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Prosodic Information in the Resolution of Relative Clause Attachment Ambiguity in L2 Sentence Processing

Hyun-Jin Kim*

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This study investigates the nature of L2 sentence processing mechanisms by examining whether or to what extent the sensitivity to prosody would affect the resolution of relative clause attachment ambiguity. The study examines how native speakers of a high attachment language would resolve the attachment ambiguity of their second language which has the opposite preference. Twelve Korean-speaking L2 learners of English and twelve native English speakers participated in a listening task to examine the effect of different types of prosodic information, such as prosodic boundary and focal prominence, along with a silent-reading task. The results showed that L2 learners' high attachment preferences in English were consistent in both tasks, but the focal prominence factor reinforced this preference in the listening task. The findings suggest that L2 learners' parsing routines generally followed their L1-specific high attachment, and this default preference was reinforced by convergent prosodic prominence and intonation contour. Emphasizing that L2 sensitivity to prosody reflects a specific modular organization, the study argues that an L1-induced default projection in processing of relative clause attachment can be enhanced or reduced by specific accentual patterns in L2 sentence processing, without the need to claim shallow processing of L2 learners.

Keywords: relative clause attachment, ambiguity resolution, prosody, sentence processing

1 Introduction

Research in the field of second language (L2) processing has investigated whether L2 processing is driven by essentially the same mechanisms as first language (L1) processing, or whether it is fundamentally different from L1 processing (e.g., Clahsen & Felser, 2006a, 2006b; Dekydtspotter et al., 2006; Dussias, 2003). As an attempt to respond to this line of inquiry, the present study examines the resolution of relative clause attachment ambiguities in L2 learners' processing. When a complex noun phrase (NP) is followed by a relative clause (RC) as in a sentence like (1), ambiguity arises regarding which noun phrase (NP1 or NP2) the relative clause is attached to.

* **Hyun-Jin Kim**, Teaching Professor, Dasan University College, Ajou University

(1) Someone shot the servant of the actress who was on the balcony.
NP1 NP2 RC

Studies on the attachment preference of RC construal found clear cross-linguistic differences in sentence processing strategies. For example, when reading an ambiguous sentence like (1) silently, native speakers of English prefer to interpret the relative clause as being attached to NP2, *the actress*. In adult native speakers of English, this "low attachment preference" has been found in both off-line (Cuetos & Mitchell, 1988; Dussias, 2003; Fernández, 2003) and on-line studies (Carreiras & Clifton, 1999; Fernández, 2003). On the other hand, in other languages such as Spanish, readers preferentially interpret the same RC as modifying NP1, *the servant*. This tendency is known as "high attachment preference." High attachment languages include Spanish (Carreiras & Clifton, 1993; Cuetos & Mitchell, 1988), French (Frenck-Mestre & Pynte, 1997; Mitchell et al., 1990), Greek (Papadopoulou & Clahsen, 2003) and Japanese (Fernández & Hirose, 1997). Korean has also been reported as a high attachment language in the literature (Ha, 2005; Jun, 2003).

Given the clear cross-linguistic differences, examining how native speakers of one language resolve the attachment ambiguity of their second language, especially when the two languages have the opposite preference, would reveal some undetermined mechanisms in processing sentences. Also, given that even during silent reading, a prosodic analysis can be projected (Fodor, 1998) and affect L1-induced preference in complex ways, this study considers the influence of different types of prosodic information in investigating the RC ambiguity resolution in Korean-English interlanguage.

2 Literature Review

2.1 Parsing models in the relative clause attachment ambiguity

There are multiple accounts for the crosslinguistic differences in relative clause (RC) attachment. The parsing models relevant to the RC attachment ambiguity can be largely categorized into experience-based accounts (i.e., the Tuning Hypothesis) and universalist accounts (i.e., the Implicit Prosody Hypothesis, the Recency/Predicate Proximity model, and the Construal Hypothesis) (see Fernández, 2003 for a review). According to the experience-based accounts such as the Tuning Hypothesis, the parser prefers such syntactic analysis that has worked the most frequently and successfully in past experience; thus, some language-specific syntactic processing strategies must be learned through the experience (Cuetos et al., 1996). Under this hypothesis, speakers' or readers' attachment preferences can be best explained by the experience with similar structures of the language.

On the other hand, the common proposal behind universalist accounts of the cross-linguistic differences in RC attachment is that the preferences emerge not from different routines used by the parser but from different principles applying in post-syntactic phrases of language processing (Frazier, 1978; Frazier & Fodor, 1978; Gibson et al., 1996; Hemforth et al., 2015). The low attachment preference is compatible with a general syntactic reflex to minimize structure during processing, identified early on in sentence processing research (viz. Kimball's (1973) Right Association and Frazier's (1978) Minimal Attachment strategy).

Moreover, Fodor (1998, 2002) suggests that low attachment in the processing of RCs in English also involves a prosodic tendency to include the RC in the same prosodic unit as the head noun in English. Fodor proposed the Implicit Prosody Hypothesis (IPH) as one of the crucial parsing models under the universalist accounts. Implicit Prosody Hypothesis (IPH) states that:

> The default prosodic contour projected during silent reading influences ambiguity resolution. Other things being equal, the parser will prefer the analysis associated with the most natural prosodic contour for the construction (Fodor, 2002, p. 113).

This hypothesis assumes that a prosodic analysis is projected even in silent reading where the prosodic analysis is supposed to be conducted implicitly rather than explicitly, as in speaking and listening. Fodor (1998) has proposed that cross-linguistic variation in the parsing of RC attachment ambiguity may be attributable to prosodic differences among languages. Prosodic phonology (e.g., Nespor & Vogel, 1986) suggests that the mapping between a syntactic structure and a prosodic structure differs across languages. According to Fodor (1998, 2000), low attachment in the processing of RCs in English involves a prosodic tendency to include the RC in the same prosodic unit as the head noun in English. The prosodic patterns of one language differ from those of another and thus exert varying influences on the prosodic processor (Fodor, 2002; Jun, 2003). Therefore, prosodic information is an important factor that should not be overlooked in the investigation of RC attachment disambiguation.

2.2 Influence of prosody in RC attachment disambiguation

Prosody of spoken language carries important information that could potentially guide parsing (Clifton & Duffy, 2001). Research on auditory sentence processing has successfully demonstrated that prosodic information can bias ambiguity resolution in L1 processing (Frazier et al., 2006; Kjelgaard & Speer, 1999; Schafer et al., 1996). Factors that were found to affect prosodic choice include phrase boundary, the length of phrases, speech rate, and prominence marking (Carlson et al., 2001).

One of the most studied prosodic factors is the prosodic boundary effect. Prosodic boundary can disambiguate the interpretations of many constituent structure ambiguities in spoken language (e.g., Carlson et al., 2001 for PP attachment). For example, in sentences like (2), the potential ambiguity disappears with prosodic boundary in front of the RC, *who was on the balcony,* resulting in high attachment preference. Listeners are found to interpret a prosodic boundary before an RC as a marker of a stronger syntactic boundary, which prompts high attachment (Fodor, 1998, 2002).

(2) [Someone shot the servant of the actress] # [who was on the balcony].

Although most research on prosody has emphasized prosodic boundary effects, there are group of researchers who attempted to find prosodic cues other than prosodic boundary. For instance, Schafer et al. (1996) investigated the role of focal prominence, which is conveyed by a pitch accent, in determining syntactic attachment of complex NPs. They formulated 'focus attraction hypothesis' which predicts that "an adjunct will be taken to modify a phrase P if P is focused than if it is not, grammatical and pragmatic constraints permitting" (p. 136). To test the predictions of the focus attraction hypothesis, Schafer et al. (1996) examined English native speakers' preferred interpretation when the accent of stimuli falls either on NP1 or NP2, as in example (3).

(3) a. The sun sparkled on the propeller of the PLANE that the mechanic was so carefully examining.
b. The sun sparkled on the PROPELLER of the plane that the mechanic was so carefully examining.

They found that accented NPs were more likely to be taken as head of the RC. The participants were more inclined to take the RC to modify NP2 when it is accented than when NP1 is accented, suggesting that the default preference remains after accent manipulation. They found a stronger effect when the head received a contrastive accent (L+H*). The results thus conformed to the predictions of their hypothesis being applied to RC attachment structures. Schafer et al.'s findings suggest that the most important information is considered to be most elaborated, and therefore, syntactic attachment may be based on decisions on the semantic structure. Their study supports the view that considers prosody as a structure closely related to both syntax and information structure.

Fodor (1998) argues that prosodic differences among languages may account for cross-linguistic differences in the parsing of RC attachment ambiguities. Jun's (2003) study is one of the few studies which takes both break and prominence factors into consideration to investigate how these

factors influence cross-linguistic prosodic phrasing. Prosodic phrasing refers to "grouping of words within an utterance" (Jun, 2003, p. 220), which is influenced by syntactic, semantic, and pragmatic factors. Since Jun's study provided insightful guidelines for the current investigation, her study is to be discussed in detail.

Jun (2003) showed how the default phrasing of a sentence is defined phonologically, differs across languages, and how the prosodic phrasing of a sentence in each language, both default and nondefault, matches the interpretation of RC attachment by individual speakers. Jun (2003) constructed four different prosodic conditions to investigate how the prosodic phrasing of a complex head noun followed by an RC could affect NS's interpretation of RC attachment. Jun's prosodic manipulation was realized as follows: "a) put pause or a phrase break between the first NP and the second NP; b) put pause or a phrase break between the RC and the immediately adjacent NP; c) put contrastive focus on NP1; and d) put contrastive focus on NP2" (Jun, 2003, p. 229).

Jun's study included the Korean language. Since Korean is a head-final language, a modifier such as a relative clause comes before the modified element, NP. Thus, Korean presents a relative clause and a complex NP in the opposite order to that of head-initial languages like English. In both cases, NP2 is closer site to the RC. The sentence (4) illustrates the Korean equivalent of a complex NP and RC structure *the servant of the actress who was on the balcony*.

(4)	[palkoni-ey iss-nun]	yepaywu-uy	hain-ul ...
	balcony-loc be-rel	actress-poss	servant-ACC
	RC	NP2 (low NP)	NP1 (high NP)

In Jun's (2003) study, five Korean informants preferred high attachment when there were no prosodic cues indicating how the RC, NP2, and NP1 were grouped. They also preferred high attachment when there was a prosodic boundary after the RC. However, a prosodic boundary after the NP2 was mapped to low attachment in Korean informants. Importantly, Jun found that focus creates a prosodic boundary in Korean. For example, when NP1 is focused, prosodic boundary is created before NP1, leading low attachment. However, when NP2 is focused, prosodic boundary is created before NP2, attracting high attachment. From these results, Jun (2003) claimed that the existence of a prosodic boundary before RC is more important than the prominence in determining the attachment preferences in Korean. The results revealed a direct relationship between the prosodic phrasing and the interpretation of RC attachment, suggesting that "the most common default phrasing is language-specific and seems to be responsible for different attachment preferences across languages" (p. 244).

An interesting question can be asked here: Will Korean-English L2 learners' parsing routines follow high attachment (L1), low attachment (L2) or will they have no defined preference? The cross-linguistic variations in parsing of a specific syntactic structure seem to be *prima facie* evidence for learning. If the native-like parsing strategies in one language must be acquired through experiences, it is also worth investigating whether and how L2 learners have acquired such language-specific parsing routines through L2 sentence processing.

2.3 Ambiguity resolution in L2 sentence processing

Studies have examined the way how L2 learners process RC attachment ambiguities of the target language in real time, but the results are not conclusive (Dekydtspotter et al., 2008; Dussias, 2003; Felser et al., 2003; Papadopoulou & Clahsen, 2003). A body of research argues that non-native speakers resolve RC attachment ambiguity differently from native speakers (Felser et al., 2003; Papadopoulou & Clahsen, 2003; cf. Frenck-Mestre, 2005). These studies show that L2 learners generally fail to display any attachment preferences of ambiguous RCs in the target languages regardless of L1-L2 language constellation and their L2 proficiency (Dussias, 2003; Felser et al., 2003; Papadopoulou & Clahsen, 2003; cf. Frenck-Mestre, 2005). Felser et al. (2003) and Papadopoulou and Clahsen (2003) provide evidence against the transfer of L1 processing strategies. These studies claim that there are the fundamental differences in the processing mechanism between NSs and L2 learners; while native speakers are driven by a structural reflex, non-native speakers rely on the context, pragmatics and world knowledge as well as lexical-semantic information, engaging in shallow processing of sentences.

On the other hand, Dekydtspotter et al. (2006) argue that non-nativelike processing strategies do not necessarily support the shallow processing of L2 learners, since a range of other factors could account for non-nativelike processing, including non-native prosody. They propose that the question about the nature of L2 processing can be answered by examining the degree to which L2 processing exhibits reflexes of specific modular relations. Specific interactions can provide evidence on the nature of the mechanisms deployed in L2 processing. Prosodic information has thus emerged as a major factor in explaining differences in the manner in which ambiguities are resolved in sentence processing. In an investigation of English-French interlanguage, Dekydtspotter et al. (2008) found that learners' interpretations were affected by the length of the RC, specifically its phonological weight. Effects of intonation contour were found in a subset of learners.

Given that relatively fewer studies have investigated prosodic factors in sentence disambiguation in L2 processing, compared to L1 processing (e.g., Frazier et al., 2006; Kjelgaard & Speer, 1999; Schafer et al., 1996), further investigation with different L1 and L2 pairing is required. Along this line, the

present study seeks to determine the specific manner in which Korean learners of English integrate prosodic information into the processing of ambiguous attachment of RCs. Ultimately, this study attempts to examine whether or to what extent L2 sensitivity to prosody reflects a specific modular organization.

The two research questions for the present study are as follows.

(1) Which kind of prosodic information are Korean-English L2 learners more sensitive to, prosodic boundary or focal prominence?
(2) Do Korean-English L2 learners interpret the RC attachment ambiguity exhibiting specific structural preferences or do they exhibit shallow processing without structural preferences?

3 Methods

3.1 Participants

The present study included two groups of participants: Twelve adult Korean-speaking L2 learners of English (L2 learner group) and a control group of twelve monolingual English speakers (NS group). The participants were undergraduate or graduate students enrolled at an American university, with normal hearing. The mean age of the NS group was 23.1 years old (range: 20-28). The mean age of the L2 learner group was 27.7 years old (range: 24-31 and their mean length of residence in the U. S. was 2.8 years. The L2 participants' mean reported iBT TOEFL score was 232.

3.2 Experimental materials

First, eight sentences with ambiguously attached relative clauses were constructed as base sentences. Each base sentence contained a complex NP of the form NP1 of NP2 and a RC which can modify either of the two NPs in direct object position. The preposition *of* introduces a phrase that is an argument of the first NP (NP1). Several factors were considered in the design of base sentences, given that RC attachment might be affected by factors such as pragmatic felicity, RC length, and frequency (e.g., Dekydtspotter et al., 2008). First, the context was made neutral in meaning so that the RC would not semantically favor either of the nouns as a subject. Second, the number of syllables of a complex NPs and a RC for each sentence was controlled to be the same. Third, the base sentences differed in terms of the relationship between NP1 and NP2. Four sentences include kinship relationships between NP1 and NP2, such as *the mother of the student*, whose relationship is not reversible (*the student of the mother). On the other hand, the other four sentences have various reversible professional relationships between NP1 and NP2, such as *the secretary of the dentist*. Lastly, all stimuli sentences include

verbs and nouns which should be familiar to L2 learners, excluding less common words used in L1 processing research (e.g., *scowled* or *colonel* in Clifton et al., 2002).

Next, the base sentences were manipulated with the placement of prominence as well as major prosodic boundary, producing four sets for each of the eight base sentences. The aural stimuli for this study were created based on prosodic manipulation suggested in Jun (2003); each condition was labeled as Pause 1 Condition (IPh boundary, noted as [IPh (L-H%)], after NP1), Pause 2 Condition (IPh boundary after NP2 before RC), Focus 1 Condition (contrastive focus on NP1), and Focus 2 Condition (contrastive focus on NP2). The stimuli were recorded by a trained linguist. All experimental sentences were consulted by four native speakers of English for grammaticality and appropriateness. A sample set of stimuli with four experimental conditions is provided in Table 1.

Table 1. A Sample Set of Stimuli

Condition	Stimuli example
Pause 1	Janice talked with the doctor [IPh (L-H%)] of the banker who was famous for his book.
Pause 2	Janice talked with the doctor of the banker [IPh (L-H%)] who was famous for his book.
Focus 1	Janice talked with the DOCTOR (L+H*) of the banker who was famous for his book.
Focus 2	Janice talked with the doctor of the BANKER (L+H*) who was famous for his book.

Acoustic analyses of pause duration and fundamental frequency (F0) were conducted for the crucial regions to examine if the stimuli manipulation was achieved as intended. If measurements revealed any deviation for a particular item, that item was re-recorded and reanalyzed. Thus, Figure 1-4 can be taken to be representative of all items in each condition with respect to the realization of prosodic manipulation.

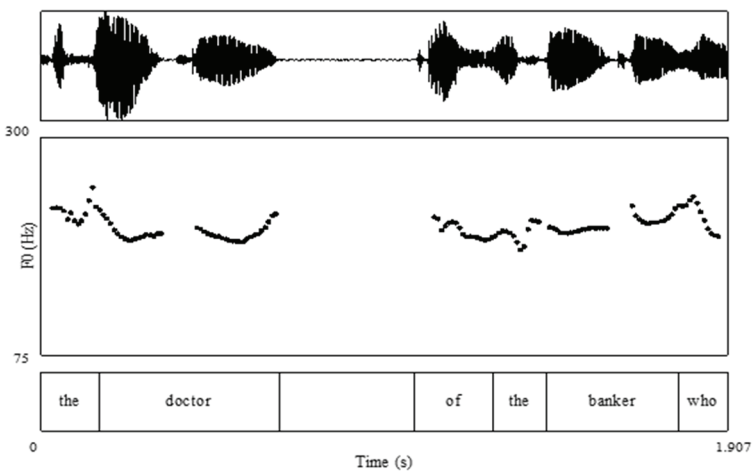


Figure 1. Plots of F0 for Pause 1 condition

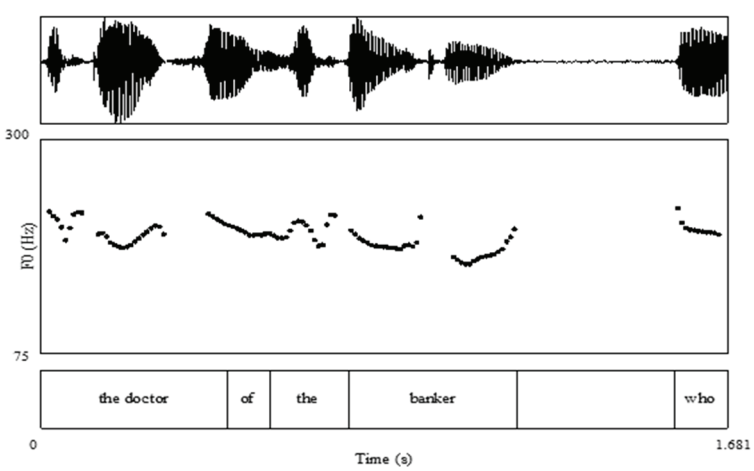


Figure 2. Plots of F0 for Pause 2 condition

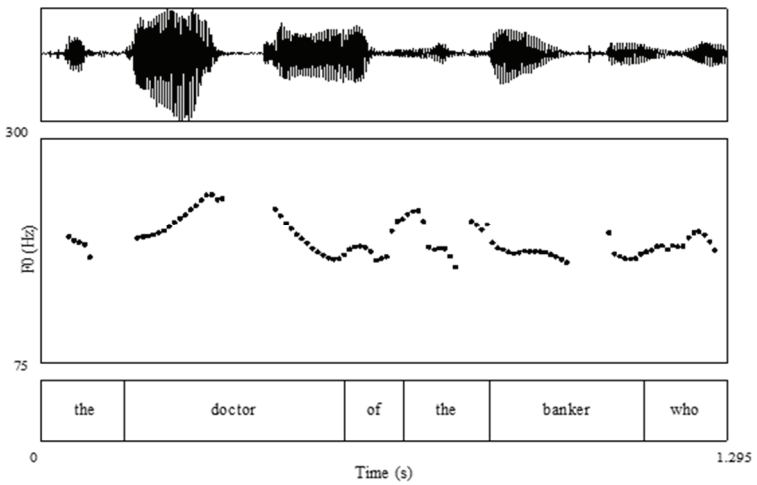


Figure 3. Plots of F0 for Focus 1 condition

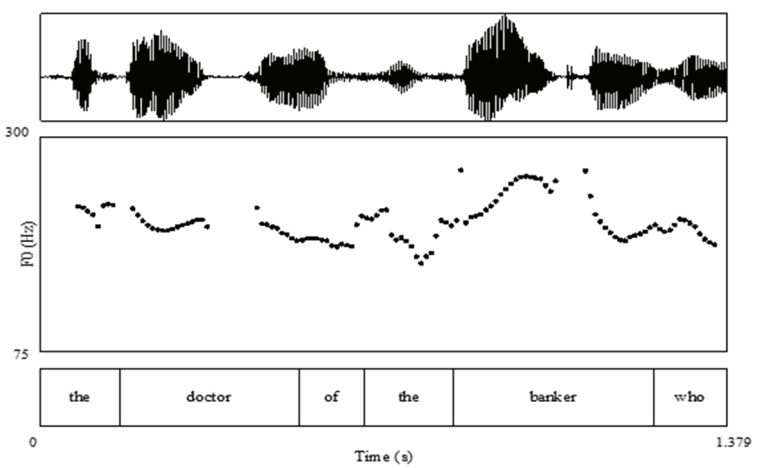


Figure 4. Plots of F0 for Focus 2 condition

The mean difference in pause duration between Pause 1 Condition and Pause 2 Condition was 0.38 seconds (*SD* = 0.08), ensuring the IPh boundary manipulation was consistent across the two conditions. Regarding prominence manipulation, the mean difference in pitch between NP1 and NP2 was 35.78

Hz. In other words, accented constituents were significantly prominent, exhibiting higher F0 maxima than the corresponding constituents without a prominent accent. The F0 maxima analyses revealed minimal phonetic differences within focus conditions (41. 6 Hz in Focus 1 Condition vs. 30 Hz in Focus 2 Condition, $p > .15$) and within pause conditions (4. 9 Hz in Pause 1 Condition vs. 10. 5 Hz in Pause 2 Condition, $p > .5$), suggesting that the conditions did not differ from each other.

To summarize, the results of the acoustic measurements of stimuli verified that the major manipulations of pause and prominence factors were completed successfully as intended for the purpose of the study.

3.3 Procedures

The participants first completed a language background questionnaire. Then, both NS and L2 learner groups were engaged in a silent reading task. After a short break, the main experimental task of the study was administered. The silent reading task was conducted to see default preferences of the two groups without any explicit prosody. For the silent reading task, participants read the experimental sentences silently and chose an answer to a question such as "Who was famous for his book?" by selecting one of the three choices, (a) the doctor (NP1); (b) the banker (NP2); (c) cannot decide. The participants were asked to choose the third choice only when they cannot understand the meaning of the sentence and encouraged to make one of two choices between (a) and (b). For the main listening task, 64 aural stimuli were presented in the randomized order and played twice to the participants. After listening to each aural stimulus (a set of examples provided in Table 1), they responded to a visually displayed interpretation question by selecting one of three choices (NP1, NP2, and cannot decide), which was the same as in the silent reading task. For both tasks, the respondents were asked to judge as quickly as possible, to follow their immediate intuitions, and not to go back. The order in which the NP1 and the NP2 appeared in the answer sheet was randomly assigned for each item, so that the respondents would not merely circle their choices by its order. The experiment session was held in a quiet language lab.

4 Results

4.1 Silent reading task

The results from the silent reading task provided baseline preferences of NS and L2 groups of this study in RC ambiguity interpretation when there is no explicit prosody. A repeated measures ANOVA was performed on the mean NP1 responses, and a main effect of group was found ($F(1, 22) = 50.1$, $p < .001$). Independent samples *t*-test confirmed that the mean NP1 responses of

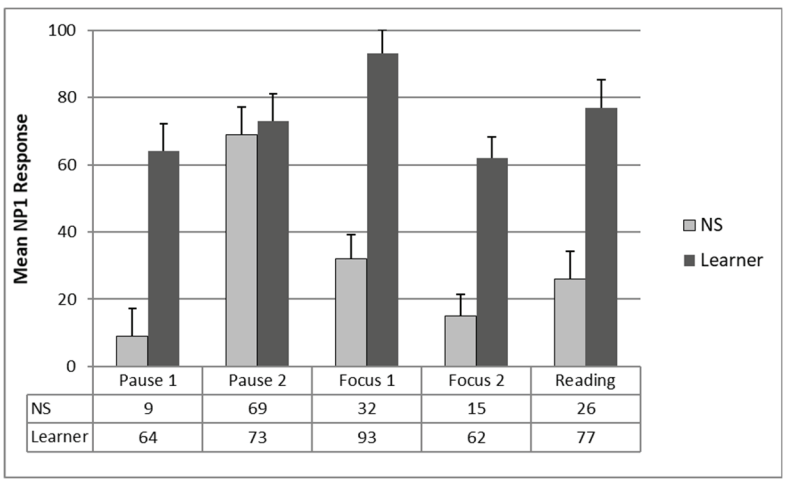
two groups are significantly different ($t(22) = 4.36$, $p < .001$). Regarding the average NP1 answer rates of each group, 77% of NP1 answers ($SD = 28.02$) were selected when the L2 learner group decided the attachment site, showing general high attachment preference in the silent task. In contrast, 26% of responses ($SD = 18.06$) of native speakers of English were toward NP1 answers, showing low attachment preference. This was mainly consistent with the relevant literature. This distribution illustrates a clear divide in preference of NP1 as the RC attachment site between the two groups. The result of L2 learner group suggests a strong L1 effect in RC attachment ambiguity resolution in English sentences, as Korean has been reported as a high attachment language (Ha, 2004; Jun, 2003).

To sum up, the silent reading task found that the Korean-English L2 group predominantly preferred NP1 attachment (the high attachment) without any explicit prosody, whereas the English NS group showed a strong NP2 attachment preference (the low attachment). Thus, results from the silent reading task reported here set the default preference of each group of this study. The following section provides the results of the main experimental task that examines if and how these preferences would change in response to specific prosodic manipulation.

4.2. Listening task

Results of the listening task showed how the L2 group and the native group responded to prosodic manipulation when resolving the syntactic ambiguity. Figure 5 illustrates the percentage of NP1 answers by each group for the four different experimental conditions[1].

[1] Percentages of NP2 answers are not presented because participants were basically forced to choose one of two responses. They did not have difficulty in understanding the experimental sentences, thus none of them chose 'cannot decide.'



	Pause 1	Pause 2	Focus 1	Focus 2	Reading
NS	9	69	32	15	26
Learner	64	73	93	62	77

Figure 5. Mean NP1 response by group and condition

A repeated measures ANOVA was performed on the mean NP1 responses. There were a main effect of group ($F(1, 22) = 50.15$, $p < .001$) and a main effect of condition ($F(4, 19) = 7.97$, $p < .001$). The significant effect of condition in the L2 group as well as the NS group suggests that both groups utilized prosodic information to some extent when disambiguating RC sentences with ambiguity. L2 learners and native speakers of English resolved the syntactic ambiguity by responding differently to each prosodic cue in contrast to silent reading ($F(4, 19) = 2.93$, $p = .048$; $F(4, 19) = 8.06$, $p < .001$, respectively).

As shown in Figure 5, focus conditions (Focus 1 and Focus 2 Conditions) strongly affected the L2 learner group rather than the NS group. Repeated measures found a significant interaction between the focus factor and attachment preference in L2 group ($F(2, 21) = 5.47$, $p = 0.12$). The interaction in the NS group was not statistically significant ($p > .05$). When NP1 is accented, the L2 learner group predominantly chose NP1 as a head noun (93%). The mean NP1 response of this condition was significantly higher than that of the silent reading (77%) ($t(11) = 1.63$, $p = 0.04$). This seems to suggest that their high attachment preference in silent reading was reinforced by converging prosodic prominence. In Focus 2 Condition, although their preference of high attachment was reduced, the effect was not so great as to reverse their default preference of NP1. As displayed in Figure 5, the NS group did not respond to the prominence manipulation.

In contrast to focus conditions, pause conditions (Pause 1 and Pause 2 conditions) affected the NS group more strongly than the learner group. In the NS group, a significant interaction was found between the prosodic boundary

factor and attachment preference ($F(2, 21) = 16.61$, $p < .001$). Overall, NSs' attachment pattern showed low attachment preference, except for one condition, which was Pause 2 Condition. A prosodic boundary placed after NP2 increased the rate of NP1 answers (69%), showing the strong effect of prosodic boundary in attachment preference. Importantly, it seems that for native speakers, the boundary effect in Pause 2 Condition was strong enough to make them reverse their default preference (low attachment) to high attachment. The mean NP1 response of this condition was significantly higher than that of the silent reading (26%) ($t(11) = 4.09$, $p < .001$). For L2 learners, high attachment preference without explicit prosody slightly decreased in Pause 1 condition, but the difference was not statistically significant ($p > .05$).

To summarize, for Korean L2 learners whose default preference is high attachment, accenting NP1 clearly increased the probability that it would be taken as head of the RC. English NSs reportedly preferred low attachment except for Pause 2 Condition, which is consistent with the literature about the prosodic boundary effect in English (Fodor, 1998, 2002). The results suggest that Korean L2 learners of English and native speakers of English were significantly different from each other in the ways that they responded to each prosodic factor. The NS group showed the strong effect of prosodic boundary in attachment preference. L2 learners' default preference for high attachment remained in a listening task, but the converging prosodic prominence reinforced these preferences.

5 Discussion

The current study investigated the nature of sentence processing mechanisms in L2 by examining whether or to what extent the sensitivity to prosody would affect the resolution of RC attachment ambiguity. Specifically, the study asked the following research questions: (1) Which kind of prosodic information are Korean-English L2 learners more sensitive to, prosodic boundary or focal prominence? (2) Do Korean-English L2 learners interpret the RC attachment ambiguity exhibiting specific structural preferences or do they exhibit shallow processing without structural preferences?

First of all, this study found that the L2 learners and native speakers of English resolve the ambiguity by responding differently to prosodic information. In the listening task, L2 learners were more sensitive to prosodic prominence factor than to prosodic boundary factor while native speakers were highly sensitive to prosodic boundary factor. That is, Korean learners of English reacted to focus information and remained less sensitive to prosodic boundary information in RC interpretation. The L2 learners exhibited consistent high attachment preferences both in the reading and listening tasks. Their strong bias toward NP1 answers can be attributed to the L1 influence. Importantly, their high attachment preference remained in a listening task, but

the default preference seemed to be reinforced by converging prosodic prominence. Diverging prosody information, however, was not crucial enough to make them reverse the default attachment preference. This could be due to computational complexity interacting with the salience of the prosodic cues.

The patterns in the attachment preference interacting with two prosodic factors suggest that Korean-English L2 learners' parsing routines generally follow their L1-specific high attachment and this default preference is reinforced by convergent prosodic prominence and intonation contour. These findings can be understood in a classical model of prosodic processing. That is, a default prosodic phrasing is projected from syntax and matching intonation contours enhance the RC attachment whereas mismatching patterns discourage it. The study strongly suggests that default rules of prosodic projection affect L2 learners' sensitivity to prosodic cues in the input. This further suggests that L2 sensitivity to prosody reflects a specific modular organization.

The finding of this study suggests clear L1 effects in the processing strategies of RC attachment interpretation in Korean-English interlanguage. It is thus important to note that the differences found between native and L2 processing do not necessarily serve as evidence for the Shallow Structures Hypothesis (Clahsen & Felser, 2006a) which would expect an absence of specific structural preferences in nonnative processing. Another potential source of differences between native and nonnative processing might be the salience of the cue which makes prosody-syntax calculation easier for nonnative speakers. In other words, non-native prosodic representations can produce target-deviant interpretations without the need to claim shallow processing by L2 learners (Dekydtspotter et al., 2006).

6 Conclusion

The current investigation revealed interesting interaction patterns between prosodic factors and attachment preferences in Korean-English L2 learners' sentence processing. It was a preliminary study with a small sample size, but the findings suggest that an L1-induced default projection from syntax can be enhanced or reduced by specific accentual patterns in L2 sentence processing. The results can be accounted for by a general model of prosodic processing principles and independently motivated L1 differences. L2 processing is driven by essentially the same mechanisms as first language (L1) processing.

Future research needs to consider other factors such as shorter RCs that may affect prosodic processors. Fodor (1998) suggests that attachment preferences may be partly determined on the basis of the prosodic weight of the attaching constituent relative to that of the host constituent. Recent studies show that the longer an attaching constituent, the more likely it is to attach to the higher site, NP1 (e.g., Hemforth et al., 2015). This is because

the length of constituent influences prosodic phrasing. If a constituent is longer, it is more likely to be an independent prosodic unit, and therefore, more likely to attach non-locally. Therefore, future research may include shorter RCs and examine how the preference tendency changes or retains.

It is hoped that the findings and discussion presented here will be a meaningful contribution to the body of relative clause ambiguity resolution in particular, and L2 processing mechanisms in general. Further investigations with a larger sample size and with various L1s and L2s are definitely called for to advance our understanding of second language prosodic processors and processing mechanisms.

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Hyun-Jin Kim, Teaching Professor
Ajou University
206 World cup-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,
South Korea
Phone: 031-219-3044
E-mail: hjinkim@ajou.ac.kr

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