The Boundary Cues in Korean English Learners' Speaking*

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Kang, Seokhan & Ahn, Hyunkee. 2010. The Boundary Cues in Korean English Learners' Speaking. *The Linguistic Association of Korea Journal. 18*(3). 57-69. Acoustic cues for segments are enhanced at the edges of the prosodic domains. The enhancements occur as the forms of longer duration, strengthening, alternation of the degree of overlap with adjacent segments, and glottalization. This study investigated different realizations of final boundary effect for Korean English learners and English native speakers. Finding was that the Korean English learners had longer duration of final syllables, higher F0, longer pause duration, and smaller pitch difference. On the contrary, the Native English speakers had shorter duration of final syllables, lower F0, shorter pause duration, and larger pitch difference between adjacent phrases. The result implies that boundary effect could be affected by the background language.

Key Words: Second language acquisition, F0, boundary, duration, final lengthening, strengthening

1. Introduction

It is well-established that boundary in a phrase or a sentence affects acoustic parameters. Durational lengthening or strengthening of the fundamental

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frequency has been found to occur. Our interest here is to search for variations of the boundary effect for two different groups: Korean English learners and English native speakers.

In general, acoustic cues for segments are enhanced at the edges of the prosodic domains. The enhancements occur as the forms of longer duration (Beckman & Edwards, 1991; de Pijper & Sanderman, 1994; Wightman et al., 1992), strengthening (Fourgeron & Keating, 1997), alternation of the degree of overlap with adjacent segments (Byrd & Saltzman, 1998), and glottalization (Dilley et al., 1996).

Lengthening means that a word or syllable that precedes the end of a major syntactic unit is lengthened. Lengthening is common for the final syllable of a sentence, but its lengthening is different depending on the prosody domains. In general, the boundary in utterance is the longest, while the segmental duration in the prosody word is the shortest. On the other hand, strengthening is related with a phrasal accent in the boundary which realizes as HL% or LL% in the declarative sentences. Acoustically boundary effect causes higher fundamental frequency and intensity in the final edge.

In spite of the general cross-linguistic features in the prosodic cues such as final lengthening and strengthening, there are variations depending on back-ground languages. Yang (2008) examined boundaries for native Mandarine speakers and English Mandarine learners, reporting that in L1 Mandarine speech, final lengthening is a salient cue of prosodic boundaries and the pre-boundary syllable was lengthened the most. On the contrary, in English Mandarine speech, final lengthening is not a salient cue of prosodic boundaries, whereas silent pause duration is a prominent temporal cue in L2 speech. Podlipsky (2008), in his perceptual study of English and Czec, reported that L2 learners redefined the value of vowel duration in the boundary as a perceptual cues. This study was meaningful in that boundary effect could be changeable when they acquired L2.

The current study investigates the different realization of boundary effect for Korean English learners and English native speakers. The goal of the study is to extend our understanding on factors influencing the L2 acquisition in boundary effect. If the Korean group produces the boundary cues differently from English native speakers, we predict that their production would involve in L1

interference.

2. Methodology

2.1 Participants

The data were collected from 40 adult participants of two groups. None reported being diagnosed with a language or speech disorder. The participants were divided into two groups of 20 each: Koreans learning English (10 males and 10 females), and Native English speakers (10 males and 10 females). Most of the Native English participants were visiting students who took part in a summer Korean learning program in a university in Seoul, Korea. Korean subjects were students majoring in English or international studies at the same university. The students had no experiences of learning English abroad.

2.2 Materials and Procedures

All participants were recorded reading sentences with multi-phrase patterns. Ten English sentences consisted of two or three phrases with 7 to 12 words. The sentences were non-terminal patterns which indicated that the utterance had not yet ended and that more would be said (Delattre, 1972; Grover, Jamieson & Dobrovolsky, 1987). It was assumed that the non-terminal patterns had different boundary features with the terminal sentences. The sentences with non-terminal patterns described as intermediate phrases, according to Beckman and Pierrhumbert (1986), contained at least one pitch accent with the pattern of H* or L*. Along with the acoustic feature of the fundamental frequency, the final lengthening occurs in the end of the phrases. As the boundary cues, we investigated these two cues.

As the inter-phrase cues, we analyzed the pause duration and F0 difference between adjacent phrases. Pause duration is known as the indicator of English proficiency (Trofimovich & Baker, 2007), while F0 difference between adjacent phrases is closely tied with resetting F0 (Swerts, et al., 1996). The analysis for both cues would support our hypothesis that Korean English learners'

production would involve in L1 interference. In this experiment, following sentences were analyzed.

(1) sentences
1. Fourteen years later, Mary met him at the same place.
2. Raise your right hand, if the pastor calls your name.
3. With a light hammer, the carpenter hit the nail.
4. All of a sudden, the policeman rushed to the market.
5. We went to London and Boston.
6. If a tree could talk, what would it say?
7. When did he go swimming, Wednesday or Thursday
8. I see the sun shining brightly, all over the lake.
9. People couldn't sleep well last night, because of the noise.
10. What's the weather like today, sunny or cloudy?

Each participant was asked to read each English sentence one time. Before they produced the sentences, it was confirmed that they did know what the sentences meant, and they knew how to pronounce them. Also Korean subjects were presented 20 minutes to practice the sentences before the experiment. The sounds were recorded in SONY TASCAM DA-P1 DAT recorder with Schure SM 10A microphone, digitalized in 44.05 kHz and 16 bit resolution. The analysis was done only for the boundary segments.

2.3 Measurements

Ten sentences were presented to evaluate the prosody of each group. The acoustic cues of the fundamental frequency (in Hertz) and duration (in Milliseconds) were measured. The duration and fundamental frequency were measured using waveform and wideband spectrograms with PRAAT (5.1.17). All acoustic cues were measured from the initial acoustic signal in both the waveform and the spectrograms to the final acoustic cues of the boundary such as burst or spectral cues (Kent & Read, 2003; Ladefoged, 2001). The values of mean F0 and duration of the segments were measured at the boundary, while pause duration and F0 difference between adjacent phrases were analyzed at the

inter-boundary part between two intermediate phrases. Especially F0 difference was measured as the difference of the Hertz from the final point of F0 in the previous phrases to the initial point in the following phrases.

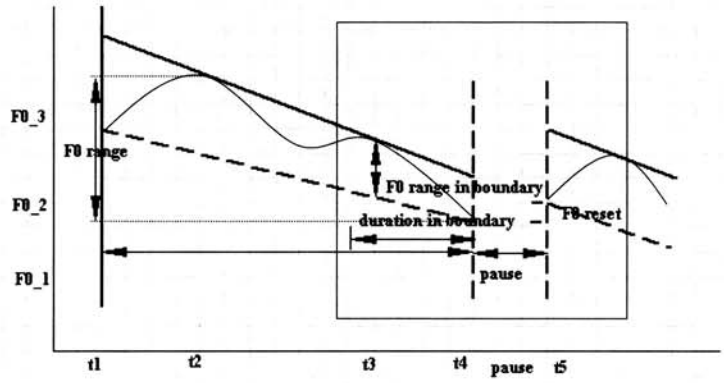


Figure 1. The suprasegmental features in two intermediate phrases. Y-axis shows the F0 range, while X-axis represents the duration. In this study, the boundary cues presented in the box area are studied.

Boundary cues are realized in the final syllable of utterance as the forms of longer duration and strengthening as seen in Figure 1. The final lengthening is represented phonetically as longer durational time, while strengthening could be expressed as the higher fundamental frequency. This study measures duration and the mean value of the fundamental frequency in the boundary segment of sentences. Also, in the sentences containing two intermediate phrases the conjunction between the first and second phrase was assessed. The pause duration between the two phrases were measured. Additionally, the F0 in the final point of the preceeding phrase was compared to the F0 in the initial point of the following phrase.

Figure 2 represents comparing sounds of an English native speaker with a Korean English learner. The horizontal axis represents time (in seconds) and the vertical axis represents the F0 range (in Hertz). The analyzed parameters are duration and F0 at the boundary, and pause and F0 difference between two phrases.

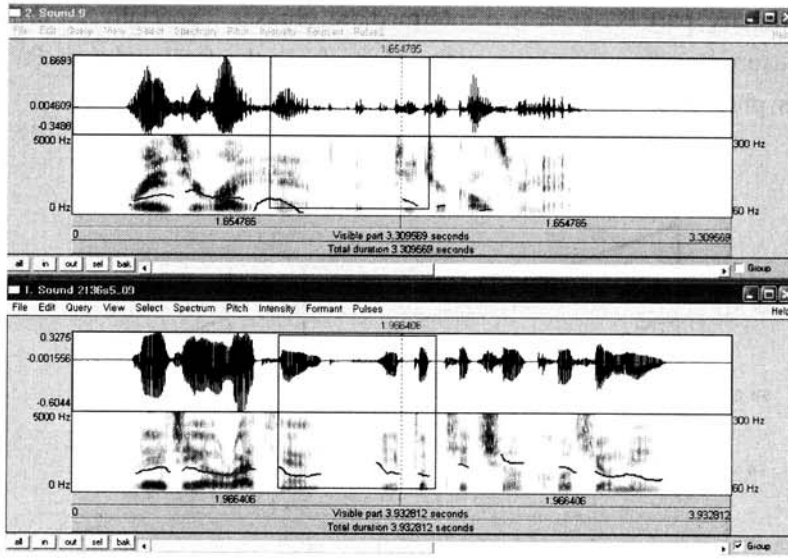


Figure 2. Two time-wave and spectrograph displays of the sentence, *Raise your right hand, if the teacher calls your name.* A production of a Korean English learner was shown in the upper display and that of an English native speaker was shown on the bottom. Two groups clearly showed the different characteristics in duration and F0 at the boundary between two iPs as seen in the box areas.

3. Result and Discussion

The sentences were analyzed to investigate differences between the two groups. Table 1 presents the mean values and standard deviations of F0 and duration at the boundary, and F0 difference and pause duration between two phrases.

Table 1. Mean and standard deviation of parameters

Measure		Native English	Korean English
Boundary	F0 (Hz)	115 (35)	144 (40)
	Duration (S)	0.30 (0.10)	0.34 (0.11)
Inter-phrase	F0 dif. (Hz)	15.95 (38)	3.66 (43)
	Pause duration(S)	0.15 (0.14)	0.36 (0.26)

3.1 Syllable duration at the boundary

The independent t-test confirmed that there was significant effect for duration_boundary, $t = 3.611$, $p < .05$. The results were summarized in Figure 2. The results for the duration of the boundary segment exhibited that the effect of final lengthening had a severe influence on Korean English learners rather than on English native speakers. It was interesting that the duration of the boundary segments was longer for Korean group, even though final lengthening was exhibited by English natives (Wightman et al., 1992). It seems that vowel insertion for the Korean group causes longer duration because the English loan words in Korean have the tendency to add the default vowel of [ɨ] in case that the last syllable ends in a consonant in English (e.g., golf [kolpɨ]).

Generally, final-lengthening varies depending on the prosodic hierarchy and is known to be the cross-linguistic phenomena. Hemming (2001) on the study of English and Swedish reported that the end of the text is the longest, and the final duration of paragraph, sentence, and clause, are followed, while the end of the prosody word is the shortest. However, in the study of L2 acquisition, the effect of background language significantly influences on the boundary duration. Kang (2006) on the perception study of Mandarine, English, Korean speakers reported that both English and Korean speakers relied on the preceeding vowel duration in deciding the voicing, but Mandarine speakers didn't. In this respect, even though cross-linguistically prosody domain has some influence on the duration of length, its influence is limited by the effect of L1 interference.

3.2 F0 at the boundary

As for the mean value of the F0 in the boundary segment, the independent t-test confirmed that there was significant effect for duration_boundary, $t = 27.231$, $p < .0001$. The results suggested that the degree of final-strengthening was larger for the Korean English learners than for English native speakers. English native speakers in the final segments exhibited lower F0.

In general, final strengthening is related with discourse signals. Nakajima & Allen (1993) found that F0 values tend to signal topic shift and topic orientation across pause boundaries. Korean English learners' production of high pitch in the boundary could be translated into their failure to discourse shift using the

fundamental frequency. As a signal that one sentence is finished, they should drop the F0 significantly, but they couldn't. This failure control of the pitch might cause the confusion to English native speakers. The mean values of duration and F0 were presented in Figure 3.

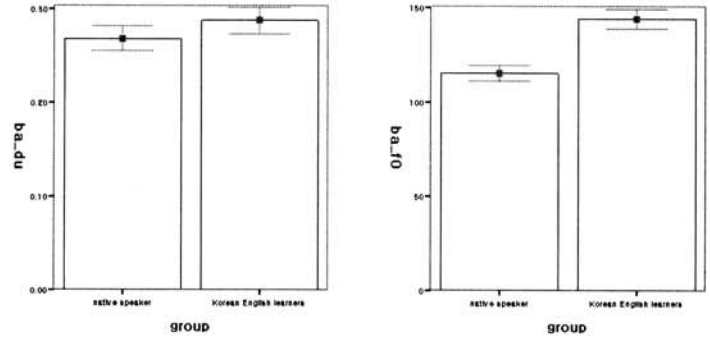


Figure 3. Mean values with standard errors for two acoustic parameters [(a) Duration at the boundary; (b) Mean value of F0 at the boundary] by two groups. Korean English learners took 79% in F0 and 88% in duration, compared with English native speakers.

3.3 Pause duration between adjacent phrases

The independent t-test confirmed that there was significant effect for duration_boundary, $t = 33.589$, $p < .0001$. The result revealed that the pause duration was longer for the Korean English learners, and shorter for English native speakers.

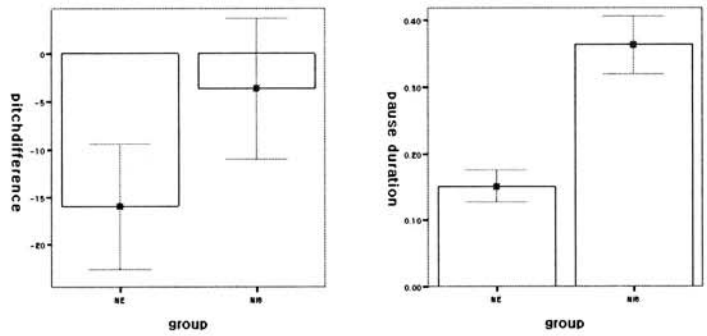
Pause duration indicate the speaker's difficulty in English speaking. Learners commonly pause more in L2 than in L1, regardless of cross-language and cross-cultural differences. Studies show that the pause duration decreases as L2 learners gain more experience (Trofimovich & Baker, 2007). However, the pause duration as an indicator of fluent English is affected by learner's age at the time of first exposure to their L2 than on the amount of their experience with L2 (Olynyk, et al., 1987). This means that even Korean adult subjects who have already experienced in learning English over 10 years may cause problem of English proficiency. In this study, pause duration for Korean English learners is over 2 times more than for English native speakers.

3.4 F0 difference between adjacent phrases

The independent t-test confirmed that there was significant effect for duration_boundary, $t = 3.881$, $p < .05$. This result indicates that Korean group has a smaller F0 difference between the two intermediate phrases. The Native English speakers show a higher difference of 20 Hz: the lower F0 of the previous phrase and the higher F0 of the following phrases. On the other hand, Korean English learners have differences around 3 Hz.

The low pitch difference for Korean English learners in this area causes the problem in resetting F0 between two phrases. English native speakers have a tendency to reset F0 strongly at the boundaries of non-terminal phrases so that the F0 difference between two adjacent phrases is significantly greater than Korean group.

To summarize, the Native English speakers have shorter duration of final syllables, lower mean value of F0, and shorter pause duration and larger difference of F0 between phrases. On the contrary, the Korean English learners have longer duration of final syllables, higher mean value of F0, and longer pause duration and narrower difference of F0 between phrases as seen in Figure 4.



(a) F0 difference between two iPs (b) Pause duration between two iPs

Figure 4. Mean values with standard errors for two acoustic parameters [(a) F0 difference between two phrases; (b) Pause duration between two phrases] by two groups. Korean English learners took 22% in F0 difference and 240% in pause duration, compared with English native speakers.

4. Implication and Conclusion

Boundary cues are pauses, changes in duration, or adjustments of pitch that mark the ends of language units. Speakers can use boundary cues to mark major linguistic structures and to give forms to a conversation. Cross-linguistically final lengthening and strengthening occur.

In spite of general phenomena in this part, we find that the degree for the lengthening and strengthening is different. Korean English learners show comparatively longer duration and higher mean value of pitch in the boundary segments as well as longer pause duration and narrower difference of F0 between adjacent phrases. On the other hand, English native speakers show comparatively shorter duration and lower mean value of pitch in the boundary segments, along with shorter duration of pause and narrower difference of F0 between adjacent phrases.

The boundary features which Korean English learners produce causes the trouble in resetting F0 between two intermediate phrases in the unfinished phrases. In these phrases, F0 values between the previous and following phrase show smaller pitch difference for Korean English learners, while English native speakers produce comparatively larger difference of F0 as 15 Hz, dropping F0 in the final point of the first phrase and raising F0 in the initial point of the second phrase.

It is somewhat exciting that the final lengthening and strengthening are more influential for Korean English learners: longer duration and higher level of pitch. Their characteristics stems from L1 interference or uncertainty on English pronunciation. The addition of default vowel [ɨ] at the end of consonant-final words or the failure of falling F0 at the boundary cleary results from L1 interference. On the other hand, considering that Korean subjects are university students, their particular pronunciation may be tied with problems of the English speaking education.

It is interesting that advanced Korean English learners fail to reset the F0 between two phrases. English native speakers have a tendency to reset F0 strongly at the boundaries of non-terminal phrases so that the F0 difference between two adjacent phrases is comparatively greater than Korean group. Considering that the fundamental frequency was related with the vibration of

the vocal folds in the larynx, Korean speakers still had trouble in resetting the physiological activities. They may acquire the prosody patterns of English in final lowering associated with a sense of fading off, or finalizing the terminal sentences, but resetting F0 in the non-terminal phrases.

In spite of some similar parameters with English native speakers, the difficulty in controlling F0 in boundary segments and comparatively weak resetting of F0 at the adjacent phrases may cause the confusion to English native speakers on whether the sentence has ended and another one has begun.

In conclusion, it is clear that Korean English learners produce the parameters at the boundary or in the inter-phrases differently from English native speakers. Through analyzing the parameters of pitch range, durational length, boundary cues, the parameters are different in the area. Korean English learners shows different patterns in duration and F0 in the boundary segments.

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