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# PROSODIC RESOLUTION OF A SYNTACTIC AMBIGUITY IN KOREAN LEARNERS OF ENGLISH

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This study investigates how native Korean-speaking second language learners of English (L2ers) use prosody for syntactic disambiguation. Korean L2ers with different English-proficiency levels and native English speakers participated in morpho-syntax and prosody experiments. The morpho-syntax experiment assessed interference of Korean morpho-syntactic features in the prosody experiment and verified the subjects' proficiency levels. In the prosody experiment, participants heard the syntactically ambiguous beginning portion of a sentence and then chose the most likely of two visually presented continuations. The results show that (1) Korean L2ers at all levels used the relative strength of prosodic boundaries to correctly disambiguate syntactically ambiguous utterances; (2) correct continuation selection increased significantly as proficiency increased; and (3) late closure bias was not completely suppressed in L2.

**1. INTRODUCTION.** Prosody contributes to a listener's syntactic parsing of spoken sentences, in particular those involving syntactic ambiguities. That is, prosody is an indirect and partial indicator of the syntax of an utterance. In the past, many studies have investigated prosodic disambiguation in native-language sentence processing by adult listeners, showing effects in early versus late closure ambiguities (Kjelgaard and Speer 1999, Schafer et al. 2000), PP-attachment ambiguities (Schafer et al. 2005, Warren et al. 2000), or RC-attachment ambiguities (Fodor 2002, Jun 2003), among others. This paper concentrates on the effects of prosodic boundaries on the resolution of early versus late closure ambiguities, as shown in (1).

- (1) a. Early closure: When that moves the square will encounter a cookie.  
b. Late closure: When that moves the square it will encounter a cookie.

Kjelgaard and Speer (1999) examined the interaction of prosody with syntax in comprehending ambiguous early/late closure utterances in English by employing two off-line tasks (which measure the end product of the process) and two on-line tasks (which measure relatively immediate process near the critical regions). The materials consisted of 18 pairs of sentences such as (2).

- (2) a. Early closure: Whenever the guard checks the door is locked.  
b. Late closure: Whenever the guard check the door it's locked.

They were carefully recorded by a trained speaker to be sure that all the critical words were clearly intelligible. All of the sentences were produced with three prosodic conditions: cooperating prosody, in which the strongest phrase boundaries in the sentence (e.g., intonation phrase (IPh) boundary or phonological phrase (PPh)<sup>1</sup> boundary; see §2 for more information) coincided with the subordinate clause boundaries, baseline prosody, which did not provide any disambiguating prosodic cues, and conflicting prosody, in which the strongest phrase boundaries were in misleading syntactic locations instead of at the subordinate clause boundaries.

The results from four experiments consistently showed that cooperating prosody facilitated comprehension the most, whether an IPh or a PPh was utilized. In the baseline and conflicting conditions, the results demonstrated faster and easier processing with late closure structures than with early closure structures. In the cooperating condition, no difference in the response time was observed between late and early closure structures, which means that garden-pathing (i.e., the syntactic preference toward the simplest structure – late closure structures in this context) was suppressed. Kjelgaard and Speer concluded that both IPhs and PPhs determine syntactic structures, that prosodic constituency is

<sup>1</sup> As the prosodic phrase subordinate to the intonation phrase (IPh), the phonological phrase (PPh) in Kjelgaard and Speer 1999 is an equivalent to the intermediate phrase (ip).

recognized at the very initial stage of processing, and that prosody guides syntactic parsing by determining syntactic structures.

Schafer et al. (2000) investigated the use of prosody in English native speakers' production and comprehension of the same type of closure ambiguity as in Kjellaard and Speer 1999. In a production experiment, nine pairs of English native speakers played a cooperative game task with a predetermined set of sentence frames to choose from, into which the speakers inserted critical words (e.g., names of objects). This quasi-spontaneous game task was designed in order to elicit more natural speech than typically found in tasks requiring subjects to read printed materials aloud. The speech obtained from the game task was tested in an experiment of listening comprehension. The comprehension materials involved only one base fragment for the sentence beginning (e.g., *when that moves the square ...*), which was produced with different prosodies by different speakers. Two different pairs of the sentence-ending portion were used, each of which was presented in a separate block of the experiment.<sup>2</sup> One block involved the original continuations of the sentences. In the other, the initial segments of the continuations were replaced with those of the opposite syntactic structure conditions of the original sentences, in order to control any disambiguating effects of coarticulation.

For both the original and the segmentally crossed continuations, the overall percentages of correct categorizations were above chance; 80% for the early closure cooperating sentences and 79.61% for the late closure cooperating sentences; 68.45% for the early closure ambiguous sentences and 64.23% for the late closure ambiguous sentences; 66.66% for the early closure conflicting sentences and 46.66% for the late closure conflicting sentences. Schafer et al. pointed to the high percentage of correct categorization as a sign of prosodic disambiguation.

With truncation, some utterances lost phonetic information of the prosodic boundary at *square*. As a result, some of the late closure sentences did not provide boundary tones; the performance with the early closure sentences in the ambiguous and conflicting conditions was unexpectedly better than that with the late closure in the ambiguous and conflicting conditions.

Schafer et al. found that the percentage correct for ambiguous and conflicting prosody conditions was at or above chance. They interpreted this finding to indicate that the relative strength of the prosodic break is not the only disambiguating factor. High/low pitch accents or phrasal tones, for instance, may be factors as well.

Like English native listeners, Korean native adult listeners commonly utilize prosodic boundaries to resolve syntactic ambiguities (e.g., Kang and Speer 2003, Schafer and Jun 2002). For instance, syntactic disambiguation effects of Korean Accentual phrases (APs; see §2 for more information) were discussed in Schafer and Jun 2002. In a cross-modal naming task and an auditory questionnaire, they tested sentences containing phrases such as (3a, b).

- |     |   |  |
|-----|---|--|
| (3) | a. Hyenmyenghan aki-uy      appa<br>[wise                    baby-Gen]    daddy<br>'the daddy of a wise baby' | b. Hyenmyenghan aki-uy      appa<br>wise                    [baby-Gen daddy]<br>'the wise daddy of a baby' |
|-----|---|--|

An AP boundary was present or absent between the adjective and NP1 or/and between NP1 and NP2, resulting in four prosodic groupings. One phrase grouping, which contained an AP only between NP1 and NP2, had the intended interpretation, 'the daddy of a wise baby', as in (3a). Another grouping, which contained an AP only between the adjective and NP1, had the intended interpretation, 'the wise daddy of a baby', as in (3b). The other two groupings phrased each word separately, following the default prosodic pattern, or grouped all three words together. Results of the two tasks showed significantly different effects of APs on syntactic parsing decisions, depending on their presence or absence.

In children's first language (L1) processing, use of prosodic phrasing has been less clear (e.g., Beach et al. 1996, Choi and Mazuka 2003, Trueswell et al. 1999, Snedeker and Trueswell 2001). For

<sup>2</sup> Schafer et al. (2000) used two different sets of sentence endings.

<Original continuations>

- When that moves the square  
 a. ... it should land in a good spot.  
 b. ... will encounter a cookie.

<Segmentally crossed continuations>

- When that moves the square  
 a. ... we'll encounter a problem.  
 b. ... is shut off from the best path.

example, Choi and Masuka (2003) found that children could use prosodic boundary information to resolve word segmentation ambiguities but not to disambiguate sentences containing syntactic ambiguities. Choi and Mazuka (2003) attributed this distinction between adults and children to different use of sources of information (e.g., syntactic, prosodic, or discourse cues) during on-line processing, or to difficulties that children might have faced due to the nature of the tasks. Since L1 acquisition as well as children's L1 processing generally shed light on second language (L2) acquisition and L2 processing, L1 learners' limited prosodic disambiguation calls attention to the question of whether this limitation can be overcome by second language learners.

In the field of second language acquisition, developmental processes in morpho-syntax and segmental-level phonology have been of great interest. Little attention has been paid to the acquisition of prosodic structures, although it is well-known that even advanced learners tend to fail to acquire native-like prosody in L2 production (e.g., Flege et al. 1999, Jun and Oh 2000, Kim 2002, Kim and Kim 2001, Piske et al. 2001, Ueyama 2000, Ueyama and Jun 1998). Jun and Oh (2000) studied English native speakers' production of Korean to evaluate which aspects of prosody are acquired earlier. They found that English-native advanced L2 learners of Korean were better at grouping words into phonological phrases than were intermediate and beginning learners. However, even advanced learners were not good at producing all of the surface tones of an accentual phrase. For instance, the AP-final high tone was realized in a native-like pattern because it is perceptually salient and tonally invariable. Also, it has a distinctive function of demarcating a phrase boundary. Other surface tones in an AP, which have more variable realization, did not exhibit phonetic accuracy in production. Since the boundary tones of APs are distinctive and meaningful in Korean, while the surface tones in APs are not, Jun and Oh concluded that phonological properties of intonation are acquired earlier than phonetic properties of intonation in L2 acquisition.

The second language processing field has also been relatively silent about the perception of intonation in L2 and the use of L2 prosody in the comprehension of spoken sentences. Harley et al. (1995) investigated whether Cantonese-speaking students could take advantage of early exposure to English in phonological acquisition. Cantonese speakers were provided with conflicting prosodic cues in addition to syntactic cues and were asked to interpret ambiguous sentences. Materials were composed with sentences such as (4).

- (4) a. [The new teacher's watch] has stopped.  
b. [The new teachers watch] baseball on TV.

The sentences were recorded with cooperating prosody. The recording was edited by splicing the segments in the square brackets in (4a) and (4b) in order to create the conflicting prosody conditions. After the sentences were edited, stress was located before the head noun of the NP in (4a), while stress occurred after the head noun, on the verb, in (4b). The results showed that the subjects attended more to prosodic cues than to syntactic cues in identifying more than half of the ambiguous utterances. The authors argued that if the materials had included syntactic structures produced with cooperating prosody, it would have become even more obvious that prosodic cues were the most powerful in resolving the ambiguous sentences.

Since relatively few studies have been devoted to learning and processing prosody in second languages, it is worthwhile to examine how L2ers of English acquire prosodic structures and apply them to reduce syntactic ambiguity. Assessment of prosody's role in assisting an L2 parser to process ambiguous sentences may provide evidence of whether prosodic bootstrapping exists in L2 processing, as it does in native language processing (Christophe et al. 1997).

The present paper, investigating early versus late closure ambiguities in English sentences such as (5), replicated Schafer et al. (2000)'s comprehension experiment. The same forced-choice continuation selection task was employed; materials used in the prosody experiment were copies of the sound files from Schafer et al. While Schafer et al. tested only native speakers of English, this study included both English native speakers and Korean L2ers of English.

- (5) a. Early closure: When that moves the square will encounter a cookie.  
b. Late closure: When that moves the square it will encounter a cookie.

The examples above contain a subordinate clause with a verb (*moves*) that can be intransitive or transitive. (5a) is an early closure sentence in which the subordinate verb is intransitive and the following noun is a subject of the main clause, whereas (5b) is a late closure sentence in which the subordinate verb is transitive and the following noun is the direct object of the subordinate clause. When a listener hears the beginning of the sentence through *square*, the sentence can continue as either (5a) or (5b). Thus, (5) illustrates a temporary syntactic ambiguity between early and late closure of the verb phrase and a subordinate clause.

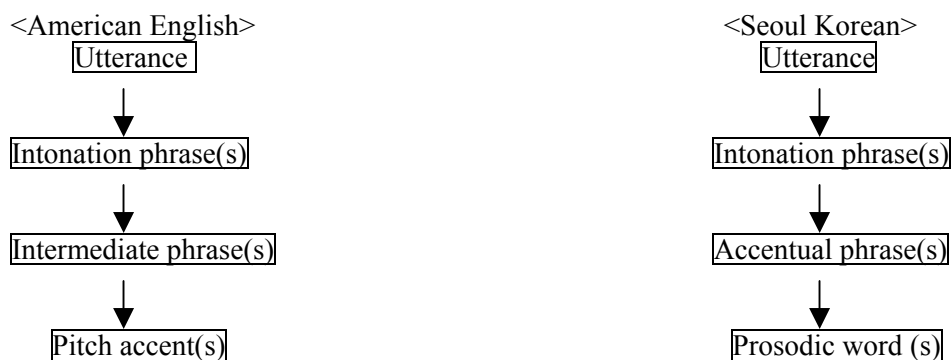
This type of ambiguity can be resolved simply by morpho-syntactic cues. However, the morpho-syntactic cues (i.e., *will* or *it will*) are available only after processing has begun for the ambiguous region (i.e., *square*), because of the nature of spoken language and the highly incremental process of parsing sentences. On the other hand, prosodic cues are present when the ambiguous region is interpreted, which suggests that prosodic cues could be more efficiently used in reducing closure ambiguities. As prosodic disambiguation for the syntactic closure ambiguity has been shown in many L1 studies (e.g., Kang and Speer 2003, Kjelgaard and Speer 1999, Misono et al. 1997, Schafer and Jun 2002, Schafer et al. 2000), this study allows us to compare L2 prosodic processing with L1 prosodic processing.

One hundred seventy-six Korean high-school students differing in English-language proficiency and twenty native speakers of English participated in two experiments, one testing morpho-syntax and one prosody, within a single session. The morpho-syntax experiment was conducted in order to control for interference of L1 (Korean) morpho-syntactic features such as argument-drop and topicalization in the parsing of (5), as explained in §3. Another purpose of this experiment was to assess the English morpho-syntactic knowledge of Korean L2ers at different proficiency levels. The next section of the paper will introduce critical theoretical assumptions for the experiments. The following section turns to the presentation of the two experiments.

## 2. THEORETICAL ASSUMPTIONS.

**2.1 INTONATION MODEL: PROSODIC HIERARCHY IN ENGLISH AND KOREAN.** This study assumes the intonation models developed by Pierrehumbert and Beckman (Pierrehumbert 1980, Beckman and Pierrehumbert 1986) for English and by Jun and colleagues (Jun 1993, Venditti et al. 1996) for Korean. The intonation model of each language is schematized in Figure 1.

FIGURE 1. HIERARCHY OF PROSODIC CONSTITUENTS IN AMERICAN ENGLISH AND IN SEOUL KOREAN.



In both English and Korean, it is assumed that an utterance contains two hierarchically structured levels of prosodic phrases above the level of a word. A constituent at any level is made up of one or more constituents at the immediately lower level. An English utterance is produced with one or more intonation phrases (IPhs), which are delimited by a boundary tone, H% (high) or L% (low). An IPh is composed of one or more intermediate phrases (ips), which are marked by a phrase accent, H- (high), L- (low) or !H- (downstepped high). The phrase accent is realized by spreading the tone over the syllables from the final pitch accent to the right edge of the ip. An ip must contain at least one pitch accent, such as a H\* (high), L\* (low) or bitonal accent, which occurs on the stressed syllable of a prominent word.

In Korean, an IPh contains one or more accentual phrases (APs) instead of ips. An AP is demarcated by a distinctive final rising phrase tone (i.e., Ha tone). The default tonal pattern of an AP consists of four syllables realized as THLH, where T stands for a phonologically conditioned high or low tone, and HLH is a high-low-high sequence. The middle tones within an AP can be realized or omitted, depending on the number of syllables within the AP (e.g., T(HL)H). The initial tone of an AP is controlled by the laryngeal value of its first segment: when the first segment is a tense or aspirated obstruent, the AP is realized as HHLH. Otherwise, it is realized as LHLH. At the lowest level, Korean does not have a string of pitch-accents as English does. Accordingly, the Korean f<sub>0</sub> contour is shaped by a sequence of accentual phrase tones and boundary tones, whereas the English f<sub>0</sub> contour is shaped by pitch-accents and edge tones (i.e., boundary tones and phrase tones).

IPh phrases in English and Korean have several similar phonetic and phonological properties: lengthening of the final syllable of the IPh, a long silent period following the final syllable, a boundary tone following the immediate sub-component tone (intermediate phrase accents in English and accentual phrase tones in Korean), and pitch reset or discontinuity of pitch. In the lower-level prosodic phrase, English ips and Korean APs have contrasting properties despite similar functions of delimiting phrase boundaries. English ips have more variable tonal patterns (e.g., H-, !H- or L-) and stronger durational information to indicate the boundary location (e.g., final lengthening or pausing) than the Korean counterparts, APs (Jun 1993, Venditti et al. 1996). Thus, at least with respect to the perception and use of IPhs, the L1 (Korean) linguistic behavior is expected to be consistent with L2 (English) linguistic behavior, and Korean L2ers should exhibit use of IPhs early in acquisition without difficulty.

The following section will briefly present two major human sentence processing models—the Garden Path model and the Constraint-based model – and their accounts of syntactic parsing preferences. Then the Informative Boundary Hypothesis, which is the most relevant prosodic hypothesis for the current study, will be introduced.

**2.2 SENTENCE PROCESSING.** The Garden Path model (Frazier 1987) claims that in cases of syntactic ambiguity, only one syntactic structure is initially built by using structure-based principles such as Minimal Attachment and Late Closure. Minimal Attachment (p. 582) says “do not postulate any potentially unnecessary nodes.” Late Closure (p. 582) says “if grammatically permissible, attach new items into the clause or phrase currently being processed (i.e., the phrase or clause postulated most recently).” Frazier predicts that when the actual structure conflicts with the structure initially built, reanalysis occurs and processing time increases. Other factors, such as the most plausible meaning, come into play at reanalysis.

According to the Late Closure principle, a late closure structure like (5b) is a universally favored parse, while an early closure structure like (5a) is not; when interpreting *the square* in (5b), a parser would attach it to the VP instead of as the subject of the main clause. This object-analysis preference is viewed differently in the constraint-based model. The constraint-based model predicts all types of information to be involved simultaneously in parsing decisions. The parser considers all possible analyses, which are weighted based on how compatible they are with the other information available. As a result, a particular analysis is foregrounded and others are backgrounded. The relative frequency of parses has been viewed as a particularly strong constraint in this approach. For example, McDonald et al. (1994) proposed a frequency-based hypothesis, which claims that parsing should be described as a tendency to foreground the most frequent syntactic analysis, not the one preferred by syntactic principles, as argued in the Garden Path Model.

In spoken-language processing, prosodic information is available to affect syntactic parsing decisions. In line with the Garden Path Model, Pynte and Prieur (1996) posited a delayed use of prosodic information, so that it contributes only to reanalysis. Alternatively, early use of prosodic phrasing and its immediate effects on the resolution of syntactic ambiguity have been argued in on-line studies using cross-modal naming tasks (e.g., Kjelgaard and Speer 1999) or eye-tracking (e.g., Snedeker and Trueswell 2003).

There have been many prosodic processing proposals (Carlson et al. 2001, Clifton et al. 2002, Price et al. 1991, Pynte and Prieur 1996, Schafer 1997, Schafer et al. 2000, Stirling and Wales 1996, and Watson and Gibson, in press, among others). Clifton et al. (2002) examined the interpretation of a

prosodic boundary in the context of the Informative Boundary Hypothesis (hereafter IBH), following Carlson et al. (2001) and Schafer et al. (2000). According to the IBH, the informativeness of a local prosodic boundary and its interpretation are determined not by the boundary's absolute size (or strength) but by its size relative to certain other boundaries at other relevant positions. For instance, the effect of an ip would depend on whether it followed an IPh in a critical position or merely a word-level boundary. Consider the following example (Clifton et al. 2002:88-89).

(6) A[Susie learned] B[that Bill telephoned] C[after John visited].

Sentence (6) illustrates the syntactic structure of an ambiguous sentence in which a constituent C can be attached to A or B. If the pre-C boundary is relatively larger than the pre-B boundary, C attaches high to A. If the pre-C boundary is relatively smaller than the pre-B boundary, C attaches low to B. If equal-sized boundaries occur at the pre-B and pre-C positions, attachment is decided by other factors. Therefore, differences in the size of a phrase boundary relative to other boundaries determine the syntactic analysis.

Clifton et al. tested the IBH with three listening experiments using diverse syntactic structures. The structures contained syntactically ambiguous constituents which can attach high or low in the syntactic tree (e.g., *old men and women with very large houses*, *Johnny and Sharon's in-laws*, *the daughter of the Pharaoh's son*, and *I met the daughter of the colonel who was on the balcony*). Either an IPh or an ip preceded the ambiguously attached constituents (e.g., *with very large houses*, *in-laws*, *son*, and *who was on the balcony*), and a phrase boundary of either a different size or an equal size preceded the second conjoint (e.g., *and women* and *and Sharon*) or the second argument introduced by *of* (e.g., *of the Pharaoh* and *of the colonel*). The results of the three experiments supported the hypothesis: attachment of the ambiguous constituents consistently showed sensitivity to the relative sizes of the prosodic boundaries. The proportion of high attachment choices was larger when the earlier boundary was smaller than the prosodic boundary before the ambiguous constituents.

Although the current study does not test the predictions of the IBH in detail, its findings seem to support it to some extent. This point will be discussed in Conclusion.

**3. MORPHO-SYNTAX EXPERIMENT.** In the present study, a morpho-syntax experiment was conducted after a prosody experiment within a single session. Since the current study aimed to explore effects of prosody in the syntactic processing of Korean L2ers at different levels of English proficiency, it was important to control other factors involved in the parsing of a sentence such as (5). Specifically, the confounding effects of different morpho-syntactic knowledge in English across proficiency levels ought to receive substantial consideration, especially when one is examining closure ambiguities. Closure ambiguities are resolved by correctly interpreting a noun phrase following a subordinate verb as a subject for the early closure sentence or as a direct object for the late closure one. Korean noun phrases undergo various syntactic phenomena, such as subject-drop or topicalization, that are unacceptable or unnatural in English. The morpho-syntax experiment was designed to help determine whether the Korean L2ers showed negative transfer of these two features of Korean morpho-syntax.

Although the morpho-syntax experiment was administered after the prosody experiment, it is being introduced prior to the prosody experiment because 1) information on the results of this experiment can help correctly interpret any possible weak results of the prosody experiment, which could be due to negative transfer of Korean morpho-syntax; 2) this experiment can help justify the placement decisions of the Korean L2ers in the prosody experiment.

**3.1 MATERIALS.** Sixty trials were constructed from five base sentences for "subject-drop," four base sentences for "topicalization," and three base sentences for "perception of the definite article."<sup>3</sup> Each base sentence was produced as five tokens. For the purpose of effectively correlating the results of this experiment to those of the prosody experiment, the materials tested here were made as similar to the prosody experiment materials as possible. For most items, (1) verbs of movement (e.g., *arrive*,

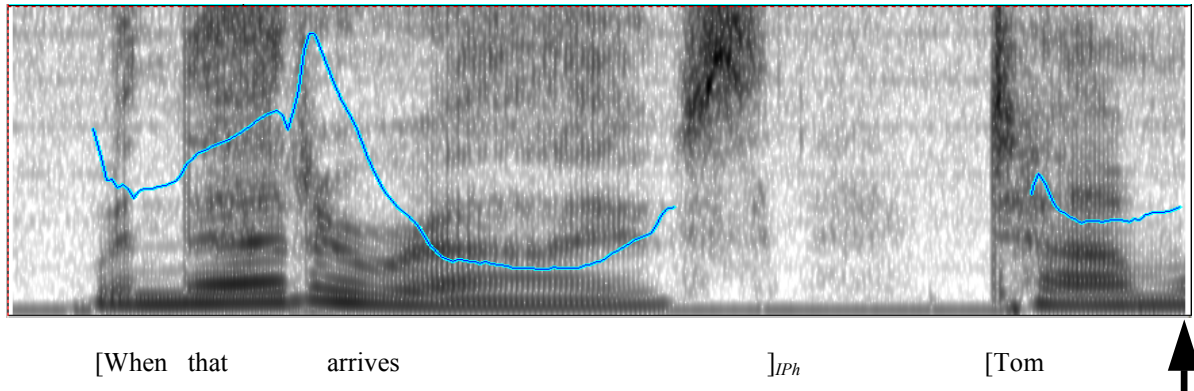
<sup>3</sup> In a pilot study of the prosody experiment, Korean participants tended to answer incorrectly for items which contained disfluencies near the definite article. Although I included 15 tokens to test Korean students' perception of definite articles, misperception of the definite articles was not a significantly interfering factor for syntactic ambiguity resolution in this study. Consequently, they will not be discussed further in this paper.



*move*, or *push*) were selected for the subordinate clause; (2) a demonstrative pronoun (e.g., *that*) was used as a subordinate subject, and the third person nominative pronouns (e.g., *he*, *she*, or *they*) were used as main clause subjects.

The materials were carefully recorded in a sound-attenuated booth by a trained native speaker of English. All of the sentences were produced completely from the beginning to the end, in cooperating prosody. Subordinate clause boundaries coincided with IPhs, which were delimited by boundary tones with following pauses, final syllable lengthening, or pitch reset. Auditory stimuli were created by digitally truncating sentences at the offset of the final segment at the intended location, as shown in FIGURE 2. Truncation did not leave any phonetic cues to the following segmental identity.

FIGURE 2. AN EXAMPLE SPECTROGRAM WITH AN ARROW SHOWING TRUNCATION LOCATION IN *WHEN THAT ARRIVES (IPh) TOM WILL ENCOUNTER A COOKIE* IN TABLE 2 BELOW.



As described further below, subjects listened to the sentence fragments over headphones and then chose between two visually presented continuations of the fragment. An auditory stimulus and a visual stimulus for each base sentence are listed in Tables 1 and 2.

**3.1.1 SUBJECT-DROP.** In Korean, a subject can be omitted when it is either understood or not important in the conversation. To control any subject-drop effects on the parsing of English sentences and to evaluate the Korean L2ers' knowledge of unlicensed subject-drop, it is necessary to test items in which an NP in the main clause subject position should be interpreted only as a subject of the clause. As shown in Table 1, each item in the subject-drop set of items contained a nominative pronoun in the main subject position as one of the two given endings. The nominative case can occur only in the subject position, so the grammatical relation of the NP should not have been confusing.

TABLE 1. AUDITORY AND VISUAL STIMULI USED IN THE MORPHO-SYNTAX EXPERIMENT TO EXAMINE SUBJECT-DROP EFFECTS.

Subject-drop		auditory stimuli	visual stimuli
	a subordinate verb with obligatorily intransitivity	(a) When that arrives (IPh)	will encounter a cookie. he will encounter a cookie.
	a subordinate verb with weak transitivity	(b) When that moves (IPh)	will encounter a cookie. he will encounter a cookie.
	a subordinate verb with equi-biased transitivity	(c) When that pushes them (IPh)	will encounter a cookie. they will encounter a cookie.
	a subordinate verb with equi-biased transitivity	(d) When that pushes the squares (IPh)	will encounter a cookie. they will encounter a cookie.
	without the aux. in the subordinate clause	(e) When John sleeps (IPh)	snores. he snores.

In the materials, transitivity varied from (a) to (c). Item (a) involved an obligatorily intransitive verb, *arrive*. Since the verb does not allow a direct object at all, an NP following the subordinate verb *arrive* should be read as a subject. *Move* was classified as a weak transitive verb with a slightly more

preferred interpretation for the intransitive, while *push* was counted as equi-biased between the transitive and intransitive, based on an analysis of the Touchstone Applied Science Associates corpus and the Brown corpus (Gahl et al. 2004). In spite of varied preferences for transitivity, both *move* and *push* can be transitive or intransitive. But the grammatical analysis of the NPs following these two verbs should not have been difficult, due to the case-marking on the NPs (e.g., nominative NPs in the main clause subject position (b) and (c), and an accusative NP in the subordinate clause direct object position (c)). Item (d) employed the verb *push* and the common noun *the squares* instead of a case-marked pronoun for its direct object. The grammatical relation of the common noun would not be determined as easily as the accusative NP in item (c). However, analysis of the NP as a direct object should not have been so demanding, because *push* is not intransitive-biased, and the universally preferred direct-object analysis could lead to the correct interpretation of the NP. Item (e) was added on the assumption that subject-drop could occur more commonly with a finite verb than with an auxiliary in Korean L2ers.<sup>4</sup>

Subject-drop was expected to influence only the less proficient or beginning L2ers' performance, because this phenomenon is generally found only in the language learner's initial syntax (Kim 2003).<sup>5</sup> Subject-drop was not expected to interfere in processing by the advanced and intermediate learners, since L2ers with these levels of proficiency should know that an English sentence requires a subject.

**3.1.2 TOPICALIZATION.** Although untopicalized structures are more common than topicalized structures in Korean, topicalization is often used to emphasize a preceding common noun or proper noun by repeating it with its corresponding pronoun in discourse. On the other hand, English uses topicalized structures very infrequently, which means that topicalized structures are acceptable, but not preferred. Therefore, topicalization materials examined whether L2ers know the correct use of topicalization in English (items (f) and (h)) and how much they prefer topicalization (items (g) and (i)). It was predicted that the advanced L2ers would be aware of the correct use and low frequency of topicalization, while the intermediate and beginning learners would choose topicalized structures more readily.

<sup>4</sup> This assumption was based on the fact that Korean tense morphemes always follow a verb stem, yielding a word order such as subject (nominative marker) - verb stem- past tense marker - declarative marker, as in (6). As a verb stem sits between a subject and a tense morpheme, if subject-drop occurs, it happens immediately before a verb stem, but not immediately before the tense morphemes in Korean.

(6) *John-i wa - ss - ta*  
 John-Nom come-Past-Dec  
 'John came.'

However, occurrence of subject-drop with a finite verb was not found to be significantly more frequent than that with an auxiliary. Therefore, item (e) will not be discussed separately from other items with respect to subject drop.

<sup>5</sup> As for the relation of the subject-drop parameter with L2 initial syntax, it is argued that the parametric values of the functional feature in L1 will transfer to the initial syntax of L2, and L2 learners will start out with their L1 parametric values (Kim 2003). Many studies have been conducted for the case in which speakers with subject-drop languages learn non-subject-drop L2s. Vainikka and Young-Scholten (1994) found that adult Turkish and Korean learners of German initially used null subjects. However, they claimed that it is unclear what brings about the L2 null subject phenomenon; it could be the L1 transfer effect, or it could be the unmarked linguistic principle of economy.

TABLE 2. AUDITORY AND VISUAL STIMULI USED TO TEST TOPICALIZATION.

Topicalization	auditory stimuli	visual stimuli
	(f) When that <i>arrives</i> (IPh) she	will encounter a cookie. he will encounter a cookie.
	(g) When that <i>arrives</i> (IPh) Tom	will encounter a cookie. he will encounter a cookie.
	(h) When that <i>moves</i> (IPh) she	will encounter a cookie. he will encounter a cookie.
	(i) When that <i>moves</i> the cones (IPh)	the cones, they will encounter a cookie. they will encounter a cookie.

In items (f) and (h), the first NP, *she*, and the second NP, *he*, following the subordinate verb, do not agree in gender. If L2ers consistently chose a continuation containing a nominative pronoun, *he*, it would imply that they have not acquired the correct use of topicalized structures. Items (g) and (i) assessed L2ers' preference between simple structures and topicalized structures, as both of the given endings are acceptable. If the results showed that topicalization was preferred, this would be a sign of L1 transfer. The structure of item (i) is much less frequent than that of item (g). In the analysis of the data, item (i) was excluded because a number of participants reported that even though both continuations were technically grammatical, the one with a repeated NP sounded so unnatural that they had trouble selecting a continuation.<sup>6</sup>

**3.2 PROCEDURE.** The morpho-syntax experiment was conducted after a five-minute break following the prosody experiment. The experiment was run on E-Prime version 1.1 on PCs in quiet language labs. Korean high school students participated in the experiment in groups of five, as a class activity under the supervision of a teacher and an experimenter. Native speakers of English took part in the experiment individually in a quiet room. The procedure was almost the same as in the prosody experiment except there were neither specific instructions nor a practice block, because participants should have been familiar with the task format after the prosody experiment. The materials were contained in one block with no break between trials and the order of item presentation was randomized. On each trial, a visual attention signal ("Ready?") appeared on the screen. Following this, each sentence beginning was presented twice over headphones to the participants. While listening to each auditory stimulus, they saw another visual attention signal, "+" at the center of the screen. They then chose between two endings visually presented on the left and right sides of the computer screen by pressing one of two keys, "q" and "p." The correct choice was balanced for left and right sides of the screen within participants.

**3.3 PARTICIPANTS.** Two language groups participated in the morpho-syntax experiment. The first consisted of 176 Korean high school students at four levels of English proficiency (beginning, intermediate, advanced without immersion experience, and advanced with immersion experience), and the second consisted of 20 native speakers of English. The Korean high school students were grouped based on the YBM/Si-sa's<sup>7</sup> informal report (2004) of the students' average TOEIC scores of standardized high schools, actual TOEIC scores of one foreign language high school, immersion experience, and English mid-term scores of one standardized high school.

High school students were used for the sample population of Korean L2ers because of ease of attaining a number of subjects in a short period of time and the availability of the language lab facilities. According to the YBM/Si-sa's report and consultation with teachers from the two high schools, so-called "advanced" students in the English subject in regular high schools tend to have scores around 550-600 out of 990 points in TOEIC, which suggests that they are not really advanced according to

<sup>6</sup> Some of them stopped the experiment and asked whether this item was correctly built. Others reported that they were so confused that they randomly chose one ending.

<sup>7</sup> YBM/Si-sa introduced TOEIC first to Korea and now is one of the administrations which work in cooperation with the Educational Testing Service (ETS). It also organizes the TOEIC Committee to supervise language evaluation activities ([www.ybm.co.kr/eng/ybm\\_eng04\\_1.html](http://www.ybm.co.kr/eng/ybm_eng04_1.html)).

the proficiency scales provided by the Korean TOEIC committee or the TOEIC Examinee Handbook from ETS (see the Appendix for example scales). On the other hand, the foreign language high school has had average scores above 650 points in TOEIC, which means that most students there are at least above the beginning level. In order to get participants with different levels of proficiency ranging from beginning to advanced, students were drawn from two schools—one regular high school and one foreign language high school.<sup>8</sup>

The two experiments (which together required 40 minutes on average) had to be completed in 50 minutes as a kind of class activity. This time restriction prevented the administration of a separate proficiency test. Unfortunately, no one criterion was available to evaluate English proficiency of all participants from the two schools. Since the foreign language high school obliges all students to take TOEIC on a regular basis, I was allowed access to the participants whose TOEIC scores were above 730 points. At the other regular school, only a few of students had TOEIC scores, which were around 530 points. Therefore, based on the information available, the participants from the foreign language high school were placed into the two advanced groups, and those from the regular high school were placed into the intermediate and beginning groups.

The advanced group, determined by a score of over 730 points, was divided again into two groups by immersion experience: the advanced group with immersion experience was called the “extra-advanced group” (average TOEIC score of 862.5; score range of from 775 to 960; length of stay in English-speaking countries from 1 to 11 years), while the advanced group without immersion experience was named the “advanced group” (average TOEIC score of 818.5; score range of 735 to 930). The participants from the regular high school were broken into two levels by means of their English mid-term scores.<sup>9</sup> Following the English teachers’ suggestions, the participants who achieved scores above 80 points out of 100 on the mid-term examination were placed into the intermediate group. The rest of participants were categorized as the beginning group.

The English native speakers were undergraduate students taking a course in the Department of Linguistics at the University of Hawai‘i at Mānoa. They participated in the present experiment under the Linguistics Beyond the Classroom (LBC) requirement and received course credit as compensation.

In sum, four groups of 176 Korean high school students and one group of 20 native speakers of English were tested in the current study. All participants had normal hearing and normal or corrected-to-normal vision. It is conceivable that the placement of the Korean L2ers could have been somewhat unreliable, since no one standard was applied to evaluate the participants’ proficiency. To mitigate this, each group of Korean L2ers consisted of at least 40 students. As shown below, the proficiency grouping was supported by the results of the morpho-syntax experiment.

### 3.4 RESULTS. The results are presented in Table 3 and Figure 3.

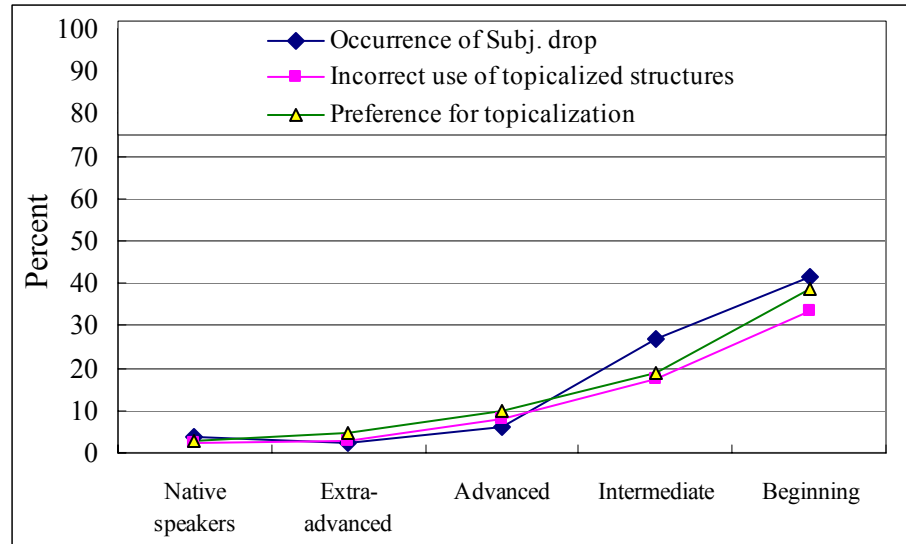
TABLE 3. MEAN PERCENTAGES OF SUBJECT-DROP, INCORRECT USE OF TOPICALIZATION AND TOPICALIZATION PREFERENCE BY PROFICIENCY.

%	Native speakers	Extra-advanced	Advanced	Inter-mediate	Beginning
Occurrence of Subj. drop	3.60	2.20	6.10	26.95	41.41
Incorrect use of topicalized structures	2.50	2.75	8.00	17.62	33.52
Preference for topicalization	3.00	4.50	10.00	19.05	38.89

<sup>8</sup> The names of the two schools remain anonymous upon request.

<sup>9</sup> The English mid-terms were taken a week before the experiment began in the regular high school, and TOEIC was taken in the same week that the experiment began in the foreign language high school.

FIGURE 3. MEAN PERCENTAGES OF SUBJECT-DROP, INCORRECT USE OF TOPICALIZATION AND TOPICALIZATION PREFERENCE AS A FUNCTION OF ENGLISH PROFICIENCY LEVELS.



A repeated measures ANOVA was performed on the percentage correct with “Type” (subject-drop vs. correct use of topicalization vs. preference for topicalization) as a within-subjects factor and “Group” (native speakers and four levels of proficiency) as a between-subjects factor. This analysis revealed a significant main effect of proficiency ( $F(4,191) = 48.459, p = 0.000$ ), indicating that Korean morpho-syntactic carryover decreased significantly as English proficiency increased.

A further analysis of the proficiency effect using a Tukey’s HSD test showed that there were no significant differences among the native speaker group, the extra-advanced group, and the advanced group, while there were significant differences between other pairs of groups (native speakers vs. intermediate/beginning; extra-advanced vs. intermediate/beginning; advanced vs. intermediate/beginning; intermediate vs. beginning; all  $p$ ’s < 0.001). The results suggest that each proficiency group from the beginning to the advanced levels had distinctively different knowledge of the relevant grammatical structures (i.e., subject-drop or topicalization). Therefore, the results clearly reflected different English proficiency across groups and validated the placement of participants in terms of their proficiency.

The non-significant differences among the native speakers, the extra-advanced group, and the advanced group indicate that regardless of immersion experience, English morpho-syntactic competence of all of the advanced learners was almost identical and native-like: they knew that English does not permit subject-drop, and that topicalized structures are dispreferred. Since negative transfer of L1 morpho-syntax would not interfere in L2 processing, advanced learners’ results in the prosody experiment should accurately reflect their use of prosody.

The intermediate learners and the beginning learners had not achieved native-like morpho-syntactic knowledge: although they performed better than chance, they seemed to frequently omit a subject (26.95% subject drop choices for the intermediate group and 41.41%, for the beginning group); they exhibited imperfect knowledge of the topicalized structures (17.62% incorrect grammatical choices for the intermediate group and 33.52%, for the beginning group); and they used topicalized structures more frequently than expected (19.05% for the intermediate group and 38.89% for the beginning group). With regard to these two groups, their language behavior in the prosody experiment should be interpreted as limited by their morpho-syntactic competence.

**4. PROSODY EXPERIMENT.** The purpose of the prosody experiment was to determine whether the Korean-English L2ers at different levels of proficiency would be able to use prosody in the parsing of spoken English sentences involving temporary closure ambiguities. Participants in the forced-choice categorization task heard 53 early and 53 late closure sentences from which the disambiguating parts

(i.e. *will ...* in (5a) and *it ...* in (5b)) had been removed. Then they matched the ambiguous portion with the most likely of two visually presented disambiguating continuations.

The L2ers at all levels were predicted to utilize relative prosodic boundary strength patterns, since both English and Korean employ two levels of prosodic boundaries. As a result, most L2ers were expected to comprehend the ambiguous closure structure at a better-than-chance level. The late closure bias should have been overridden by prosodic cues in processing early closure sentences. However, more proficient L2ers were predicted to achieve a higher percentage correct than others from their better knowledge of English morpho-syntax. Also, the more advanced L2ers were expected to more effectively employ prosodic information which is not transferred from Korean, such as pitch accents or phrase tones.

**4.1 MATERIALS.** The prosody experiment utilized multiple pronunciations of two sentences: *When that moves the square will encounter a cookie* and *When that moves the square it will encounter a cookie*. As discussed above, these utterances contained a transitive/intransitive verb ambiguity which results in a temporary syntactic ambiguity between early and late closure of the subordinate verb phrase.

The 53 early and 53 late closure sentences were produced by thirteen untrained native speakers of English, who participated in Schafer et al.'s (2000) cooperative game task. This task generated quasi-spontaneous speech. Therefore, the materials were more natural than those typically produced in sentence reading tasks, which lack realistic constraints on normal and spontaneous conversational speech. As discussed further below, the majority of the utterances were produced with prosody that reflected the syntactic structure. The sentences were composed of relatively easy vocabulary, which could preclude any possible effect of lexical deficiency on the process of disambiguation.

This experiment differs from Schafer et al.'s in terms of its size and structure. Schafer et al.'s experiment was composed of two blocks (212 items, in total), as discussed above. Since the percentages of correct answers for the segmentally crossed continuations were not significantly different from those for the original continuations, and this current study examined L2 learners as its target population, the current study tested only the original continuations, in order to eliminate any interference from confounding factors such as vocabulary or fatigue.

The 106 items in this prosody experiment were broken into three blocks. Block 1 consisted of 14 early and 22 late closure sentences; block 2, 17 late and 17 early closure sentences; block 3, 22 early and 14 late closure sentences. Between the blocks, there were one-minute breaks in order to prevent the L2ers from becoming bored and losing attention. The three blocks were randomly ordered and the order of items was also randomized within each block.

**4.2 PROCEDURE.** Groups of five Korean students participated at a time in the experiment in quiet language labs in each school, under the supervision of a teacher and an experimenter. Native speakers of English participated in the experiment individually, also in a quiet room. Before the experiment began, they were told that they were engaging in a listening comprehension study, but they were informed of neither the syntactic ambiguities nor the prosodic conditions tested in the current study. Participants received an instruction sheet which explained all the vocabulary used in the experiment and the game context in which the materials were collected. The instructions and explanation were given in Korean for the Korean L2ers and in English for the English native speakers.

A practice block of eight items was given to familiarize subjects with the task format. Each trial began with a visual ready signal. Next, participants listened to the syntactically ambiguous fragment (i.e., the beginning of the utterance, *When that moves the square*), which was played twice over headphones. Then, they chose between early or late closure continuations (e.g., *... will encounter a cookie* vs. *... it will encounter a cookie*). The early closure continuations were visually presented on the left of the computer screen, and the late closure ones on the right side. Participants were encouraged to answer as quickly as possible.

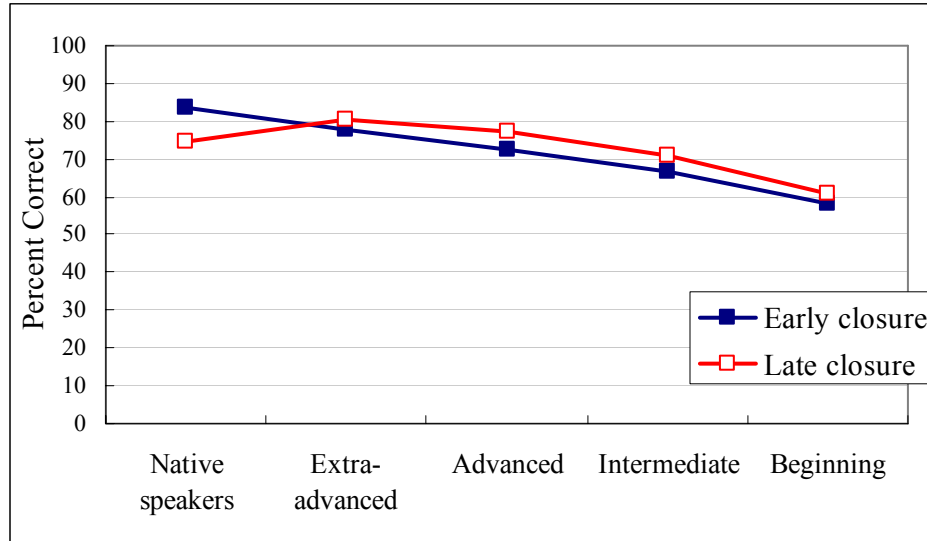
**4.3 PARTICIPANTS.** The subjects were the same 176 Korean high school students and 20 native speakers of English who participated in the morpho-syntax experiment.

**4.4 RESULTS: GLOBAL ANALYSIS.** The results are presented in Table 4 and Figure 4.

TABLE 4. MEANS FOR CORRECT CATEGORIZATION: COMPARISON BY ENGLISH PROFICIENCY AND SYNTAX.

%	Native speakers	Extra-advanced	Advanced	Intermediate	Beginning
Early closure	83.40	77.83	72.41	66.89	58.18
Late closure	74.34	80.42	77.45	70.80	60.83
Total	78.87	79.13	74.93	68.85	59.50

FIGURE 4. MEANS FOR CORRECT CATEGORIZATION: COMPARISON BY ENGLISH PROFICIENCY AND SYNTAX.



A one-sample t-test was conducted on the actual score correct (range from 0 to 106) of the subjects in each group, comparing them to an expected value of 53 correct (50%), in order to check that each group, especially the beginning group, obtained scores above the level of chance. As predicted, the analysis revealed that all groups across proficiencies performed above the chance-level: beginning,  $t=5.312$ ,  $df=53$ ,  $p=0.000$ ; intermediate,  $t=10.165$ ,  $df=41$ ,  $p=0.000$ ; advanced,  $t=17.698$ ,  $df=39$ ,  $p=0.000$ ; extra-advanced,  $t=24.995$ ,  $df=39$ ,  $p=0.000$ ; native speakers,  $t=13.450$ ,  $df=19$ ,  $p=0.000$ . These results suggest that prosody facilitated the L2ers' processing of closure syntactic ambiguity regardless of proficiency level.

A repeated measures ANOVA was performed on the percentages of correct categorization with "Syntax" (early closure syntax and late closure syntax) as a within-subjects factor and "Group" (native speakers, extra-advanced, advanced, intermediate, and beginning groups) as a between-subjects factor.

The analysis revealed a significant main effect of proficiency ( $F(4, 191) = 25.570$ ,  $p=0.000$ ), suggesting that there was a significant change in the percentages of correct categorization as proficiency increased. The different patterns of percentage correct among the two advanced groups and native speakers, as shown in Figure 4, is not because of any morpho-syntactic interference, since the extra-advanced and the advanced groups showed almost native-like competence in the relevant syntactic structures in the morpho-syntax experiment.<sup>10</sup> On the other hand, the descending scores of the intermediate and the beginning groups in this experiment could be credited to their incomplete grammar of English as well as to negative transfer effects of Korean morpho-syntax. This means that their pro-

<sup>10</sup> However, the result of the advanced group was numerically lower than that of the extra-advanced group.

sodic use was somewhat masked by their morpho-syntactic limitation in English and its interference in the parsing of the spoken sentences.<sup>11</sup>

A significant interaction of “Syntax” and “Group” was found ( $F(4, 191) = 4.091, p = 0.003$ ), which indicates that the two closure structures were treated differently by the five groups of participants. Figure 4 shows that the native speakers and the Korean L2ers differed in the way they used prosody to resolve the closure ambiguity. Native speakers of English performed better on the early closure condition than on the late closure one, which suggests that L1 prosody (English) overrode the universal late closure preference.

Conversely, L2 prosody did not completely suppress the universal preference for late closure. Late closure syntax obtained significantly higher percentages of correct responses than early closure syntax, regardless of proficiency levels, although both early and late closure syntax showed above chance-level performance. A repeated measures ANOVA run only with the data of the L2ers at four levels of proficiency found a significant main effect of syntax ( $F(1, 172) = 13.216, p = 0.000$ ). The interaction between “Syntax” and “Group” (extra-advanced, advanced, intermediate, and beginning) was not significant ( $F(3, 172) = 0.351, p = 0.789$ ), showing that all four levels of proficiency exhibited the same pattern of percentage correct with respect to the two syntactic structures. These results were unpredicted and rather surprising, because the more proficient L2ers were expected to suppress the Late Closure strategy more effectively when prosodic cues were present, assuming they had better knowledge of L2 prosody.

The question of why the significant interaction of syntax and native language emerged is unanswered. For now, it is conceivable that certain prosodic cues (e.g., ip boundaries) are less informative in L2 processing than in L1 processing, due to lack of positive transfer of Korean prosody and to difficulty in the mastery of L2 prosody. This is merely a speculation which needs further investigation.

**4.5 DETAILED ANALYSIS: COOPERATING VS. AMBIGUOUS VS. CONFLICTING PROSODY.** In Schafer et al.’s study, the sentences were analyzed in the ToBI system (Beckman and Elam 1997) by two teams of transcribers. One team was provided with the complete sentences, and the other team with only the incomplete fragments of the sentences through *the square*. The two teams’ transcriptions were very similar. On the basis of the second team’s transcriptions, Schafer et al. categorized the materials into three types of prosodic structures: cooperating, ambiguous, and conflicting prosody. However, the three prosodic conditions did not have equal numbers of tokens, as the majority of sentences received cooperating prosodic structures (73%).<sup>12</sup> Another thing to be noted about the prosodic conditions is that the auditorily presented beginnings of the sentences lost phonetic cues following *the square*, after the whole sentences were digitally edited to remove the disambiguating portions (Schafer et al. 2000:176).

Prosodic constituents correspond to syntactic constituents or constituents at other linguistic levels (Pierrehumbert 1980). Although the correspondence between prosody and syntax has been found to be complex, prosody can reduce syntactic ambiguity. Under the assumption that a well-formed mapping of prosodic phrasing with a syntactically ambiguous sentence can disambiguate it, and based on the results in Schafer et al. (2000), the following predictions were made with regard to the three prosodic categorizations. When the strongest prosodic boundary is located at the subordinate clause boundary (i.e., cooperating prosody), categorization should be significantly above chance level. When equal-strength prosodic boundaries occur before and after *the square* (i.e., ambiguous prosody), categorization should not be as high as that with cooperating prosody. However, the more proficient L2ers could make correct categorization at an above-chance level, because choices of edge tones or pitch accents could contribute to their syntactic disambiguation. When a weaker prosodic boundary

<sup>11</sup> For example, if the beginning group had not used prosody and always applied late closure, its percentage correct could have been around 41.41%, because subject-drop could have led a parser to accidentally choose a correct ending. If the beginning group had been able to use prosody perfectly, the percentage correct could have been around 61.11%, due to the preference for topicalization. The actual result of the beginning group (58.18%) shows merely the approximate size of prosodic effects on syntactic parsing decisions.

<sup>12</sup> This is a major difference from Kjelgaard and Speer 1999, in which the utterances were carefully recorded by a trained speaker and had an equal number of tokens in each condition.



is at the subordinate clause boundary than the other critical location (i.e., conflicting prosody), correct categorization should be lower than that with cooperating and ambiguous prosody. Since cooperating prosody is expected to aid disambiguation more strongly, late closure bias would be suppressed more effectively in this prosody.

As discussed above, the number of items in each prosody set was not balanced: the materials contained 40 tokens of the early cooperating condition, 10 of the early ambiguous condition, 3 of the early conflicting condition, 37 of the late cooperating condition, 9 of the late ambiguous condition, and 7 of the late conflicting condition. The results of each syntactic condition, sorted into three prosodic conditions (cooperating, ambiguous, and conflicting conditions), are presented in Table 5 and Figures 5-6.

TABLE 5. MEANS FOR CORRECT CATEGORIZATION FOR THREE TYPES OF PROSODY FOR EACH SYNTAX ACROSS DIFFERENT ENGLISH PROFICIENCY LEVELS.

%	Native speakers	Extra-advanced	Advanced	Intermediate	Beginning
Early cooperating	88.88	81.38	77.31	70.36	60.69
Early ambiguous	71.00	68.25	60.75	59.29	52.59
Early conflicting	51.67	62.50	45.83	46.03	43.21
Late cooperating	82.03	87.77	85.88	77.16	63.06
Late ambiguous	59.44	65.83	57.50	57.94	56.79
Late conflicting	52.86	60.36	58.57	53.74	54.23

FIGURE 5. MEAN PERCENTAGE CORRECT AS A FUNCTION OF LEVELS OF ENGLISH PROFICIENCY FOR DIFFERENT PROSODIC CATEGORIES IN EARLY AND LATE CLOSURE SYNTAX.

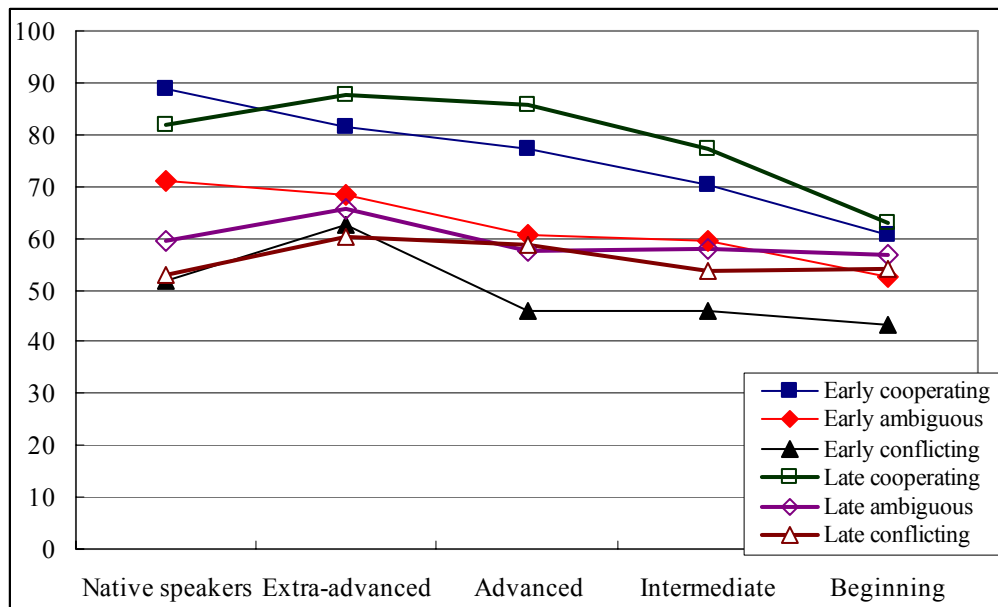
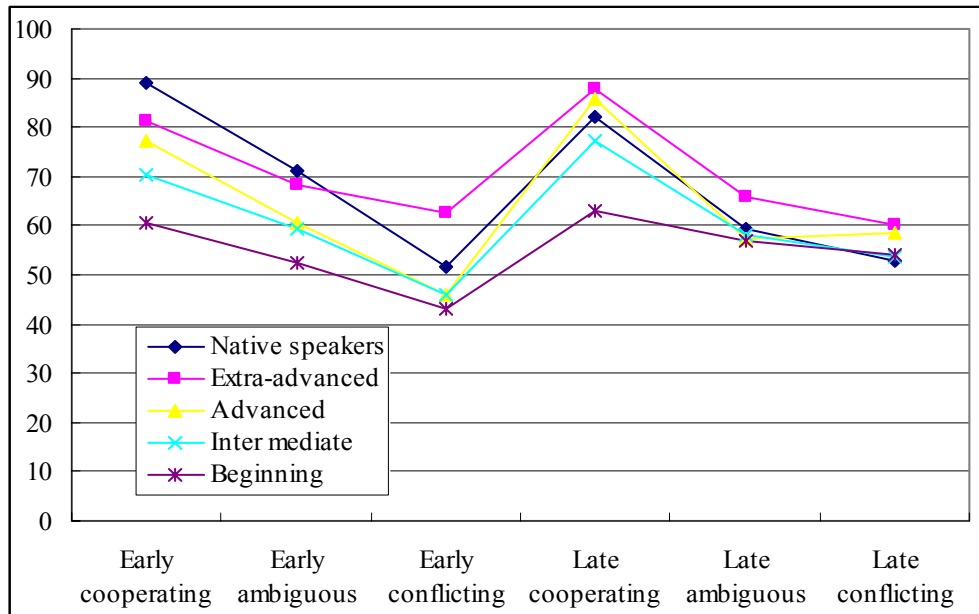


FIGURE 6. MEAN PERCENTAGE CORRECT AS A FUNCTION OF PROSODIC CONDITIONS IN EACH TYPE OF SYNTAX FOR DIFFERENT LEVELS OF ENGLISH PROFICIENCY.



For all groups, participants' percentage correct showed sensitivity to a well-formed prosody-syntax mapping and a relative boundary strength distinction. Cooperating sentences reduced the closure ambiguity more effectively than ambiguous and conflicting sentences, confirming the prediction that correspondence from prosody to syntax contributes to their disambiguation. More crucially, the comparison between cooperating and ambiguous prosody in percentage correct shows that relative boundary strength produced effects on syntactic processing decisions, and most Korean L2ers were able to use relative boundary strength in prosodic disambiguation. The percentage correct for ambiguous prosody was higher than for conflicting prosody, suggesting that the latter misleads the syntactic parser.

In contrast to the above prediction, late closure bias still held for Korean L2ers' processing of cooperating sentences, unlike native speakers' (see Figure 5). In fact, the percentage correct of cooperating sentences across proficiency levels (see Figure 5) patterns with that of all the sentences (see Figure 4). This is not surprising, because most sentences were produced with cooperating prosody. Therefore, these results confirm the previous analysis.

The extra-advanced learners performed slightly better than the advanced learners for the items with cooperating prosody, suggesting different competence of English prosody between two groups, or reflecting their slight but not significant difference of English morpho-syntax. For the items with ambiguous and conflicting prosody, the results of the extra-advanced learners almost resemble those of the native speakers. Both groups had results above the chance level, while the other groups did not. The results of the native speakers and the extra-advanced learners in ambiguous and conflicting prosody suggest that the relative strength of prosodic boundaries is not the only prosodic cue to disambiguation. Variation in edge tones, pitch accents, or pitch ranges may also be responsible for disambiguation (Schafer et al. 2000). Given the immersion experience of the extra-advanced group, the overall better performance of the extra-advanced group compared to the advanced group suggests that immersion experience might be a crucial factor for mastering these aspects of L2 prosody.

In sum, comparable patterns in the use of the three sets of prosody were found across all groups in the parsing of early and late closure structures: cooperating prosody was more facilitating than ambiguous or conflicting prosody in terms of the percentages of correct categorization. The significantly better facilitation effect of cooperating prosody implies that (1) processing of ambiguous structures is easier when prosodic structure is similar to syntactic structure; (2) relative boundary strength at key

positions (e.g., around *the square*) is the most important prosodic factor in L2 comprehension; and (3) tonal cues may affect syntactic parsing only in learners with immersion experience.

**5. GENERAL DISCUSSION.** This study investigated the reliability of prosodic disambiguation in Korean-English L2 processing of closure ambiguities by conducting a morpho-syntax experiment and a prosody experiment. Korean L2ers at all levels used the relative strength of prosodic boundaries to correctly disambiguate syntactically ambiguous utterances at an above-chance level. The L2 parsing mechanism is therefore sensitive to prosodic representation, and prosody can be an important source of information for resolving syntactic ambiguity.

As English proficiency increased, there was a significant increase in the correct processing of ambiguous fragments. This can be attributed partially to improvement in L2 morpho-syntax, assessed separately in the morpho-syntax experiment: each proficiency level showed distinctive developmental competence in morpho-syntax until the advanced level. This has the following implications: (1) the morpho-syntactic interference somewhat obscured Korean L2ers' use of prosody. If there was a way of eliminating the interference in the prosody experiment, syntactic disambiguation effects of prosody depending on proficiency-levels would be clearer; (2) the improvement in prosody was clearest between advanced and extra-advanced groups, because their morpho-syntactic competence was almost identical and native-like. Therefore, the use of prosody between these two groups can be clearly compared and interpreted.

Significantly better performance with cooperating prosody than with other prosody suggests that the L2ers were able to make correct use of relative boundary strengths, which is consistent with the findings in Schafer et al. (2000), based on native speakers of English. Also, this finding seems to support the predictions of the Informative Boundary Hypothesis (IBH) (Clifton et al. 2002), which uses the relative strength of a prosodic boundary for syntactic disambiguation, but not its absolute strength. However, the results argue against purely local theories of prosodic boundaries such as the Anti-Attachment Hypothesis (AAH) (Watson and Gibson 2004/in press), which predicts blocking of local attachment of an incoming word by the presence of an intonation phrase boundary (IPh). Thus, this study provides further support for the theory that the syntactic parser must be sensitive to the overall prosodic representation rather than a local presence of prosodic boundaries.

The Korean L2ers showed somewhat different parsing strategies from native speakers with regard to the use of prosody, although prosody is an important factor responsible for syntactic disambiguation in both L1 and L2. The Korean L2ers showed a bias toward late closure; also, Korean L2ers without immersion experience seemed to show insensitivity to pitch variation in ambiguous and conflicting prosody. The latter finding suggests that the speakers' choice of pitch accents or phrase tones was less helpful for Korean L2ers who had not been immersed in English-speaking countries. Conceivably, successful acquisition of L2 prosody would require exposure to the target language environment. A relevant claim was made by Flege and his colleagues (Flege 1995, Flege et al. 1999). They argued that detection of phonetic difference between L1 and L2 sounds decreases as "age of arrival" increases. Late arrival deteriorates the establishment of L2 categories due to the greater establishment of the L1 categories. This claim suggests that arrival to English-speaking countries and age of arrival affect the learning of English.

So far, several hypotheses with respect to the perception of L2 segments have been advanced (e.g., Best 1995, Best et al. 2001, Flege 1987/1995, Lado 1957). For instance, the Perceptual Assimilation Model (PAM), proposed by Best and her colleagues (Best 1995, Best et al. 2001) claims that L2 learners perceptually assimilate L2 sound contrasts to L1 sounds. If each of two L2 sounds is assimilated to different native categories (phonemes), discrimination of the two sounds is expected to be excellent. If one L2 sound is assimilated to an L1 category and the other is not, but still falls within L1's phonetic space, discrimination is expected to be good to very good. If two L2 sounds fall in the phonetic space of L1, but neither of them is assimilated to an L1 category, their proximity to each other and to native categories in the phonetic space would determine the discriminability of the two sounds. Thus, the discriminability of the L2 sounds is determined based on L2 learners' perception of their relation to sounds in the L1.

However, there has not been any model or hypothesis that accounts for L2ers' detection and use of intonational cues. In order to establish a model appropriate for Korean L2ers' use of prosody, fur-

ther study is needed with more controlled materials (e.g., control of the number of tokens in each prosodic condition and the types of edge tones and pitch accents). Control of tonal features is important; for example English has more varied phrase tonal patterns than Korean. So, the type of phrase tone used to demarcate an intermediate phrase could affect Korean L2ers' processing of ips and their disambiguation of sentences. Effects of subtypes of the cooperating, ambiguous and conflicting patterns<sup>13</sup> should also be examined in order to thoroughly evaluate various predictions of prosodic hypotheses such as the IBH or AAH. Furthermore, it is necessary to study varied syntactic structures such as those in materials containing argument structures and heavy or light adjuncts, since the occurrence of prosodic boundaries is not equally felicitous before those different structures (Carlson et al. 2001, Schafer et al. 2000).

This study does not directly reveal how or when prosody interacts with syntax in the incremental course of ambiguity resolution, since the current experiment did not utilize on-line methods. In order to investigate real-time processing (e.g., whether prosody was used in the initial analysis or in re-analysis), on-line experiments such as an eye-tracking study should be employed. But the findings of this study suggest that like L1ers, L2ers are sensitive to prosodic disambiguation of syntax, and interpret local prosodic cues with respect to the larger prosodic structure.

<sup>13</sup> For example, subtypes of cooperating prosody for the early closure syntactic structure are as follows: the first pattern is produced with an IPh and no edge tone (IPh-0) in the two key positions, the second pattern with an IPh and an ip (IPh-ip), and the third pattern with an ip and no edge tone (ip-0).

## APPENDIX

EXAMPLES FOR THE PROFICIENCY SCALES (<http://www.ets.org/toEIC/related.html#publications>)

## 1. Proficiency scale in Korea

([http://exam.ybmsisa.com/toEIC/toEIC01\\_2.asp](http://exam.ybmsisa.com/toEIC/toEIC01_2.asp))

Level	TOEIC Score	평가 (GUIDELINE)
<b>A</b>	860 이상	<p><b>Non-native</b> 로서 <b>충분한 커뮤니케이션을 할 수 있다.</b></p> <p>자기의 경험범위내에서 전문분야 이외의 화제에 대해서도 충분한 이해와 표현이 가능하다.</p> <p>Native speaker 의 수준에는 아직 미달되지만, 어휘, 문법구문을 정확하게 파악하고 유창하게 영어를 구사할 수 있다.</p>
<b>B</b>	730 이상	<p><b>어떤 상황에서도 적절한 커뮤니케이션을 할 수 있는 바탕을 갖추고 있다.</b></p> <p>일상회화는 완전히 이해하고 응답도 빠르다. 특정분야의 화제에 대처할 능력을 갖고 있다.</p> <p>정확성과 유창함에는 개인차가 있으며, 문법, 구문상의 잘못이 발견될 수 있으나 의사소통에 지장을 줄 정도는 아니다.</p>
<b>C</b>	470 이상	<p><b>일상생활의 필요를 충족하고, 한정된 범위내에서는 업무상의 커뮤니케이션이 가능하다.</b></p> <p>일상회화라면 요점을 이해하고 응답에도 지장이 없다. 복잡한 상황에서의 응대나 의사소통에는 우열의 차가 있다.</p> <p>기본적인 문법.구문은 익히고 있으며, 표현은 모자라지만 그런대로 자기의사를 전달하는 어휘력을 갖추고 있다.</p>
<b>D</b>	220 이상	<p><b>일상회화에서 최저한의 커뮤니케이션이 가능하다.</b></p> <p>상대방이 천천히 말하거나 되풀이 하여 말하면, 간단한 회화는 이해할 수 있다. 화제가 신변 이야기 면 응답도 가능하다.</p> <p>회화 문법 구문 모두 불충분한 점이 많으나, 상대방이 Non-native 에게 각별한 배려를 해주면 의사소통을 할 수 있다.</p>
<b>E</b>	220 미만	<p><b>커뮤니케이션을 할 수 있는 단계에 이르지 못했다.</b></p> <p>간단한 회화를 상대방이 천천히 말해도 부분적으로 밖에 이해하지 못한다. 단편적으로 단어를 나열하는 정도로서, 실질적인 의사소통은 어려운 단계이다.</p>

## 2. An International Electric and Electronics Company in Japan

Class	TOEIC Scores	English Ability Expectations
1st	750 or more	Ability sufficient for overseas assignment
2nd	Less than 750, but 700 or more	Able to negotiate with people from other countries and to make business presentations
3rd	Less than 700, but 630 or more	Able to take an overseas business trip unaccompanied
4th	Less than 630, but 550 or more	Able to take an overseas business trip with an assistant
5th	Less than 550, but 450 or more	Able to communicate with people from other countries at a minimum level
No class	Less than 450, but 350 or more	For employees not involved in overseas-related operations
	Less than 350, but 250 or more	Beginners

## 3. A Defense Company in France

English Competency Level	
TOEIC Score	Description
900–990	Managers who are able to represent the company unaccompanied and with final authority in negotiating agreements and contracts with native English-speaking partner organizations.
*800–850	Managers who are able to represent the company unaccompanied in contributing to the negotiation of agreements and contracts with partner organizations using English.
700–750	Individuals who actively participate in meetings with partner organizations using English.
600	Individuals who accompany and support staff members with primary responsibility for business meetings. May be called upon to give a short, prepared speech and/or to take the minutes of the meeting.
400–500	Individuals who, with the assistance of vocabulary/grammar aids have occasional and short-term contact in English. This may include welcoming visitors (in person or by telephone) and working with the mail.
<i>These five descriptors may be used as guidelines only. They should be adapted to real situations and should not be considered definitive.</i>	

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