Age-Related Effects on Syntactic Ambiguity Resolution in First and Second Languages: Evidence from Korean-English Bilinguals[1]

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1. Introduction

One of the major questions that have intrigued researchers of language processing is the universality of language processor—are sentence processing operations universal or language-specific? Recent work on sentence processing of relative clause (RC) attachment preferences (e.g., *Someone shot the servant of the actress who was on the balcony*) has revealed clear cross-linguistic variation as well as differences in parsing in bilinguals and monolinguals (e.g., Cuetos & Mitchell, 1988; Dussias, 2003; Fernandez, 1999; Papadopoulou & Clahsen, 2003). These cross-linguistic parsing variations constitute primary evidence that some, if not all, aspects of parsing need to be learned. This poses additional problems for language learners because they not only have to acquire the representational knowledge of the target language but also the native-like ways to process sentences. One of the major issues dealt with in research on bilingual language acquisition is the question of language separation. A related question can be asked here; can bilinguals acquire distinct sentence processing strategies when their languages show parsing variations?

Other related questions that naturally follow from the previous issues are the variables associated with the development of sentence processor. Similarly to first and second language acquisition studies, it seems reasonable to expect the effect of language-specific properties and learner-based variables in the due process. One variable of such interest is the age at which a bilingual has been exposed to the target language. In other words, would there be age-related effects on the development of language processor as on grammatical acquisition? Nevertheless, there is little data on the relationship of this variable to RC attachment. In addition, any conclusion concerning bilingual processing based solely on speakers of Western languages seems incomplete, calling for experiments designed to reveal the relationship between sentence processing and linguistic development in second language with users of non-Western languages (Juffs, 2001).

With these questions in mind, the present studies examine the aspect of sentence processing—the RC attachment ambiguity resolution—comparing monolinguals and bilingual speakers of Korean and English, and addresses the question of how and to what extent the two languages are kept separate in terms of sentence processing and what role the age of language acquisition have on the development of parsing routines.

2. Cross-linguistic Differences in Sentence Processing: The Relative Clause Attachment Ambiguity

For many years, researchers from various disciplines have tried to find some of the factors that influence readers' comprehension when they are faced with several possible interpretations of a sentence, and to answer the question of whether any universal account can be postulated for this process across languages. In short, readers and listeners appear to prefer a simple analysis to a more complex one. One of the universally observed principles in line of the parser's preference of the

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computationally simpler analysis is Late Closure (Frazier & Clifton, 1996, 1997) or Recency (Gibson, Pearlmutter, Canseco-Gonzalez, & Hickock, 1996). This locality-based principle prefers to attach the incoming input inside the phrase that the parser is currently working on. For instance, the effect of this principle can be observed in a sentence below, for it has been observed that the parser prefers the analysis given in (1a) to the one in (1b) across languages. That is, given the ambiguity, the parser prefers to associate *yesterday* with the verb in the sentential complement clause, meaning *Mary died yesterday*, than to associate it with the main verb—i.e., *John told us yesterday.*

(1) a. $_{S1}$ [John told us $_{S2}$ [that Mary died yesterday]]
     b. $_{S1}$ [John told us $_{S2}$ [that Mary died] yesterday]

This choice is derived by cognitive reasons, namely the restrictions on short-term memory. Given that this principle is based on cognitive needs and is not tied to any language-specific aspect, it is expected to be universal.

However, evidence of cross-linguistic variation in the way that people observe such locality-based principles has been found in several studies, which can seriously undermine the universalist stance regarding the human sentence processing (e.g.; Carreiras & Clifton, 1999; Cuetos & Mitchell, 1988; Igoa et al., 1998; Mitchell & Cuetos, 1991). These researchers have shown that there is a clear cross-linguistic variation in processing strategies employed in the resolution of a RC attachment ambiguity—i.e., the complex NP (NP-*of*-NP) followed by a relative clause as shown in (2).

(2) Someone shot the <u>servant</u> of the <u>actress</u> <u>who was on the balcony</u>.
                    NP1   NP2   RC
                 (high NP)   (low NP)

This sentence is ambiguous because the RC—i.e., *who was on the balcony*—can modify either *the servant* (NP1 or high NP) or *the actress* (NP2 or low NP)[2]. In their seminal study of cross-linguistic parsing variations, Cuetos and Mitchell (1988) found that English speakers in general showed a weak tendency to attach the relative clause (*who was on the balcony*) to the NP2 (*the actress*) or no real attachment preference, whereas Spanish speakers strongly preferred to attach the same adjunct in the same structure to the NP1 (*the servant*).

These cross-linguistic parsing variations have been replicated in a number of off- and on-line studies testing both monolingual and bilingual speakers of English and Spanish (e.g., Carreiras & Clifton, 1999; De Vincenzi & Job, 1993; Dussias, 2003; Fernandez, 1995, 1998; Mitchell & Cuetos, 1991). In light of these results, it has been contended that such findings showing language specificity provides evidence against the universal operation of locality-based parsing strategies, such as Late Closure, as has been claimed by Frazier (1987). Ever since then, this structure has been used in various languages as a stringent test on the current parsing models.

Although the findings are not unequivocal, preference of an attachment to NP1 or high NP—high attachment (HA) preferences—as the ultimate attachment decision in general have been found in comparable constructions in Dutch (Brysbaert & Mitchell, 1996, 2000; Mitchell & Brysbaert, 1998), French (Pynte, 1998; Pynte & Colonna, 2000, but see Baccino, De Vincenzi & Job, 2000), German (Hemforth, Konieczny & Scheepers, 2000a, b; Hemforth, Konieczny, Scheepers & Strube, 1998; Hemforth, Konieczny, Seelig & Walter, 2000; Konieczny & Hemforth, 2000), Greek (Papadopoulou & Clahsen, 2003), Italian (Frenck-Mestre & Pynte, 2000, but see De Vincenzi & Job, 1993), and Japanese (Kamide & Mitchell, 1997, but see Kamide, 1998), whereas low attachment (LA) was preferred as the ultimate attachment decision in Basque (Ziardegi, Carreiras, & Laka, 2004), Brazilian Portuguese (Miyamoto, 1998), English (e.g., Carreiras & Clifton, 1999; Cuetos & Mitchell, 1988), and Norwegian, Romanian, and Swedish (Ehrlich, Fernandez, Fodor, Stenshoel, & Vinereanu, 1999).

The accumulative evidence from various language studies so far has questioned the idea that purely syntactic factors are sole determinants in making decisions on these structural relations. This renders highly implausible any syntactically determined universal account of RC attachment that

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[2] The term "high" and "low" here refers to the position of NP in the phrase marker of the complex NP.

cannot provide an adequate account of individual variations within and across languages. Consequently, these various cross-linguistic findings have motivated several authors to propose alternative hypotheses about parsing strategies besides a parsing model that exclusively relies on structural principles for the guidance in human sentence processing. Most parsing models assume that the parsing apparatus is innate and universal, but they differ from one another in that some consider the parsing tendencies, such as a locality preference, universal although to a differing degree, while others consider them entirely tuned by language experience. In this paper, the selected parsing models that bear relevance to the resolution of RC ambiguity are categorized into the following two—i.e., Universal vs. Experience-based Accounts—as presented below.

(3) a. Universal Account
     i)   The Construal Hypothesis (e.g., Frazier & Clifton, 1996, 1997)
     ii)   The Implicit Prosody Hypothesis (IPH) (e.g., Fodor, 1998, 2002)
     iii) The Dual System with Anaphoric Binding and Syntactic Attachment (e.g., Hemforth, Konieczny & Scheepers, 2000a, b)
     iv)   The Recency-Predicate Proximity Model (e.g., Gibson et al., 1996)
   b. Experience-based Account
     i)   The Tuning Hypothesis (e.g., Cuetos, Mitchell & Corely, 1996)

The first three parsing models under the Universal Account have argued that the observed cross-linguistic differences lie outside the parser and that they are rather reflections of language-specific aspects of grammar, such as the prosody under the IPH, the consistency in using an overt relative pronoun in relative clause constructions under the Dual System, and the availability of a syntactic alternative to express the genitive relationship under the Construal Hypothesis. On the other hand, the Recency-Predicate Proximity Model assumes that the parser obeys structural principles but that the weight of these principles in relation to each other varies across languages. Lastly, the Tuning Hypothesis under the Experience-based Account agrees that the parsing algorithm may be universal. Nevertheless, they have argued that some syntactic processing strategies are language-specific and must be learned through the experience with the target language. Under the Tuning Hypothesis, the parser favors the analysis that has worked most frequently in the past, and the attachment preferences in this case are determined based on the previous experience with similar structures.

To summarize, no single syntactic strategy can account for all the empirical data obtained to date. Although the evidence does not completely exclude the universal operations of the parser, a general human sentence processing model should be able to entertain the effect of language experiences on the development of parsing routines, which has been most apparent in bilingual processing studies. The parsing models under the Universal Account have been proposed mainly to explain the cross-linguistic variations in monolingual speakers. Therefore, it is difficult for them to account for the observed differences in monolingual and bilingual speakers of the same language. As a competitor to the Universal Account, exposure-based contenders seek more evidence showing that people are different in their parsing strategies depending on their past experience with the pertinent structures in their general use of language. Research on bilingual sentence processing is an excellent candidate to find such findings, which shall be reviewed briefly in the following section.

3. Resolving RC Attachment Ambiguity in Bilingual Processing

The observed cross-linguistic parsing variations in question appear to be prima facie evidence for learning, which makes sentence processing research all the more important for a better understanding of language acquisition. For if the native-like parsing routines in a given language must be acquired through experiences with that language, it also needs to be investigated whether second language (L2) learners, including bilinguals with ultimate L2 proficiency, have successfully acquired such language-specific parsing strategies and indeed use them in processing their L2. Native language effects in the processing strategies of bilinguals raise crucial questions for researchers, not the least of which is whether ultimate attainment is even a possible goal in second language acquisition. If efficient parsing strategies or routines need to be learned in tune with language-specific characteristics, this may have

crucial consequences for learnability problems, and the failure to learn and use the right processing routines for the target language may result in what Fernandez (1999) calls a sub-optimal grammar in a non-native language.

Consequently, a considerable body of research has focused on the interaction between the bilingual's first language (L1) and L2. Especially, questions have been raised as to whether bilinguals are influenced by the strategies developed in their L1 when analyzing sentences in the L2, or whether they use distinct strategies for processing sentences in their two languages. Given that cross-linguistic variations exist, one might expect four possible types of the manner in which bilingual speakers process their languages when their languages show different parsing preferences with respect to the RC attachment ambiguity, as presented in Table 1 below.

Table 1. Four Possible Types of Bilingual Processing

Type	Characteristic (examples of empirical studies)
Differentiation	Distinct strategies in processing L1 and L2
L1 Transfer	L1 strategy in processing L1 and L2 (e.g., Fernandez, 1998; Frenck-Mestre, 2002)
L2 Transfer	L2 strategy in processing L1 and L2 (e.g., Dussias, 2003)
Amalgamation	Identical but neither L1- or L2-based strategies in processing L1 and L2 (cf. Felser, Roberts, Marinis, & Gross, 2003; Papadopoulou & Clahsen, 2003)

The first type is the case of differentiation in which bilingual speakers process their languages like monolingual speakers of each language do. The second and third types are the cases of transfer where bilinguals transfer their L1-based strategies in processing both L1 and L2, or vice versa. The fourth possibility is the case of amalgamation where bilinguals use a blend of L1- and L2-based parsing strategies in processing both L1 and L2. Therefore, except for the first possible type, i.e., differentiation, bilinguals use identical strategies in L1 and L2 processing, be they L1-based, L2-based, or neither. To date, all but the first type of bilingual processing have been observed in the empirical studies. Such patterns of results observed with bilinguals in studies of L2 sentence processing show the effect of differences in individual language experiences on the RC attachment differences. This suggests that there may exist not only a quantitative difference between L2 processing and L1 processing but also a qualitative difference.

4. Study I
4.1. Research Questions

The present study extends this line of inquiry with monolingual and bilingual speakers of Korean, and compares first and second language processing in monolingual and bilingual speakers of Korean and English in the resolution of RC attachment ambiguities. This study was designed to replicate the cross-linguistic and individual variations previously observed in monolingual and bilingual processing, and to investigate the extent to which the age of the onset of L2 acquisition (AOA) affects the parsing decisions in Korean-English bilingual speakers. The aim of the present study is thus to address the following questions:

    a.   Are there parsing differences between Korean and English monolinguals in the RC ambiguity resolution?
    b.   Do bilingual speakers of Korean and English parse similarly to monolingual speakers of these languages in the RC ambiguity resolution?
    c.   Does AOA have an effect on parsing? (with AOA operationalized here as the age of arrival in the country of the target language)

The sentence below in (4) illustrates the Korean equivalent of a constituent structure in question, i.e., the one with a complex NP and a relative clause.

(4) [Palkhoni-ey iss-nun] yepaywu-uy   kay-lul   nwukwunka   chong-ulo   ssw-ass-ta.
    balcony-loc be-rel   <u>actress</u>-pos   <u>dog</u>-acc   someone   gun-instrument   shoot-past
        [RC]   NP2[3]   NP1
    (= Somebody shot the dog of the actress that was on the balcony)

Korean is a head-final language with its canonical word order being SOV. It has case markers or postpositions rather than prepositions, indicating the relationship between noun phrases as shown in (4). Additionally, an empty category may appear at any argument position in Korean. With regard to the relative clause construction, an adnominal suffix at the end of a clause (e.g., *nun*) indicates the embedded clause, such as a complement or relative clause, and a modifier comes before the modified element. Thus, Korean presents a relative clause and nouns in an order opposite to that of head-initial languages like English as in the example shown above. In linear terms (i.e., in terms of the number of intervening words), however, NP2 is still the closest site to the RC and consequently should be favored by locality more than NP1.

Based on the previous findings from cross-linguistic and bilingual studies, it is predicted that English monolingual speakers will show low attachment (LA) preference in resolution of relative clause attachment ambiguity. On the other hand, the parsing preference for Korean monolingual speakers is expected to be toward high attachment (HA), based on the results of studies with Japanese monolinguals (Fernandez & Hirose, 1997; Kamide & Mitchell, 1997; Miyamoto, Gibson, Pearlmutter, Aikawa, & Miyagawa, 1999), since the sentence orders in Korean and Japanese are almost identical. According to the Universal Accounts, bilinguals are not expected to be different regarding their parsing preference from monolinguals when processing in each language, as it is the language of the input that determines the attachment preference under the universal parsing models. In other words, Korean-English bilinguals should exercise different parsing routines in processing Korean and English sentences. Furthermore, all the bilingual groups regardless of their age of arrival in the U.S. should show the same attachment preference as monolingual speakers depending on which language they are currently processing.

However, if it is the linguistic experience of individuals that determines the parsing routines as argued by the Experience-based Account, bilinguals should show parsing strategies different from those of monolinguals. Moreover, each bilingual group might exhibit parsing behaviors different to some extent from one another, since their linguistic experience is expected to differ from one another, resulting from the difference in the length and the nature of exposure to L2 that is correlated with the age of L2 acquisition.

4.2. Participant

There were three groups of participants: monolingual native speakers of Korean (n=21) and English (n=15), and bilingual speakers of Korean and English (n=41). The bilingual participants were subdivided into the following three: early bilinguals whose AOA ranged from birth to seven years; late bilinguals whose AOA ranged from eight to twelve; and very late bilinguals who were very late bilinguals studying in a Ph D program at a university in the U.S. and their length of U.S. residence was at least 5 years. The last bilingual group was included in this study to see whether Korean-English bilinguals with advanced L2 proficiency and relatively lengthy L2 exposure can learn to parse like monolingual native speakers of the target language, despite the very late exposure to L2. The composition of the bilingual participants is shown in Table 2 below.

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[3] For the sake of convenience, I will refer to the NP that is closer to a RC as NP2, and the NP that is closer to a main predicate as NP1, for both English and Korean sentences.

Table 2. Group of Participants

Group	Number of Participants	AOA	Mean Age of Group	Mean Length of U.S. Residence (year)
Early K-E bilingual	12	0 ≤AOA ≤ 7	1.89	19.53
Late K-E bilingual	11	8 ≤AOA ≤ 12	10.91	10
Very late K-E bilingual	18	22 ≤AOA ≤ 33	25.63	6.86

Prior to their participation in the survey, all subjects completed a language-background questionnaire including the items regarding self-rated proficiency and language use in each of the subjects' two languages. According to the reports in the language-background questionnaire, most early Korean-English bilinguals in the present study felt that they spoke (11 out of 13), read (13 out of 13), understood (12 out of 13) and wrote (13 out of 13) better in English in general, and considered English, not Korean, as their native language. Nonetheless, most of them (10 out of 13) reported that they spoke both English and Korean on a regular basis (e.g., at home, at school, with friends, etc.). Moreover, parents of most early bilinguals (9 out of 13) always or frequently spoke Korean to them at home, and all these early bilinguals used both languages (10 out of 13) or Korean (3 out of 13) at home. As for the late bilinguals, about half of them felt that they spoke and understood both languages at the same level, and a few of them even felt that they spoke and understood Korean better than English, although about a half of them felt that they could read English better than Korean. Most of the late bilinguals felt that they wrote better in English, and all of them considered English as their second language. The parents of the late bilinguals always talked to them in Korean. More than half of the late bilinguals always spoke Korean at home, while the rest reported they used both languages at home. Most importantly, all of the late bilinguals reported that they spoke Korean on a regular basis (e.g., at school, with friends at church, etc.).

4.3. Material

The off-line experimental protocol consisted of an English version and a Korean version of a questionnaire. Each questionnaire included 48 items with 16 ambiguous target sentences, as shown in (5) and (6), and 32 fillers. All items were followed by comprehension questions asking about the content of the given sentence. Fillers were used to prevent the participants from figuring out the intention of this research. The words that comprised the sentences were carefully chosen among the basic-level words that are commonly used in everyday life so that the sentences could be readily understood. Specially, the verbs or adjectives that were included in the relative clauses were carefully chosen to ensure that all were basic and commonly used words, in order to control any potential confounding effect of the frequency or the difficulty of the word.

(5) Example from English target sentences
Someone shot the dog of the actress who was on the balcony.

Q. _____ was on the balcony.
Dog _____   Actress____

(6) Example from Korean target sentences
Palkhoni-ey iss-nun yepaywu-uy kay-lul   nwukwunka   chong-ulo   ssw-ass-ta.
balcony-loc be-rel actress-pos dog-acc someone gun-instrument shoot-past
(= Somebody shot the dog of the actress that was on the balcony)

Q. _____i/ka palkhoni-ey   iss-ess-ta. (= ____ was on the balcony)
Kay (=Dog)____   Yepaywu (=Actress)_____

To test the question of language dependency (i.e., whether language determines the type of processing strategy used in sentence processing) as accurately as possible, the target sentences in the Korean version of the questionnaire were made similar to those in the English version except for one sentence in which word-to-word translation was not possible. All the target sentences in both Korean and English questionnaires were followed by a fill-in-blank type of questions as shown in (5) and (6). Two orders in presenting options for answers were used to counterbalance for potential biasing effects. In one order, the two potential heads for the relative clause were probed in the same order as they appeared in the test sentence, or the question was followed by two statements that corresponded to the alternative attachments starting with the non-local attachment. In the other order, the alternative heads were presented in the reverse order. Finally, to help control for the presentation order effect in the questionnaire items, 15 versions of the Korean questionnaire with different presentation orders were made and distributed to the participants in each language survey. The same was done with the English version of the questionnaire.

4.4. Procedure

Prior to the questionnaire task, all participants, including monolinguals, filled out a language background questionnaire that contained questions regarding the amount of language use and the self-rated proficiency in each of the participants' two languages. In order to test language dependency in bilingual processing, the bilingual subjects were tested on their parsing preference in relation to relative clause attachment ambiguity in both Korean and English. The two off-line tasks for bilinguals were administered at least two weeks apart. Monolinguals were tested in their respective native language. The order of administration was counterbalanced, so approximately a half of the subjects in each bilingual group received the Korean version first and received the English version two weeks later. The other half of each bilingual group received the questionnaires in the reverse order. In each version of the questionnaire, the participants were instructed to read the sentences at their normal speed of reading and answer the question that followed each sentence by placing a check in the blank next to the best answer based on their first interpretation of the sentences.

4.5. Results

Figure 1 provides the percentage of the participants in each group who preferred HA in the Korean and English questionnaires. That is, the higher the percentage, the more the participants preferred HA analyses.
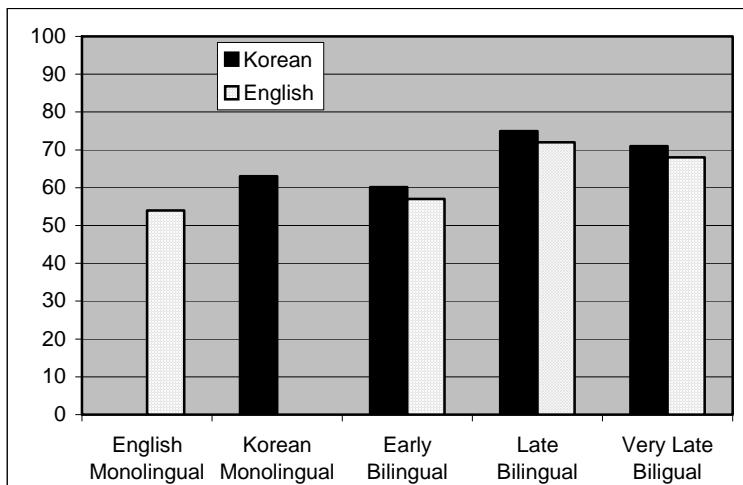
Figure 1. Percentage of High Attachment (HA) Preference for Groups Tested in Korean and English (Study I)

The results showed that Korean monolinguals, who showed HA preference in the resolution of a RC attachment ambiguity, differed significantly from English monolinguals that showed very weak LA preference or no preference in the said ambiguity resolution. In processing Korean, all four groups— i.e., Korean monolinguals and three bilingual groups—preferred HA analyses, with the late bilinguals showing the strongest preference and the early bilinguals the weakest. Nonetheless, the difference among the groups did not reach significance [$F(3, 54) = 2.219$, $p = .096$]. This indicates that all three bilingual groups performed similarly to Korean monolinguals when resolving a RC attachment ambiguity in Korean.

On the other hand, as for the English processing, an omnibus ANOVA was highly significant ($F(3, 50) = 5.791$, $p < 0.003$). Planned comparisons ($\alpha = .05$) indicated that the English monolinguals differed significantly from the late bilinguals and very late bilinguals. The early bilinguals did not differ significantly from the English monolinguals. These findings differ from the previous findings on Spanish-English bilingual processing reported in Fernandez (1998) and Dussias (2003). In both studies, attachment preferences for English monolinguals and early bilinguals differed significantly from each other, while in the present study, the performance by the early bilingual group was not significantly different from that of the English monolinguals.

Furthermore, the results of a mixed 2 x 3 ANOVA showed no main effect of language ([$F(1, 29) < 1$]). In other words, all three bilingual groups used identical processing strategies in processing L1 and L2. Although there was no interaction of language and type of bilinguals, the main effect of bilingual type was found ([$F(2, 29) = 8.29$, $p = .001$]), which indicated that early bilinguals differed from late and very late bilingual groups. Late and very late bilinguals did not differ from each other.

A scattered plot in Figure 2 below shows the relationship between AOA and the number of target sentences with HA preference in English monolinguals and Korean-English bilinguals in English processing. Both English monolinguals and early bilinguals showed individual variations in the RC attachment preference. Nevertheless, a regression line indicates that the later a bilingual arrived in the L2-speaking environment, the stronger his/her HA preference was in processing L2 or English, which would be the case of L1 transfer in L2 processing.
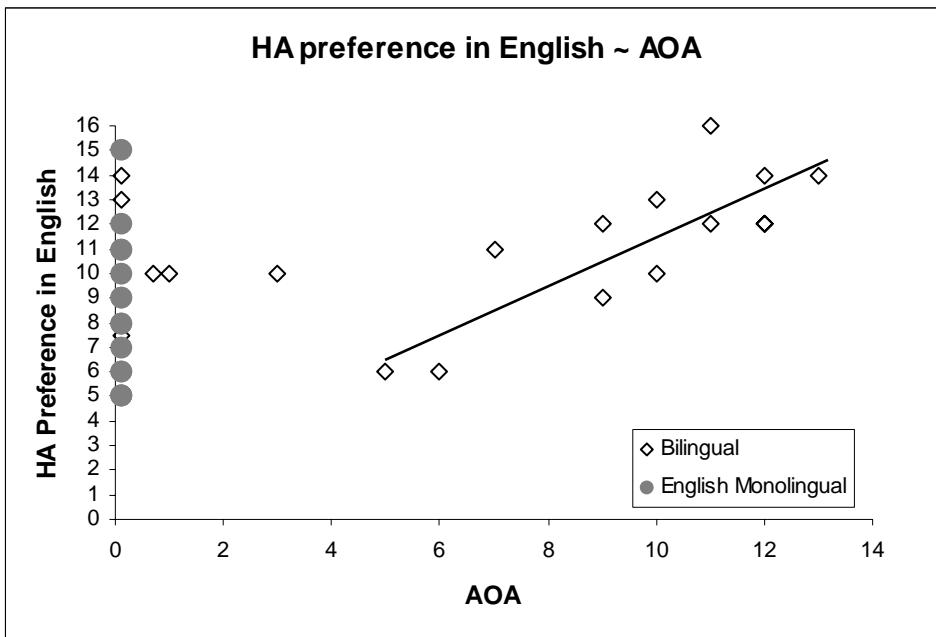
Figure 2. Monolingual and Bilingual HA Preference in English Processing with respect to AOA

However, since the bilinguals' proficiency in the two languages was not measured independently, it is possible that the proficiency variable may be modulating the attachment preference found in the

present study as a confounding factor. Therefore, the factor of language dominance was computed by calculating the difference between bilinguals' self-rated proficiency in English and Korean, i.e., Language Dominance = Self-rated English Proficiency – Self-rated Korean Proficiency. Namely, the higher the dominance variable was, the more dominant a bilingual participant was in English. Table 3. shows the correlation results of AOA or Language Dominance with HA preference in English and Korean.

Table 3. Correlation between AOA, Language Dominance, and HA preference

Variable / HA preference in	AOA	Language Dominance
Korean (L1)	.37*	-.13
English (L2)	.40*	-.62*

(* : significant at α = .05)

The correlation between AOA and the HA preference percentage showed that AOA could predict parsing preferences in both languages: AOA was significantly correlated with HA preferences both in Korean and English. However, Language Dominance could predict only for English or L2 processing, as it was significantly correlated with attachment preferences only in L2 or English processing, but not in L1 or Korean processing.

5. Preliminary Results from Study II

Preliminary results from a related study that had an independent measure of bilinguals' proficiency, i.e., cloze tests in Korean and English, show similar but slightly different results. In this second study (Study II), there were three participant groups—i.e., English monolinguals (n=26), Korean monolinguals (n=22), and early Korean-English bilinguals (n=16) whose AOA ranged from birth to 8 years. Each questionnaire had 20 target sentences and 40 fillers. The materials and procedure for Study II were very similar to those of the first study presented above (Study I), except for the fact that the materials used in Study II were revised from the sentences used in Study I with the help of a native English speaker, to make them sound more natural and ambiguous.
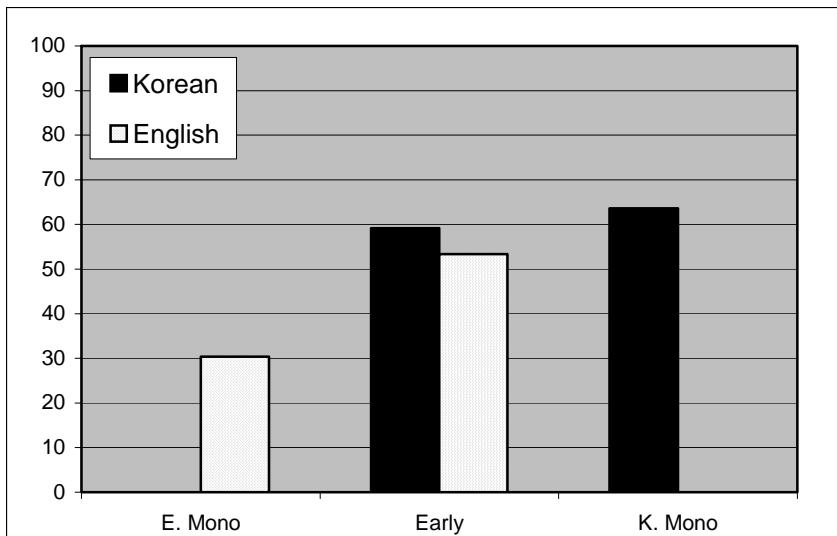
Figure 3. Percentage of High Attachment (HA) Preference for Groups Tested in Korean and English (Study II)

Figure 3 above shows the percentage of HA preference in English and Korean by each participant group. In Study II, English monolinguals showed a strong LA preference and differed significantly from Korean monolinguals who showed HA preference (30.4% for English monolinguals vs. 59.4% for Korean monolinguals). However, this time, early bilinguals differed from English monolinguals in English processing, which is different from what the results in the Study I showed. As for Korean processing, early bilinguals did not differ from Korean monolinguals. Contrary to their parsing behaviors, early bilinguals performed in native-like manners in an English cloze test, but not in a Korean cloze test, as shown in Table 4 below. Such findings suggest that having a native-like grammar does not necessarily entail native-like parsing strategies in one's language system or vice versa, which needs to be investigated further. With regard to the question of language dependency in bilingual processing strategies, early bilinguals in Study II also used identical parsing strategies in processing two different languages, as in Study I.

Table 4. Cloze Test Scores in English and Korean

Cloze test \ Group	English monolingual	Korean monolingual	K-E bilingual
English	38.92/40	NA	38.5/40
Korean	NA	38.83/40	26.88/40

To find out whether the discrepancy in the results between the two studies is due to the participants or the slight change in the materials, a subset analysis was conducted on the thirteen target sentences used in both Study I and II with minimal or no changes. Figure 4 below shows the subset analysis results.
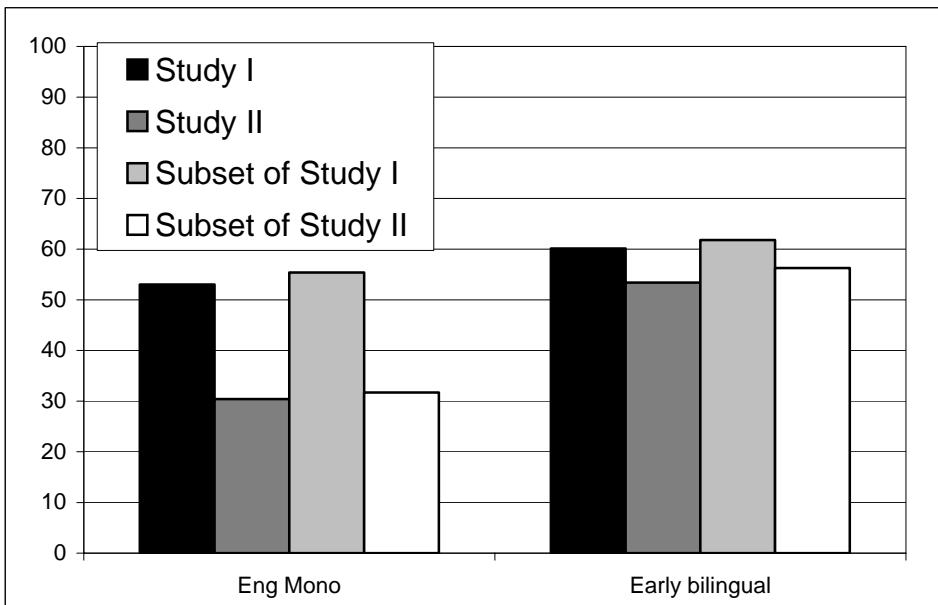
Figure 4. Percentage of HA Preference in English Processing by English Monolinguals and Early Bilinguals from the Subsets and Entire Sets of Study I and II

As clearly shown in Figure 4, the discrepancy was due to the differences in attachment preferences by English monolingual participants. That is, the percentage of HA preference by English monolinguals in Study I was significantly higher than that of the entire set or the subset of the target sentences in Study II. On the other hand, early bilinguals showed similar percentages of HA preference in all four analyses of English processing. Furthermore, comparisons of the subsets from Study I and II that were

almost identical with the same experimental procedures reveal that parsing preferences of early bilinguals in Study II were similar to those of English monolinguals in Study I, which suggests that the parsing behaviors of these early bilinguals were still similar to those of English monolinguals.

6. Discussion and Conclusion

To summarize, the present findings reveal clear cross-linguistic variations between Korean and English monolinguals in parsing preferences regarding the RC attachment ambiguity. The results of Korean processing in Study I and II showed consistent HA preferences both in Korean monolinguals and all three Korean-English bilingual groups when resolving a RC attachment ambiguity, with the early bilinguals showing the weakest HA preference. On the other hand, English monolinguals were not consistent across the two studies; they showed no preference in Study I but strong LA preference in Study II. Therefore, whether the early bilinguals differed from English monolinguals in processing English depended on English monolinguals.

With respect to the issue of language separation in bilingual processing, the bilingual parsing preference patterns in English processing showed results almost parallel to those in Korean processing. That is, these bilinguals used the same parsing strategies in processing two completely different languages, preferring high attachment in relative clauses, although there was a slight difference in the strength of the attachment preferences.

The results of the present studies also reveal individual variations in bilingual processing, the importance of the age of language acquisition, and the influence it has in determining parsing strategies for bilinguals. Particularly, all three bilingual groups parsing similarly to Korean monolinguals in processing Korean or L1, regardless of the variation in their Korean proficiency, strongly suggests that the age of language acquisition may be a better predictor than language proficiency in the development of parsing routines, at least for the RC attachment ambiguity resolution. In the same line, the early bilingual group, showing a weak HA preference, was the only group that did not differ significantly from the English monolingual group in processing English or L2. Late learners of L2 or English used L1- or Korean-based parsing strategies when processing L2, despite their advanced L2 proficiency and/or relatively lengthy exposure to L2. Fernandez (1998, 1999) and Dussias (2003) found the same results in L2 processing with some of their early Spanish-English bilingual groups. All of these findings indicate that bilingual speakers exhibit parsing behaviors different from those of monolinguals. Furthermore, they strongly suggest that the bilingual language experience influenced by the age of L2 acquisition, which strongly correlates with the length and the type of L2 exposure in their language experience, has an impact on developing their parsing routines.

Interestingly, the data from the early bilinguals in the present studies also indicates that some bilinguals may amalgamate strategies from their languages into one set of language-independent strategies. For the early bilinguals was the only group who did not differ from respective monolingual groups in processing either Korean or English, although they were found to use similar processing strategies in processing two different languages. Fernandez (1998) also found that her Spanish early learners of English used a strategy that could not be considered either Spanish- or English-based. These findings lend support to the idea that some bilinguals, maybe those who started to learn their L2 fairly young, develop a parsing strategy of their own that could be a compromise between L1-based and L2-based processing routines. Whether the age of L2 acquisition is the primary factor responsible for this variation among bilinguals concerning the development or choice of parsing routines needs further research, since it is only one of the many variables that hinge on individual language history.

The parsing preferences of the Korean-English bilinguals found in the present studies are generally not compatible with the predictions by the parsing models under the Universal Account but most explicable in terms of the Experience-based Account, in which a different language experience of a particular group influence the development of parsing strategies, thus resulting in different parsing routines depending on construction frequencies in the environment. Moreover, the Experience-based Account can also provide accounts for Korean-English bilinguals having a difficulty in learning to parse English sentences with the RC attachment ambiguity and for some English monolinguals lacking a clear parsing preference for either attachment. For the relevant construction (NP1-*of*-NP2-RC) is not

as common in English, thus providing less exposure for both bilinguals and monolinguals. This also raises the question of whether all types of ambiguity are susceptible to age-related effects to the same degree, which needs to be investigated further.

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