The Role of Prosody in English Sentence Processing: Evidence from L1-Korean EFL Learners*

Jee Hyun Ma
(University of Hawai’i at Mānoa)


This study investigates Korean L1 speakers' preference for prosodic as opposed to syntactic cues in English sentence processing. The participants were 63 middle school second graders and 70 high school second graders in Seoul, Korea, including both male and female students with different English proficiency levels. The competing cues task and the comprehension time task were conducted to explore the role of prosody in English sentence processing. In the competing cues task, it was generally the case that learners did not primarily attend to syntax when processing English sentences. Instead, all groups of learners were much more likely to attend to prosody. In the comprehension time task, the sentences with cooperating prosody needed significantly less comprehension time than sentences with conflicting prosody in all groups. This suggests that the recognition of prosodic features is an influential factor in English sentence processing.

Keywords: prosodic cues, syntactic cues, cooperating prosody, conflicting prosody

1. Introduction

'Prosody' is generally defined as the intonation structure of spoken sentences. It also includes loudness, rate, word stress and pauses that sometimes occur at the ends of sentences and clauses, and a lengthening of the words immediately prior to a clause boundary (Cutler, Dahan and van Donselaar 1997, J H Ma 2006, Selkirk 1986, Thompson, Aidinejad and Ponte 2001). With the developments in psycholinguistic and neurolinguistic theories as well as in computer technology, prosody has received increasing attention in psycholinguistic (J H Ma 2006, S-A Jun 2003, Schafer, Speer, Warren and White 2000, Warren 1996) and neurolinguistic research (Eckstein and Friederici 2005, Steinhauser, Alter and Friederici 1999) over the last several decades.

In psycholinguistic studies, prosody has been debated in its role in word or

* I would like to thank three anonymous reviewers for their comments and suggestions. I would also like to deeply thank Dr. Jin-Wan Kim for supporting me in every respect throughout the development of this paper.
sentence processing. Some studies rarely mention prosody, either as an aid to word recognition or as a carrier of rich semantic information (MacDonald, Pearlmutter and Seidenberg 1994, Marslen-Wilson and Tyler 1980). Other theorists have gone so far as to suggest that the prosodic structure perceived by a listener is determined by the syntactic analysis the listener had recovered for the spoken sentences (Lieberman 1965). Others even theorize that prosodic variables cannot be of much use to sentence processing since they are not powerful enough to cause syntactic misanalyses (Pritchett 1988). In contrast to these claims, many studies have demonstrated that prosody does convey information that plays a major role in sentence processing (Allbritton, McKoon and Ratcliff 1996, Beach 1991, Ferreira 1993, Harley, Howard and Hart 1995, Kjelgaard 1995, Kjelgaard, Titone and Wingfield 1999, Speer and Dobroth 1993, Speer, Kjelgaard and Dobroth 1996, Steedman 1991, Stirling and Wales 1996, Tyler and Warren 1987, Warren, Grabe and Nolan 1995, Ying 1996).

There have also been debates concerning how much priority should be given to prosody in language teaching (Harley, Howard and Hart 1995, Ioup 1984, Speer, Kjelgaard and Dobroth 1996, Ying 1996). Many language teachers regard prosody as an inessential or notoriously difficult area to teach. This is especially the case in an EFL setting like Korea where students learn English largely from school textbooks, continuously focusing on reading and grammar and ignoring other aspects of language acquisition such as suprasegmental features. However, prosody is particularly important in communication and listening comprehension. Moreover, no one disputes that language learning universally includes the four closely related skills of reading, writing, listening, and speaking (Morgan, Meier and Newport 1987). Though it is essential that language learning should involve each of these whole language skills, prosody has not been given much attention in English language learning in Korea.

Learners have difficulties producing the features regarding prosody when they do not have enough opportunities to hear the prosodic features of speech (Anderson-Hsieh 1992). Thus it is not surprising that Korean students so often focus on comprehension at the lexical level that they do not attend to the overriding intonation, pause, and rhythm of an utterance when listening to spoken discourse (J H Ma 2006). This study examines the role of prosody in Korean L1 speakers’ processing of English sentences and concludes that it is important to re-think the traditional ideas that prosody does not play a fundamental role in language acquisition. By investigating this, the present study could provide meaningful findings regarding the importance of prosody in EFL settings where it has previously been neglected.
1.1. The Role of Prosody in Second Language Sentence Processing

Prosody plays a number of important roles in language processing. It indicates the emotion of a speaker, the semantic focus of a sentence, or disambiguates the meaning of an otherwise ambiguous sentence (Wingfield and Titone 1998). Speakers also use prosody in order to secure successful interaction with their conversational partners (Swerts and Hirschberg 1998, Yaeger-Dror 2002), and the prosody of an utterance can affect how quickly and how well listeners can understand the information that speakers provide (Birch and Clifton 1995). In addition, prosodic cues can be used not only to predict material which has yet to be spoken (Schafer, Speer, Warren and White 2000, Snedeker and Trueswell 2003) but also to enhance listener's recognition memory of spoken words or sentences (Eckstein and Friederici 2005, J H Ma 2006, Robinson 1977, Speer, Crowder and Thomas 1993).

Various studies have demonstrated the contribution of prosodic cues in determining the speaker's intended meaning when an utterance was potentially ambiguous (Allbritton, McKoon and Ratcliff 1996, Beach 1991, Harley, Howard and Hart 1995, Kjelgaard 1995, Kjelgaard, Titone and Wingfield 1999, Speer, Kjelgaard and Dobroth 1996, Stirling and Wales 1996, Warren, Grabe and Nolan 1995, Ying 1996). In written language, readers can resolve local ambiguity by reading more of the text. In spoken language, on the other hand, the prosodic structure of the sentence can be used for averting potential ambiguity (Kjelgaard, Titone and Wingfield 1999). In other words, when speakers provide appropriate prosodic cues under certain circumstances, listeners are able to use these cues to guide their interpretation of a phrase or sentence that has a global or local potential syntactic ambiguity. However, few studies are known to investigate the relative weight given to prosody by Korean L1 speakers in guiding their interpretation of ambiguous utterances.

One interesting study was conducted by Harley, Howard and Hart (1995) who, using the Competition Model, investigated the relationship between the age of arrival in the L2 environment and a preference for prosodic, as opposed to syntactic cues, to sentence interpretation in English. Previous L1 studies found that older learners are more attentive to syntactic cues and younger learners to phonological cues (Fernald and Mazzie 1991, Read and Schreiber 1982). Harley, Howard, and Hart (1995) thus expected that the younger L2 learners would pay greater attention to prosodic cues than the older ones, and that the older L2 learners would be more likely to attend to syntactic cues than the younger ones. However, the researchers found that all learner groups, regardless of age, followed prosodic cues to the sentence structure in ambiguous sentences in contrast to the expectation. Harley (2000) did another replication study and the result was the same.

The study by Harley, Howard and Hart (1995) is very meaningful for second
language acquisition (SLA) considering most previous L2 studies on sentence processing have focused on the effect of semantic and syntactic cues in sentence interpretation but few have paid attention to prosodic cues, which are important for real communication. Also, not much work has investigated how both older and younger L2 learners process ambiguous sentences (Ying 1996). Unfortunately, Harley, Howard and Hart (1995) did not control the amounts of formal instruction in English and English proficiency level of the participants. However, L2 proficiency level should be crucially considered in investigating prosody in L2 learning. Harley, Howard and Hart (1995) also pointed out that ‘the ability to override prosodic cues and focus on the syntax of the sentence may be a sophisticated metalinguistic skill, generally available only to native speakers of the target language and not readily manifested without prompting.’ This remark suggests that the level of English proficiency that a learner has can affect the degree of attention paid to prosodic and syntactic cues in L2 sentence processing. Another factor to be considered in examining prosody in L2 learning is the participants' possible L1 influence. In Harley, Howard and Hart's study (1995), participants were all L1 speakers of Cantonese, which is well known as a representative tonal language, in which prosodic cues play a major role in determining meaning. Therefore, it constitutes a valuable study to investigate the L2 learners’ dependence on prosodic cues with different English proficiency levels and different (non-tonal) L1s. Additionally, measuring the reaction time is one of the most widely-used ways for examining sentence processing and it can provide meaningful information regarding the role of prosody in English sentence processing. This study partially replicates the study of Harley, Howard and Hart (1995) considering the above-mentioned limitations. The current study explores Korean L1 speakers’ attendance on prosodic structures in interpreting English sentence.

A few words about the Competition Model are necessary before going on to the examination of age factor and sex differences in learning and using prosody.

1.2. The Competition Model

The Competition Model is a functionalist language processing model based on the concepts of form-function mapping, probabilistic processing, and language acquisition as mediated by environmental factors (Bates and MacWhinney 1982, 1989). The mapping between form and function is not one to one but many to many (Bates and MacWhinney 1982, MacWhinney 1987, McDonald 1989). According to the Competition Model, sentence interpretation occurs via the cooperation and competition of various cues such as semantic, syntactic, and phonological cues. The strength with which these cues influence the process depends on the total form-function mapping distributions
of the language involved. That is, the stronger or more informative the mapping is between the particular and the function, the more likely that form will be used in assigning that function. One can therefore evoke learners' preferred strategies by presenting them with conflicting cues and examining learners' choices revealing their preferred strategy. There have been many studies designed in the framework of the Competition Model. They primarily dealt with conflicting cues such as semantics, word order, animacy and case marking cues (Bavin and Shopen 1989, Heilenman and McDonald 1993, Kail 1989, McDonald 1989, Sasaki 1992). However, developments in linguistic theory, as well as in computer technology, have led to a barrage of experiments examining the process involved in comprehending spoken language and, in particular, the role of prosody in this process.

1.3. Age Factor in Learning and Using Prosody

How the age of the learner affects the acquisition of an L2 is an issue that remains controversial (Birdsong 1999, Harley and Wang 1997, Long 1990, Singleton 1989, 1997). Although in the long-term outcomes, younger children in a natural acquisition environment are more likely than older children and adults to attain a native-like level of L2 proficiency (Long 1990), numerous short-term studies, with special focus on syntax, in both natural and classroom environments have shown advantages for older and later starters. Regarding phonological and prosodic skills, evidence from first language studies suggests that older learners are more attentive to syntactic cues, and younger children to prosodic cues (Fernald and Mazzie 1991, Read and Schreiber 1982). Working with native English speakers, Read and Schreiber (1982) found that the English L1 children relied more heavily on the prosodic cues than did the adults, who could better attend to the syntax. Similarly, Mandel, Jusczyk and Nelson (1994) found that sentential prosody helps infants and children organize and remember speech information better. However, different findings emerged in the L2 studies of Harley, Howard and Hart (1995) and Harley (2000). In the two studies, both Cantonese speaking ESL learners and Polish speaking ESL learners focused on the prosody of the English sentences regardless of age. Only the English L1 speakers at the high grade levels were generally more attentive to syntactic than prosodic cues. In Ying's study (1996), prosodic cues were robust in constraining ESL adult learners' processing of ambiguous sentences, suggesting that prosodic cues could help adult L2 learners disambiguate ambiguous sentences. Cutler and Swinney (1987) also found that the use of prosodic information during sentence comprehension is obviously well developed in adult listeners.
1.4. Sex Differences in Learning and Using Prosody

There are contradictory studies on whether there are gender differences in learning and using prosody. Also there is a persistent belief that females are superior to males where phonetic and prosodic skills are concerned. However, this superiority is not evident in all studies. Snow and Hoefnagel-Höhle (1982) observed no significant difference between boys and girls in the ability to imitate unfamiliar Dutch words. Likewise, Suter (1976) did not find any influence of sex on the pronunciation scores of adult ESL students. In Shen's study (1990), L2 learners were able to perceive and categorize the distinctive features and convey the shade-meaning carried by the appropriate intonational patterns of L2 regardless of sex.

On the other hand, Asher and Garcia (1969) found that Spanish-speaking girls were more successful than boys in acquiring a near-native pronunciation in English, especially in the beginning stages of learning. No matter what the age of the child coming to the United States was and no matter how long the child lived in the United States, more girls had a near-native pronunciation than boys. Thompson (1991) also pointed out the superiority of women even after prolonged residence in America. He stated that women were judged to have better accents in English than did the men. In contrast, there are studies that show superiority of men in pronunciation accuracy. For example, Hassan (2001) studied the relationship between gender and pronunciation accuracy of English with Arabic speaking Egyptian college students. Male students outperformed female students in their performance of English pronunciation accuracy. As shown above, many studies showed contradictory results of the effects of gender on learning and using prosody especially focusing on pronunciation. Moreover, little research to date has directly explored the role of prosody in L2 sentence processing considering gender differences, and the issue still remains unclear.

2. Purpose

The purpose of this study is to investigate Korean L1 speakers' preference for prosodic as opposed to syntactic cues in English sentence processing depending on learners' age, sex, and English proficiency level. On the basis of previous theoretical and empirical research and with the consideration of limitations of previous studies, the following research questions were formulated for the present investigation:

(1) Do age, sex, and English proficiency level affect the degree of attention to prosodic cues or syntactic cues in English sentence processing?
(2) Do age, sex, and proficiency level affect the comprehension time of English sentences with cooperating or conflicting prosody?

There are several terms needed to be clarified to understand this study. The term ‘cues’ will frequently be used in this study. Cues are ‘the sources of information a listener uses to decide which function is meant to be expressed by a given form’ (Kilborn and Ito 1989). There exist various cues in language: prosodic cues, semantic cues, syntactic cues, and animacy cues. Among these, prosodic and syntactic cues will be used in the present study. Prosodic cues refer to cues that have suprasegmental information such as stress, intonation, pitch, lengthening, and pause. Syntactic cues are cues that have grammatical information such as word order and agreement. When a cue disagrees with other cue(s), the term ‘conflicting cues’ is used. On the other hand, the term ‘cooperating cues’ is used when a cue agrees with other cue(s). Similarly, when prosodic and syntactic boundaries coincide in a sentence, the term ‘cooperating prosody’ will be used. Otherwise, the term ‘conflicting prosody’ will be used.

Two different tasks were conducted in this study to investigate the research questions: a competing cues task and a comprehension time task. Detailed information will be provided in section 3.

3. Methods

3.1. Participants

The participants of this study were 63 middle school second graders (Younger Learners: YL, age=13-14) and 70 high school second graders (Older Learners: OL, age=16-17) in Seoul, Korea. All middle school students came from one school located in Seoul. High school students came from two different schools, one girls’ and one boys’ high school located in Seoul. Students who had the experience of staying in English speaking countries were excluded for the reliability of the study. To investigate the effect of the age, sex, and English proficiency level, both male and female students with high English proficiency level (HL) and low English proficiency level (LL) were included in almost equal proportions (see Table I). The final-term English examination scores of the middle school were used for determining English proficiency level since there was no standard nation-wide English exam which the middle school students took at the time at which the data was gathered. The National English Examination by Seoul Metropolitan Office of Education was used for English proficiency level for high school students.¹

¹ Two different test scores, one for younger learners and the other for older learners, were
Table 1. The organization of the participants

<table>
<thead>
<tr>
<th></th>
<th>YL</th>
<th>OL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HL</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>LL</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HL</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>LL</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>63</td>
<td>70</td>
</tr>
</tbody>
</table>

The researcher conducted t-tests to make sure that there was no significant English proficiency difference between male and female students who belonged to the same English proficiency level within each age group from the beginning and confirmed that there was no significant difference. Figure 1 and 2 show the test score means for the groups with residual errors.

![Figure 1. Mean for middle school students' test scores.](image)

used to determine the participants' English proficiency level in this study. Listening and reading comprehension tests were included in almost equal proportions in both tests. However, it is recommended to use the same standardized test such as (Junior) TEPS or cloze test to determine learners' proficiency level for future research.
3.2. Tasks

Two different tasks were conducted in this study to investigate the research questions: competing cues task and comprehension time task. All sentence stimuli were recorded and edited in a professional recording studio in the language lab by a female native speaker of American English after training with the researcher. All sentences were recorded at a normal speaking rate.

3.2.1. Competing Cues Task

The purpose of the competing cues task was to determine the degree to which learners of different groups would attend to prosodic or syntactic cues to the ambiguous sentence structure, under conditions where syntax and prosody were placed in conflict. This task was basically adapted from Harley, Howard and Hart (1995) and Read and Schreiber (1982). However, several vocabulary items and sentences were replaced with ones whose lexical items were familiar to participants, as determined by a pilot study. The ambiguous sentences involved manipulating sentences, as shown in (1) and (2):

(1) *The new teacher's watch* has stopped.

(2) *The new teachers watch* baseball on TV.

Two sentences were first recorded separately. Then, the researcher edited the recording so that the italicized part of (1) replaced that of (2), creating a prosodic contour in the stimulus sentence (2) that competed with the sentence...
In other words, the stress falls on the verb, not on the head noun of the subject noun phrase which is the normal expected point. Following Harley, Howard and Hart (1995) and Read and Schreiber (1982), three types of sentence manipulations were included in the competing cues task. In the first type of sentence manipulation, the heavier stress falls after the head noun of the subject noun phrases, as shown above. In the second and third type of sentence manipulation, the stress falls before the head noun of the subject noun phrases (see (3) - (6)). The complete list of sentences and the construction of ambiguous sentences are shown in Appendix A.

(3) Our cats look at the poor mouse.

(4) Our cat's look sometimes surprises me at night.

(5) Managers of great singers are busy.

(6) When they are great, singers are busy.

The students' task consisted of listening to the sentences presented one by one on audiotape and repeating a part of each sentence out loud — a part that could be identified as subject noun phrases. The students were asked to repeat the part after listening to each sentence completely in order to ensure that they actually waited for the syntactic disambiguation information. This task consisted of 29 sentences. Among them, 19 sentences were in harmony with syntax and prosody, and 10 sentences were not. First, the researcher showed a demonstration with Sentences 1 to 5, which all had cooperating cues. Sentences 6 to 10 with cooperating prosody served as practice examples and the remaining sentences were made up of sentences with cooperating and conflicting cues.

3.2.2. Comprehension Time Task

This task was designed to test whether cooperating or conflicting prosodic and syntactic boundaries have effect on the comprehension time of English sentence, and whether L2 learners' ages, genders, and proficiency levels would affect the comprehension time of it. This task was originally developed by Speer, Kjelgaard and Dobroth (1996) for examining the influence of prosodic

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2 The researcher cut the italicized part of (1) right after the word “watch,” not in front of the word “has,” not to make the intonational phrase boundary too salient in the stimulus sentence.

3 Following Harley, Howard and Hart (1995), all sentence subjects consisted of at least two words since one-word subjects lack sufficient prosodic information, particularly stress.
structure on the resolution of temporary syntactic closure. However, the sentences used in this study were selected and newly made through the pilot study with middle school low English proficiency level students, so that all the participants in this study could understand the meaning of each sentence. Sentences were edited after recording to create conditions where syntactic and prosodic boundaries were in harmony (Cooperating Prosody: (7) and (9)), and where syntactic and prosodic boundaries did not coincide (Conflicting Prosody: (8) and (10)). Two types of conflicting prosody were created: (a) prosodic boundaries are placed after potential syntactic boundary; (b) prosodic boundaries are placed before potential syntactic boundaries. Prosodic boundaries were produced with lengthening and a fall in pitch on the phrase-final word (Speer, Kjelgaard and Dobroth 1996). ‘%’ indicates a prosodic boundary and ‘/’ indicates a syntactic boundary.

(7) Tony finished the book % / before he went to bed. (Cooperating)

(8) Tony finished the book / before % he went to bed. (Conflicting)

(9) When I finish all this book, % / I’ll go to see some movies. (Cooperating)

(10) When I finish all % this book, / I’ll go to see some movies. (Conflicting)

In this task, students were asked to listen to the sentences presented one by one on audiotape first and push the red button as soon as they understand the meaning of each sentence and then tell the researcher the meaning they understood. Twenty sentences were created for this task. Among them, there were eight sentences with cooperating prosody, eight sentences with conflicting prosody, and four filler sentences. In order to discourage the effect of sentence arrangement, all of the sentences were edited in random order after recording. The complete list of sentences and the construction of conflicting prosody sentences are shown in Appendix B.

3.3. Procedures

As a preliminary step for the main study, a pilot study was conducted. The pilot study was carried out for both tasks with 10 middle school second graders. The results of the pilot test confirmed the appropriateness of both tasks. All participants in the pilot study were able to follow the research procedures and had no difficulty in repeating the complete subject noun phrase in the unambiguous sentences and giving their interpretation of the sentences to the researcher. Then, the main study was conducted as follows.

Two tasks were conducted with a five-minute break in between. Participants
carried out the two tasks; the competing cues task followed by the comprehension time task. Each participant was tested in a sound-attenuated room under the guidance of the researcher.

The procedure of the competing cues task followed that of Harley, Howard and Hart (1995). The researcher showed what was required — the repetition of the sentence subject — using the first five sentences. Then, participants were asked to continue in the same way for the remaining sentences. The researcher provided positive feedback continuously when participants repeated the syntactic subject of each sentence. In other words, to maintain consistency with Harley, Howard and Hart (1995), some effort to bias the subject toward syntactic processing of the ambiguous sentences was made.

After a five-minute break finishing the competing cues task, the comprehension time task was conducted. The sentences for the comprehension time task were presented to participants over the same tape recorder of the competing cues task. Participants listened to pre-recorded materials and pushed a red button as quickly as possible when they understood the meaning of each sentence. The participants were ensured that each stimulus was one single sentence, not two separate sentences. Then they were asked to tell the researcher the meaning of each sentence. The researcher measured the reaction time of each participant. A few participants gave somewhat odd interpretations of the sentences, although they were not totally wrong. However, those examples were not considered in this study since the researcher assumed that the reaction time was more important than the correctness of interpretation in sentence processing if the interpretation was not completely wrong.

SPSS for windows was used for the data analyses with the alpha level set at .05 in all cases.

4. Results

4.1. Competing Cues Task

Ten ambiguous sentences and 14 unambiguous sentences were scored separately. The participants' answers were scored as either 1 or 0. If the participants repeated the correct part of the sentences (the subject noun phrase) following syntax, they received 1 point for each sentence for both types. Thus, the maximum possible score was 14 for unambiguous sentences and 10 for ambiguous sentences.

Table 2 presents the descriptive statistics for unambiguous sentences. This shows that all learner groups were able to carry out the task of repeating the subject of a sentence when syntactic and prosodic cues were in harmony.
Table 2. Descriptive statistics of performance on unambiguous sentences of competing cues task (Max=14)

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Level</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>YL</td>
<td>M</td>
<td>HL</td>
<td>16</td>
<td>12.81</td>
<td>1.47</td>
</tr>
<tr>
<td></td>
<td>LL</td>
<td>16</td>
<td>12.25</td>
<td>1.29</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>HL</td>
<td>16</td>
<td>12.69</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LL</td>
<td>15</td>
<td>12.40</td>
<td>1.24</td>
<td></td>
</tr>
<tr>
<td>OL</td>
<td>M</td>
<td>HL</td>
<td>17</td>
<td>13.29</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>LL</td>
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<td>12.88</td>
<td>0.60</td>
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<tr>
<td></td>
<td>LL</td>
<td>18</td>
<td>13.11</td>
<td>0.96</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Descriptive statistics of performance on ambiguous sentences of competing cues task (Max=10)

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Level</th>
<th>N</th>
<th>Follow Syntax</th>
<th>Follow Prosody</th>
<th>Other</th>
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<tbody>
<tr>
<td>YL</td>
<td>M</td>
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<td>16</td>
<td>2.75</td>
<td>6.44</td>
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<tr>
<td></td>
<td>LL</td>
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<td>1.59</td>
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<td>6.38</td>
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<td>3.06</td>
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<td>1.94</td>
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<td>1.55</td>
<td>8.11</td>
<td>0.34</td>
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</tr>
</tbody>
</table>

Even though the older female learners with high English proficiency got the highest score numerically (M=13.72) and the younger male learners with low English proficiency the lowest score (M=12.25), all groups were able to repeat on average more than 12 out of 14 normal sentence subjects correctly. Results for unambiguous sentences show that the listeners could perform the task with high accuracy. Some mean scores were even higher than those of native speakers in Harley, Howard and Hart (1995).

In the case of ambiguous sentences, three response categories were also tallied like Harley, Howard and Hart (1995): (a) follow syntax – the participants followed the syntax in identifying the sentence subject; (b) follow prosody – the participants followed the sentence prosody, ignoring the syntax; (c) other – all other types of responses except (a) and (b). Table 3 displays the descriptive statistics for ambiguous sentences, which is a robust part of this study. The most striking finding with respect to the ambiguous sentences was that all groups paid most attention to prosodic cues in identifying the sentence segment to repeat even though they learned English mostly from the school textbook ignoring prosody. This suggests that prosodic cues were the most powerful ones.
in determining what was to be repeated for all learner groups. These results are consistent with those of Harley (2000) and Harley, Howard and Hart (1995).

To examine the effect of age, sex, and English proficiency level on the results, three factorial ANOVAs were conducted for each responding category: following syntax, following prosody, and other. Only the results of the responding categories of following syntax and prosody (Table 4 and 5) were selected to be reported since those two are the main ones of the present study.

According to the results of the ANOVAs, only English proficiency level had a significant main effect on the degree of attention paid to syntactic and prosodic cues. There was no significant difference between age groups, nor between male and female learners. The learners with high English proficiency were significantly more likely to follow syntactic cues than the ones with low English proficiency, and less likely to follow the prosody, in selecting the sentence segment to be repeated in the ambiguous sentences. However, all learner groups, regardless of age, sex, and English proficiency level, primarily followed prosodic cues to the sentence structure in interpreting ambiguous sentences in contrast to the expectation that they would be more likely to adhere to syntax in the ambiguous sentences since they have learned English largely from the

Table 4. ANOVA summary for following syntax responding category

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
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*p < .05

Table 5. ANOVA summary for following prosody responding category

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*p < .05
school textbooks. Considering age, sex, and English proficiency level, all interaction effects were not significant. This confirms that English proficiency level is a main factor in the learners' performance on the competing cues task.

4.2. Comprehension Time Task

Measuring the reaction time is another way to investigate the role of prosody in second language sentence processing. In this study, the comprehension time of eight cooperating and eight conflicting prosody sentences was measured respectively. Comprehension time of the four filler sentences with cooperating prosody was excluded for the reliability of the task. Table 6 illustrates the descriptive statistics for all groups. As shown in Table 6, the sentences with cooperating prosody produced faster comprehension time than sentences with conflicting prosody across all groups. The older female learners with high English proficiency responded fastest to the sentences with both cooperating \((M=1.56)\) and conflicting prosody \((M=2.47)\), and the younger male learners with low English proficiency responded most slowly to the sentences with both cooperating \((M=3.45)\) and conflicting prosody \((M=4.40)\).

To examine the effect of age, sex, and English proficiency level on the results, two factorial ANOVAs were conducted and the results are summarized in Table 7 and Table 8.

The older the learner and the higher their proficiency level, the less comprehension time is needed. In other words, the older and high English proficiency learners tended to react faster after listening to both cooperating and conflicting prosody sentences. There was no interaction effect. Overall, the most important finding was that the comprehension time of cooperating prosody sentences was shorter than that of conflicting prosody sentences across all learner groups. The results are encouraging since they demonstrate the importance of prosody in resolving syntactic ambiguity during sentence processing and comprehension.

### Table 6. Descriptive statistics of performance on comprehension time task

<table>
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<tr>
<th>Age</th>
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<th>Conflicting RT (second)</th>
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<td>M</td>
<td>HL</td>
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<td>2.41</td>
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<tr>
<td></td>
<td></td>
<td>LL</td>
<td>16</td>
<td>3.45</td>
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<tr>
<td></td>
<td>F</td>
<td>HL</td>
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<td></td>
<td>LL</td>
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<td></td>
<td>F</td>
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<td></td>
<td></td>
<td>LL</td>
<td>18</td>
<td>2.33</td>
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Table 7. ANOVA summary for cooperating sentences

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* p < .05

Table 8. ANOVA summary for conflicting sentences

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* p < .05

5. Discussion

5.1. Competing Cues Task

In contrast to the adult English L1 speakers in Read and Scheiber (1982) and the older English L1 speakers in Harley, Howard and Hart (1995), older learners in this study followed prosodic cues to sentence structure in ambiguous sentence just as often as the younger learners in the competing cues task. The overall findings of previous L1 studies indicated that adult (or older) English L1 speakers could attend to syntactic cues better than younger English L1 speakers. Read and Scheiber (1982) found that university undergraduates could attend to the syntax in sentences with conflicting prosody whereas elementary school children heavily relied on the prosodic cues. In Harley Howard, and Hart's study (1995), the older native speakers paid more attention to syntax in ambiguous sentences, keeping with the findings of Read and Scheiber (1982). In the present study, however, all groups of learners, regard-
less of age, appeared to prefer the prosodic processing strategy and there was no clear indication that the older learners were more likely to rely on syntax in the ambiguous sentences. This suggests that prosodic cues are of primary importance to English sentence processing even after considerable exposure to target language instruction which focuses on reading and syntactic structures. This phenomenon also is not as strongly related to age as might have been supposed on the basis of the L1 findings of previous studies (Bates, MacWhinney, Caselli, Devescovi, Natale and Venza 1984, Harley, Howard and Hart 1995, Kail 1989, MacWhinney and Price 1980, Read and Schreiber 1982).

There is a persistent assumption that females are superior to males where phonetic and prosodic skills are concerned. However, numerous previous studies using the Competition Model had not separated participants by sex. Thus, there has been no way to see the difference of degree to attention to prosodic and syntactic cues between male and female learners. To supplement previous studies, participants were divided considering their sex in this study and there was no significant difference between male and female learners regarding the degree of attention to prosodic or syntactic cues to L2 sentence processing.

Unlike age and sex, English proficiency level showed a significant main effect in the competing cues task. The high English proficiency learners tended to pay more attention to syntax in selecting the segment of an ambiguous sentence to repeat, and the low English proficiency learners to prosody. This suggests that level of proficiency in English is a main factor in the learners’ performance on the competing cues and also shows that prosodic cues are quite robust in constraining L2 learners’ processing of ambiguous sentences. Harley, Howard and Hart (1995) provided a sensible explanation for this result, stating that ‘the ability to override prosodic cues and focus on the syntactic cues might be a sophisticated skill’ that only learners with high proficiency of the target language can access. This explanation can also apply to the current study. The role of prosody in L2 sentence processing can be affected by degree of proficiency. Learners could use more of the syntactic information of the L2 as they develop and become more proficiency with the L2. Since the details of the prosodic system of an L2 may not be acquired until an advanced stage of language acquisition (Ioup and Tansomboon 1987, Pennington and Ellis 2000), it might also be possible for L2 learners in this study to use the ‘pick the loud noun’ phrase strategy that is essentially a nonlinguistic strategy (Bates, MacWhinney, Caselli, Devescovi, Natale and Venza 1984). In other words, the prosodic cues, in artificially manipulated ambiguous sentences, could be considered more salient to L2 learners in the study than the syntactic cues when they processed ambiguous English sentences.

However, the most important finding with respect to the ambiguous sentences was that all groups of listeners regardless of age, sex, and English profi-
ciency level, paid most attention to prosodic cues at the competing cues task. All learners in this study have learned English through formal instruction in Korea. Thus it can be assumed that this instruction was analytic in orientation, with an emphasis on the explicit learning of grammar and not much focus on prosody. Despite this classroom experience, all groups of listeners did not attend to syntax in general when processing the ambiguous sentences but were much more likely to attend to prosody. Thus, it can be argued that prosody has effects in English sentence processing and the effects are not secondary but fundamental.

5.2. Comprehension Time Task

It is not a new idea that prosody influences the syntactic analysis and sentence interpretation a listener recovers for a spoken sentence (J H Ma 2006, Speer, Kjelgaard and Dobroth 1996). The comprehension time task addressed two types of prosody effects on English sentence processing time. One was the cooperating prosody, when the prosodic boundary was located at the appropriate potential syntactic boundary, and the other was conflicting prosody, when the prosodic boundary was located at the inappropriate potential syntactic boundary. Results showed that the sentences with cooperating prosody needed significantly less comprehension time than the sentences with conflicting prosody. In other words, syntactic processing was facilitated when prosodic and syntactic boundaries coincide, whereas syntactic processing was interfered with when prosodic boundaries were placed at misleading points for all learner groups. These findings suggest that prosody is one of the primary sources of getting sentence meaning and must be recognized properly in order for the sentence to be understood. More specifically, Speer, Kjelgaard and Dobroth (1996) found that the correspondence between prosodic and syntactic cues could play a large role in English sentence processing, and the process of sentence comprehension is crucially facilitated when there is a correspondence between prosodic cues and other linguistic cues such as syntactic cues. These results were re-confirmed by our results from the comprehension time task. In the competing cues task, English proficiency level only had the main effect, whereas, in the comprehension time task, age and English proficiency level showed the main effects. This result suggests that processing time shortens as learners develop and become more proficient with the L2. Overall, all learner groups responded faster in cooperating than in conflicting prosody sentences, suggesting that regardless of level or age, prosodic structure is an important factor in spoken sentence comprehension.
6. Conclusion

This study investigated the role of prosody in L2 sentence processing, which has not received much attention in SLA. It has been found that the recognition of prosodic features is an influential factor in constraining L2 learners’ processing of ambiguous sentences. This study also demonstrated that L2 learners’ level of English proficiency is a crucial factor in the degree of learning and using prosody as well as syntax in English.

This study was carried out with middle and high school students, and did not include elementary school learners and (young) adult learners. Thus, in the current study, it is hard to tell the effect of age in learning and using prosody. Further research needs to be conducted with various age groups of learners, so that more generalizable findings can be drawn. Another task-related limitation of this study was that prosody was artificially manipulated in an isolated sentence, not in a natural language context. As Snedeker and Trueswell (2003) as well as Pennington and Ellis (2000) pointed out, artificial manipulations of prosodic information to test its effect without considering natural language context might not provide right answers. Thus, it would be meaningful to include a natural language context for future research in order to explore the role of prosody in English sentence processing. Another task related question can also be raised. A learner’s preference to use prosodic cues over syntactic cues in comprehending ambiguous sentences could be affected by the parts of a sentence that participants are focusing on their comprehension. In the test sentences used in this study, prosodic and syntactic cues were competing in the earlier section of sentences (i.e., subject and verb/noun). Given that the task guided participants to repeat the earlier parts of sentences, it might be possible that participants have not focused upon syntactic structure disambiguation, thus giving rise to strong dependence upon prosodic cues in comprehending sentences. Future research may test the end parts of sentences with mismatched prosodic cues. Further experiments which consider the above mentioned factors would result in a more comprehensive understanding of the role of prosody in L2 sentence processing.

References


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Appendix: Stimuli for the Tasks

Appendix A: Stimuli for the Competing Cues Task

1. Complete List
   (1) My older sister never cleans her room.
   (2) The kids in the hall are very noisy.
   (3) The corner store sells a lot of candy.
   (4) A cold drink of lemonade tastes good in the summer.
   (5) The third grade class is studying trees.
   (6) Most of my friends like school.
   (7) My new bicycle is broken.
   (8) Sumi and her friend went to the movie on Saturday.
   (9) The rabbit in the classroom loves apples.
   (10) Too much candy will make you sick.
   (11) The big black cat had four kittens.
   (12) *The new teachers watch baseball on TV. (Type 1)
   (13) The fastest runner wins the race.
   (14) *Managers of great singers are busy. (Type 3)
   (15) My friend Jason came to play yesterday.
   (16) *Your sisters answer questions quickly. (Type 1)
   (17) A large piece of chocolate cake will fill you up.
   (18) *The young students guards don’t get tired easily. (Type 2)
   (19) The girl’s lunch was terrible.
   (20) Many Korean students skip breakfast.
   (21) *Only some winter birds fly south. (Type 3)
   (22) *Our cat’s look sometimes surprises me at night (Type 2)
   (23) *My friends play the piano at school. (Type 1)
   (24) *Our neighbor’s fish lives in a tank. (Type 2)
   (25) His new puppy has run away.
   (26) *Almost all young children like to eat cake. (Type 3)
   (27) This old house needs to be painted.
   (28) *All my friend’s work was lost on the bus. (Type 2)
   (29) The sound of this violin is very special.

   * indicates conflicting prosody and syntax.

2. Construction of Ambiguous Sentences
   In each item, the italicized part of the first sentence replaces the italicized part of the second sentence.
Type 1
(1) The new teacher's watch has stopped.
(2) The new teachers watch baseball on TV.
(3) My friend's play made everyone laugh.
(4) My friends play the piano at school.
(5) Your sister's answer surprised everyone.
(6) Your sisters answer questions quickly.

Type 2
(7) Our neighbors fish in the lake on weekends.
(8) Our neighbor's fish lives in a tank.
(9) The young student guards his books carefully.
(10) The young student guards don't get tired easily.
(11) Our cats look at the poor mouse.
(12) Our cat's look sometimes surprises me at night.
(13) All my friends work in a bank.
(14) All my friend's work was lost on the bus.

Type 3
(15) Managers of great singers are busy.
(16) When they are great, singers are busy.
(17) Only some winter birds fly south.
(18) At the beginning of winter, birds fly south.
(19) Almost all young children like to eat cake.
(20) When they are young, children like to eat cake.

Appendix B: Stimuli for the Comprehension Time Task

1. Complete List
(1) People thought the earth stayed in one place and the sun moved.
(2) *Because he could not see well, Henry % went to a doctor.
(3) *New York is one % of the biggest cities in the world.
(4) Reading is a good way to learn a new language.
(5) People think they will find better jobs in the city.
(6) *The lady thinks the bananas % smell good.
(7) I hate making mistakes when I speak in English.
(8) Tony finished the book before he went to bed.
(9) * When I finish all % this book, I'll go to see some movies.
(10) Many young musicians loved Mozart, and they learned a lot from him.
(11) Dentists think that eating candy is bad for the teeth.
(12) *People thought the earth % stayed in one place and the sun moved.
(13) Because he could not see well, Henry went to a doctor.
(14) New York is one of the biggest cities in the world.
(15) *Tony finished the book before % he went to bed.
(16) When I finish all this work, I'll go to see some movies.
(17) *People think they will find better % jobs in the city.
(18) The accident happened before Mrs. Baker was married.
(19) The lady thinks the bananas smell good.
(20) *Reading is a good % way to learn a new language.

* indicates conflicting prosody sentences. % indicates prosodic boundaries.
There are several potential syntactic boundaries in one sentence. Therefore, syntactic boundaries are not marked here.

2. Construction of Conflicting Prosody Sentences

Type 1
(1) *Because he could not see well, Henry % went to a doctor.
(2) *The lady thinks the bananas % smell good.
(3) *People thought the earth % stayed in one place and the sun moved.
(4) *Tony finished the book before % he went to bed.

Type 2
(5) *New York is one % of the biggest cities in the world.
(6) * When I finish all % this book, I'll go to see some movies.
(7) *People think they will find better % jobs in the city.
(8) *Reading is a good % way to learn a new language.
Jee Hyun Ma
Department of Second Language Studies
University of Hawai'i at Mānoa
1890 East-West Road
Honolulu, HI 96822
U.S.A.
E-mail: jeehyun@hawaii.edu

Received: February 20, 2007
Revised version received: May 20, 2007
Accepted: May 28, 2007