Acquisition of Second Language Intonation

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ABSTRACT

Foreign accents in second language (L2) production are caused by interference from the phonological system and phonetic realization of the speaker's first language (L1), including both segmental and prosodic features. This paper examines the intonation structure of Seoul Korean and its realization by American English speakers. Four English speakers of Korean, differing in fluency, and two Korean speakers participated in the experiment. Forty sentences were designed to test the realization of intonation patterns by varying the number of syllables within a word and a sentence, and by varying the conditions for the segment-tone interaction. Results show that, as with segmental data, more advanced L2 speakers produce more native-like intonation patterns and prosodic structure than less advanced speakers. However, although advanced L2 speakers are better at grouping words into phrases, they are not better at producing surface tonal realizations of an accentual phrase than less advanced speakers. This suggests that phonological properties of intonation are acquired earlier than phonetic properties of intonation.

1. INTRODUCTION

Most foreign accent studies involving second language (L2) production have centered on the sound system and its realization in the first language (L1), focusing primarily on segmental features [12,7,8]. In contrast, there have been few studies on suprasegmental aspects of L2 learning [e.g., 9,11]. For a complete understanding of second language acquisition, though, it will be necessary to examine the suprasegmental or prosodic features of accent as well as the segmental features. Ueyama and Jun [11] investigated the acquisition of English intonation by Japanese and Korean speakers focusing on the interaction between the phonology and phonetics of L1 and L2 intonation. They suggest that both the phonological system and phonetic realization of intonation structure should be taken into consideration in assessing acquisition of second language intonation.

This paper examines the intonation of Seoul Korean produced by American English speakers at differing levels of proficiency. It investigates which aspects of Korean intonation are acquired earlier/later by American English speakers.

2. INTONATION MODELS

The intonation models adopted for this paper are the intonational structure of English developed by Beckman and Pierrehumbert [2] and the intonational structure of Korean developed by Jun [3,4]. The intonation model of each language is illustrated in Figure 1.

The intonational structures of English and Korean differ in several respects. First, the f0 contour of an English Intonation phrase (IP) is determined by pitch accents which are linked to a stressed syllable and the sequence of a phrasal accent (T-) followed by a boundary tone (T%), while the f0 contour of a Korean IP is determined by a sequence of accentual phrase (AP) tones and a boundary tone (X%). An AP is smaller than an IP but larger than a word, and it is demarcated by phrasal tones. Second, the tone type of pitch accents in English is not sensitive to the size of a word, but AP phrasal tones in Korean do change depending upon a word's size. For example, an AP that has more than 3 syllables will have an LHLH pattern, whereas an AP with less than 4 syllables will have a rising (LH/LLH/LHH) pattern. Third, the AP-initial tone in Korean will be H if the AP begins with an aspirated or tense obstruent, and it will be L otherwise. English has segmentally perturbed microprosody, but this does not affect the tonal pattern. Fourth, in English the type and location of pitch accents and boundary tones change a sentence's meaning, while in Korean the location of the phrase boundary (AP or IP) and the type of IP boundary tone change the meaning. For example, wh- and yes/no-questions in Korean are segmentally the same, but they are distinguished by intonational phrasings: the sentence is a yes/no-question if an AP boundary is placed after the wh-word, but a wh-question otherwise [6]. In English these two types of questions are distinguished by lexical items (wh- vs. any), not by intonational phrasing.
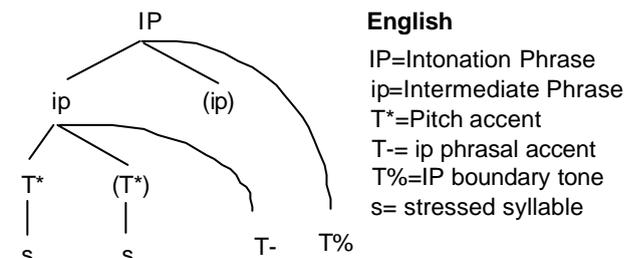
English

IP=Intonation Phrase
ip=Intermediate Phrase
T*=Pitch accent
T-= ip phrasal accent
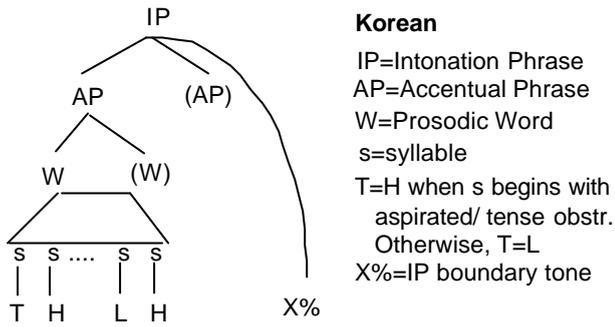T%=IP boundary tone
s= stressed syllable

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          IP                    Korean
                               IP=Intonation Phrase
      AP      (AP)             AP=Accentual Phrase
                               W=Prosodic Word
   W      (W)                   s=syllable
                               T=H when s begins with
 s  s .... s  s                   aspirated/ tense obstr.
 |  |     |  |                    Otherwise, T=L
 T  H     L  H      X%          X%=IP boundary tone
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Figure 1: Intonation structure of English and Korean

3. EXPERIMENT

3.1. The Corpus

40 sentences were designed by varying the number of syllables within a word, the AP-initial segments (i.e., plain, aspirated, tense consonants), the syntactic structures, and the function of wh-words to investigate which intonational properties of Korean are acquired earlier/later by American English speakers.

3.2. Subjects

Four male English speakers of Korean, differing in proficiency, and two male Korean speakers participated in the experiment. Table 1 shows L2 speakers' backgrounds in Korean.

Subjects	Yrs. in Korea	Major /Spouse's lg.	Yrs. of studying / speaking Kor.
Advanced	6	Korean history/Korean	6 yrs/ 16 yrs
Intermed 1	8	English/Korean & Eng.	3 yrs/ 8 yrs
Intermed 2	3	Korean history/Eng.	6 yrs/ 6 yrs
Beginner	1	English literature/NA	1 yr/ 1 yr

Table 1: Language background information for L2 speakers

3.3. Procedure

Speakers read randomized sentences four times in the UCLA Phonetics Lab. Pitch tracks of each sentence were analyzed using PitchWorks software (*Scicon).* Transcriptions of the tones and phrasings (i.e., AP, IP) of all the utterances were made by both authors using Korean ToBI (K-ToBI) [1,5]. f0 values were measured in the middle of the target syllables.

4. RESULTS AND DISCUSSION

4.1. The Number of Phrasings

More advanced L2 speakers produced more native-like intonation patterns and prosodic structure than less advanced speakers. Specifically, advanced speakers were better at grouping words. Thus, the more advanced the speaker, the fewer phrase boundaries he produced. Table 2 illustrates the number of APs & IPs for each speaker. Although the advanced speaker produced a number of APs close to that of the native speakers, he produced a substantially higher number of IP boundaries than native speakers.

Subjects	#. of sent-med APs	# of sent-med IPs
Native 1	179	2
Native 2	193	7
Advanced	197	65
Intermed 1	221	68
Intermed 2	215	72
Beginner	251	116

(data: total 328 words [=82 words x 4 times])
Table 2: The number of APs and IPs for each speaker.

This result suggests a general learning constraint on prosodic development that limits the number of words in one phrase. We believe that the production of a one-word-phrase by less advanced speakers reflects a limitation on information processing at early stages of L2 acquisition as is often found in children's L1 acquisition data.

4.2. Realization of Accentual Phrase Tones

When we examined the surface tonal realization of an AP depending on the length of the phrase and the initial segment of the AP, we found that not all surface tones were produced equally well. Speakers were in general good at producing AP-final H tones and rising tone patterns for short APs (e.g., LH, LLH, LHH), but they were not good at producing the second tone in a long AP (i.e., H_1 in LH_1LH_2), nor were they proficient at producing AP-initial H tones due to segment type. Figure 2 shows f0 tracks for sentence (1) where the subject phrase (marked by a topic marker) has 6 syllables. Both of the native speakers produced a LHLH pattern as predicted, but the Advanced Speaker and Intermediate Speaker 2 produced a flat low tone until the end of the phrase. Intermediate Speaker 1 produced an ambiguous tonal pattern, and the Beginner produced two clear APs for the subject phrase— one for each word.

(1) <u>mina sonsengnimun</u>   minarul   miwoheyo
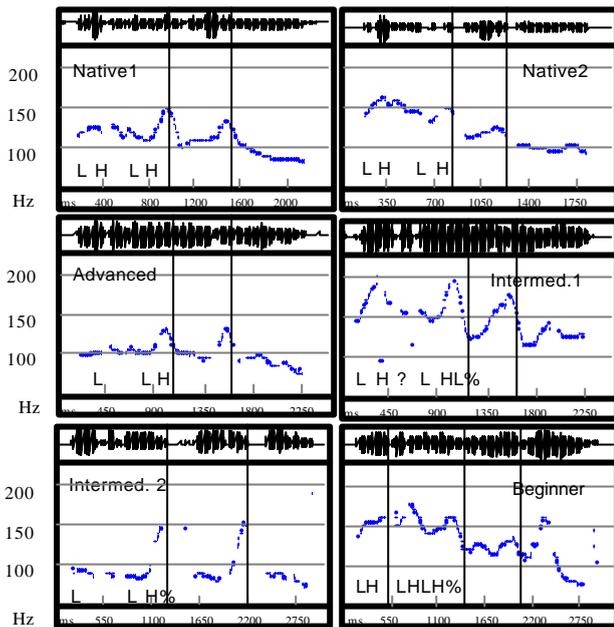 'Mina's teacher-TOP' 'Mina-ACC.' 'hates'
    -> Mina's teacher hates Mina.

Figure 2: Pitch tracks of sentence (1) for all speakers, focusing on the tonal pattern of the subject phrase.

The initial tone of a Korean AP is H when the segment is aspirated or tense, but L otherwise. The f0 difference between these two tones is substantial, and it is sustained until the end of the syllable. This segmentally-triggered f0 difference, i.e. microprosody, exists in English, but it is smaller than the difference observed in Korean and the effect disappears around the middle of the syllable. Figure 3 shows the f0 difference between AP-initial H and L tones in terms of percentage of each speaker's pitch range (shown in % to normalize pitch range differences among speakers). Native speakers of Korean showed a 30-50% difference between H and L tone, but in general English speakers of Korean showed a 10-20% difference, except for Intermediate Speaker 1. This suggests that acquisition of AP-initial tone is not correlated with L2 experience.

The fact that speakers were in general better at producing the AP-final H tone than other tones suggests that AP-final H tone is easier to acquire than other AP tones. We believe that this is because the AP-final H tone is perceptually more salient than other tones due to its consistency and invariability. As mentioned above, the surface tones of an AP vary depending upon the number of syllables in the AP and the initial segment of the AP, but the AP-final H tone rarely varies, particularly in reading. This finding may also suggest that speakers acquire tones linked to phonological properties of prosody earlier than those linked to phonetic properties (see [11] for similar findings). For Korean-ToBI [5], Jun claimed that the surface realization of AP tones in Korean does not change the meaning of an utterance, but phrase boundaries do. Thus, she proposed to label phrase boundaries of APs and IPs on a phonological tone tier and the surface realization of AP or IP tones on a phonetic tier. Since the right edge of a Korean AP is almost always marked by a H tone, this H tone is a strong perceptual cue for an AP final boundary, which is phonological. Thus, in addition to the phonetic saliency of AP-final H, L2 speakers of Korean may have acquired the AP-final H tone earlier than other surface AP tones because of the H tone's function of marking a phrase-final boundary, a distinctive property of Korean prosody.
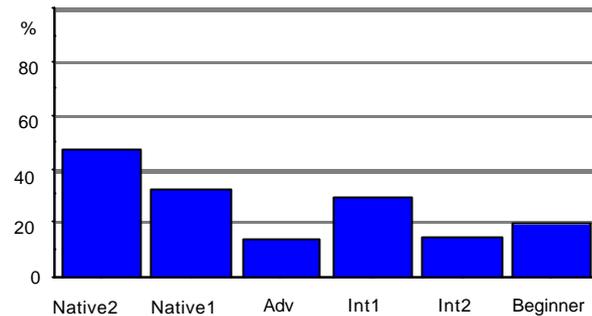

Figure 3: f0 difference between AP-initial H and L tones (in % of each speaker's pitch range)

4.3. Syntactic Structure

Jun [3] suggests that a given phrase or sentence can have various accentual phrasings due to several factors, including the syntactic structure constraint in (2). It states that an AP cannot end with a word, W_n, which is the initial member of a branching structure.

(2) syntactic constraint

$$*\{W_1 ... W_n\}$$
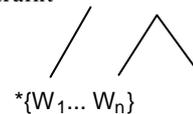
Examination of the data reveals that more advanced speakers do not violate the syntactic constraint when they produce APs with more than one word. However, we could not find any data from less advanced speakers in which the syntactic constraint was violated, because their APs usually included only one word.

4.4. Wh-question versus Yes/No-question

Korean wh- and yes/no-questions are segmentally the same, but are distinguished by intonational phrasing [6]. For example, *"olmattongan"* could be either a wh-word meaning 'how long' or an indefinite pronoun meaning 'for any length'. When it is used as a wh-word, the word begins a new AP and dephrases the following words. That is, there is no AP boundary after a wh-word. On the other hand, when it is used as an indefinite pronoun, an AP boundary is placed after the word. In English, these two

types of questions are distinguished by lexical items (wh- vs. any), but not by intonational phrasing.

As mentioned earlier, though, less advanced speakers often produce each Korean word as one AP. This was true for these cases as well, regardless of whether the sentence contained a wh-word or an indefinite pronoun. Therefore, it was impossible for us to determine whether the speakers' correct phrasings of yes/no-questions resulted from their acquisition of this intonation pattern or from their inability to combine words into phrases. Thus, in this paper, we will focus on AP phrasing for wh-questions.
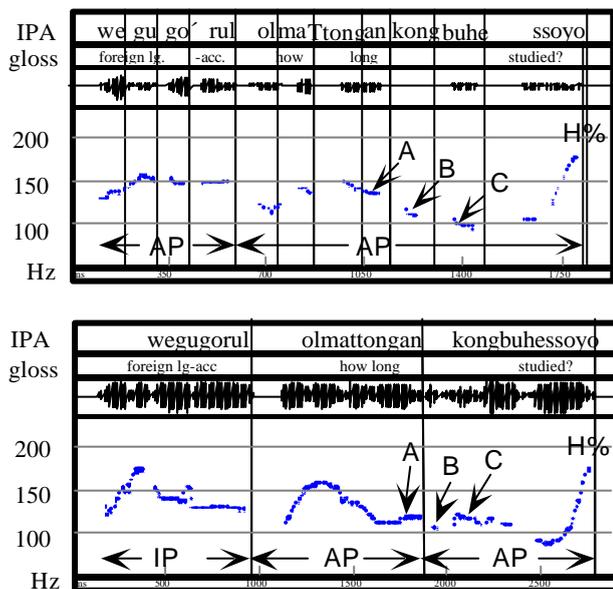

Figure 4: f0 track of a wh-question, 'how long did you study a foreign language?', produced by a native speaker (upper) and the Beginner (lower).

Figure 4 shows f0 tracks for the sentence 'How long did you study a foreign language?' as produced by a native speaker (above) and the Beginner (below). The wh-word is interpreted as a wh-pronoun. The native speaker produced the object noun, *wegugorul,* in one AP and the wh-word, *olmattongan*, and the following verb, *kongbuhessojo* in another AP. If we measure the native speaker's f0 values for the final syllable of the wh-word, *an*, and the initial two syllables of the following verb, *kong* and *bu*, the results will be in the order of *an>kong>bu*. This is labeled on the pitch track as A, B, and C, respectively. In contrast, the Beginner produced the first word in one IP and the others in two APs, thereby failing to produce the intended wh-question meaning. There is an AP boundary after the wh-word, so the f0 value of A is higher than that of B, which is lower than that of C. Figure 5 shows the mean f0 values for A, B, and C for this sentence as produced by all the speakers.
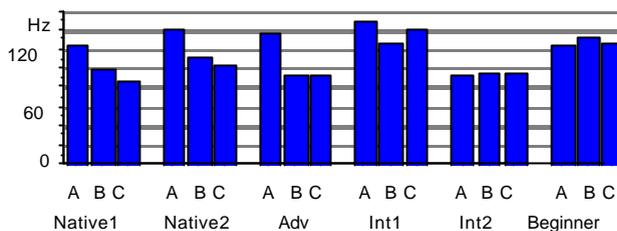

Figure 5: Mean f0 of A, B, and C of the sentence in Figure 4.

Fig. 5 shows that only the advanced speaker showed a native-like pattern. Less advanced speakers produced an AP boundary after 'how long', resulting in B<C or A<B. B surfacing as the highest f0 was another indication of a phrase boundary—it implied that stress (i.e., pitch accent) was placed at the beginning of the AP. Table 3 shows the percentage of successfully produced 'wh-' questions from a larger data set for each speaker.

Subjects	Correct % of 'wh-' phrasing	
	total 48 cases	total 40 cases
Native1	48/48 (100%)	40/40 (100%)
Native2	44/48 (92%)	36/40 (90%)
Advanced	30/48 (62.5%)	25/40 (62.5%)
Intermed 1	no data	11/40 (27.5%)
Intermed 2	20/48 (42%)	14/40 (35%)
Beginner	no data	12/40 (30%)

Table 3: Correct % of 'wh-' phrasing in a larger data set

The advanced speaker was better at producing accentual phrasings suitable for a wh-question than the other three L2 speakers. The other speakers were similarly poor at producing wh-questions that were distinct from yes/no-questions. Less advanced speakers were successful only when the sentence was short and familiar. When the sentence was long or unfamiliar, they tended to produce each word as a single AP or IP. This explains the large number of APs and IPs in their production throughout the data, as shown in Table 2. The data show that acquiring the intonational variation that reflects semantic and pragmatic structures in a language requires substantial experience with that language.

Finally, we found that even advanced speakers produced stress in Korean following English rhythmic patterns, though not as often as less advanced speakers. This suggests that a lexically linked prosodic feature in L1 is more likely to be transferred to L2 prosody and is difficult to suppress. This is in line with findings from segmental studies where L1's phonemic contrasts are more likely to be transferred to L2 than allophonic or subphonemic variation [8].

5. CONCLUSION

In sum, more advanced speakers of L2 were better at grouping or phrasing words, whether triggered by the length of the phrase or by meaning, than less advanced speakers. They were better at producing phrase-final tones that mark a phrase boundary, but were not necessarily better at producing other surface tones in a phrase. Considering that phrase boundary tones are distinctive in Korean intonation and the surface realization of AP tone patterns is not, these results imply that L2 speakers acquire phonological features of intonation earlier than phonetic features, supporting the claim of [11].

The data also show that it is difficult to acquire phonological phrasing related to semantics (i.e., wh- vs. yes/no). Even the advanced speaker was only 63% successful. Finally, less advanced speakers tend to produce each word in one AP or IP in their L2 production. This reflects a limitation on information processing as found in the acquisition of phrasing in L1. Still, the findings in this study are based on four speakers, thus more data is needed to generalize the findings.

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