

Phonetic Aspects of English Stress
Produced by South Kyungsang Korean Speakers*

Dokyong Yi**

ABSTRACT

A purpose of this study is to investigate the acoustic characteristics of English stress produced by the two groups of South Kyungsang (henceforth, SK) Korean speakers: high-proficiency and low-proficiency with reference to English native speakers. Another purpose is to compare results from the high- and low-proficiency SK Korean subjects with those of the native speakers, and to provide an analytical account of how approximate the high-proficiency SK Korean subjects' production is to the native speakers' and how different the low-proficiency SK Korean subjects' is from the native speakers'. Results indicated that the native speakers' main strategy used in producing stressed syllables was duration while the high-proficiency SK Korean subjects' was predominantly pitch-oriented. The low-proficiency SK Korean subjects' pitch patterns showed regularity, emphasizing the penultimate syllable with pitch. In comparing duration among the three groups, both groups of the SK Korean subjects became more even in their duration values for each syllable as the structure of the word or the sentence became more complex.

Keywords: stress, duration, pitch, intensity

1. Introduction

In English pronunciation, the most important characteristic is stress (Celce-Murcia et al., 1996; Brown, 1994; Kreidler, 1989). However, many Korean native learners of English are not aware of it, nor are they taught, since the English suprasegmentals are different from the Korean ones: English is classified as a stress-timed language, whereas Korean is a syllable-timed one. Each English word has a unique stress pattern with certain syllables more prominent than others. Korean learners of English do not have accurate knowledge about stressed syllables nor do they produce the English stress pattern properly: they give all syllables equal stress, which is the influence of their L1 (Celce-Murcia et al., 1996). In order to provide a suitable method for teaching stress, it is necessary to investigate what the problems are in producing stress regarding the

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** Institute of Foreign Language Education, Inje University

terms of duration, pitch, and intensity. In addition, it is significant to analyze the problems in relation to the effect of their L1 accent pattern. When the findings can actually be used in classrooms, they have to be properly modified for the learners' proficiency levels.

The following are the specific research questions:

1. What are the high-proficiency SK Korean subjects' strategies in producing stressed syllables among pitch, duration, and intensity in isolation, at sentence-initial position, at sentence-medial position, and at sentence-final position? In addition, how are they different from what the native speakers use in producing stress?
2. Do the low-proficiency SK Korean subjects use any strategies in producing stressed syllables? If not, then do they emphasize any certain syllables regularly due to their native dialect, SK Korean? Additionally, how are they different from loan words adaptation of North Kyungsang Korean?
3. What are the findings in comparing the ratio of unstressed to stressed syllables of the three groups in duration, pitch, and intensity? If any, which component of stress contributes more to their production of stressed syllables?

2. Literature Review

Stress is the combined function of loudness, pitch, and length (Picket, 1980; Ladd, 1996; van Heuven & Sluijter, 1996; Ladefoged, 2001). It can be measured by intensity (in decibels), frequency (in Hertz), and duration (in milliseconds). Ladefoged (2001) states that a stressed syllable is often, but not always, louder than an unstressed syllable, and it is usually, but not always, on a higher pitch. The most reliable cue for a listener to identify is that a stressed syllable often has a longer vowel sound. Moreover, it is assumed that increases in duration seemed to have the primary purpose of marking syntactic units for the listener (Klatt, 1975). Therefore, Klatt (1975) and Ladefoged (2001) treat duration of the stressed syllable more significantly than other factors with respect to the listener's point of view. Ladefoged (2001) lists the relative importance of these three parameters in the perception of stress as: duration, intensity, and pitch.

It has been identified that English stressed vowels in word-final syllables of phrase-final words were significantly longer than vowels in any other positions. In addition, it is assumed that increases in duration seemed to have the primary purpose of marking syntactic units for the listener, and that speech perception is an easier process if acoustic cues to phrase boundary locations are present (Klatt, 1975). It is expected that Korean learners of English have a tendency to produce each syllable with equal amount of time since Korean is a syllable-timed language (Han, 2001), but Koo (1996) and Chun (1988) investigate how syllables move toward

the final syllable and find out that Seoul Korean learners of English produce the final syllable with lower pitch and shorter duration than other syllables.

In many languages different tunes are used to differentiate individual words. Such languages are called tone languages, and Kyungsang Korean is one of them. Kyungsang Korean can be regarded as a kind of pitch-accent language with two marked tones – low and high – because there appears only one marked tone (the first marked tone) in a word or a rhythm unit and the underlying tones of the other syllables are modulated by the tone neutralization process and the tone modulating process as in Japanese (Hayata, 1974; Chung, 1980; Kim, 1997; Kenstowicz & Sohn, 2000; Sohn, 2001).

Kenstowicz and Sohn (2000) state that when foreign words are adapted into this dialect, they must be assigned a pitch peak. Since any syllable of the word can be accented in the native lexicon, one might expect the accent of the donor language to be copied more or less faithfully. In native North Kyungsang Korean, accent can be singled or doubled. It is also stated that high pitch falls on long vowels in loan word adaptation in English (Kenstowicz & Sohn, 2000; Sohn, 1999; Kim, 1988; Chung, 1991). In Lee's (2003) investigation, he reviews and applies Kenstowicz and Sohn's (2000) and Kim's (1997) statements to prove that loan word adaptation in South Kyungsang Korean Tone pattern is not different from the tone pattern for loan word in North Kyungsang Korean.

3. Methods

3.1 Subjects

A total of forty-six subjects were chosen: four native speakers and forty-two SK Korean speakers. All of the native speakers were male and aged from their late twenties to their late thirties. All have lived in Korea from three to five years and have been teaching English in Kyungnam Province for three to four years. All have normal hearing and health. The SK Korean subjects were divided into two groups: high-proficiency and low-proficiency. The high-proficiency consisted of twenty students whose TOEIC scores ranged from 500 to 750. They were sophomores, juniors, and seniors. The low-proficiency group consisted of twenty-two students whose TOEIC scores ranged from 130 to 320. All were freshmen and majoring in engineering. All subjects voluntarily participated in the experiment.

3.2 Stimuli

Speech samples included nine words and twenty seven sentences. The nine words consisted of a one-syllable word, two two-syllable words, three three-syllable words, and three four-syllable words. In collecting speech samples, the number of syllables in each word and the

position of stress for each word were considered to be important; however, the quality of stressed vowels was not deemed important or relevant. The number of syllables in one word varies in English, from one to eight syllables, but most typical numbers of syllables are one, two, three, or four. For this study words with the typical syllabic counts were used along with the various stress positions.

The nine words are listed below and presented in isolation. Also, the nine words are placed at three different positions in each sentence: initial, medial, and final. Altogether, twenty seven sentences were prepared to test acoustic features within the sentences.

One-syllable Word

- (1) moon

Two-syllable Words

- (2) making: stress falls on the first syllable
 (3) concern: stress falls on the second syllable

Three-syllable Words

- (4) sympathy: stress falls on the first syllable
 (5) important: stress falls on the second syllable
 (6) employee: stress falls on the third syllable

Four-syllable Words

- (7) ordinary: stress falls on the first syllable
 (8) philosophy: stress falls on the second syllable
 (9) information: stress falls on the second syllable

The twenty seven sentences are as follows:

The nine words at sentence initial positions:

- (10) Moon's son lives in Paris.
 (11) Making money is his first concern.
 (12) Concern for human rights has always been important.
 (13) Sympathies lie firmly with the Conservative Party.
 (14) Important people usually have dinner here.
 (15) Employees usually complain about their work.
 (16) Ordinary people wouldn't do such a thing.
 (17) Philosophy is a difficult subject.
 (18) Information super highway is another name for the Internet.

The nine words at sentence-medial positions:

- (19) The owner of Sun and Moon is my sister.
 (20) He was making coffee in the middle of night.

- (21) His main concern is making more money.
- (22) There was no sympathy between them.
- (23) People who are important usually have a lot of power.
- (24) Our school employees work very hard.
- (25) Anything out of ordinary makes her depressed.
- (26) Peter studied philosophy at university.
- (27) Giving unnecessary information can harm you.

The nine words at sentence-final positions:

- (28) We will soon travel the moon.
- (29) Her first interest is money-making.
- (30) His affair was none of her concern.
- (31) She wrote a letter expressing her sympathy.
- (32) It makes them feel important.
- (33) The meeting is only for new employees.
- (34) She can't stand anything out of the ordinary.
- (35) Language is a part of philosophy.
- (36) This book is packed with useful information.

3.3 Data Collection

Stimuli were typed in the recording stimulus file of ALVIN, a software for speech perception research. Each typed-in sample appeared twice randomly in the ALVIN window on the laptop monitor. The Praat software package was used to analyze recorded samples. Each recorded sample was subjected to spectrographic analysis. Measured pitch ranged from 74 Hz to 500 Hz regardless of subjects' gender, and measured intensity varied from 0 dB to 100 dB in the spectrogram. Using the spectrogram, the researcher set each syllable and measured their duration in milliseconds. In measuring duration, pitch, and intensity of a syllable, a whole syllable was measured, including consonants and vowels (Ladefoged, 2001). For accuracy of pitch and intensity analysis, minimum and maximum pitches were measured to obtain an average pitch and an average intensity for each syllable.

4. Results and Discussion

Results indicated that the most obvious place where the native speakers adjust for stress is in the duration of the stressed syllable since increases in duration seem to have the primary purpose of making syntactic units of the listeners (Klatt, 1973). The native speakers most

frequently manipulated duration of the stressed syllable as a means of creating emphases on syllables as in Figure 1 while the high-proficiency SK Korean subjects' was pitch as in Figure 2. In the native speakers' production, lengthening occurred on the last syllable of every test word in isolation and at sentence-final position, as expected by the utterance-final lengthening in English. In producing three-syllable words with final stress, the native speakers lengthened the stressed syllables while they dropped pitch on the same syllables as in Figures 1 and 4. In addition, duration of the unstressed syllable next to the stressed syllable was very short. Figures 1 and 4 support Ladefoged's (2001) and Lass' (1996) claim that a stressed syllable is usually but not always on a higher pitch and that the most reliable cue for a listener to detect is a longer vowel sound.

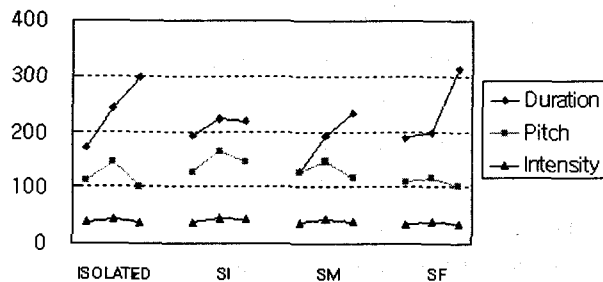


Figure 1. Syllabic analysis of the word, *employee*, produced by the native speakers

Realization of stressed syllables produced by the high-proficiency SK Korean subjects was predominantly pitch-oriented while the native speakers most frequently manipulated the duration of the syllable as a means of creating emphases on syllables. In the case of three-syllable words with final stress, the subjects marked the stressed syllable solely by high pitch without lengthening it as in Figure 2, which makes a distinctive contrast with the stress pattern of the native speakers.

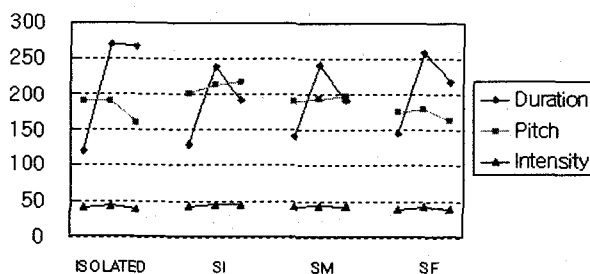


Figure 2. Syllabic analysis of the word, *employee*, produced by the high-proficiency SK Korean subjects

The low-proficiency SK Korean subjects tended to increase duration, pitch, and intensity of the second syllable at all four environments, and this result proved that the subjects do not understand stress placement as in Figure 3. The figure showed regularity, emphasizing the penultimate syllable with pitch.

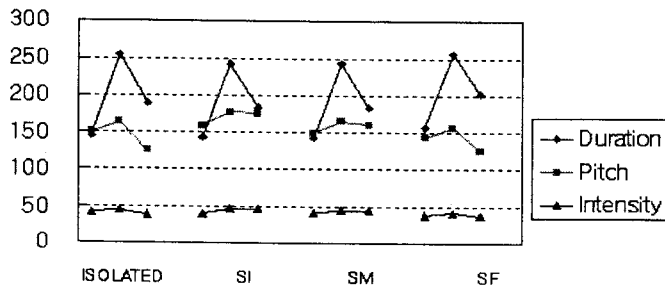


Figure 3. Syllabic analysis of the word, *employee*, produced by the low-proficiency SK Korean subjects

In comparing duration among the three groups, both groups of the SK Korean subjects became more even in their duration values for each syllable as the structure of the word or the sentence became more complex. This indicated that the SK Korean subjects' dependency upon their mother language as well as resulting in interlanguage production (Gass & Selinker, 1983; Park, 2001; Celce-Murcia et al., 1996). The experiment showed that the SK Korean subjects produced final syllables at utterance-final positions with longer duration as in Figure 4 and lower pitch as in Figure 5 than other syllables while Seoul Korean speakers of English learners produced them with shorter duration and lower pitch (Koo, 1996; Chun, 1988).

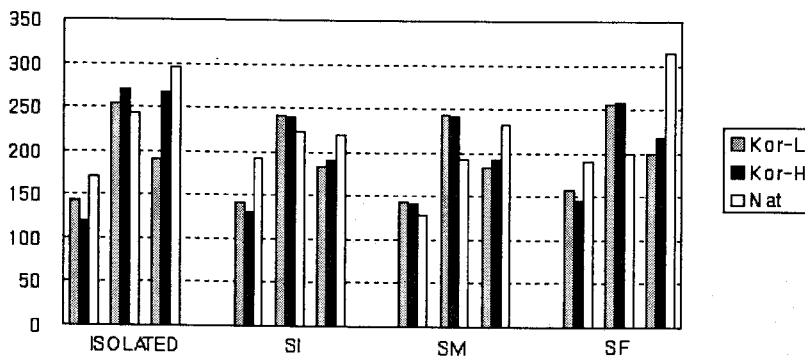


Figure 4. Syllabic duration analysis of the word, *employee*, for the three groups

As theoretical point of view, Figure 5 showed that the high-proficiency SK Korean subjects' production for the word, *employee*, was the most accurate among the three groups, and it

proved the high-proficiency SK Korean subjects had knowledge on a stress pattern for the word. However, the native speakers' production was rather incorrect – theoretically speaking – since they did not emphasize the stressed syllable with pitch as in Figure 5, but from the listeners' perspective their production was intelligible. This proved that the high-proficiency SK Korean subjects used only pitch to emphasize stressed syllables due to the characteristic of their mother language, which is South Kyungsang Korean.

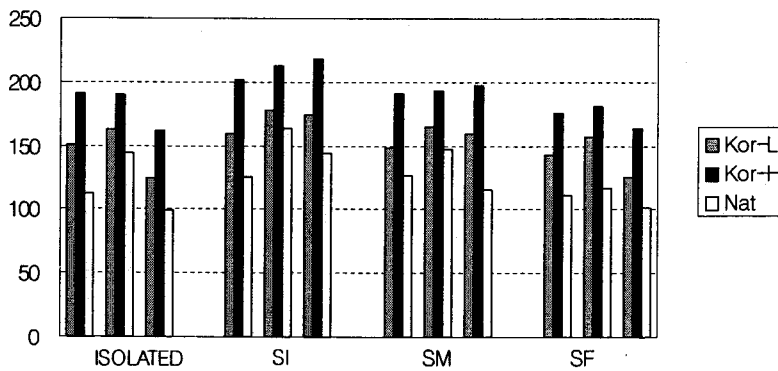


Figure 5. Syllabic pitch analysis of the word, *employee*, for the three groups

The experiment showed that patterns of syllabic intensity varied little between the native speakers and the Korean subjects regardless of the word being in isolation or in any of the three sentence positions. In Figure 6, it can be observed that syllabic intensity levels for the native speaker are consistently lower than the Korean subjects. Ratios between the first and second syllables and the second and third syllables are not comparative while those of the native speakers are comparative.

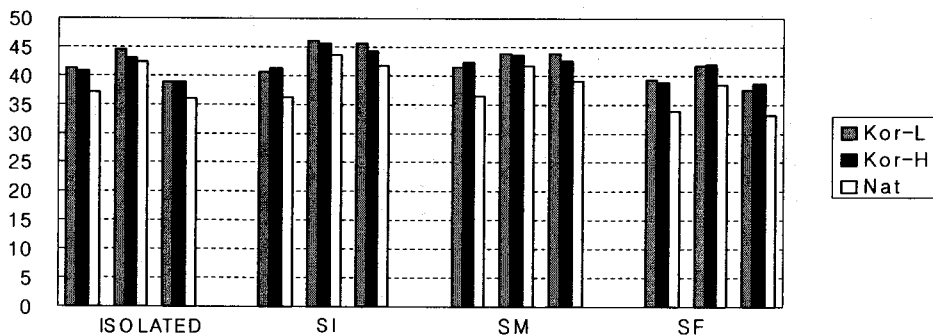


Figure 6. Syllabic Intensity analysis of the word, *employee*, for the three groups

In order to calculate the percent ratio of duration, pitch, and intensity values of unstressed to those of stressed syllables, the following formula was used.

$$\text{Syllable Ratio (\%)} = \frac{(\text{value of stressed syllable} - \text{value of unstressed syllable})}{(\text{value of unstressed syllable})} * 100$$

All calculations and data processing were performed using MICROSOFT EXCEL.

In comparing duration ratio among the three groups, the native speakers' average ratio for two-syllable words was 151% while the high-proficiency SK Korean subjects' average ratio was 79% and the low-proficiency SK Korean subjects was 45% as in Figure 7. However, in the case of the three- and four-syllable words, the SK Korean subjects' average ratio showed negative values while the native speakers' showed positive values, which means that the SK Korean subjects lengthened the unstressed syllables and shortened the stressed ones. Moreover, it was observed that the native speakers used increasing or decreasing syllabic duration as a means of altering stress within their own language and it also means that stress indication is more than likely connected to the use of duration.

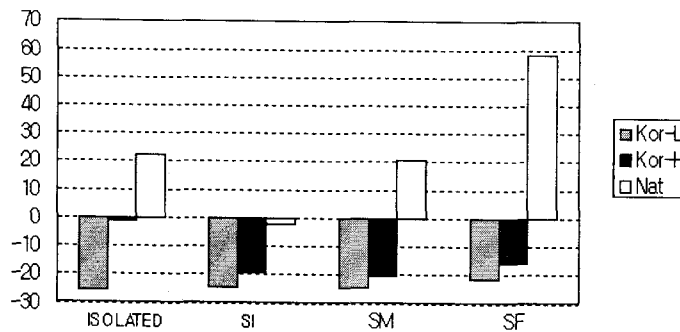


Figure 7. Duration ratio for the speech sample, *employee*

For the pitch ratio, the native speakers' pitch ranged from 100 to 130 Hz while the SK Korean subjects' ranged from 140 to 225 Hz. This phenomenon can be explained by the two factors: the first is that the greater number of female subjects increased pitch values and the second factor is that Korean speakers' average F_0 is approximately 40 Hz higher than that of American English speakers (Yang, 1996). Among the twelve examined ratios, five pitch ratios for the high-proficiency SK Korean speakers showed positive values like the native speakers while the low-proficiency SK Korean speakers only showed negative values as in Figure 8. It was observed that there was tendency for the high-proficiency SK Korean speakers to try to use pitch to emphasize the stressed syllables. In comparing duration and pitch ratios, the results clearly showed that duration contributes most to stress production for the native speakers while pitch does not.

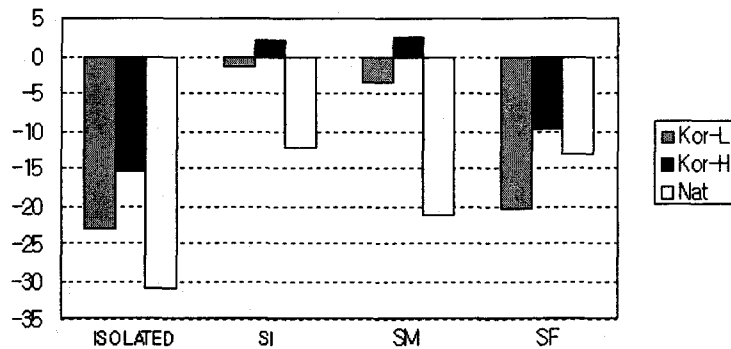


Figure 8. Pitch ratio for the speech sample, *employee*

In comparing intensity ratio among the three groups, the SK Korean subjects did tend to over-emphasize the intensity of their speech, possibly as a means of ensuring correct pronunciation as in Figures 6 and 9. The intensity ratio of stressed to unstressed syllables for the SK Korean subjects was not comparative while that of the native speakers was comparative. This analysis was indicative of the fact that the native speakers did not use vocal pressure or syllabic intensity as a means of indicating stress, either within a word or within a sentence. Another significant result obtained from the analysis was that intensity patterns and pitch patterns were very similar even though intensity did not appear to be a component of stress production by neither the native speakers nor the Korean subjects.

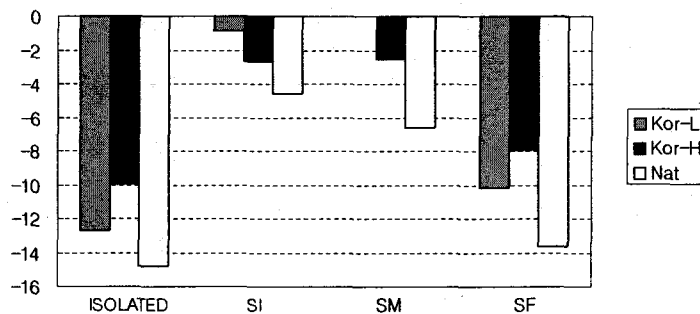


Figure 9. Intensity ratio for the speech sample, *employee*

5. Conclusion

Production of the stimuli by the two high- and low-proficiency groups of South Kyungsang Korean speakers and the native speakers of English was compared and analyzed into duration (ms), pitch (Hz), and intensity (dB). Results showed that the native speakers' main strategy

used in producing stressed syllables was duration while the high-proficiency SK Korean subjects' was predominantly pitch-oriented due to the characteristic of their mother language. The low-proficiency SK Korean subjects did not seem to use any strategy, but showed regularity, emphasizing the penultimate syllable. Both groups of the SK Korean subjects became more even in their duration values for each syllable as the structure of the word or the sentence became more complex. This indicated that the SK Korean subjects' dependency upon their mother language as well as resulting in interlanguage production.

In producing the one-syllable word, *moon*, all three groups showed the similar results, which is the lengthening of the syllable in isolation and at sentence-final position. Pitch values at sentence-initial and sentence-medial positions were lower than in isolation and at sentence-final position for all three groups. For the two-syllable words, duration was used in the native speakers' stress production while pitch was not emphasized. Both of the SK subjects lengthened the last syllables whether stressed or not, and they showed no consistency in pitch. For the three and four-syllable words, the native speakers' results showed they depend on duration more than pitch or intensity in producing stress while the high SK subjects' showed more dependency on pitch.

The experiment also showed that the SK Korean subjects produced final syllables at utterance-final positions with longer duration and lower pitch than other syllables while Seoul Korean speakers of English learners produced them with shorter duration and lower pitch. Since duration turned out to be a crucial factor in producing stress, teaching methods should be based on making up for the lack of duration to provide an effective way of teaching English stress.

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▲ Dokyong Yi

Institute of Foreign Language Education, Inje University
605 Ubang-dong Kimhae-si Kyungsangnam-do, Pusan, 621-749, Korea
Tel: 016-860-3380
E-mail: yicathy@inje.ac.kr