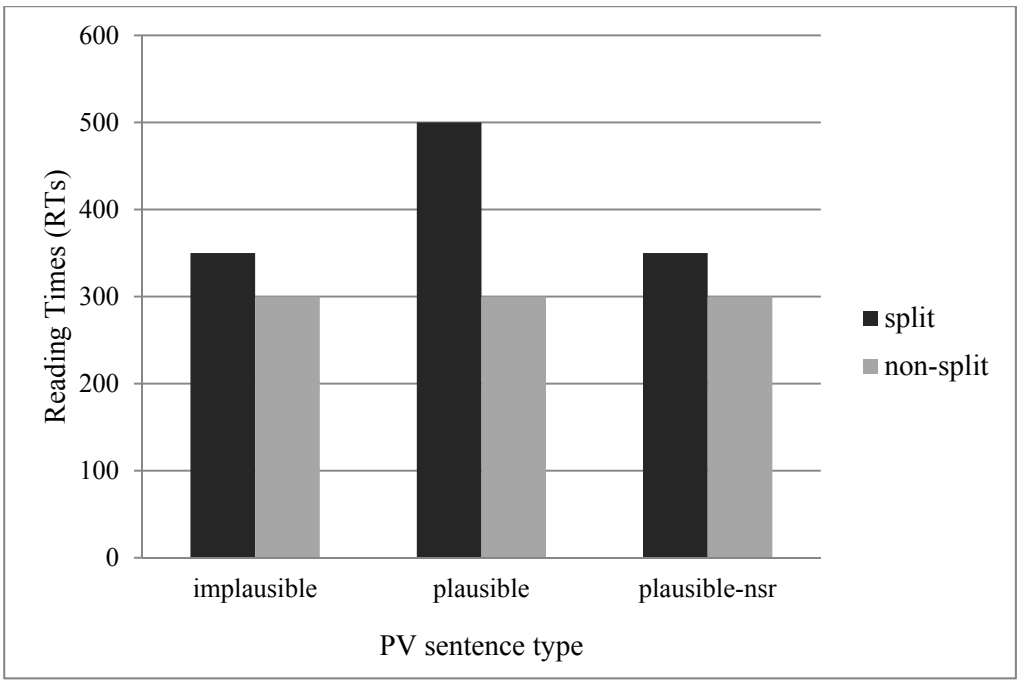


Figure 3.2 Predicted reading times (RTs) with plausibility effect

However, if readers are unable to use plausibility information in this way, but they are still sensitive to reanalysis, then the reading time differences between split and non-split sentences should be about the same in both the implausible and plausible sentences, and in both cases, these differences should be greater than in the plausible-nsr sentences, as shown in Figure 3.3.

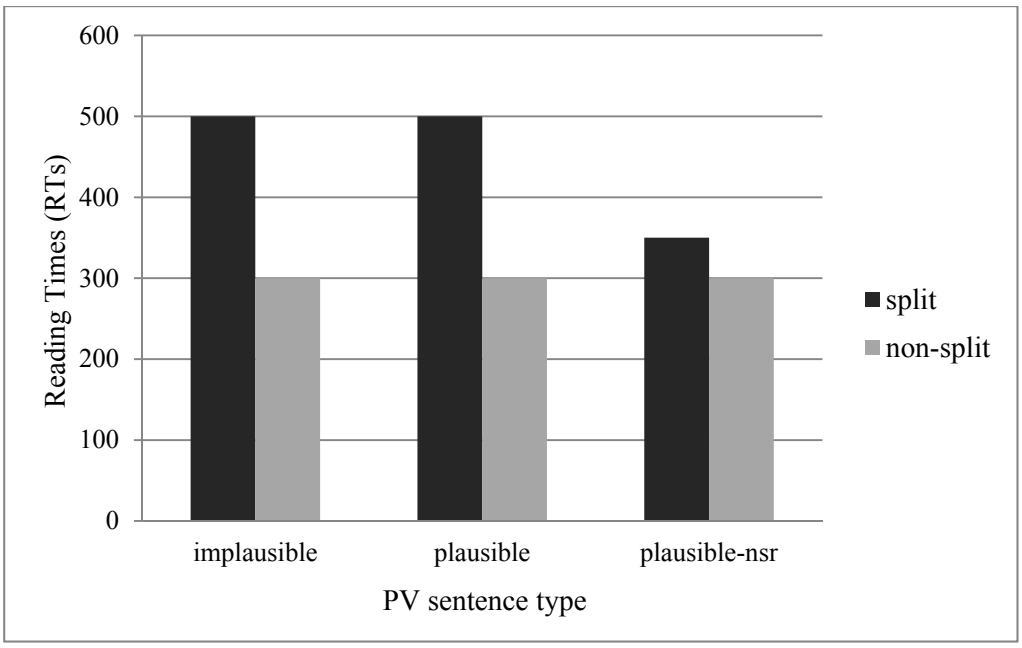


Figure 3.3 Predicted reading times (RTs) with no plausibility effect but reanalysis

Lastly, if readers are unable to use plausibility information and have difficulty with split PV constructions regardless of whether they require both syntactic and semantic reanalysis, then the reading time differences between split and non-split conditions should be roughly the same in all three sentence types. Figure 3.4 illustrates an idealized pattern of results that is consistent with these predictions.

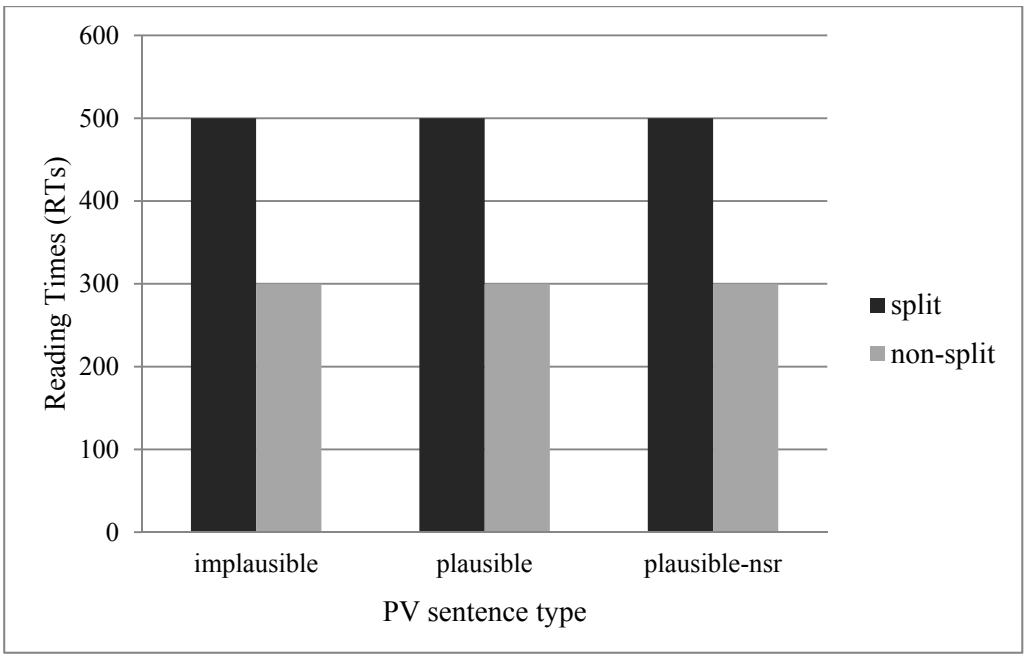


Figure 3.4 Predicted reading times (RTs) with no plausibility effect but difficulty with split PV condition

With respect to the different participant groups under investigation, it is possible that this last pattern of results is especially relevant to the LL group. This would be consistent with the particular difficulties that LLs have shown for PV constructions in other domains. In other words, these LLs might show a quite consistent pattern of processing difficulty for PVs if the particle (and the remaining portion of sentences) in the split condition incurs measurable processing costs regardless of sentence type.

For other two groups, however, it is expected that they should show a pattern of results as in Figure 3.2 if they are able to use plausibility information to recover from initial misanalysis as they did in the previous experiment. In addition, EBs might show a pattern of results indicating that

they are particularly adept at using plausibility information in their structural reanalysis.

3.3 Methodology

3.3.1 Participants

Three groups of participants were tested -- 43 native speakers of English (NSs), 45 late learners (LLs), and 29 early bilinguals (EBs). These were the same participants as in the experiment on SC ambiguity sentences reported in Chapter 2. (See Chapter 2 for the details related to these groups.)

3.3.2 Materials and Design

The materials for the PV manipulation consisted of 72 sets of sentences (as in (8) above), with 24 items from each PV sentence type. (See Appendix B for the complete set of items.) The experiment therefore had a 2X3 design, in which PV alternation (split vs. non-split) and PV sentence type (implausible, plausible, plausible-no semantic reanalysis) were manipulated. Each experimental item was followed by a yes/no comprehension question, with an equal number of correct "yes" and "no" answers in each condition (e.g., *Mary ran the fox that crossed the road over when it jumped in front of her car. / Did Mary hit a fox with her car?*). The possibility of an NP occurring between the verb and the particle for all split PV conditions was checked using the *Corpus of Contemporary American English* (Davies, 2008). It was found that NPs occurred in this position in at least two example

sentences in this corpus, indicating that the split PVs in the experimental items are possible constructions that are attested in actual language data.

In addition to these experimental items, 32 fillers of different structural types were created. (Again, see Appendix C for the complete set of filler items.) These filler items were matched in length and complexity with the experimental items and were included to distract participants from the purpose of the experiment. This experiment was also interleaved with the experiment investigating SC ambiguity sentences, which is discussed separately in Chapter 2. This experiment involved 40 items. Altogether, there were 144 sentences in the experiment, which were organized into counterbalanced lists.

In order to assess the LL participants' knowledge of PVs, a multiple-choice test was created for the verbs used in the experimental items, which was administered after the self-paced reading task (see the *Procedure* section below). (See Appendix D for the complete set of items in this test.) For this test, participants were asked to read each sentence and choose the definition for the PV that best fit the context (e.g., *I <u>ran over</u> a rabbit on the way home.* (1) To explain quickly, (2) To hit with a vehicle, (3) To exceed a time limit, (4) To read through).

3.3.3 Plausibility Norming Experiment

As mentioned in Chapter 2, an online plausibility judgment experiment was conducted with 28 native speakers from UTA to ensure that the

manipulation of plausibility worked as intended in these items. As explained above, they were asked to judge the plausibility of the beginning portions of the experimental sentences (40 SC ambiguity sentences + 72 PV sentences). For PV sentences, the beginning of each PV sentence type (implausible, plausible, plausible-nsr) in each condition (split vs. non-split; e.g., *Mary ran the rabbit*. vs. *Mary ran over the rabbit.*) was provided. As in SC ambiguity sentences, participants were asked to rate the plausibility of each sentence (or indicate how much sense each sentence made) on a scale from 1 (completely implausible) to 5 (completely plausible). The test items were counterbalanced and presented to each participant in a different random order.

Figure 3.5 below shows the results for the PV sentences.

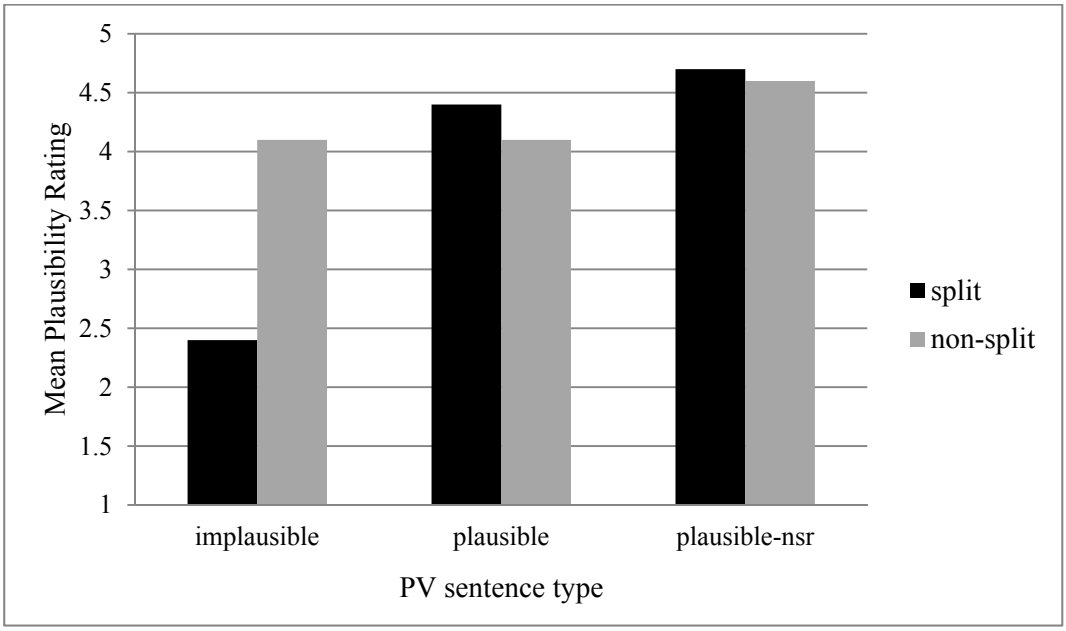


Figure 3.5 Mean plausibility ratings for PV sentences

Table 3.1 Mean plausibility ratings and results of the analyses of variance for PV sentences

	Mean plausibility ratings	
implausible/split	2.4	
implausible/non-split	4.2	
plausible/split	4.4	
plausible/non-split	4.2	
plausible-nsr/split	4.7	
plausible-nsr/non-split	4.6	
sentence type F1(2,52) F2(2,66)	216.03***	57.64***
alternation F1(1,26) F2(1,66)	46.77***	28.20***
interaction F1(2,52) F2(2,66)	110.19***	45.92***
	F1 (1,26)	F2 (1,22)
implausible (split vs. non-split)	119.98***	98.74***
plausible (split vs. non-split)	6.35*	2.25
plausible-nsr (split vs. non-split)	< 1	< 1
*$p < .05$. **$p < .01$. ***$p < .001$*		

As shown in Table 3.1 above, 2x3x2 ANOVAs were performed on these data by subjects and items. For the analysis by subjects, both PV sentence type (implausible, plausible, plausible-nsr) and PV alternation (split vs. non-split) were repeated measures. For the analysis by items, PV sentence type was a non-repeated measure, while PV alternation was a repeated measure. In both of these analyses, list/item group was included as a grouping factor. These analyses revealed significant main effects of both PV sentence type ($F1$ (2, 52) = 216.03, $p < .001$; $F2$ (2, 66) = 57.64, $p < .001$) and PV alternation ($F1$ (1, 26) = 46.77, $p < .001$, $F2$ (1, 66) = 28.20, $p < .001$). More importantly, there was also a significant interaction between PV sentence type and PV alternation ($F1$ (2, 52) = 110.19, $p < .001$; $F2$ (2, 66) = 45.92, $p < .001$).

In order to explore the nature of this interaction, pairwise comparisons of split and non-split sentences were conducted for each PV sentence type. For the implausible sentences, split sentences were rated reliably lower than non-split sentences ($F1$ (1, 26) = 119.98, $p < .001$, $F2$ (1, 22) = 98.74, $p < .001$). For the plausible sentences, although there was a trend suggesting that split sentences were rated higher than non-split sentences, this difference was reliable only in the by-subjects analysis ($F1$ (1, 26) = 6.35, $p < .05$; $F2$ (1, 22) = 2.25, $p = .15$). For the plausible-nsr sentences, there was no significant difference between the split and non-split versions (both F's <1). The results show that the implausible items were indeed considered more implausible when they are split than when they are not split, confirming that the experimental manipulation worked as intended.

3.3.4 Procedure

The procedures followed those described for the experiment reported in Chapter 2. The session began with a language background questionnaire, the results of which are reported in section 2.3.1. The experiment again employed a self-paced reading task (Just et al., 1982), the procedures for which are the same as described in the previous experiment (again, see Chapter 2 for details). Immediately after completing the reading task, participants in the LL group took the PV multiple-choice test. This task was again administered using DMDX. Participants read sentences that included the

PVs from the experimental items one at a time on the computer screen. For each sentence, they selected the definition for the PV that best fit the context from four choices using the 1-4 keys on the keyboard. No feedback was provided, and the next question appeared automatically. The items were presented in a different random order for each participant, and there were three practice items to familiarize participants with the task. The overall accuracy rate on the PV multiple-choice test for LL group was 90.23% (*SD* = 5.77).

3.3.5 Data Analysis

As discussed in the previous experiment, for the NS and EB groups, the data from participants with error rates (ERs) of 20% or greater on the complete set of comprehension questions (i.e., on the questions for filler and experimental items) were eliminated from the analysis. Based on this criterion, the data from three NS participants and one EB participant (a Spanish-English bilingual) were excluded. For the LL group, the data from participants (a) with ERs of 25% or greater on the complete set of comprehension questions or (b) with ERs of 20% or greater on the PV multiple choice test were eliminated from the analysis. This led to the exclusion of datasets from 13 LL participants -- six were excluded based on comprehension question accuracy; two were excluded based on PV multiple choice test accuracy; five were excluded because they did not meet either of these criteria. Thus, 40 NSs, 32 LLs, and 28 EBs were included in the data analysis. Items on which participants made

100% errors in one of the conditions were also eliminated from the analysis. For PV sentences, this meant that one item was eliminated for the LL group.

RT data were analyzed only for trials on which the participant correctly answered the comprehension question. Prior to the analysis of these data, values that were two standard deviations above or below a participant's mean for a given region were replaced with the value two standard deviations above or below this mean. The statistical analyses of the ER and RT data are presented by group (NS, LL, EB) below.

3.4 Results

3.4.1 Native Speakers

In the statistical analyses for this sentence type, 2x3x2 ANOVAs were performed by subjects (*F*1) and items (*F*2). For the analysis by subjects, both PV sentence type (implausible, plausible, plausible-nsr) and PV alternation (split vs. non-split) were repeated measures. For the analysis by items, PV sentence type was a non-repeated measure, while PV alternation was a repeated measure. In both of these analyses, list/item group was also included as a grouping factor. These analyses were followed up with tests of the simple effect of alternation (split vs. non-split) in all three sentence types (implausible, plausible, plausible-nsr sentences).

The mean ERs on the comprehension questions for the six experimental sentence types and results of the analyses of variance are presented in Table 3.2. For this NS group, this analysis revealed no

statistically reliable differences among the test sentences (sentence type: $F1 < 1$; $F2$ (2, 66) = 1.86; alternation: $F1 < 1$; $F2$ (1, 66) = 2.03; interaction: $F1$ (2, 76) = 1.24; $F2 < 1$), indicating essentially no influence of the experimental factors on overall comprehension.

Table 3.2 NSs' mean ERs (in percentages) on the comprehension questions and results of the analyses of variance

	Mean Error Rates	
implausible/split	6.67%	
implausible/non-split	7.50%	
plausible/split	10.00%	
plausible/non-split	6.88%	
plausible-nsr/split	8.13%	
plausible-nsr/non-split	7.92%	
sentence type F1(2,76) F2(2,66)	< 1	1.86
alternation F1(1,38) F2(1,66)	< 1	2.03
interaction F1(2,76) F2(2,66)	1.24	< 1
	F1 (1,38)	F2 (1,22)
implausible (split vs. non-split)	< 1	< 1
plausible (split vs. non-split)	3.07	< 1
plausible-nsr (split vs. non-split)	< 1	2.61
**p < .05. **p < .01. ***p < .001*		

The RT patterns for the NS group on the six experimental conditions are illustrated in Figure 3.6. Because this figure does not provide the clearest indications of processing time differences between split and non-split sentences for each sentence type, the reading profiles for each of these sentence types are graphed separately, in Figures 3.7, 3.8 and 3.9 below. Note that the data for the particle in both split and non-split sentences are presented in Region 9 -- that is, the region where they occurred in split sentences -- in the figures and tables below.

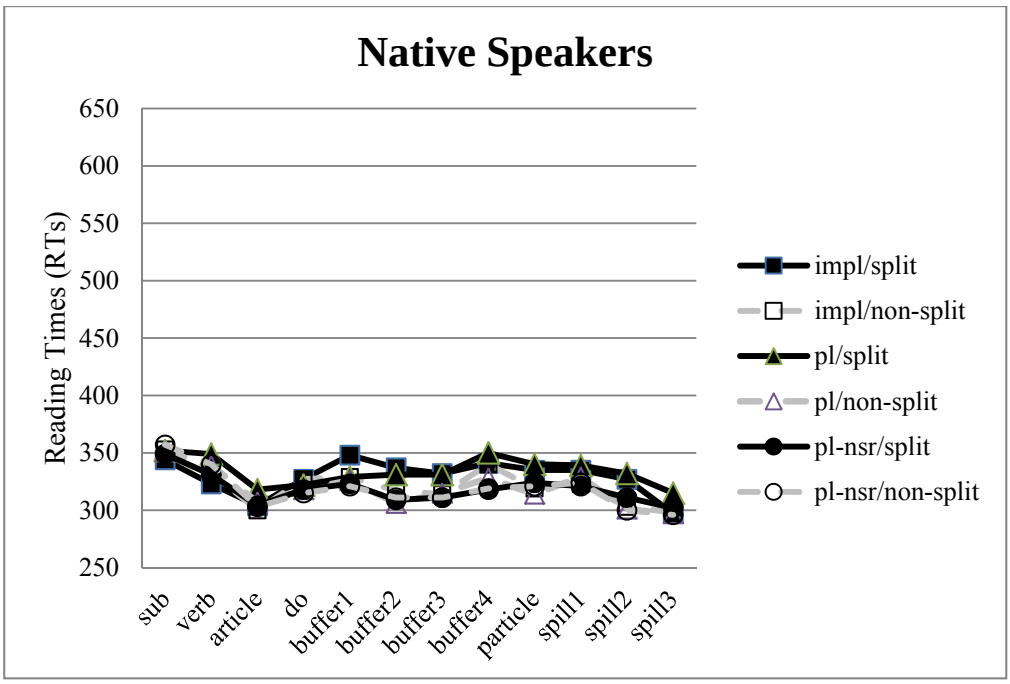


Figure 3.6 NSs' mean word by word reading times (ms) for PV items.

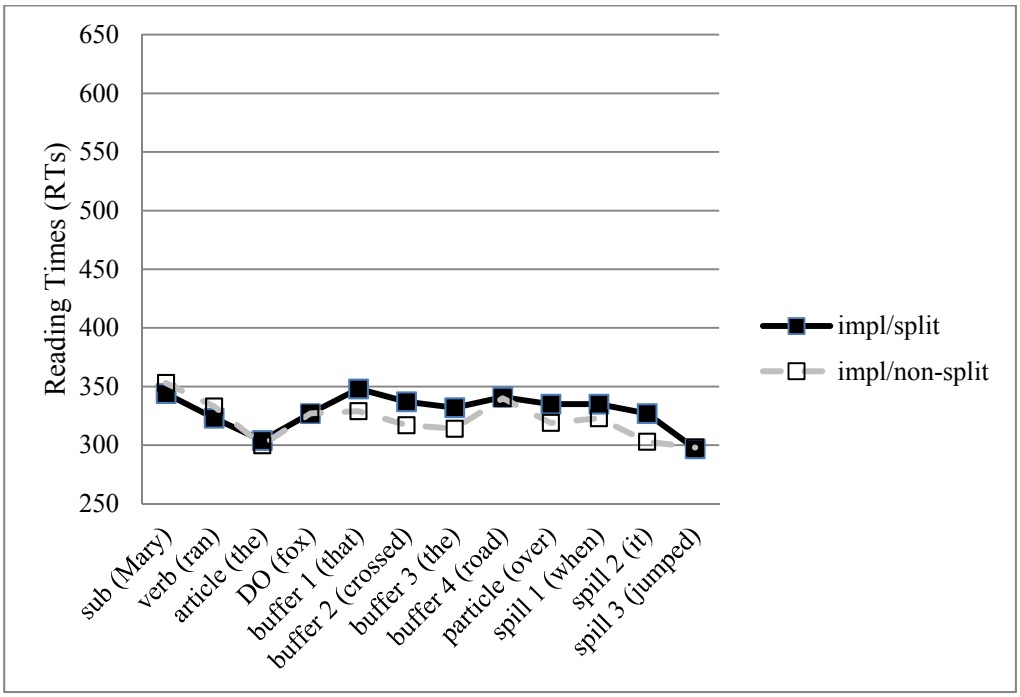


Figure 3.7 NSs' mean word by word reading times (ms) for implausible sentences.

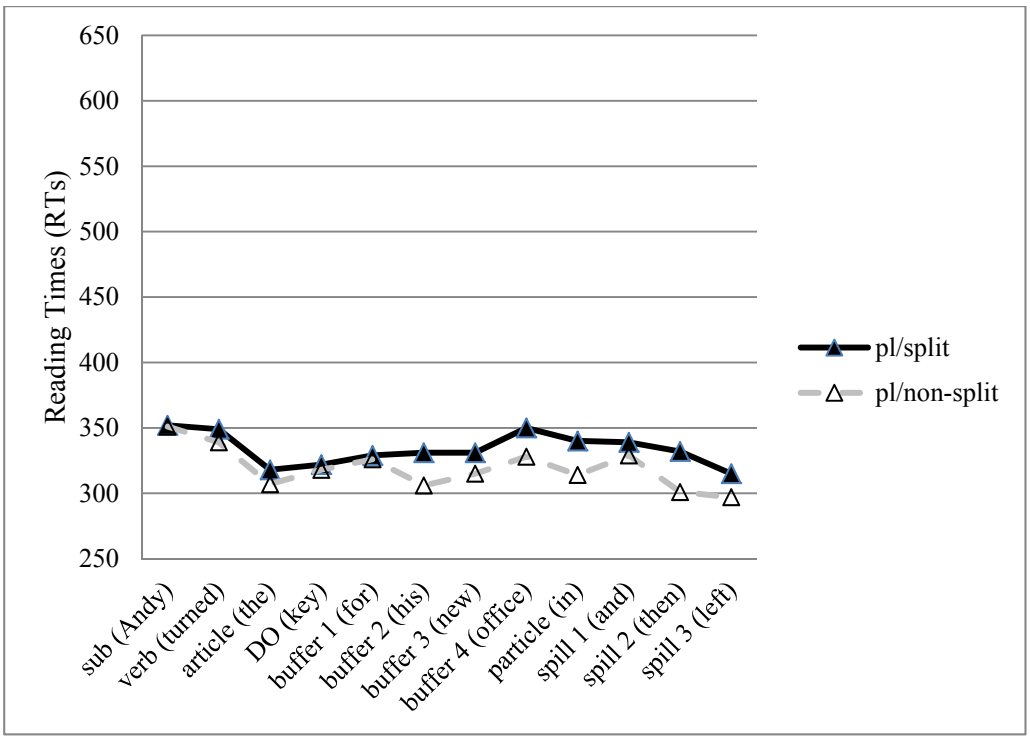


Figure 3.8 NSs' mean word by word reading times (ms) for plausible sentences.

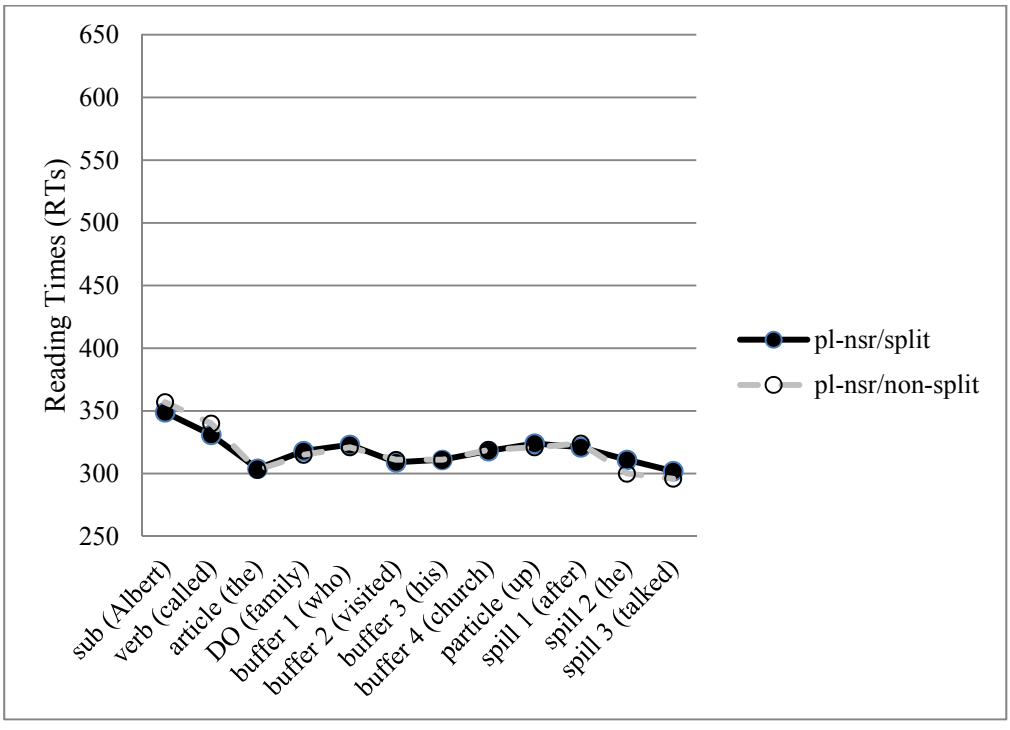


Figure 3.9 NSs' mean word by word reading times (ms) for plausible-nsr sentences.

The mean RTs for the NS group in each region are presented Table 3.3, along with the results of the associated ANOVAs. As in SC ambiguity sentences, only the results for Regions 3-12 will be reported. Note that since there were three different types of PVs, region labels (i.e., article, DO, etc.) are used in these tables.

Table 3.3 NSs' mean RTs and results of the analyses of variance for PV sentences

	Region 3 (article)		**Region 4 (DO)**		**Region 5 (buffer1)**		**Region 6 (buffer2)**		**Region 7 (buffer3)**	
implausible/split	304		327		348		337		332	
implausible/non-split	300		327		329		317		314	
plausible/split	318		322		329		331		331	
plausible/non-split	307		318		326		306		315	
plausible-nsr/split	304		318		323		309		311	
plausible-nsr/non-split	303		315		321		311		311	
sentence type F1(2,76) F2(2,66)	2.94	3.37*	1.32	< 1	5.54**	1.11	4.52*	1.98	3.55*	1.17
alternation F1(1,38) F2(1,66)	1.94	1.95	< 1	< 1	2.94	3.28	9.70**	9.65**	4.14*	5.57*
interaction F1(2,76) F2(2,66)	< 1	< 1	< 1	< 1	1.39	1.10	3.21*	3.51*	1.64	1.86
	F1(1,38)	F2(1,22)	F1(1,38)	F2(1,22)	F1(1,38)	F2(1,22)	F1(1,38)	F2(1,22)	F1(1,38)	F2(1,22)
implausible (split vs. non-split)	< 1	< 1	< 1	< 1	5.05*	4.96*	6.09*	5.99*	5.38*	4.63*
plausible (split vs. non-split)	2.25	2.61	< 1	< 1	< 1	< 1	9.26**	12.47**	5.05*	5.73*
plausible-nsr (split vs. non-split)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
	Region 8 (buffer4)		**Region 9 (particle)**		**Region 10 (spill1)**		**Region 11 (spill2)**		**Region 12 (spill3)**	
implausible/split	341		335		335		327		297	
implausible/non-split	340		319		323		303		298	
plausible/split	350		340		339		332		315	
plausible/non-split	328		314		329		301		297	
plausible-nsr/split	318		324		321		311		302	
plausible-nsr/non-split	319		321		324		300		296	
sentence type F1(2,76) F2(2,66)	6.79**	3.50*	< 1	< 1	3.78*	1.21	2.73	1.31	2.62	1.38
alternation F1(1,38) F2(1,66)	2.00	1.81	5.24*	12.18***	2.35	1.99	14.70***	15.00***	4.54*	4.81*
interaction F1(2,76) F2(2,66)	2.11	2.56	1.92	2.27	1.43	1.50	1.72	1.37	2.42	2.14
	F1(1,38)	F2(1,22)	F1(1,38)	F2(1,22)	F1(1,38)	F2(1,22)	F1(1,38)	F2(1,22)	F1(1,38)	F2(1,22)
implausible (split vs. non-split)	< 1	< 1	4.24*	4.36*	2.21	2.64	6.76*	4.72*	< 1	< 1
plausible (split vs. non-split)	8.21**	5.32*	6.89*	10.14**	2.88	2.08	18.13***	14.92***	6.88*	10.56**
plausible-nsr (split vs. non-split)	< 1	< 1	< 1	< 1	< 1	< 1	1.43	< 1	1.12	< 1

**p < .05. **p < .01. ***p < .001*

For Region 3 (article), there were no statistically reliable differences among the test sentences (sentence type: $F1 = 2.94$; $F2$ (2, 66) = 3.37, $p < .05$; alternation: $F1$ (1, 38) = 1.94; $F2$ (1, 66) = 1.95; interaction: both F's < 1). This was also the case for Region 4, where the DO was presented (sentence type: $F1$ (2, 76) = 1.32; $F2 < 1$; alternation: both F's < 1; interaction: both F's < 1).

However, the NS group showed a slightly delayed plausibility effect beginning at Region 5 (buffer 1). In this region, although there was no significant main effect of alternation or interaction (alternation: $F1$ (1, 38) = 2.94; $F2$ (1, 66) = 3.28; interaction: $F1$ (2, 76) = 1.39; $F2$ (2, 66) = 1.10), there was a marginal main effect of sentence type ($F1$ (2, 76) = 5.54, $p < .01$; $F2$ (2, 66) = 1.11). More importantly, the simple effect of alternation was significant only for implausible sentences ($F1$ (1, 38) = 5.05, $p < .05$; $F2$ (1, 22) = 4.96, $p < .05$), indicating that only split implausible sentences took significantly longer than their non-split counterparts.

This plausibility effect carried over into the subsequent two regions (Region 6 & Region 7). For Region 6 (buffer 2), the main effect of alternation was significant both by subjects and by items ($F1$ (1, 38) = 9.70, $p < .01$; $F2$ (1, 66) = 9.65. $p < .01$). Crucially, the interaction of sentence type and alternation was also significant ($F1$ (2, 76) = 3.21, $p < .05$; $F2$ (2, 66) = 3.51. $p < .05$). Under planned comparisons, the simple effect of alternation was significant for implausible sentences ($F1$ (1, 38) = 6.09, $p < .05$; $F2$ (1, 22) = 5.99, $p < .05$), indicating that split implausible sentences took significantly longer

than implausible non-split sentences. Interestingly, the simple effect of alternation was also significant for plausible sentences ($F1$ (1, 38) = 9.26, $p < .01$; $F2$ (1, 22) = 12.47, $p < .01$), indicating that split plausible sentences were read significantly longer than plausible non-split sentences. This latter pattern of results does not lend itself to clear interpretation.

A comparable pattern of results was found for Region 7 (buffer 3). In this region, although the interaction between sentence type and alternation was not statistically significant ($F1$ (2, 76) = 1.64; $F2$ (2, 66) = 1.86), the main effect of alternation was significant ($F1$ (1, 38) = 4.14, $p < .05$; $F2$ (1, 66) = 5.57, $p < .05$). Under planned comparisons, there was a significant simple effect of alternation for implausible sentences ($F1$ (1, 38) = 5.38, $p < .05$; $F2$ (1, 22) = 4.63, $p < .05$). There was also a significant simple effect of alternation for plausible sentences ($F1$ (1, 38) = 5.05, $p < .05$; $F2$ (1, 22) = 5.73, $p < .05$).

For Region 8 (buffer 4), although the main effect of alternation and interaction were not significant either by subjects or by items (alternation: $F1$ (1, 38) = 2.00; $F2$ (1, 66) = 1.81; interaction: $F1$ (2, 76) = 2.11; $F2$ (2, 66) = 2.56), the main effect of sentence type was significant in both analyses ($F1$ (2, 76) = 6.79, $p < .01$; $F2$ (2, 66) = 3.50, $p < .05$). Under planned comparisons, the simple effect of alternation was significant only for plausible sentences ($F1$ (1, 38) = 8.21, $p < .01$; $F2$ (1, 22) = 5.32, $p < .05$).

At the particle, which is again reported in Region 9 for both split and non-split sentences, although the main effect of sentence type and interaction

were not significant (sentence type: both *F*'s < 1; interaction: *F*1 (2, 76) = 1.92; *F*2 (2, 66) = 2.27), the main effect of alternation was significant both by subjects and by items (*F*1 (1, 38) = 5.24, $p < .05$; *F*2 (1, 66) = 12.18, $p < .001$). Under planned comparisons, the simple effect of alternation was significant for both the implausible and plausible sentences (implausible: *F*1 (1, 38) = 4.24, $p < .05$; *F*2 (1, 22) = 4.36, $p < .05$; plausible: *F*1 (1, 38) = 6.89, $p < .05$; *F*2 (1, 22) = 10.14, $p < .01$). This pattern of results indicates clear garden-path effects for the split versions of both the plausible and implausible sentence types.

These effects continued into the spill-over region. Immediately after this particle, in Region 10 (spill 1), there were no statistically reliable differences among the test sentences (sentence type: *F*1 (2, 76) = 3.78, $p < .05$; *F*2 (2, 66) = 1.21; alternation: *F*1 (1, 38) = 2.35; *F*2 (1, 66) = 1.99; interaction: *F*1 (2, 76) = 1.43; *F*2 (2, 66) = 1.50). However, at Region 11 (spill 2),although the main effect of sentence type and interaction were not significant (sentence type: *F*1 (2, 76) = 2.73; *F*2 (2, 66) = 1.31; interaction: *F*1 (2, 76) = 1.72; *F*2 (2, 66) = 1.37), the main effect of alternation was significant in both analyses (*F*1 (1, 38) = 14.70, $p < .001$; *F*2 (1, 66) = 15.00, $p < .001$). Under planned comparisons, the simple effect of alternation was again significant for both the implausible and plausible sentences (implausible: *F*1 (1, 38) = 6.76, $p < .05$; *F*2 (1, 22) = 4.72, $p < .05$; plausible: *F*1 (1, 38) = 18.13, $p < .001$; *F*2 (1, 22) = 14.92, $p < .001$), indicating clear garden-path effects for the split versions of each sentence type.

A different pattern of results was found in the final spill-over region, Region 12 (spill 3). In this region, there was again no significant main effect of sentence type or interaction (sentence type: $F1$ (2, 76) = 2.62; $F2$ (2, 66) = 1.38; interaction: $F1$ (2, 76) = 2.42; $F2$ (2, 66) = 2.14). However, there was a significant main effect of alternation in both analyses ($F1$ (1, 38) = 4.54, $p < .05$; $F2$ (1, 66) = 4.81, $p < .05$). Under planned comparisons, the simple effect of alternation was significant only for plausible sentences ($F1$ (1, 38) = 6.88, $p < .05$; $F2$ (1, 22) = 10.56, $p < .01$), indicating that only split plausible sentences elicited significantly longer RTs than their non-split counterparts. This finding indicates that NSs showed a reverse plausibility effect at this point, as they had processing difficulty with split plausible sentences, but not for split implausible sentences.

Clear indications of this reverse plausibility effect were also found in analyses that combined the data from the spill-over regions after the particle (Regions 10-12) in order to capture distributed indications of processing difficulty. Table 3.4 provides the mean RTs in this combined spill over region, again along with the results of the associated statistical tests.

Table 3.4 NSs' mean RTs and results of the analyses of variance in combined spill-over regions for PV sentences

	Region 10-12	
implausible/split	324	
implausible/non-split	310	
plausible/split	334	
plausible/non-split	313	
plausible-nsr/split	314	
plausible-nsr/non-split	309	
sentence type F1(2,76) F2(2,66)	5.31**	1.88
alternation F1(1,38) F2(1,66)	11.37**	10.95**
interaction F1(2,76) F2(2,66)	1.49	1.69
	F1(1,38)	F2 (1,22)
implausible (split vs. non-split)	3.60	3.09
plausible (split vs. non-split)	12.57**	14.78***
plausible-nsr (split vs. non-split)	< 1	< 1
**p < .05. **p < .01. ***p < .001*		

In this region, although there was no significant main effect of sentence type or interaction (sentence type: $F1$ (2, 76) = 5.31, $p < .01$; $F2$ (2, 66) = 1.88; interaction: $F1$ (2, 76) = 1.49; $F2$ (2, 66) = 1.69), the main effect of alternation was significant both by subjects and by items ($F1$ (1, 38) = 11.37, $p < .01$; $F2$ (1, 66) = 10.95, $p < .01$). Under planned comparisons, there was a significant simple effect of alternation only for plausible sentences ($F1$ (1, 38) = 12.57, $p < .01$; $F2$ (1, 22) = 14.78, $p < .001$), indicating that only split plausible sentences took significantly longer than their non-split counterparts.

3.4.2 Late Learners

The LLs' mean ERs on the comprehension questions for the six experimental sentence types and results of the analyses of variance are

presented in Table 3.5. For this group, this analysis revealed no statistically reliable differences among the test sentences (sentence type: $F1$ (2, 60) = 2.87; $F2$ (2, 65) = 3.62, $p < .05$; alternation: both F's < 1; interaction: both F's < 1), again indicating essentially no influence of the experimental factors on overall comprehension.

Table 3.5 LLs' mean ERs (in percentages) on the comprehension questions and results of the analyses of variance

	Mean Error Rates	
implausible/split	14.84%	
implausible/non-split	18.49%	
plausible/split	15.84%	
plausible/non-split	15.93%	
plausible-nsr/split	12.50%	
plausible-nsr/non-split	12.76%	
sentence type F1(2,60) F2 (2,65)	2.87	3.62*
alternation F1(1,30) F2 (1,65)	<1	< 1
interaction F1(2,60) F2(2,65)	< 1	< 1
	F1(1,30)	F2(1,22)
implausible (split vs. nonsplit)	2.38	< 1
plausible (split vs. nonsplit)	< 1	< 1
plausible-nsr (split vs. nonsplit)	< 1	< 1
**p < .05. **p < .01. ***p < .001*		

(*Note: For the simple effect of alternation in plausible sentences, by-items degrees of freedom was F2 (1, 21)*)

The RT patterns for the LL group on the six experimental conditions are illustrated in Figure 3.10. The reading profiles for the split and non-split versions of each sentence type are presented in Figure 3.11, Figure 3.12, and Figure 3.13. The mean RTs for this group in each region are presented Table 3.6, along with the results of the associated ANOVAs.

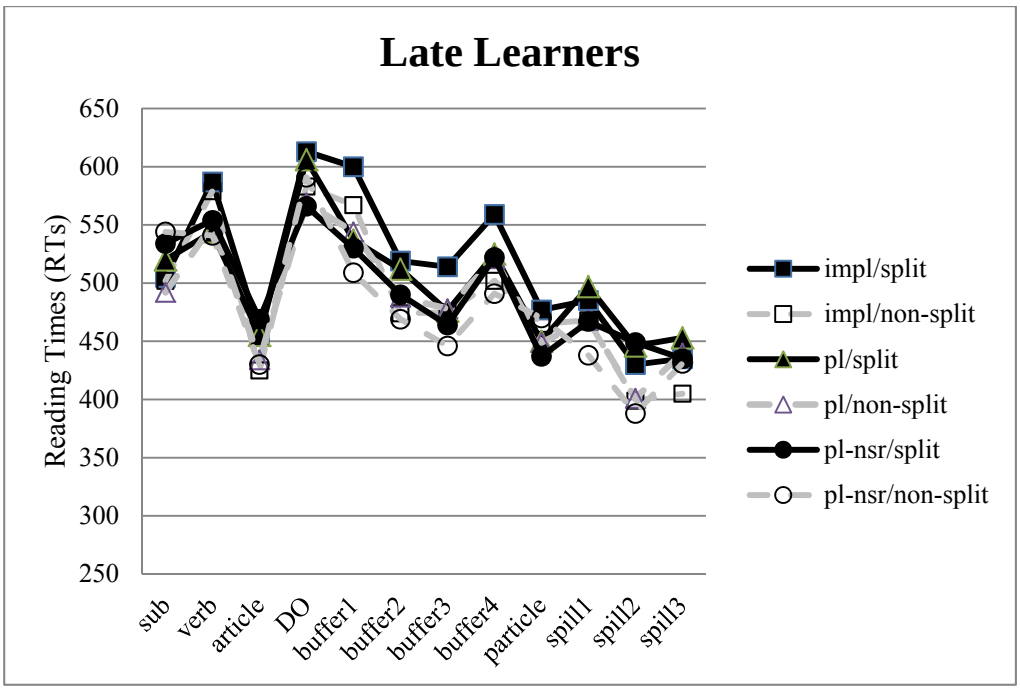


Figure 3.10 LLs' mean word by word reading times (ms) for PV items.

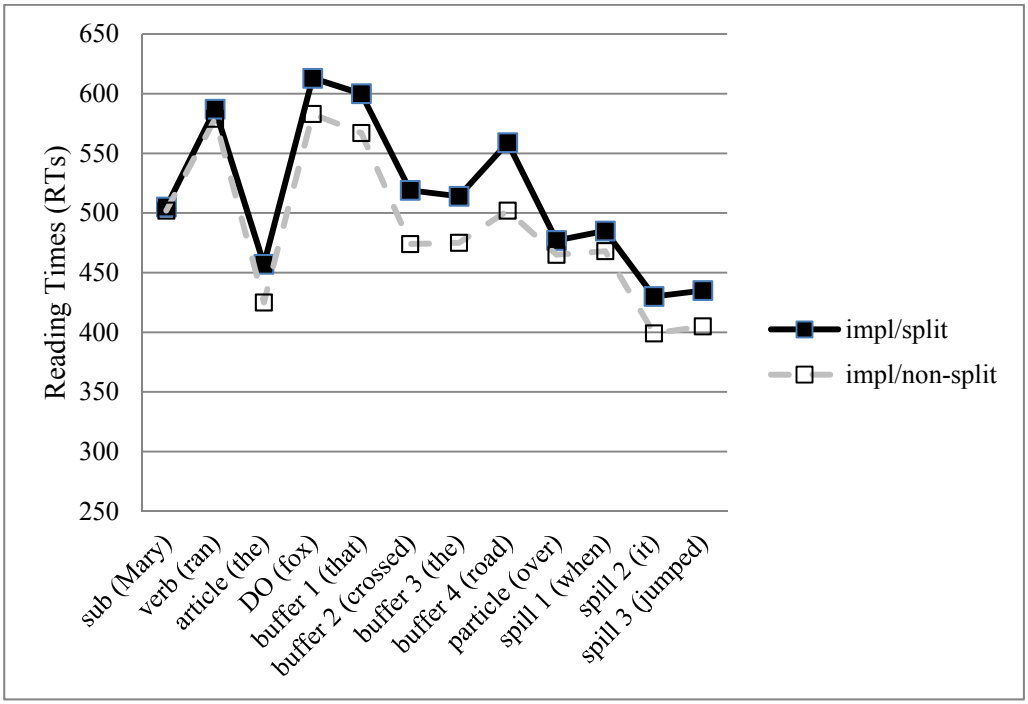


Figure 3.11 LLs' mean word by word reading times (ms) for implausible sentences.

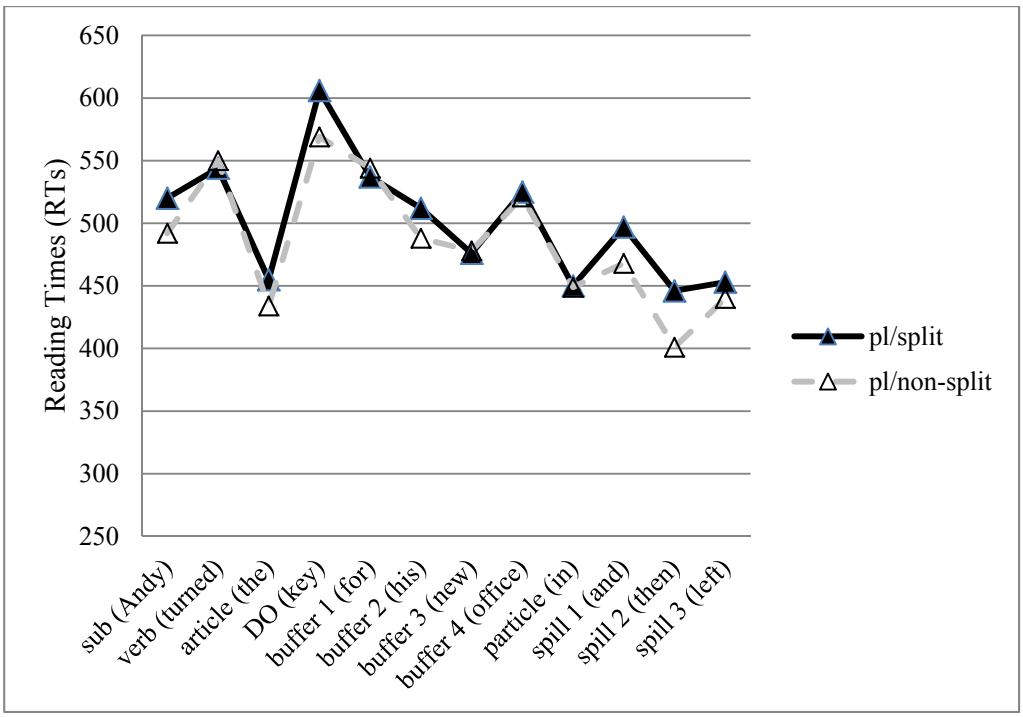


Figure 3.12 LLs' mean word by word reading times (ms) for plausible sentences.

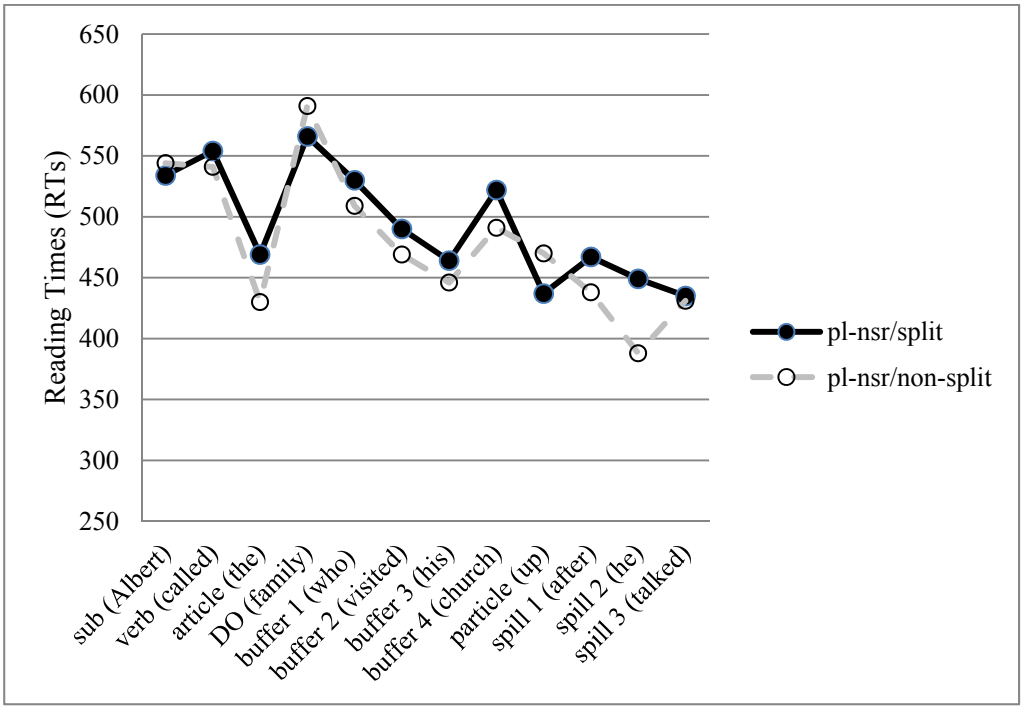


Figure 3.13 LLs' mean word by word reading times (ms) for plausible-nsr sentences.

Table 3.6 LLs' mean RTs and results of the analyses of variance for PV sentences

	Region 3 (article)		**Region 4 (DO)**		**Region 5 (buffer1)**		**Region 6 (buffer2)**		**Region 7 (buffer3)**	
implausible/split	457		613		600		519		514	
implausible/non-split	425		583		567		474		475	
plausible/split	455		606		537		512		476	
plausible/non-split	434		569		544		488		478	
plausible-nsr/split	469		566		530		490		464	
plausible-nsr/non-split	430		591		509		469		446	
sentence type F1(2,60) F2 (2,65)	< 1	< 1	< 1	< 1	7.78***	4.61*	1.22	< 1	2.71	1.81
alternation F1(1,30), F2 (1,65)	11.96**	6.86*	< 1	< 1	1.46	1.62	8.73**	8.49**	5.29*	7.23**
interaction F1(2,60), F2(2,65)	< 1	< 1	1.51	< 1	1.01	< 1	< 1	< 1	< 1	2.52
	F1(1,30)	F2(1,22)	F1(1,30)	F2(1,22)	F1(1,30)	F2(1,22)	F1(1,30)	F2(1,22)	F1(1,30)	F2(1,22)
implausible (split vs. non-split)	4.48*	2.39	1.18	< 1	2.37	1.63	7.45*	7.57*	6.60*	7.38*
plausible (split vs. non-split)	3.67	1.44	2.14	1.70	< 1	< 1	2.04	1.38	< 1	< 1
plausible-nsr (split vs. non-split)	10.36**	6.24*	< 1	< 1	1.21	1.53	< 1	2.60	< 1	3.20
	Region 8 (buffer4)		**Region 9 (particle)**		**Region 10 (spill1)**		**Region 11 (spill2)**		**Region 12 (spill3)**	
implausible/split	559		477		485		430		435	
implausible/non-split	502		465		468		399		405	
plausible/split	525		450		497		446		453	
plausible/non-split	521		449		468		401		440	
plausible-nsr/split	522		437		467		449		435	
plausible-nsr/non-split	491		470		438		388		431	
sentence type F1(2,60) F2 (2,65)	1.37	< 1	3.78*	1.33	3.77*	2.00	< 1	< 1	4.02*	1.52
alternation F1(1,30), F2 (1,65)	5.57*	8.95**	< 1	< 1	4.62*	5.56*	19.98***	36.87***	4.05	3.47
interaction F1(2,60), F2(2,65)	2.48	2.05	1.70	1.80	< 1	< 1	1.26	1.33	1.11	< 1
	F1(1,30)	F2(1,22)	F1(1,30)	F2(1,22)	F1(1,30)	F2(1,22)	F1(1,30)	F2(1,22)	F1(1,30)	F2(1,22)
implausible (split vs. non-split)	5.99*	12.67**	< 1	1.07	< 1	< 1	4.52*	9.09**	8.96**	5.45*
plausible (split vs. non-split)	< 1	< 1	< 1	< 1	2.42	1.69	7.11*	7.59*	< 1	< 1
plausible-nsr (split vs. non-split)	2.82	3.80	4.13	2.73	2.08	4.63*	25.18***	24.06***	< 1	< 1

**p < .05. **p < .01. ***p < .001*

***Note**: For the simple effect of alternation in plausible sentences, by-items degrees of freedom was F2 (1, 21)*

For Region 3 (article), the main effect of sentence type and the interaction between sentence type and alternation were not significant either by subjects or by items (all *F*'s < 1). Interestingly, the main effect of alternation was significant (*F*1 (1, 30) = 11.96, $p < .01$; *F*2 (1, 65) = 6.86, $p < .05$). Under planned comparisons, the simple effect of alternation was significant only for plausible-nsr sentences (*F*1 (1, 30) = 10.36, $p < .01$; *F*2 (1, 22) = 6.24, $p < .05$). For Region 4, where the DO was presented, no statistically reliable differences were found among test sentences (sentence type: both *F*'s < 1; alternation: both *F*'s < 1; interaction: *F*1 (2, 60) = 1.51; *F*2 < 1). For Region 5 (buffer 1), although the main effect of sentence type was significant both by subjects and by items (*F*1 (2, 60) = 7.78, $p < .001$; *F*2 (2, 65) = 4.61, $p < .05$), there was no significant main effects of alternation or interaction (alternation: *F*1 (1, 30) = 1.46; *F*2 (1, 65) = 1.62; interaction: *F*1 (2, 60) = 1.01; *F*2 < 1).

However, the LL group showed a delayed plausibility effect beginning at Region 6. For Region 6 (buffer 2), although the main effect of sentence type and interaction between sentence type and alternation were not significant (sentence type: *F*1 (2, 60) = 1.22; *F*2 < 1; interaction: both *F*'s < 1), the main effect of alternation was significant both by subjects and by items (*F*1 (1, 30) = 8.73, $p < .01$; *F*2 (1, 65) = 8.49, $p < .01$). Under planned comparisons, the simple effect of alternation was significant only for implausible sentences (*F*1 (1, 30) = 7.45, *p*

< .05; *F*2 (1, 22) = 7.57, *p* < .05), indicating that only split implausible sentences took significantly longer than their non-split counterparts.

This plausibility effect carried over into the subsequent two regions (Region 7 & Region 8). For Region 7 (buffer 3), again the main effect of sentence type and interaction were not significant (sentence type: *F*1 (2, 60) = 2.71; *F*2 (2, 65) = 1.81; interaction: *F*1< 1; *F*2 (2, 65) = 2.52). However, the main effect of alternation was significant both by subjects and by items (*F*1 (1, 30) = 5.29, *p* < .05; *F*2 (1, 65) = 7.23, *p* < .01). Under planned comparisons, the simple effect of alternation was again significant only for implausible sentences (*F*1 (1, 30) = 6.60, *p* < .05; *F*2 (1, 22) = 7.38, *p* < .05), indicating that only split implausible sentences took significantly longer than implausible non-split sentences.

Similar results were obtained for Region 8 (buffer 4). There was no significant main effect of sentence type or interaction (sentence type: *F*1 (2, 60) = 1.37; *F*2 < 1; interaction: *F*1 (2, 60) = 2.48; *F*2 (2, 65) = 2.05). However, the main effect of alternation was again significant (*F*1 (1, 30) = 5.57, *p* < .05; *F*2 (1, 65) = 8.95, *p* < .01). And as in the previous region, under planned comparisons, the simple effect of alternation was significant only for implausible sentences (*F*1 (1, 30) = 5.99, *p* < .05; *F*2 (1, 22) = 12.67, *p* < .01), indicating that only split implausible sentences took significantly longer than their non-split counterparts.

At the particle, which is again reported in Region 9 for both split and non-split sentences, there were no statistically reliable differences among test

sentences (sentence type: $F1$ (2, 60) = 3.78, $p < .05$; $F2$ (2, 65) = 1.33; alternation: both F's < 1; interaction: $F1$ (2, 60) = 1.70; $F2$ (2, 65) = 1.80). In the subsequent regions, however, there were indications of processing difficulty for split sentences across all three sentence types. In Region 10 (spill 1), the main effect of alternation was significant in both analyses ($F1$ (1, 30) = 4.62, $p < .05$; $F2$ (1, 65) = 5.56, $p < .05$). However, there were no significant simple effects under planned comparisons. In Region 11 (spill 2), again the main effect of alternation was significant both by subjects and by items ($F1$ (1, 30) = 19.98, $p < .001$; $F2$ (1, 65) = 36.87, $p < .001$). And under planned comparisons, there was a significant simple effect of alternation in all three sentence types (implausible: $F1$ (1, 30) = 4.52, $p < .05$; $F2$ (1, 22) = 9.09, $p < .01$; plausible: $F1$ (1, 30) = 7.11, $p < .05$; $F2$ (1, 22) = 7.59, $p < .05$; plausible-nsr: $F1$ (1, 30) = 25.18, $p < .001$; $F2$ (1, 22) = 24.06, $p < .001$), indicating longer RTs for split sentences across the board. Region 12 (spill 3) revealed a different pattern of results, but still no indication of a reverse plausibility effect. In this region, although there were no significant main effects of sentence type and alternation and no interaction, the simple effect of alternation was significant only for implausible sentences ($F1$ (1, 30) = 8.96, $p < .01$; $F2$ (1, 22) = 5.45, $p < .05$), indicating that split implausible sentences took significantly longer than implausible non-split sentences.

There were also no reverse plausibility effects in analyses that combined the data from the spill-over regions after the particle (Regions 10-12). Table 3.7

provides mean per-word RTs in this combined spill-over region, again along with the results of the associated statistical tests.

Table 3.7 LLs' means and results of the analyses of variance in combined spill-over regions for PV sentences

	Region 10-12	
implausible/split	457	
implausible/non-split	430	
plausible/split	476	
plausible/non-split	444	
plausible-nsr/split	458	
plausible-nsr/non-split	425	
sentence type F1(2,60) F2 (2,65)	5.91**	2.61
alternation F1(1,30) F2 (1,65)	19.12***	21.17***
interaction F1(2,60) F2(2,65)	< 1	< 1
	F1(1,30)	F2(1,22)
implausible (split vs. nonsplit)	5.57*	7.08*
plausible (split vs. nonsplit)	9.36**	4.29
plausible-nsr (split vs. nonsplit)	9.85**	11.82**
**p < .05. **p < .01. ***p < .001*		

*(**Note**: For the simple effect of alternation in plausible sentences, by-items degrees of freedom was F2 (1, 21))*

In this region, although the main effect of sentence type and interaction were not significant (sentence type: $F1$ (2, 60) = 5.91, $p < .01$; $F2$ (2, 65) = 2.61; interaction: both F's < 1), the main effect of alternation was significant both by subjects and by items ($F1$ (1, 30) = 19.12, $p < .001$; $F2$ (1, 65) = 21.17, $p < .001$). Under planned comparisons, there was a significant simple effect of alternation in all three sentence types (implausible: $F1$ (1, 30) = 5.57, $p < .05$; $F2$ (1, 22) = 7.08, $p < .05$; plausible: $F1$ (1, 30) = 9.36, $p < .01$; $F2$ (1, 22) = 4.29, $p = .05$; plausible-

nsr: $F1$ (1,30) = 9.85, $p < .01$; $F2$ (1, 22) = 11.82, $p < .01$), again indicating longer RTs for split sentences across the board. This finding indicates that LLs experienced processing difficulty for split PV sentences regardless of the sentence type and were unable to use plausibility information in their recovery process.

3.4.3 Early Bilinguals

The EBs' mean ERs on the comprehension questions for the six experimental sentence types and results of the analyses of variance are presented in Table 3.8. For the EB group, this analysis revealed no statistically reliable differences among three sentence types as well as between split and non-split conditions (sentence type: $F1 < 1$; $F2$ (2, 66) = 1.17; alternation: $F1 < 1$; $F2$ (1, 66) = 2.91; interaction: $F1$ (2, 52) = 4.00, $p < .05$; $F2 < 1$). Under planned comparisons, there was a marginal effect suggesting higher ERs for split sentences only under the plausible condition ($F1$ (1, 26) = 8.87, $p < .01$; $F2$ (1, 22) = 3.12).

Table 3.8 EBs' mean ERs (in percentages) on the comprehension questions and results of the analyses of variance

	Mean Error Rates	
implausible/split	8.33%	
implausible/non-split	9.52%	
plausible/split	11.90%	
plausible/non-split	6.25%	
plausible-nsr/split	8.04%	
plausible-nsr/non-split	10.12%	
sentence type F1(2,52) F2(2,66)	< 1	1.17
alternation F1(1,26) F2 (1,66)	< 1	2.91
interaction F1(2,52) F2(2,66)	4.00*	< 1
	F1(1,26)	F2(1,22)
implausible (split vs. non-split)	< 1	< 1
plausible (split vs. non-split)	8.87**	3.12
plausible-nsr (split vs. non-split)	< 1	2.62
**p < .05. **p < .01. ***p < .001*		

The RT patterns for the EB group on the six experimental conditions are illustrated in Figure 3.14. The reading profiles for the split and non-split versions of each sentence type are presented in Figure 3.15, Figure 3.16, and Figure 3.17. The mean RTs for this group in each region are presented Table 3.9, along with the results of the associated ANOVAs.

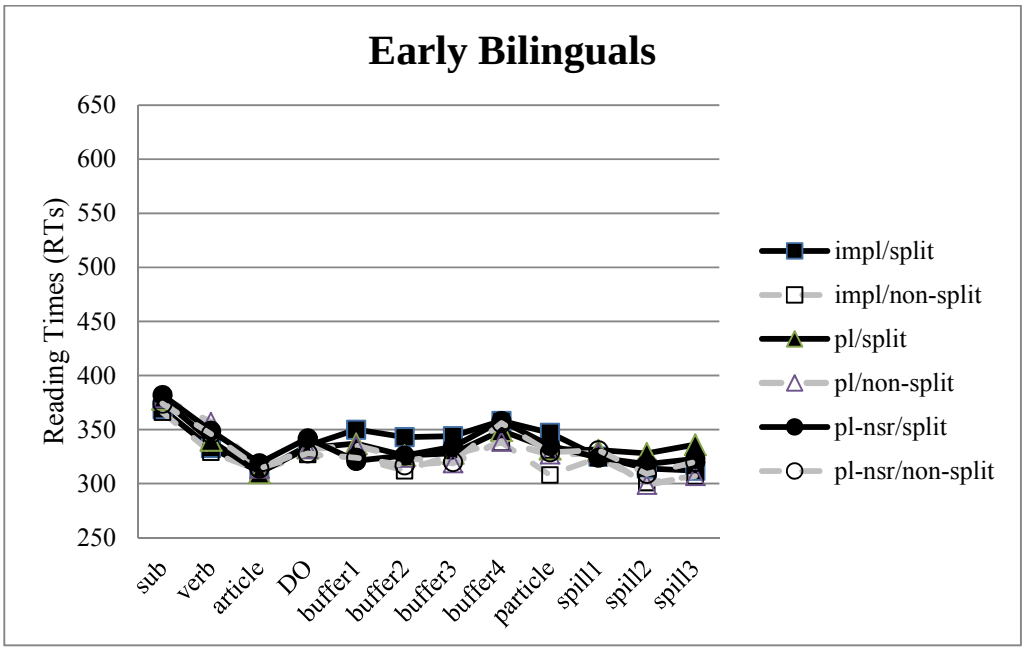


Figure 3.14 EBs' mean word by word reading times (ms) for PV items.

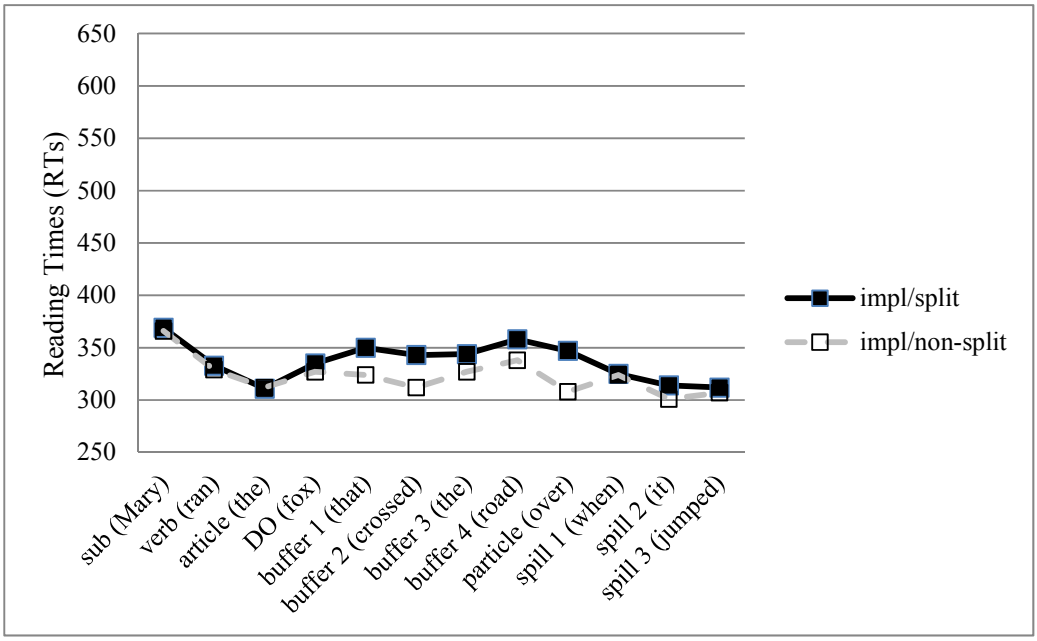


Figure 3.15 EBs' mean word by word reading times (ms) for implausible sentences.

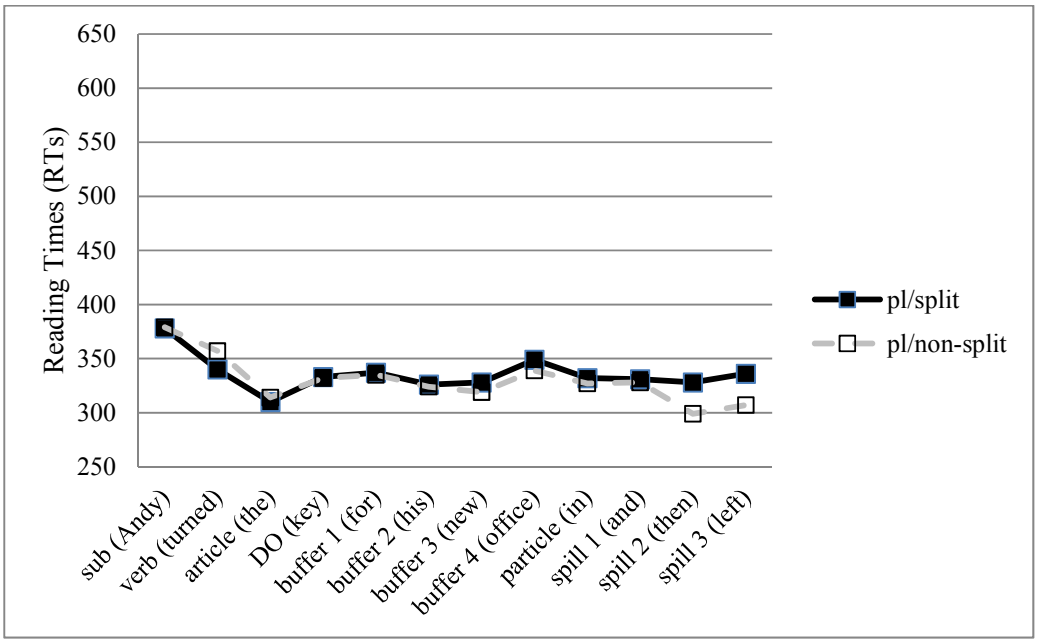


Figure 3.16 EBs' mean word by word reading times (ms) for plausible sentences.

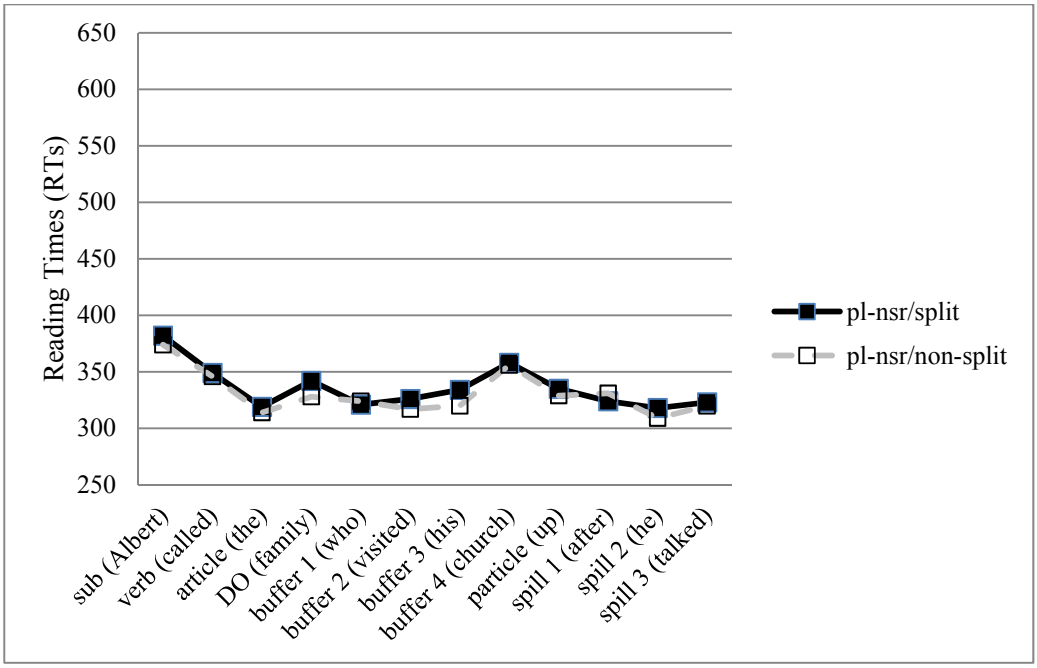


Figure 3.17 EBs' mean word by word reading times (ms) for plausible-nsr sentences.

Table 3.9 EBs' mean RTs and results of the analyses of variance for PV sentences

	Region 3 (article)		**Region 4 (DO)**		**Region 5 (buffer1)**		**Region 6 (buffer2)**		**Region 7 (buffer3)**	
implausible/split	311		335		350		343		344	
implausible/non-split	312		327		324		312		327	
plausible/split	310		333		337		326		328	
plausible/non-split	314		332		335		324		319	
plausible-nsr/split	319		342		321		326		334	
plausible-nsr/non-split	314		328		324		317		320	
sentence type F1(2,52) F2(2,66)	< 1	< 1	< 1	< 1	3.71*	1.84	< 1	< 1	2.08	< 1
alternation F1(1,26) F2 (1,66)	< 1	< 1	< 1	2.13	2.59	2.78	7.46*	5.87*	5.54*	11.93***
interaction F1(2,52) F2(2,66)	< 1	< 1	< 1	< 1	3.41*	1.97	2.39	1.75	< 1	1.31
	F1(1,26)	F2(1,22)	F1(1,26)	F2(1,22)	F1(1,26)	F2(1,22)	F1(1,26)	F2(1,22)	F1(1,26)	F2(1,22)
implausible (split vs. non-split)	< 1	< 1	< 1	< 1	9.66**	6.35*	8.05**	10.23**	2.55	7.75*
plausible (split vs. non-split)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.32	< 1
plausible-nsr (split vs. nonsplit)	< 1	< 1	1.05	4.82*	< 1	< 1	1.04	1.91	3.09	8.86**
	Region 8 (buffer4)		**Region 9 (particle)**		**Region 10 (spill1)**		**Region 11 (spill2)**		**Region 12 (spill3)**	
implausible/split	358		347		325		314		312	
implausible/non-split	338		308		324		301		307	
plausible/split	349		332		331		328		336	
plausible/non-split	339		327		328		299		307	
plausible-nsr/split	358		335		324		318		323	
plausible-nsr/non-split	356		329		331		309		320	
sentence type F1(2,52) F2(2,66)	1.07	< 1	< 1	< 1	< 1	< 1	< 1	< 1	3.36*	1.77
alternation F1(1,26) F2 (1,66)	2.09	2.49	3.09	9.70**	< 1	< 1	12.44**	11.84**	5.84*	6.33*
interaction F1(2,52) F2(2,66)	< 1	< 1	3.65*	2.69	< 1	< 1	1.95	< 1	2.21	1.44
	F1(1,26)	F2(1,22)	F1(1,26)	F2(1,22)	F1(1,26)	F2(1,22)	F1(1,26)	F2(1,22)	F1(1,26)	F2(1,22)
implausible (split vs. non-split)	2.32	3.23	6.10*	10.32**	< 1	< 1	5.29*	1.72	< 1	< 1
plausible (split vs. non-split)	< 1	< 1	< 1	< 1	< 1	< 1	7.74**	8.94**	6.20*	5.84*
Plausible-nsr (split vs. non-split)	< 1	< 1	< 1	1.53	< 1	< 1	2.39	2.88	< 1	1.32
**p < .05. **p < .01. ***p < .001*										

For Region 3 (article), no statistically reliable differences were found among the test sentences (all F's < 1). This was also the case for Region 4, where the DO was presented (sentence type: both F's < 1; alternation: $F1$ < 1; $F2$ (1, 66) = 2.13; interaction: both F's < 1).

Similar to the NSs, the EB group showed a slightly delayed plausibility effect beginning at Region 5 (buffer 1). In this region, although the main effect of alternation was not significant ($F1$ (1, 26) = 2.59; $F2$ (1, 66) = 2.78), there was a marginal main effect of sentence type and a marginal interaction (sentence type: $F1$ (2, 52) = 3.71, p < .05; $F2$ (2, 66) = 1.84; interaction: $F1$ (2, 52) = 3.41, p < .05; $F2$ (2, 66) = 1.97). Under planned comparisons, a significant simple effect of alternation was found only for implausible sentences ($F1$ (1, 26) = 9.66, p < .01; $F2$ (1, 22) = 6.35, p < .05), indicating that only split implausible sentences took significantly longer than their non-split counterparts.

The plausibility effect carried over into the subsequent region, Region 6 (buffer 2). In this region, although the main effect of sentence type and interaction were not significant in both analyses (sentence type: both F's < 1; interaction: $F1$ (2, 52) = 2.39; $F2$ (2, 66) = 1.75), the main effect of alternation was significant both by subjects and by items ($F1$ (1, 26) = 7.46, p < .05; $F2$ (1, 66) = 5.87, p < .05). Under planned comparisons, the simple effect of alternation was significant only for implausible sentences ($F1$ (1, 26) = 8.05, p < .01; $F2$ (1, 22) =

10.23, $p < .01$), indicating that split implausible sentences took significantly longer than implausible non-split sentences.

For Region 7 (buffer 3), although the main effect of sentence type and interaction was not significant in both analyses (sentence type: $F1$ (2, 52) = 2.08; $F2 < 1$; interaction: $F1 < 1$; $F2$ (2, 66) = 1.31), the main effect of alternation was again significant both by subjects and by items ($F1$ (1, 26) = 5.54, $p < .05$; $F2$ (1, 66) = 11.93, $p < .001$). Under planned comparisons, there was a marginal simple effect for implausible sentences ($F1$ (1, 26) = 2.55; $F2$ (1, 22) = 7.75, $p < .05$), again suggesting longer RTs only for split implausible sentences relative to their non-split counterparts. For Region 8 (buffer 4), there were no statistically reliable differences among the test sentences (sentence type: $F1$ (2, 52) = 1.07; $F2 < 1$; alternation: $F1$ (1, 26) = 2.09; $F2$ (1, 66) = 2.49; interaction: both F's < 1).

At the particle, which is again reported in Region 9 for both split and non-split sentences, although there was no significant main effect of sentence type (both F's < 1), there was a marginal main effect of alternation and interaction (alternation: $F1$ (1, 26) = 3.09; $F2$ (1, 66) = 9.70, $p < .01$; interaction: $F1$ (2, 52) = 3.65, $p < .05$; $F2$ (2, 66) = 2.69). Under planned comparisons, the simple effect of alternation was significant only for implausible sentences ($F1$ (1, 26) = 6.10, $p < .05$; $F2$ (1, 22) = 10.32, $p < .01$), indicating that split implausible sentences took significantly longer than their non-split counterparts. For Region 10 (spill 1),

however, no statistically reliable differences were found among the test sentences (all F's < 1).

However, at Region 11 (spill 2), although the main effect of sentence type and interaction were not significant (sentence type: both F's < 1; interaction: $F1$ (2, 52) = 1.95; $F2$ < 1), the main effect of alternation was significant both by subjects and by items ($F1$ (1, 26) = 12.44, p < .01; $F2$ (1, 66) = 11.84, p < .01). Under planned comparisons, there was a marginal simple effect for implausible sentences ($F1$ (1, 26) = 5.29, p < .05; $F2$ (1, 22) = 1.72), suggesting longer RTs for split implausible sentences. In addition, there was a significant simple effect of alternation for plausible sentences ($F1$ (1, 26) = 7.74, p < .01; $F2$ (1, 22) = 8.94, p < .01), indicating that split plausible sentences took significantly longer than their non-split counterparts.

A different pattern of results was found in the final spill-over region, Region 12 (spill 3). In this region, although there was no significant interaction between sentence type and alternation ($F1$ (2, 52) = 2.21; $F2$ (2, 66) = 1.44), the main effect of alternation was significant in both analyses ($F1$ (1, 26) = 5.84, p < .05; $F2$ (1, 66) = 6.33, p < .05). Under planned comparisons, the simple effect of alternation was significant only for plausible sentences ($F1$ (1, 26) = 6.20, p < .05; $F2$ (1, 22) = 5.84, p < .05), indicating that only split plausible sentences elicited significantly longer RTs than their non-split counterparts. This finding indicates that EBs showed a reverse plausibility effect, as they had processing

difficulty with split plausible sentences, but not for split implausible sentences. However, no indications of reverse plausibility effects were found in analyses that combined the data from the spill-over regions after the particle (Regions 10-12) in order to capture distributed indications of processing difficulty.

Table 3.10 provides mean per-word RTs in this combined spill-over region, again along with the results of the associated statistical tests.

Table 3.10 EBs' mean RTs and results of the analyses of variance in combined spill-over regions for PV sentences

	Region 10-12	
implausible/split	317	
implausible/non-split	310	
plausible/split	329	
plausible/non-split	310	
plausible-nsr/split	322	
plausible-nsr/non-split	318	
sentence type F1(2,52) F2(2,66)	1.37	< 1
alternation F1(1,26) F2 (1,66)	4.64*	4.73*
interaction F1(2,52) F2(2,66)	1.15	< 1
	F1(1,26)	F2(1,22)
implausible (split vs. non-split)	1.49	< 1
plausible (split vs. nonsplit)	4.15	2.36
plausible-nsr (split vs. nonsplit)	< 1	1.65
**p < .05. **p < .01. ***p < .001*		

In this region, although the main effect of sentence type and interaction were not significant (sentence type: $F1$ (2, 52) = 1.37; $F2 < 1$; interaction: $F1$ (2, 52) = 1.15; $F2$ (2, 66) < 1), the main effect of alternation was significant both by subjects and by items ($F1$ (1, 26) = 4.64, $p < .05$; $F2$ (1, 66) = 4.73, $p < .05$).

Under planned comparisons, the simple effect of alternation for plausible sentences was not significant by items ($F2$ (1, 22) = 2.36), but approached significance by subject ($F1$ (1, 26) = 4.15, p = .05).

3.5 Discussion

3.5.1 Native Speakers

As in the SC ambiguity sentences, the NS group showed a slightly delayed plausibility effect after the DO in PV sentences. In the region after this DO (buffer 1), NSs had longer RTs for split implausible sentences than for their non-split counterparts, indicating that NSs had difficulty processing the implausible DO in the split versions of this sentence type (e.g., *ran the fox*….). This plausibility effect carried over to the subsequent two regions (buffer 2 and buffer 3). Interestingly, significant RT differences between the split and non-split condition were also found for plausible sentences in buffer 2, buffer 3, and buffer 4. Since it was predicted that plausible sentences would cause processing difficulty only at/after the particle under their split version, this is a somewhat surprising result that does not lend itself to clear interpretation.

At the particle, NSs experienced processing difficulty with split versions of both plausible and implausible sentences as revealed by garden-path effects for both sentence types. These effects continued into the spill-over region. Although no reliable differences were found immediately after the particle, NSs showed

garden-path effects for both split plausible and split implausible sentences in the subsequent spill-over region (spill 2). However, this processing difficulty continued into the subsequent spill-over region (spill 3) only for split plausible sentences. Although the NSs showed a somewhat delayed reverse plausibility effect, this finding suggests that they were able to use plausibility information to recover from initial misanalysis.

For plausible-nsr sentences, on the other hand, no processing difficulty was observed at or after the particle. That is, there were no reliable RT differences between the split and non-split conditions for plausible-nsr sentences, indicating that NSs experienced no processing difficulty when split sentences did not require semantic reanalysis. This finding is consistent with the hypothesis that measurable processing costs should occur in split PV sentences only when there is both syntactic and semantic reanalysis. In sum, these results indicate that while NSs appeared to show reanalysis difficulty only for split plausible sentences that do require both syntactic and semantic reanalysis, they did not experience any processing difficulty with split plausible-nsr sentences that do not require semantic reanalysis.

3.5.2 Late Learners

The LL group showed a delayed plausibility effect two regions after the DO (buffer 2), as indicated by significantly longer RTs only for split implausible

sentences relative to their non-split counterparts. This plausibility effect, however, was slightly delayed as compared to NSs, who showed this effect immediately after the DO (buffer 1). This plausibility effect also carried over into the subsequent two regions (buffer 3 and buffer 4).

At/after the particle, on the other hand, LLs showed no reverse plausibility effect. Rather, this group seemed to experience processing difficulty in the split versions of all three sentence types. In the spill-over region (spill 2), split sentences were read significantly longer than their non-split counterparts for all three sentence types. As predicted, LLs appeared to have processing difficulty with split sentences regardless of the sentence types they were involved in.

In particular, unlike the NSs, it is important to note that LLs showed particular processing difficulty with split plausible-nsr sentences in the spill-over region (spill 2), as revealed by significantly longer RTs for split plausible-nsr sentences relative to their non-split counterparts. Interestingly, the RT difference between the split and non-split conditions in the plausible-nsr sentences was even numerically greater than in the plausible sentences. It thus appeared that split plausible-nsr sentences yield large processing demands for LLs, indicating that this group experienced processing difficulty with split PVs regardless of whether they require both syntactic and semantic reanalysis. This finding thus suggests that LLs were unable to use plausibility information, possibly due to structural difficulties involved in split PV sentences.

As mentioned earlier in this chapter, PVs present interesting problems for the language processor when the verb and the particle are separated by the intervening material. The LLs' inability to use plausibility information might be attributed to these idiosyncratic syntactic properties of split PVs. In addition, the structural distance between the verb and the particle might have led to processing overload especially for LLs so that they were unable to resort to plausibility information to recover from initial misanalysis. In our manipulation of split PV sentences, for instance, the intervening material between the verb and the particle consisted of six words, including the NP, and modifying information. Thus, it might have been too difficult for these highly proficient learners to process split PVs across this lengthy intervening material during the online reading task. The possible reasons behind these processing characteristics will be discussed in more detail in the next chapter.

3.5.3 Early Bilinguals

Like the NSs, the EB group showed a slightly delayed plausibility effect after the DO (buffer 1). However, this effect continued only until the subsequent region (buffer 2), possibly suggesting that EBs were able to recover from processing difficulty due to local implausibility more quickly compared to the other two groups.

After the particle, clear indications of reverse plausibility effects were found for this group. In the spill-over region (spill 2), although there was a marginal effect suggesting long RTs for split implausible sentences, statistically reliable RT differences between split and non-split conditions were found only for plausible sentences. This finding indicates that EBs experienced processing difficulty only for split plausible sentences one region earlier than NSs. Also, this reverse plausibility effect was more pronounced in the subsequent region (spill 3), again indicating that the EBs were able to use plausibility information to recover from initial misanalysis. Recall that NSs showed processing difficulty for both the split plausible and split implausible sentences at spill 2, and they showed a reverse plausibility effect beginning at spill 3. Thus, this pattern of results suggests that EBs were more efficient at using plausibility information to facilitate their recovery process compared to NSs.

In addition, similar to the NSs, EBs showed no processing difficulty for plausible-nsr sentences in the spill-over regions, as indicated by no reliable RT differences between the split and non-split conditions for this sentence type. As mentioned earlier, because no semantic reanalysis is required for the split plausible-nsr sentences, EBs also seemed not to experience any processing difficulty for this sentence type.

3.5.4 Conclusion

Taken together, for PV sentences, it appeared that both the NS and EB groups showed delayed plausibility effects after the implausible DO (e.g., *ran the fox that crossed the road…*), with the split implausible sentences taking significantly longer to read than their non-split counterparts. At/after the particle, although both groups of comprehenders showed a reverse plausibility effect, the pattern of results for this effect was slightly different.

For the NS group, they seemed to experience processing difficulty with split versions for both the plausible and implausible sentences at/after the particle (spill 2). However, the processing difficulty only for split plausible sentences continued into the final spill-over region (spill 3), indicating that NSs showed a delayed reverse plausibility effect and they were able to use plausibility information to recover from initial misanalysis. Note also that there were no reliable RT differences between the split and non-split conditions for plausible-nsr sentences in the spill-over region, indicating that NSs had no processing difficulty for this sentence type, which does not require the semantic reanalysis. This was the case for the EB group as well.

For the EB group, a clear reverse plausibility effect was observed one region earlier than NSs. Specifically, beginning at the second spill-over region (spill 2), it was found that EBs experienced processing difficulty with only split plausible sentences, indicating that EBs were able to use plausibility information

to recover from initial misanalysis. In fact, EBs appeared to be more adept at using this information to facilitate their recovery process compared to NSs. This finding suggests that EBs' cognitive abilities might have been transferred to online language processing. As in SC ambiguity sentences, this finding can also be taken as evidence that EBs' cognitive advantages related to conflict resolution might extend to online sentence processing. As mentioned earlier in this chapter, split PVs can yield conflicting analyses because the preferred non-PV or lexical verb analysis should be abandoned and reanalyzed upon encountering the particle. Thus, it is possible that EBs' enhanced conflict resolution abilities might have been transferred to language processing. Also, another cognitive factor such as working memory might have affected their efficient use of plausibility information during online sentence comprehension. This will be discussed in more detail in the next chapter.

Lastly, an interesting pattern of results was found for the LL group. Although LLs showed a delayed plausibility effect after the implausible DO, no reverse plausibility effect was observed for this group. This was revealed by significant RT differences for the split and non-split conditions for all three sentence types in the spill-over region (spill 2). In fact, this group seemed to experience persistent processing difficulty after the particle in all split PV sentences, regardless of plausibility, indicating that they were not able to use plausibility information to recover from initial misanalysis. This might be

attributed to idiosyncratic syntactic properties of PVs. Unlike the other two groups, only the LL group appeared to have processing difficulty for split plausible-nsr sentences in the spill-over region. This finding indicates that LLs have general processing difficulty with split PV constructions regardless of whether they require both syntactic and semantic reanalysis. Other possible reasons behind LLs' inability to use plausibility information in this sentence type will be discussed in more detail in the following chapter.

Chapter 4

General Discussion and Conclusion

A core question in psycholinguistics is the extent to which language background influences comprehenders' ability to use various information sources during real-time sentence processing. This dissertation examined whether highly proficient comprehenders of English with different language learning profiles -- NSs, LLs, EBs -- are able to make comparable use of plausibility information to avoid or recover from an initial misanalysis in the online processing of structurally complex sentences. Two sentence types involving temporarily ambiguous structural configurations--SC ambiguity sentences and split/non-split PV constructions -- were tested by using self-paced reading.

The results for all three groups of comprehenders in both sentence types are summarized in Table 4.1 below.

Table 4.1 Summary of results for all participants

		NSs	EBs	LLs
SC ambiguity	Plausibility effect	✓	✓	✓
	Reverse plausibility effect	✓	✓	✓
PV construction	Plausibility effect	✓	✓	✓
	Reverse plausibility effect	✓	✓	X

In SC ambiguity sentences, it was predicted that if comprehenders are sensitive to plausibility information and initially adopt the DO analysis in ambiguous sentences, they should find implausible ambiguous sentences more difficult to process than plausible ambiguous sentences when the ambiguous NP is encountered. At the disambiguating verb, if comprehenders are able to use plausibility information to revise initial misanalysis, it was expected that all three groups would show more processing difficulty in plausible ambiguous sentences than in implausible ambiguous sentences.

As predicted, it was found that all three groups showed slightly delayed plausibility effects after the ambiguous NP, as indicated by inflated RTs for implausible ambiguous sentences. In the disambiguating region, although reverse plausibility effects were obtained for all three groups of comprehenders, it was found that EBs were able to use plausibility information more efficiently to recover from initial structural misanalysis compared to the other two groups. After the disambiguating verb, while both the NS and LL groups seemed to have processing difficulty for both plausible and implausible ambiguous sentences, the EB group showed a processing difficulty only for plausible ambiguous sentences. In the subsequent region, however, delayed reverse plausibility effects were also observed for these two groups as they showed garden path effects in only plausible ambiguous sentences. This pattern of results shows evidence of their recovery processes having been affected by plausibility information.

As for the NS group, this finding is different from the results of Roberts and Felser's (2011). In that study, the NSs did not show any plausibility or reverse plausibility effects. Roberts and Felser contend that because the disambiguating verb appeared adjacent to the ambiguous NP in their materials, NSs might not have experienced reanalysis difficulty. In the present study, however, structural distance between the ambiguous NP and the disambiguating verb might have increased processing difficulty as the parser was committed to the incorrect analysis for longer.

In addition, unlike the findings from Roberts and Felser's study, the LL group showed reverse plausibility effects, indicating that they were able to use plausibility information to recover from initial misanalysis in this sentence type. This differed from Roberts and Felser's results in that although their L2 learners showed plausibility effects, they did not show statistically reliable evidence of a reverse plausibility effect at or after the disambiguating verb. Roberts and Felser argued that the absence of such reverse plausibility effects was due to radical structural reorganization involved in SC ambiguity sentences. However, it appeared that the LLs in the present study were able to use plausibility information to recover from initial misanalysis although structural complexity might have been increased by adding intervening materials between the ambiguous NP and the disambiguating verb. This finding indicates that like NSs and EBs, LLs were able to use plausibility information to facilitate the recovery process as they process syntactically challenging sentences.

In PV sentences, if comprehenders use plausibility information when the implausible DO is encountered, it was predicted that they would show evidence of a plausibility effect, reflected as elevated RTs at the DO in split implausible sentences. At the disambiguation region (after the particle), however, assuming that measurable processing costs occur only when there is both syntactic and semantic reanalysis, it was predicted that readers would experience processing difficulty only in split plausible sentences.

It was found that both the NS and EB groups showed plausibility effects after the implausible DO, with split implausible sentences eliciting significantly longer RTs than their non-split counterparts. In the spill-over region, while NSs showed reliable differences between split and non-split conditions for both plausible and implausible sentences, EBs showed significant RT differences between these two conditions only for plausible sentences, indicating that they experienced processing difficulty only for the split plausible sentences. This finding suggests that EBs were more adept at using plausibility information to resolve both structural and semantic misanalyses despite structural difficulties involved in split PV constructions. In addition, for both the NS and EB groups, no garden-path effects were observed in the spill-over regions for split plausible-nsr sentences, indicating that these groups did not experience processing difficulty when no semantic reanalysis was required.

For LLs, however, a different pattern of results was found. Although this group showed a plausibility effect after the implausible DO, they did not

show a reverse plausibility effect after the particle. Rather, this group seemed to have persistent processing difficulty with all split PV sentences. In particular, although both the NS and EB groups did not show any processing difficulty for the split plausible-nsr sentences, LL group appeared to experience processing difficulty with this sentence type. This finding indicates that LLs showed processing difficulty for split PV sentences regardless of whether they required both syntactic and semantic reanalysis.

More importantly, these results provide insight into why LLs were unable to use plausibility information to facilitate the recovery process in this sentence type. One possibility relates to the idiosyncratic syntactic properties involved in split PV construction. Since this split PV is not a possible syntactic structure in LLs' native language (Korean), they might have found all split PVs difficult to process regardless of plausibility. Due to this structural processing difficulty, it is possible that LLs were unable to use plausibility information to recover from initial misanalysis.

In addition, the structural distance between the verb and the particle might have made these sentences difficult to process especially for LLs during online sentence processing. As mentioned earlier, the intervening material between the verb and the particle consisted of six words in the present study. Although the results showed that LLs answered the most of comprehension questions accurately, it might have been too difficult for them to process this long intervening material during real-time reading task, possibly due to limited working memory.

When processing 'filler-gap' dependencies (e.g., *Which magazine did the old lady say that she read ____ with great pleasure*?), it was argued that there are two computational processes involved -- memory storage, and filler integration (Gibson, 1998). This is because the filler (*which magazine*) needs to be temporarily stored in working memory and associated with its subcategorizer, the verb (*read*). Similarly, in split PV sentences, there also seem to be two kinds of computational processes involved here -- memory storage, and particle integration. In particular, when processing the implausible DO, the verb (*ran*) needs to be temporarily stored in working memory and associated with its particle (*over*) because the DO (*fox*) is not an appropriate theme. However, LLs did not seem to integrate the particle well, possibly because they needed to maintain a verb in working memory across structurally complex intervening material. Thus, this might have led to processing overload, which may have meant that this LL group was not able to use plausibility information for reanalysis.

Another possibility relates to the fact that split PVs require the comprehenders to perform syntactic revisions as well as semantic revisions. In the split implausible sentences, for instance, it might have been too challenging for LLs to use plausibility information to recover from both syntactic and semantic misanalyses. Therefore, it appears that while LLs were able use plausibility information in sentences that require only syntactic revision (i.e., SC ambiguity), they were not able to use this information in sentences that require both syntactic and semantic revisions.

For EBs, on the other hand, it is possible that their cognitive advantages in domains such as working memory capacity might have affected the efficient use of plausibility information in both sentence types. With regard to utilizing the plausibility information during online sentence processing, there is some evidence that comprehenders with good working memory used this information more efficiently when the task imposed memory demands. For instance, Williams (2006) found that NSs who were most successful in the memory probe task used plausibility information early in the sentence. Also, it was found that only the L2 learners with higher performance in the memory task used plausibility information, but did so later than NSs. Williams interpreted these results to suggest that NNSs experienced more processing difficulty because they were not able to allocate sufficient cognitive resources (i.e., working memory) to perform this type of processing.

In addition, Dussias and Pinar (2010) investigated how individual differences in cognitive capacity modulate the extent to which NSs and NNSs utilize plausibility information to recover from an initial misanalysis in the processing of long-distance *wh*-questions. They found that only the L2 learners in the higher reading span group appeared to use plausibility information comparably to the NS readers. The findings suggest that cognitive advantages in terms of working memory capacity can be an important factor in determining whether plausibility information can be used to resolve syntactic ambiguities.

In light of these findings, EBs' particularly strong performance in using plausibility information to recover from misanalysis in both sentence types might also be attributed to their enhanced working memory. As mentioned earlier, a number of cognitive studies have shown that bilinguals seem to enjoy cognitive advantages in areas such as conflict resolution, multi-tasking, working memory as compared to monolinguals (Bialystok, Craik, Klein, & Viswanathan, 2004; Bialystok, Craik, & Luk, 2008; Costa et al., 2008, 2009). Thus, it is possible that EBs were able to transfer such cognitive abilities (i.e., conflict resolution, working memory) to coordinating multiple sources of information during online language processing.

To summarize, these results indicate that highly proficient comprehenders of English -- whether NSs, EBs, or LLs -- are able to use plausibility to facilitate structural processing, even in sentences that require major syntactic reanalysis (contra Roberts & Felser, 2011). The only clear limit on LLs' ability to use this information related to lexico-syntactic/semantic processing difficulty, in that they appeared to be unable to use this information to recover from misanalysis associated with the idiosyncratic structural properties of English PVs. Finally, in both sentence types, EBs appeared to make particularly efficient use of plausibility information for structural reanalysis, which might be attributed to a bilingual cognitive advantage. Indeed, the EBs' performance in terms of utilizing plausibility information during online processing provides additional insight into the interaction of language processing and other cognitive capacities.

More specifically, the findings of the present study suggest that EBs may have unique and effective cognitive advantages that can be transferred directly to online sentence processing.

With regard to the limitations of the study, the current self-paced reading study did not always capture processing difficulty at the predicted point in the test sentences. In fact, all three groups of comprehenders demonstrated delayed effects in both sentence types, which might be attributed to task effects. Thus, more sensitive processing methodologies (i.e., eye tracking) are required for future investigations in order to obtain accurate time-course information.

In addition, the EB group consisted of bilingual speakers who have different L1s whereas the LL group included only Korean-English bilinguals. Although the current study was not a comparison study, it might have been better to have the same populations of bilingual speakers to generalize the results.

Lastly, since the present study was the first experiment comparing monolingual and bilinguals' structural processing of PVs, further research on this sentence type will need to be conducted in the future. In particular, because the LL group consisted of all Korean-English late learners who do not have PVs in their native language, further research with different L2 populations who have PVs in their L1 is required to examine whether these groups of L2 learners also show some structural processing difficulties for split PV constructions. Since longer structural distance tends to be

computationally more costly than shorter distance, it might also be interesting to examine whether the amount/type of information intervening between the verb and the particle can affect the comprehenders' processing of split PVs. With an improved method of measuring processing difficulty and with a larger amount of data, including different groups of late learners, future studies can address L2 learners' structural processing of PVs to yield further pedagogical implications.

APPENDIX

SC Ambiguity Items

(1a) While Emma played the song about true love amused all the customers at the club.
(1b) While Emma played, the song about true love amused all the customers at the club.
(1c) While Emma drank the song about true love amused all the customers at the club.
(1d) While Emma drank, the song about true love amused all the customers at the club.
Did the song amuse all the customers?

(2a) As William drank the beer from European countries pleased all the guests at the party.
(2b) As William drank, the beer from European countries pleased all the guests at the party.
(2c) As William played the beer from European countries pleased all the guests at the party.
(2d) As William played, the beer from European countries pleased all the guests at the party.
Did William please all the guests?

(3a) As Ethan called the housewife with blond hair walked into the tree rather clumsily.
(3b) As Ethan called, the housewife with blond hair walked into the tree rather clumsily.
(3c) As Ethan climbed the housewife with blond hair walked into the tree rather clumsily.
(3d) As Ethan climbed, the housewife with blond hair walked into the tree rather clumsily.
Did the housewife walk into the tree?

(4a) While Alex climbed the ladder in his backyard fell to the ground with a thud.
(4b) While Alex climbed, the ladder in his backyard fell to the ground with a thud.
(4c) While Alex called the ladder in his backyard fell to the ground with a thud.
(4d) While Alex called, the ladder in his backyard fell to the ground with a thud.
Did the ladder fall onto a fence?

(5a) While Emily visited the boy from North Carolina passed by the house in the afternoon.
(5b) While Emily visited, the boy from North Carolina passed by the house in the afternoon.
(5c) While Emily parked the boy from North Carolina passed by the house in the afternoon.
(5d) While Emily parked, the boy from North Carolina passed by the house in the afternoon.
Did Emily pass by the house?

(6a) When Daniel parked the car with broken windows surprised all the people very much.
(6b) When Daniel parked, the car with broken windows surprised all the people very much.
(6c) When Daniel visited the car with broken windows surprised all the people very much.
(6d) When Daniel visited, the car with broken windows surprised all the people very much.
Was everyone surprised by the car?

(7a) While Sophia washed the clothes with silk ribbons dried on the lines in the backyard.
(7b) While Sophia washed, the clothes with silk ribbons dried on the lines in the backyard.
(7c) While Sophia wrote the clothes with silk ribbons dried on the lines in the backyard.
(7d) While Sophia wrote, the clothes with silk ribbons dried on the lines in the backyard.
Did Sophia buy the clothes with silk ribbons?

(8a) As Nathan wrote the email about national scholarships appeared in his inbox somewhat unexpectedly.
(8b) As Nathan wrote, the email about national scholarships appeared in his inbox somewhat unexpectedly.
(8c) As Nathan washed the email about national scholarships appeared in his inbox somewhat unexpectedly.
(8d) As Nathan washed, the email about national scholarships appeared in his inbox somewhat unexpectedly.
Did Nathan send the email?

(9a) As Elizabeth called the kitten with soft fur fell to the ground from the sofa.
(9b) As Elizabeth called, the kitten with soft fur fell to the ground from the sofa.
(9c) As Elizabeth ate the kitten with soft fur fell to the ground from the sofa.
(9d) As Elizabeth ate, the kitten with soft fur fell to the ground from the sofa.
Did the kitten fall to the ground?

(10a) While Matthew ate the ice-cream with chocolate sauce dropped to the floor from the table.
(10b) While Matthew ate, the ice-cream with chocolate sauce dropped to the floor from the table.
(10c) While Matthew called the ice-cream with chocolate sauce dropped to the floor from the table.
(10d) While Matthew called, the ice-cream with chocolate sauce dropped to the floor from the table.
Did the ice cream drop to the floor?

(11a) While Anthony polished the truck from his shop crashed into a bus on the street.
(11b) While Anthony polished, the truck from his shop crashed into a bus on the street.
(11c) While Anthony baked the truck from his shop crashed into a bus on the street.
(11d) While Anthony baked, the truck from his shop crashed into a bus on the street.
Did the truck hit the bus?

(12a) As Grace baked the cake for her boyfriend disappeared from the kitchen mysteriously last night.
(12b) As Grace baked, the cake for her boyfriend disappeared from the kitchen mysteriously last night.
(12c) As Grace polished the cake for her boyfriend disappeared from the kitchen mysteriously last night.
(12d) As Grace polished, the cake for her boyfriend disappeared from the kitchen mysteriously last night.
Did Grace disappear from the kitchen?

(13a) As Natalie cooked the fish with long tails swam toward the river from the sea.
(13b) As Natalie cooked, the fish with long tails swam toward the river from the sea.
(13c) As Natalie climbed the fish with long tails swam toward the river from the sea.
(13d) As Natalie climbed, the fish with long tails swam toward the river from the sea.
Did Natalie swim in the sea?

(14a) While Joshua climbed the tree with bright lights fell on his house last December.
(14b) While Joshua climbed, the tree with bright lights fell on his house last December.
(14c) While Joshua cooked the tree with bright lights fell on his house last December.
(14d) While Joshua cooked, the tree with bright lights fell on his house last December.
Did Joshua cut the tree?

(15a) While Abigail walked the dog with dirty fur barked in the distance three times.
(15b) While Abigail walked, the dog with dirty fur barked in the distance three times.
(15c) While Abigail drank the dog with dirty fur barked in the distance three times.
(15d) While Abigail drank, the dog with dirty fur barked in the distance three times.
Did the dog bark three times?

(16a) As Richard drank the milk for the kids spilled on the table in the kitchen.
(16b) As Richard drank, the milk for the kids spilled on the table in the kitchen.
(16c) As Richard walked the milk for the kids spilled on the table in the kitchen.
(16d) As Richard walked, the milk for the kids spilled on the table in the kitchen.
Did the kids drink the milk?

(17a) When Jacob tripped the girl with curly hair walked to the sidewalk across the road.
(17b) When Jacob tripped, the girl with curly hair walked to the sidewalk across the road.
(17c) When Jacob parked the girl with curly hair walked to the sidewalk across the road.
(17d) When Jacob parked, the girl with curly hair walked to the sidewalk across the road.
Did Jacob walk over to the sidewalk?

(18a) When Samantha parked the bus with thirty passengers passed by her house rather slowly.
(18b) When Samantha parked, the bus with thirty passengers passed by her house rather slowly.
(18c) When Samantha tripped the bus with thirty passengers passed by her house rather slowly.
(18d) When Samantha tripped, the bus with thirty passengers passed by her house rather slowly.
Did the bus pass by Samantha's house?

(19a) As James flew the plane from South Africa crashed into the river in the jungle.
(19b) As James flew, the plane from South Africa crashed into the river in the jungle.
(19c) As James sang the plane from South Africa crashed into the river in the jungle.
(19d) As James sang, the plane from South Africa crashed into the river in the jungle.
Did the plane crash?

(20a) As Vicky sang the song about tragic accidents upset all the people in the plane.
(20b) As Vicky sang, the song about tragic accidents upset all the people in the plane.
(20c) As Vicky flew the song about tragic accidents upset all the people in the plane.
(20d) As Vicky flew, the song about tragic accidents upset all the people in the plane.
Did the song make everyone unhappy?

(21a) As Stan edited the magazine about house decorations amused all the passengers in the boat.
(21b) As Stan edited, the magazine about house decorations amused all the passengers in the boat.
(21c) As Stan sailed the magazine about house decorations amused all the passengers in the boat.
(21d) As Stan sailed, the magazine about house decorations amused all the passengers in the boat.
Did Stan decorate houses?

(22a) As Benjamin sailed the yacht with colorful flags left from the dock very slowly.
(22b) As Benjamin sailed, the yacht with colorful flags left from the dock very slowly.
(22c) As Benjamin edited the yacht with colorful flags left from the dock very slowly.
(22d) As Benjamin edited, the yacht with colorful flags left from the dock very slowly.
Did Benjamin leave from the dock?

(23a) As Ryan confessed the crime of armed robbery shocked all the people very much.
(23b) As Ryan confessed, the crime of armed robbery shocked all the people very much.
(23c) As Ryan lectured the crime of armed robbery shocked all the people very much.
(23d) As Ryan lectured, the crime of armed robbery shocked all the people very much.
Did the crime shock everybody?

(24a) As Hannah lectured the class at Princeton university listened to her story in shocked silence.
(24b) As Hannah lectured, the class at Princeton university listened to her story in shocked silence.
(24c) As Hannah confessed the class at Princeton university listened to her story in shocked silence.
(24d) As Hannah confessed, the class at Princeton university listened to her story in shocked silence.
Did the class listen to the story?

(25a) When Joseph negotiated the treaty for free trade upset all the people at the protest.
(25b) When Joseph negotiated, the treaty for free trade upset all the people at the protest.
(25c) When Joseph visited the treaty for free trade upset all the people at the protest.
(25d) When Joseph visited, the treaty for free trade upset all the people at the protest.
Were the protesters unhappy about the treaty?

(26a) As Laura visited the village in mainland China asked all the officials for help.
(26b) As Laura visited, the village in mainland China asked all the officials for help.
(26c) As Laura negotiated the village in mainland China asked all the officials for help.
(26d) As Laura negotiated, the village in mainland China asked all the officials for help.
Did the village ask for help?

(27a) As Michael drove the car on the highway rushed down the hill and hit a deer.
(27b) As Michael drove, the car on the highway rushed down the hill and hit a deer.
(27c) As Michael wrote the car on the highway rushed down the hill and hit a deer.
(27d) As Michael wrote, the car on the highway rushed down the hill and hit a deer.
Did Michael hit someone?

(28a) As Charlotte wrote the article about wild animals surprised all the scientists from the lab.
(28b) As Charlotte wrote, the article about wild animals surprised all the scientists from the lab.
(28c) As Charlotte drove the article about wild animals surprised all the scientists from the lab.
(28d) As Charlotte drove, the article about wild animals surprised all the scientists from the lab.
Did the article surprise the scientists?

(29a) While George read the books about physical science confused all the students in the classroom.
(29b) While George read, the books about physical science confused all the students in the classroom.
(29c) While George ate the books about physical science confused all the students in the classroom.
(29d) While George ate, the books about physical science confused all the students in the classroom.
Did George confuse all the students?

(30a) As Allison ate the sandwich from the bakery slipped off the plate and onto the bench.
(30b) As Allison ate, the sandwich from the bakery slipped off the plate and onto the bench.
(30c) As Allison read the sandwich from the bakery slipped off the plate and onto the bench.
(30d) As Allison read, the sandwich from the bakery slipped off the plate and onto the bench.
Did Allison slip off of the bench?

(31a) As Tyler invented the light for the computer glowed on the desk very brightly.
(31b) As Tyler invented, the light for the computer glowed on the desk very brightly.
(31c) As Tyler taught the light for the computer glowed on the desk very brightly.
(31d) As Tyler taught, the light for the computer glowed on the desk very brightly.
Did the light glow dimly?

(32a) While Sara taught the student of electrical engineering took all the books away quickly.
(32b) While Sara taught, the student of electrical engineering took all the books away quickly.
(32c) While Sara invented the student of electrical engineering took all the books away quickly.
(32d) While Sara invented, the student of electrical engineering took all the books away quickly.
Did Sara take the books away?

(33a) As Cindy painted the picture of the roses pleased all the critics in the room.
(33b) As Cindy painted, the picture of the roses pleased all the critics in the room.
(33c) As Cindy sang the picture of the roses pleased all the critics in the room.
(33d) As Cindy sang, the picture of the roses pleased all the critics in the room.
Did the picture please all the critics?

(34a) While Luke sang the song about young love annoyed a few people at the event.
(34b) While Luke sang, the song about young love annoyed a few people at the event.
(34c) While Luke painted the song about young love annoyed a few people at the event.
(34d) While Luke painted, the song about young love annoyed a few people at the event.
Did everyone enjoy the song?

(35a) When Ashley baked the cookies with colorful sprinkles burned in the oven very badly.
(35b) When Ashley baked, the cookies with colorful sprinkles burned in the oven very badly.
(35c) When Ashley cleaned the cookies with colorful sprinkles burned in the oven very badly.
(35d) When Ashley cleaned, the cookies with colorful sprinkles burned in the oven very badly.
Did the cookies become burnt?

(36a) When Evan cleaned the toilet in the bathroom overflowed into the hallway by the kitchen.
(36b) When Evan cleaned, the toilet in the bathroom overflowed into the hallway by the kitchen.
(36c) When Evan baked the toilet in the bathroom overflowed into the hallway by the kitchen.
(36d) When Evan baked, the toilet in the bathroom overflowed into the hallway by the kitchen.
Did Evan fix the toilet?

(37a) As Claire polished the floor of the hall creaked with every footstep as people entered the store.
(37b) As Claire polished, the floor of the hall creaked with every footstep as people entered the store.
(37c) As Claire followed the floor of the hall creaked with every footstep as people entered the store.
(37d) As Claire followed, the floor of the hall creaked with every footstep as people entered the store.
Did Claire leave the store?

(38a) As Nicholas followed the professors by the limousine chatted about the exam for new students.
(38b) As Nicholas followed, the professors by the limousine chatted about the exam for new students.
(38c) As Nicholas polished the professors by the limousine chatted about the exam for new students.
(38d) As Nicholas polished, the professors by the limousine chatted about the exam for new students.
Did the professors talk about the exam?

(39a) While Cathy cooked the meal with exotic spices interested all the visitors at the concert hall.
(39b) While Cathy cooked, the meal with exotic spices interested all the visitors at the concert hall.
(39c) While Cathy composed the meal with exotic spices interested all the visitors at the concert hall.
(39d) While Cathy composed, the meal with exotic spices interested all the visitors at the concert hall.
Were the visitors interested in the meal?

(40a) While Jordan composed the opera about tragic love played on the television in the background.
(40b) While Jordan composed, the opera about tragic love played on the television in the background.
(40c) While Jordan cooked the opera about tragic love played on the television in the background.
(40d) While Jordan cooked, the opera about tragic love played on the television in the background.
Did the opera play on TV?

PV Items

Implausible Condition Items

1a. Mary ran the fox that crossed the road over when it jumped in front of her car.
1b. Mary ran over the fox that crossed the road when it jumped in front of her car.
Q: Did Mary hit a fox with her car?

2a. Dan worked the answers to the crossword puzzle out as he relaxed during the break.
2b. Dan worked out the answers to the crossword puzzle as he relaxed during the break.
Q: Did Dan play a board game?

3a. Joe cut the conversation that lasted two hours off and then left for another meeting.
3b. Joe cut off the conversation that lasted two hours and then left for another meeting.
Q: Did Joe leave for another meeting?

4a. Britney turned the position with the start-up company down and then began to look for another job.
4b. Britney turned down the position with the start-up company and then began to look for another job.
Q: Did Britney accept the position with the start-up company?

5a. Paul kicked a percentage of last year's profits back to the official as a bribe.
5b. Paul kicked back a percentage of last year's profits to the official as a bribe.
Q: Did Paul give money to the official?

6a. Brian messed the negotiations with the new company up because he drank too much at the lunch meeting.
6b. Brian messed up the negotiations with the new company because he drank too much at the lunch meeting.
Q: Did Brian successfully complete the negotiations?

7a. Tina rang the items by the cash register up and then bagged them for the customer.
7b. Tina rang up the items by the cash register and then bagged them for the customer.
Q: Did Tina bag the items?

8a. Matt ran the mugger who stole the purse down and then returned it to the victim.
8b. Matt ran down the mugger who stole the purse and then returned it to the victim.
Q: Did Matt steal the purse?

9a. Ben pulled the deal that seemed really difficult off and was promoted for his hard work.
9b. Ben pulled off the deal that seemed really difficult and was promoted for his hard work.
Q: Did Ben successfully make the deal?

10a. John filled the document that he received recently out and then mailed it to the tax office.
10b. John filled out the document that he received recently and then mailed it to the tax office.
Q: Did John mail the document to the school?

11a. Becky brushed the insult that she heard yesterday off and then went outside to smoke.
11b. Becky brushed off the insult that she heard yesterday and then went outside to smoke.
Q: Did Becky smoke outside?

12a. Bill locked the workers who demanded more money out after they refused to sign the new contract.
12b. Bill locked out the workers who demanded more money after they refused to sign the new contract.
Q: Did Bill renew the contract?

13a. Michael ripped the truck from the repair shop off and then drove to Mexico with his friend.
13b. Michael ripped off the truck from the repair shop and then drove to Mexico with his friend.
Q: Did Michael steal the truck from his friend?

14a. Fred fixed the meeting with the interested investor up but he failed to get any money.
14b. Fred fixed up the meeting with the interested investor but he failed to get any money.
Q: Did Fred get money from the investor?

15a. Alicia ran the bill that she couldn't afford up after she received her new credit card.
15b. Alicia ran up the bill that she couldn't afford after she received her new credit card.
Q: Did Alicia spend a lot of money?

16a. Jason passed the opportunity with the reputable company up because he wanted to stay with his family.
16b. Jason passed up the opportunity with the reputable company because he wanted to stay with his family.
Q: Did Jason leave his family?

17a. Judy poured her troubles with her new job out as she drank a few beers at the bar.
17b. Judy poured out her troubles with her new job as she drank a few beers at the bar.
Q: Did Judy have problem with her job?

18a. Steve bailed the company that had financial difficulties out and then hired some new executives.
18b. Steve bailed out the company that had financial difficulties and then hired some new executives.
Q: Did Steve save the company?

19a. Jim blew the photo that he took yesterday up because he wanted to see details of the scene.
19b. Jim blew up the photo that he took yesterday because he wanted to see details of the scene.
Q: Did Jim take a picture yesterday?

20a. Sally boiled the report that she wrote yesterday down and then gave a written summary to her boss.
20b. Sally boiled down the report that she wrote yesterday and then gave a written summary to her boss.
Q: Did Sally submit the summary?

21a. Charles drew the meeting with his team members out as he gave a lengthy speech.
21b. Charles drew out the meeting with his team members as he gave a lengthy speech.
Q: Did Charles end the meeting quickly?

22a. Paul thought the offer that he got yesterday over but he decided to reject it.
22a. Paul thought over the offer that he got yesterday but he decided to reject it.
Q: Did Paul accept the offer?

23a. David chewed the issue that was extremely important over before he made a final decision.
23b. David chewed over the issue that was extremely important before he made a final decision.
Q: Did David make a careless decision?

24a. Terry drank the scenery that was quite amazing in while he drove into the mountains.
24b. Terry drank in the scenery that was quite amazing while he drove into the mountains.
Q: Did Terry drive into the mountains?

Plausible/No Semantic Reanalysis Condition Items

25a. Albert called the family who visited his church up after he talked to his pastor.
25b. Albert called up the family who visited his church after he talked to his pastor.
Q: Did Albert call his friend?

26a. Alan typed the resume for his job application up after he returned home from school.
26b. Alan typed up the resume for his job application after he returned home from school.
Q: Did Alan type a report?

27a. Kirk closed the theater that played old movies up and then left for home one hour ago.
27b. Kirk closed up the theater that played old movies and then left for home one hour ago.
Q: Did Kirk go home?

28a. Stephanie threw the clothes that looked pretty old out because she wanted to get new ones.
28b. Stephanie threw out the clothes that looked pretty old because she wanted to get new ones.
Q: Did Stephanie keep her old clothes?

29a. Matt rolled the map that he drew yesterday up and then put it in his car.
29b. Matt rolled up the map that he drew yesterday and then put it in his car.
Q: Did Matt put the map on his desk?

30a. Todd took the ring with shiny black diamonds out and then placed it safely in the drawer.
30b. Todd took out the ring with shiny black diamonds and then placed it safely in the drawer.
Q: Did Todd put the ring in the drawer?

31a. Frank knocked the lamp with the green shade over when he tripped next to the table.
31b. Frank knocked over the lamp with the green shade when he tripped next to the table.
Q: Did Frank hit the lamp?

32a. Tom gave the toy that resembled a rabbit back to his sister and then played with his train.
32b. Tom gave back the toy that resembled a rabbit to his sister and then played with his train.
Q: Did Tom return the toy to his sister?

33a. Ann carried the suitcases that contained the presents on when she boarded the international flight.
33b.Ann carried on the suitcases that contained the presents when she boarded the international flight.
Q: Did Ann lose the suitcases?

34a. Jane woke the residents who had fallen asleep up when she played the piano at midnight.
34b. Jane woke up the residents who had fallen asleep when she played the piano at midnight.
Q: Did Jane play the guitar?

35a. Jared found the solution that worked for everyone out and then saved his company from bankruptcy.
35b. Jared found out the solution that worked for everyone and then saved his company from bankruptcy.
Q: Did Jared save his company?

36a. Teresa paid the loans from the large bank off after she worked at the company for a year.
36b. Teresa paid off the loans from the large bank after she worked at the company for a year.

Q: Did Teresa receive loans from a bank?

37a. Tony hid the heroin that came from Afghanistan away and then pretended not to have it.
37b. Tony hid away the heroin that came from Afghanistan and then pretended not to have it.
Q: Did Tony conceal the heroin?

38a. Sam ate the food that he cooked yesterday up and then played a new video game.
38b. Sam ate up the food that he cooked yesterday and then played a new video game.
Q: Did Sam eat all the food?

39a. Monica finished the cake that was really delicious off after she returned home from school.
39b. Monica finished off the cake that was really delicious after she returned home from school.
Q: Did Monica leave any of the cake?

40a. Jenny flipped the pancakes that contained chocolate chips over and then started to cook some bacon.
40b. Jenny flipped over the pancakes that contained chocolate chips and then started to cook some bacon.
Q: Did Jenny make bacon?

41a. Peter wrote the report that was due today up and then submitted it to his professor.
41b. Peter wrote up the report that was due today and then submitted it to his professor.
Q: Did Peter submit the report?

42a. Sarah started the business that looked very promising up and then made a lot of money.
42b. Sarah started up the business that looked very promising and then made a lot of money.
Q: Did Sarah fail in business?

43a. Sofia opened the box that contained Thai food up when she arrived home from work.
43b. Sofia opened up the box that contained Thai food when she arrived home from work.
Q: Did Sofia open the box at work?

44a. Bob cut the tree that died last year down after he decided to sell his house.
44b. Bob cut down the tree that died last year after he decided to sell his house.
Q: Did Bob plant the tree in his backyard?

45a. Maria dressed the children who were playing outside up and then took them to the party.
45b. Maria dressed up the children who were playing outside and then took them to the party.
Q: Did Maria buy a dress?

46a. Elisa brought the muffins that she baked yesterday over and then served them to her friends.
46b. Elisa brought over the muffins that she baked yesterday and then served them to her friends.
Q: Did Elisa bake the muffins?

47a. Sheryl tried the medicine for her bad cold out and then felt better the next day.
47b. Sheryl tried out the medicine for her bad cold and then felt better the next day.
Q: Did Sheryl take the medicine?

48a. Mike packed the laptop that he bought recently up and then left for conference in California.
48b. Mike packed up the laptop that he bought recently and then left for conference in California.
Q: Did Mike repair the laptop?

Plausible Condition Items

49a. Dan showed the boys who always teased him up when he finished the race in first place.
49b. Dan showed up the boys who always teased him when he finished the race in first place.
Q: Did Dan lose the race?

50a. Andrew brought the winnings from his Las Vegas vacation up as he ate dinner with his family.
50b. Andrew brought up the winnings from his Las Vegas vacation as he ate dinner with his family.
Q: Did Andrew keep his winnings a secret?

51a. Justin set the table that he bought yesterday down and then returned to the moving truck.
51b. Justin set down the table that he bought yesterday and then returned to the moving truck.
Q: Did Justin drive the truck away?

52a. Cody picked the language that seemed very difficult up and then spoke to others fluently.
52b. Cody picked up the language that seemed very difficult and then spoke to others fluently.
Q: Did Cody learn the difficult language?

53a. Barb called the politicians who misbehaved for years out because they awarded contracts to their friends.
53b. Barb called out the politicians who misbehaved for years because they awarded contracts to their friends.
Q: Did Barb award contracts to her friends?

54a. Chris told the students who made loud noises off and then left the classroom for a while.
54b. Chris told off the students who made loud noises and then left the classroom for a while.
Q: Did Chris scold the students?

55a. Albert passed the exam that tested cultural knowledge out and then answered questions from the students.
55b. Albert passed out the exam that tested cultural knowledge and then answered questions from the students.
Q: Did the students ask questions?

56a. Ross used the glue that he bought yesterday up so he needed to go to the store again.
56b. Ross used up the glue that he bought yesterday so he needed to go to the store again.
Q: Did Ross buy the glue?

57a. Lisa dropped the kids who were behaving badly off and then went to work a bit late.
57b. Lisa dropped off the kids who were behaving badly and then went to work a bit late.
Q: Did Lisa bring her kids to work?

58a. Charlie picked the trousers from his favorite tailor up when he returned home after work.
58b. Charlie picked up the trousers from his favorite tailor when he returned home after work.
Q: Did Charlie get shirts from the tailor?

59a. Mark ripped the painting that was very expensive off and then escaped to China right away.
59b. Mark ripped off the painting that was very expensive and then escaped to China right away.
Q: Did Mark escape to China?

60a. Amber turned the bag that contained the jewels over to the police and was given a reward.
60b. Amber turned over the bag that contained the jewels to the police and was given a reward.
Q: Did Amber give the bag to the police?

61a. Aaron played the game that he won easily down because he wanted to be humble.
61b. Aaron played down the game that he won easily because he wanted to be humble.
Q: Did Aaron lose the game?

62a. Blake passed the powder that was actually flour off as some cocaine and sold it to the woman.
62b. Blake passed off the powder that was actually flour as some cocaine and sold it to the woman.
Q: Did Blake sell the powder?

63a. Olivia cut the man who seemed very drunk off when she exited from the freeway.
63b. Olivia cut off the man who seemed very drunk when she exited from the freeway.
Q: Did Olivia exit from the freeway?

64a. Anna checked the computer from the school library out and then used it all week long.
64b. Anna checked out the computer from the school library and then used it all week long.
Q: Did Anna get the computer from a store?

65a. Andy turned the key for his new office in and then left to catch the train.

65b. Andy turned in the key for his new office and then left to catch the train.
Q: Did Andy leave for the train station?

66a. Chris picked the turkey that looked rather large off with his rifle and then put it in his truck.
66b. Chris picked off the turkey that looked rather large with his rifle and then put it in his truck.
Q: Did Chris kill the turkey?

67a. Jennifer took the trousers that were very stylish up because she wanted to wear them to the concert.
67b. Jennifer took up the trousers that were very stylish because she wanted to wear them to the concert.
Q: Did Jennifer want to wear a stylish pants?

68a. Joey worked the man who cleaned the bar over and then poured water on his face.
68b. Joey worked over the man who cleaned the bar and then poured water on his face.
Q: Did Joey pour wine on the man?

69a. Caleb showed his girlfriend who looked very pretty off and then went outside with her.
69b. Caleb showed off his girlfriend who looked very pretty and then went outside with her.
Q: Was Caleb embarrassed about his girlfriend?

70a. Abby broke the program that seemed very complicated down and her coworkers appreciated the explanation.
70b. Abby broke down the program that seemed very complicated and and her coworkers appreciated the explanation.
Q: Did Abby explain the program?

71a. Jeremy wore the shoes that he bought recently out because he jogged outside every day.
71b. Jeremy wore out the shoes that he bought recently because he jogged outside every day.
Q: Did Jeremy play basketball every day?

72a. Jeff asked the waitress who was very kind out but she said no without any hesitation.
72b. Jeff asked out the waitress who was very kind but she said no without any hesitation.
Q: Did Jeff go on a date with the waitress?

Filler Items

1. Jenny examined the mother in her office, and the child played quietly in the corner.
Did the child play quietly?

2. Heather disappointed her coach at the game, and her mother tried to console her.
Did Heather's mother disappoint her coach?

3. Fred photographed the swimmer at the event, and the runner got ready for the race.
Did Fred photograph the runner?

4. Linda fed her pet cat, and her dog wanted a can of food, too.
Did Linda feed her dog?

5. Mike gave matches to the camper, and his friend made a fire by the tent.
Did Mike's friend make the fire?

6. Jim listened to the pianist carefully, and the singer watched the organist at the concert.
Did the singer listen to the pianist?

7. Chris applauded the guitarist at the concert, and the band cheered for him very loudly.
Did Chris applaud the guitarist?

8. Matt replaced the actor on purpose, and the actress quit the movie after the fight.
Did the actress replace the actor?

9. Diane hugged her boyfriend at the parking lot, and her friend felt uncomfortable watching them.
Did Diane's friend feel uncomfortable?

10. Janet dressed her baby in the room, and her son got his clothes from the dresser.
Did Janet dress her baby?

11. Joe entertained the children in the backyard, and their parents drank wine at the party.
Did Joe drink wine?

12. Tony cheered for the model very loudly, and the designer took a bow after the show.
Did the designer bow?

13. Becky praised the girl for the test, and her family was proud of her good grades.
Was the girl's family proud of her grades?

14. Bobby yelled at the teacher during class, and the principal asked his parents for a meeting.
Did the principal yell at the teacher?

15. Laura could not find Bill at the party, and his girlfriend became nervous and upset.
Did Laura find Bill?

16. Jason complained about the waiter at the restaurant, and the chef gave him a free dessert.
Did Jason complain about the meal?

17. Emily greeted Paul at the door, and her family waved to him from the upstairs.
Did Emily’s family wave to Paul?

18. George arrested the burglar at the bar, and his brother phoned a lawyer for help.
Was the burglar arrested?

19. Sam hired the plumber last week, and the carpenter ordered the materials for the house.
Did the plumber order the materials?

20. Tricia yelled at the cameraman quite suddenly, and the director hurried out of the room.
Did the cameraman hurry out of the room?

21. Nick criticized the journalist at the lunch meeting, and his friend called the newspaper to complain.
Did Nick’s friend call the newspaper?

22. Ryan shot the jeweler at the shop, and the salesman reported the crime to the police.
Did salesman shot the jeweler?

23. Lisa talked to the reporter on the street, and the photographer took pictures of the scene.
Did the photographer take pictures?

24. Charles identified the man and his wife ran away from the police station almost immediately.
Did Charles run away from the police station?

25. Robert met the friend he phoned yesterday, and chatted with his friend for an hour.
Did Robert call his friend?

26. David caught the fish he will cook tomorrow, but it is not his favorite kind.
Will David cook the fish?

27. Jeff planned the party he will hold next month, but he hasn't sent invitations to people.
Has Jeff sent the invitations?

28. Joseph brewed the beer he will serve next week, but it is not very tasty.
Will Joseph serve the beer?

29. Dan wrote the speech he will deliver next month, but he hasn't practiced it yet.
Has Dan practiced the speech?

30. Jane prepared the lecture she will give next week, but still needs to review it.
Will Jane give the lecture?

31. Susan bought the wine she will drink next week, but she didn't buy any cheese.
Did Susan buy any cheese?

32. Jim painted the picture he will display next month, but he isn't happy with it.
Did Jim paint the picture?

PV Multiple Choice Test Items

Please read each sentence and choose the definition for the phrasal verbs (underlined) that you think best fits the sentence.

1. I ran over a rabbit on the way home.
   (1) To explain quickly
   (2) To exceed a time limit
   (3) To hit with a vehicle
   (4) To read through

2. She couldn't work out the source of the leak.
   (1) To end nicely
   (2) To refuse
   (3) To happen
   (4) To find the answer or solution

3. She cut him off before he said something he would regret later.
   (1) To interrupt
   (2) To make accessible
   (3) To criticize something/someone
   (4) To remove something by cutting it with a knife or a sharp tool

4. He turned down the chance to return to his country.
   (1) To fold
   (2) To reduce volume, temperature, etc.
   (3) To reject or refuse an offer, invitation, etc.
   (4) To turn face downward

5. He offered to kick ten percent back if I switched to his company.
   (1) To pay someone as part of the price
   (2) To cause trouble or pain
   (3) To spend time relaxing
   (4) To hit something/someone forcefully

6. If you cancel now, you'll mess up all my arrangements.
   (1) To succeed
   (2) To make something clean
   (3) To collect something
   (4) To spoil something or to do something very badly

7. As she rang up the groceries, he leaned over and asked if he could see her later.
   (1) To cause mental or emotional problems
   (2) To criticize someone/something
   (3) To accomplish something
   (4) To record the cost of an item on a cash register

8. The store clerk ran down the lady who forgot her change.
   (1) To chase and catch someone/something
   (2) To spend time aimlessly
   (3) To lose energy (power) or stop working
   (4) To criticize somebody/something in an unkind way

9. No one believed he would pull off the deal.
   (1) To leave the road in order to stop for a short time
   (2) To manage to do something difficult or tricky
   (3) To hit a pedestrian with a vehicle
   (4) To visit a place

10. Fill the withdrawal slip out and gave it to the bank teller.
   (1) To become smaller
   (2) To make something empty
   (3) To complete a document, form, etc.
   (4) To remove something

11. She brushed off offers of help from her friends.
   (1) To clean something quickly
   (2) To improve a skill quickly
   (3) To touch lightly in passing
   (4) To refuse to listen to somebody/something

12. The management locked the staff out because they turned down the contract.
   (1) To release something/someone
   (2) To accidentally leave the keys inside a car
   (3) To protect something/someone
   (4) To close a workplace to stop workers from entering

13. Another band has ripped off our song.
   (1) To obtain money unfairly
   (2) To discuss something
   (3) To steal something
   (4) To tear something forcefully

14. We have no time to fix up a meeting.
   (1) To arrange or organize something
   (2) To punish someone
   (3) To understand someone/something
   (4) To attach something

15. Walter ran up a bar bill at the hotel.
    (1) To move quickly
    (2) To spend a lot of money
    (3) To meet or find accidently
    (4) To find the source of something

16. Don't pass up an offer like that.
    (1) To distribute
    (2) To get information
    (3) To decline a chance
    (4) To convince someone of something

17. She poured out her story as she was having a cup of coffee.
    (1) To scorn someone
    (2) To rain heavily
    (3) To move together in large numbers
    (4) To express feelings one has kept hidden for some time

18. His decision bailed out the auto industry.
    (1) To remove water from something that is flooded
    (2) To jump out of something because it is going to crash
    (3) To save or rescue
    (4) To escape

19. When you blow up this photo of the car, you can see the license plate number.
    (1) To enlarge
    (2) To explode
    (3) To burn
    (4) To become angry

20. His original speech was boiled down into a ten-minute presentation.
    (1) To reduce the quantity of by boiling off liquid
    (2) To be unable to repress anger, excitement, etc.
    (3) To simplify or reduce to the essentials
    (4) To make something confused

21. The director drew out the interview to over an hour.
    (1) To make a shy person more outgoing
    (2) To take money out of a bank account
    (3) To cause to take part or enter
    (4) To make something continue longer than needed

22. He'd like more time to think things over.
    (1) To challenge someone/something
    (2) To encourage someone
    (3) To make something difficult
    (4) To consider something carefully

23. He spent the weekend chewing over the problem.
    (1) To create or invent something
    (2) To eat something
    (3) To think about an issue
    (4) To scold harshly

24. She wandered the streets, drinking in the atmosphere.
    (1) To drink something
    (2) To look at or experience something
    (3) To finish a drink
    (4) To make a monthly payment

25.I called up my friend as soon as I got to a phone to tell her the news.
    (1) To cry out in a loud voice
    (2) To cause a person to lose control
    (3) To make a phone call to a person or a place
    (4) To officially ask somebody for military service

26. She typed up her lecture notes and printed them out.
    (1) To bend or fold something
    (2) To listen to a lecture
    (3) To make a handwritten document
    (4) To type a finished version of a text on a computer

27. They closed up the building after everyone had left.
    (1) To join together
    (2) To move closer together
    (3) To completely close something
    (4) To deliver

28. I asked him not to throw out the Sunday newspaper.
    (1) To discard
    (2) To collect
    (3) To receive
    (4) To purchase

29. He rolled up his sleeves and started washing the dishes.
    (1) To appear in large numbers for an event
    (2) To arrive somewhere without giving advance warning
    (3) To gain an advantage against a group of enemy soldiers, etc.
    (4) To turn the end of a piece of something over and over to make it shorter

30. She took out a key from her pocket.
    (1) To destroy something
    (2) To invite somebody
    (3) To remove something from somewhere
    (4) To borrow money from a bank

31. You've knocked my drink over!
    (1) To rob a bank or other business
    (2) To learn something
    (3) To knock on a door
    (4) To push or hit something, making it fall or turn on its side

32. I gave back the money that she lent to me.
    (1) To earn money
    (2) To steal something from someone
    (3) To return something you've borrowed
    (4) To buy something with money

33. You should carry on your laptop computer when boarding the plane.
    (1) To continue
    (2) To manage or conduct
    (3) To perform a task
    (4) To carry something along

34. Ali is so sleepy in class that the teacher must wake him up every five minutes.
    (1) To become annoyed
    (2) To become happy
    (3) To make somebody stop sleeping
    (4) To make someone feel embarrassed

35. Can you find out what time the meeting starts?
    (1) To discuss something
    (2) To do something unpleasant
    (3) To discover something
    (4) To go somewhere

36. We paid off our mortgage after fifteen years.
    (1) To bribe
    (2) To pay a debt in full
    (3) To decide
    (4) To result in success or failure

37. They hid away the money in secret bank accounts.
    (1) To go somewhere to live alone
    (2) To make a note of something
    (3) To conceal something
    (4) To run a business

38. Eat up your broccoli. It's good for you.
    (1) To eat the things you like
    (2) To eat only vegetables
    (3) To eat healthy food
    (4) To eat all the food you have been given

39. We finished off the coffee and had to get some more.
    (1) To kill someone
    (2) To burn something
    (3) To consume all of something
    (4) To make somebody unhappy

40. She flipped over the bacon and fried it for another 3 minutes.
    (1) To pass on
    (2) To heat something
    (3) To make something
    (4) To turn something over onto the other side

41. Peter wrote up the report that was due today and submitted it.
    (1) To make a complete written version
    (2) To make an announcement
    (3) To give a presentation
    (4) To make an excessive valuation of something

42. They started up a new company and made a lot of money.
    (1) To make money
    (2) To invest money
    (3) To open a business
    (4) To finish something

43. I can't wait to open up my presents.
    (1) To start to talk freely about something
    (2) To expand a business
    (3) To cancel something
    (4) To unwrap or open something

44. You should cut down that dead tree before it falls on your house.
    (1) To consume less
    (2) To increase
    (3) To reduce a vertical thing to ground level by cutting it
    (4) To shoot somebody

45. She dressed up her children, and then they went to a birthday party.
    (1) To entertain someone
    (2) To put clothing on someone
    (3) To make someone wait
    (4) To annoy someone

46. He brought his daughter over to the zoo.
    (1) To earn something
    (2) To release or publish
    (3) To succeed with something difficult
    (4) To take or bring something/somebody to a particular place

47. You can try it out for 30 days without any obligation.
    (1) To compete for a place in a sports team, a part in a play, etc.
    (2) To test something to see how good or useful it is
    (3) To argue for something
    (4) To put much effort into something

48. At the end of the presentation, I packed up my laptop.
    (1) To stop doing something
    (2) To finish work
    (3) To put belongings into bags before leaving a place
    (4) To repair something

49. She showed up the girls by beating them in the beauty contest.
    (1) To attend something or arrive somewhere
    (2) To make someone feel embarrassed or ashamed
    (3) To find something/someone
    (4) To behave appropriately

50. People are going to bring up lots of different issues to try to connect the dots.
    (1) To charge excessively
    (2) To be officially charged with a crime
    (3) To calculate something
    (4) To mention

51. He set his glass down before he spoke.
    (1) To add something
    (2) To remove something
    (3) To place an object down on a surface
    (4) To explain something

52. She picked up Spanish in six months.
    (1) To learn quickly
    (2) To collect something
    (3) To obtain or buy something
    (4) To take hold of and lift somebody/something

53. He called them out over awarding the prize to their family members.
    (1) To become apparent
    (2) To offer help
    (3) To accuse someone of wrongdoing
    (4) To visit someone/somewhere

54. I was so mad at Bob that I told him off.
    (1) To entertain someone
    (2) To scold someone
    (3) To praise someone
    (4) To do something illegally

55. The protesters passed out leaflets to the growing crowd.
    (1) To write something
    (2) To die
    (3) To imitate
    (4) To give something to each person in a group

56. After you use something up, be sure to write it on the grocery list.
    (1) To finish or consume all of something
    (2) To wear something
    (3) To buy something
    (4) To pull something

57. Can you drop me off at the train station on your way to work?
    (1) To pay a brief visit
    (2) To fall asleep
    (3) To decrease in number or amount
    (4) To take something/someone to a place and leave it/them there

58. I picked up my coat from the cleaners.
    (1) To become better or to improve
    (2) To describe something
    (3) To learn something quickly
    (4) To collect something

59. They broke in and ripped off five computers last night.
    (1) To tear something forcefully
    (2) To steal something
    (3) To charge excessively
    (4) To describe something

60. He turned over the terrorist to the FBI.
    (1) To run steadily at a low speed
    (2) To protect someone/something
    (3) To deliver somebody/something
    (4) To think about something carefully

61. The government is trying to play down its involvement in the affair.
    (1) To play a game
    (2) To exploit a weakness
    (3) To minimize the importance of
    (4) To cooperate or concur

62. He managed to pass off the rocks as gold.
    (1) To come to a gradual end
    (2) To reserve a place
    (3) To set aside or disregard
    (4) To give a false character or identity to something/someone

63. Some crazy guy tried to cut me off on the way to work.
    (1) To block or get in the way of something, etc.
    (2) To separate somebody/something socially from other people
    (3) To call somebody
    (4) To remove something by cutting it with a knife or a sharp tool

64. I checked out three books from the library.
    (1) To leave a hotel, a hospital, etc. where you have been staying
    (2) To publish something
    (3) To visit somewhere
    (4) To borrow something from somewhere

65. She turned in her paper last night.
    (1) To go to bed
    (2) To hand in or submit
    (3) To fold something
    (4) To achieve a good result, performance, profit, etc.

66. The criminal tried to pick off the police officer.
    (1) To create something with a tool
    (2) To correct someone
    (3) To shoot a person, an animal, etc.
    (4) To choose something quickly

67. I asked my mom to take my skirt up so I can wear it to the party next week.
    (1) To make clothes shorter
    (2) To fill or occupy time or space
    (3) To start a new hobby, pastime, etc.
    (4) To remove

68. Max worked over Sam and then robbed him.
    (1) To repeat or do again
    (2) To request help
    (3) To beat someone
    (4) To solve a problem

69. He wanted to show off his new car.
    (1) To behave professionally
    (2) To display something you are proud of
    (3) To buy something
    (4) To take someone to a certain place

70. He broke down his plan for us so we understood it a little better.
    (1) To stop working properly
    (2) To analyze in detail
    (3) To make something fall down
    (4) To make something confusing

71. He wore out two pairs of shoes last year.
    (1) To make somebody happy
    (2) To make something look good
    (3) To make something become thin or no longer able to be used
    (4) To become refreshed

72. Ted called and asked Rachel out.
    (1) To evaluate someone
    (2) To explain something quickly
    (3) To provoke a negative reaction
    (4) To invite somebody on a date

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