



# The Prosodic Structure of Northern Kyungsang Korean

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## Abstract

This study investigates the underlying tonal pattern of pitch accent, the domain of tone interaction, and the prosodic structure of Northern Kyungsang Korean (NKK) by examining tone-syllable alignment and the realization of pitch accent in different tonal/prosodic contexts. Sixty-four sentences produced by six native speakers of NKK were digitized and f0 values of each syllable as well as the f0 minimum and maximum of each word were measured.

Based on quantitative data, we propose that the underlying tone of pitch accent in NKK is H\*+L and that the left edge of a prosodic word is marked by a low boundary tone (%L). We found that the prosodic cue of focus differs depending on the location of the pitch accent within a prosodic word. For words with non-FINAL pitch accent, the pitch range expanded under focus, and the post-focus pitch accent was mostly downstepped and sometimes deleted. For words with FINAL pitch accent, however, the pitch range was either reduced or remained the same as that in the neutral condition, and the post-focus pitch accent was always upstepped. The domain of downstep and upstep was an Intermediate Phrase (ip), a prosodic unit immediately above a prosodic word.

## 1. Introduction

Northern Kyungsang Korean (NKK), a dialect spoken in the Southeast area of Korea, has lexical pitch accent, and depending on the location of the high tone pitch accent, words may be divided into four different classes (pitch accent is marked with an acute accent):

- (1) a. INITIAL: /mé.nu.ri/ 'daughter-in-law'
- b. PENULT: /ə.mú.i/ 'mother'
- c. FINAL: /wə.nə.mín/ 'native speaker'
- d. DOUBLE: /ó.ré.pi/ 'older brother'

Previous studies on NKK tones [4, 5, 6] focus on the tone interaction of different lexical classes, and the relevant patterns can be summarized as in (2):

- (2) In a phrase (word1 + word2) ...
  - a. if word1 ≠ FINAL, word1 has a higher pitch peak than word2.
  - b. if word1 = FINAL and word2 ≠ DOUBLE, word2 has a higher peak.
  - c. if word1 = FINAL and word2 = DOUBLE, word1 has a higher peak.

For the analysis of these patterns, two different mechanisms have been employed in the literature: (i) the high tone deletes in word2 for the patterns in (2a,c) but in word1 for (2b) [5]; and (ii) HL pitch accent of word1 triggers downstep in word2 for (2a,c) but H pitch accent of FINAL word1 triggers upstep in

word2 for (2b) [4]. One difficulty here is that neither analysis is based on an in-depth experimental investigation of NKK tones employing multiple speakers. Thus, it seems necessary to check the empirical validity of the patterns reported in the previous studies before we consider any formal analysis of NKK tones. Furthermore, since most previous studies were primarily concerned with the analysis of tone interactions at the level of a compound or a relatively short phrase, it is not clear what the domain of tone interactions is and how the domain can fit into the prosodic structure of this dialect.

In this study, we aim at determining the underlying tonal pattern of pitch accent, the domain of tone interactions and the prosodic structure of NKK, based on an experimental investigation of tone-syllable alignment and the realization of pitch accent in different tonal/prosodic contexts. In so doing, we will answer following questions. What are the prosodic units in NKK? How are they defined? What is the tone type of pitch accent: H\*, H\*+L, or L+H\*? Is the surface representation fully or sparsely specified for tone? Which mechanism governs tone interaction, high tone deletion or downstep/upstep? What is the domain for the tone interaction? How does focus affect the prosodic structure and the tone interaction?

## 2. Experiment: Methods

Two main datasets were prepared. In Dataset I, words from each lexical class shown in (1) were located in sentence initial and medial position (underlined below) as shown in (3):

- (3) /ə.mú.i # mé.nu.ri # má.nna-ninteje/  
'mother' 'daughter-in-law' 'meet'-DPP SE  
'(My) mother is meeting (her) daughter-in-law'  
(DPP = Decl. Present Progressive; SE = Sentence Ender)

In Dataset II, a sequence of two words (underlined below) was located in sentence medial position, and either the first or the second word was contrastively focused (in boldface below):

- (4) a. /jəŋmi-ka # əmú.i # **minári** # məŋ-na/  
'Youngmi-Nom' 'mother' 'dropwort' 'eat'-Int SE  
'Is Youngmi eating the mother's dropwort?'
- b. /əncije # jəŋmi-nin # **ménuri** # **minári** # məŋ-ninteje/  
'No' 'Youngmi-Top' 'daughter-in-law' 'dropwort' 'eat'-DPP SE  
'No, Youngmi is eating the daughter-in-law's dropwort.'  
(Nom. = nominative, Int = Interrogative, Top = Topic)

Sixty-four sentences (thirty-two from Dataset II plus eight repetitions of four sentences from Dataset I), produced by six native speakers of NKK (three males, three females), were digitized and f0 values of each syllable as well as the f0 minimum and maximum of each word were measured. In addition to the two datasets, several sentences were collected to test alternative hypotheses about the prosodic structure of NKK.

### 3. Results and Discussion

#### 3.1 Lexical pitch accent

Several observations about the production of sentences in Dataset I can be made. First, every word in NKK starts with low  $f_0$  regardless of their classes. The  $f_0$  gradually reaches its peak on the accented syllable (sometimes on the following syllable) and, except for FINAL class words, falls down to the minimum during post-accent syllables. The gradual rise, which may suggest a case of surface tonal underspecification, is evident in the tonal contour for tri-syllabic FINAL class words where  $f_0$  values of the second syllable (marked with an arrow in Fig. 1) are intermediate between those of word-initial and word-final syllables as can be seen in Fig.1:

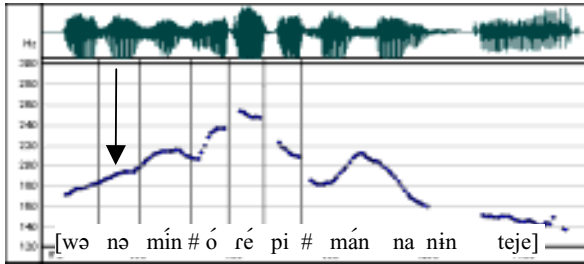


Figure 1: Pitch track showing gradual rise between the initial syllable and the pitch accented final syllable of the first word. The arrow points the  $f_0$  contour of the second syllable (*subject* JH)

Second, the word-initial low  $f_0$  values as well as the peak values are found to be different among different lexical classes. Table 1 shows the relevant results for one female subject (JH):

Table 1: Mean of word-initial Low and peak  $f_0$  values for each word class (*subject* JH)

Word class	<i>subject position</i>		<i>object position</i>	
	Low	Peak	Low	Peak
INITIAL	211.1 (6.3)	254.6 (4.8)	212.3 (15.4)	248.0 (8.6)
PENULT	187.6 (6.1)	253.5 (11.3)	174.1 (5.9)	224.8 (5.7)
FINAL	180.4 (8.8)	221.4 (6.3)	174.1 (3.7)	194.8 (5.6)
DOUBLE	228.9 (15.6)	255.8 (11.4)	225.8 (6.7)	251.8 (5.9)

(unit = Hz; standard deviations are in parentheses)

An ANOVA reveals that there is a significant main effect of word class for both Low and Peak values ( $p < .001$ ). A post-hoc test (Tukey-Kramer HSD) indicates that the Low  $f_0$  values are higher for INITIAL and DOUBLE class words than for FINAL and PENULT words, suggesting a partial undershoot of the word-initial Low tone when the word initial syllable has pitch accent. This is true for both sentential positions and all six experimental subjects. Since every prosodic word begins with a low  $f_0$  and rises to the peak, this suggests that the Low tone is associated with a prosodic word, not a phonological phrase as proposed in [4, 6].

A post-hoc test (Tukey-Kramer HSD) for peak  $f_0$  values shows that the values are statistically lower for FINAL words than for non-FINAL words (cf. [2]).  $F_0$  after the pitch accent

peak falls during the post-accent syllables but the fall was not apparent for FINAL words. Kenstowicz and Sohn [4] proposed that the underlying tone of pitch accent is H+L and when there is no post-accent syllable the L tone deletes. But, as shown and discussed in [2, 4, 6], when the accented syllable becomes penultimate by adding a suffix, the FINAL word behaves like a PENULT word showing a higher peak and  $f_0$  fall on the following suffix syllable: e.g. /wə<sup>nə</sup>mín-i # əmúí # mánná-ninteje/ ‘A native speaker of (some language) is meeting (somebody’s) mother.’ This suggests that the underlying pitch accent is H+L and the realization of H and L is determined at the postlexical level: L is not realized when there is no material after pitch accent and in that case the H is realized as a medium peak.

The next question is whether the L tone in H+L is indeed associated with the pitch accented syllable, i.e., H\*+L, or is the  $f_0$  fall after the peak rather due to the word-final low boundary tone (L%) or the word-initial low boundary tone (%L) of the following word. To resolve this issue, we examined sentences including words with different numbers of post accent syllables, ranging one to four (crucial words, subject NP, are underlined in (5)) while keeping the rest of the sentence the same: ‘Subj.NP is eating dropwort’.

- (5) a. [má.r-i # mínári # məŋninteje]  
 b. [jón.mi-ka # mínári # məŋninteje]  
 c. [jón.ma.ni-ka # mínári # məŋninteje]  
 d. [jón.ma.ni.ne-ka # mínári # məŋninteje]

We found that the slope of the pitch fall is somewhat fixed, showing a low plateau when there are two or more syllables between the peak and the word boundary, suggesting that the L tone is associated with the pitch accented syllable.

In sum, we propose that the underlying tone of pitch accent in NKK is H\*+L and the left edge of a prosodic word is marked by a low boundary tone (%L) which is realized on the word initial syllable. (6) shows the tone-syllable association for each word class under our proposal:

(6)

INITIAL	PENULT	FINAL	DOUBLE
%LH*+L	%L H*+L	%L H*+L	%LH*+L
w   σ σ σ	w   σ σ σ	w   σ σ σ	w   σ σ σ

#### 3.2 Focus and Downstep

An overall observation of Dataset II is that the prosodic cue of contrastive focus differs depending on the lexical class of a word under focus. We will discuss cases involving focused non-FINAL words in this section and focused FINAL words in the next section.

For non-FINAL words, the pitch range expanded under focus, as compared with unfocused counterparts, and the post-focus pitch accent was mostly downstepped and sometimes deleted. These patterns are mostly consistent with previous studies. Figures 2-4 show pitch tracks of the same sentence uttered with no focus (Fig.2), with focus on the first word (Fig.3), and focus on the second word (Fig.4). The sentence ends are slightly different, -na denoting a question vs. -ninteje denoting a statement, but the sentence has the same basic meaning ‘Mother is eating dropwort’. The peak of the

focused word (marked in boldface) is much higher than those of the unfocused counterparts. Also, notice in Figure 3 that post-focus word /minári/ shows a very small peak, which must be the result of downstep.

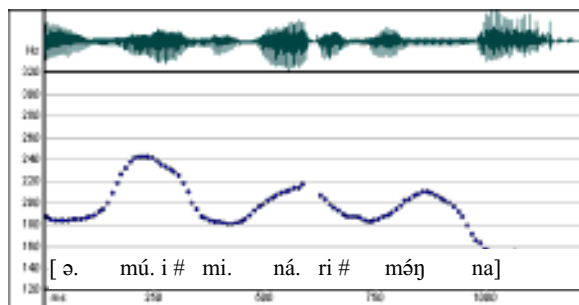


Figure 2: Pitch track of a sentence with *No focus*

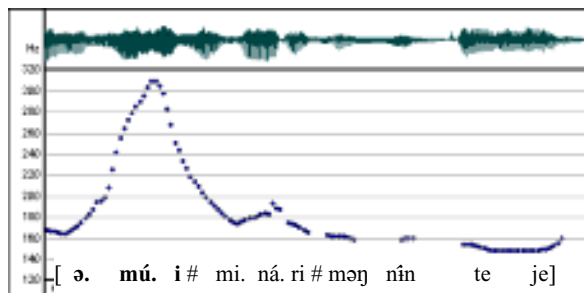


Figure 3: Same sentence as Fig. 2 with *focus on word1*

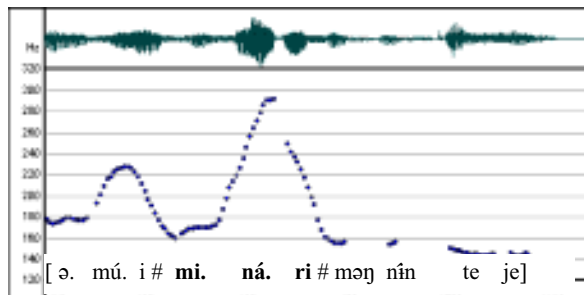


Figure 4: Same sentence as Fig. 2 with *focus on word2*

Table 2 shows the differences in pitch range (peak  $f_0$  minus initial low  $f_0$ ) between focused and unfocused words. Here, the negative values (shaded) indicate that the pitch range is bigger in the unfocused than focused condition. Notice that positive values dominate in the results from five out of six subjects. There is no indication of pitch range expansion in one subject's (LSH) results. Recordings suggest that this subject did not produce the sentence with contrastive focus.

Results also show that post-focus words were not always downstepped. They were often downstepped but sometimes deaccented (= pitch accent or H tone deletion), and the choice varied depending on the subject and the word class. Downstep was more often observed for the sentences produced by female subjects than male subjects, and more so for words belonging to FINAL and PENULT than to INITIAL and DOUBLE class. For INITIAL and DOUBLE words whose word-initial low boundary tone (%L) was typically higher in pitch compared to other classes, downstep was realized as a "shoulder", i.e., no apparent L and lowered peak.

Table 2: Pitch range differences between focused vs unfocused word1

word1	word2	JH	HJ	LIH	KTJ	HY	LSH
INITIAL	Initial	n/a	78	27	19	n/a	16
	Penult	57	9	44	41	n/a	3
	Final	56	39	3	12	-11	10
	Double	67	43	32	48	27	-1
PENULT	Initial	73	121	35	63	25	-5
	Penult	95	86	58	15	26	14
	Final	88	49	39	14	51	-5
	Double	34	84	44	11	8	1
DOUBLE	Initial	76	56	60	0	37	12
	Penult	73	58	35	24	38	-6
	Final	7	53	7	24	n/a	-6
	Double	46	50	-7	3	29	-5
Mean		61.0	60.5	31.4	22.8	22.6	2.3

(n/a = not available)

As in English and Japanese [1], downstep can happen more than once in NKK. The downstep chain, however, is broken when a word is focused. As observed in previous studies [1, 3, 4], a focused word in NKK initiates a new prosodic phrase and post-focus words are often downstepped within this phrase. We call this phrase an Intermediate Phrase (ip) (We do not call it an Accentual Phrase as in Seoul dialect [3], because it includes more than one pitch accent.) It seems that, the bitonal pitch accent triggers downstep as in Tokyo Japanese (cf. [1, 7]). Thus, FINAL class words, where the L tone of pitch accent is not realized, do not trigger downstep.

### 3.3 Final class and Upstep

The prosodic cues of an utterance with focus on FINAL words were quite different from those of focused non-FINAL words. First, when under focus, the pitch range of the FINAL word was either reduced or remained the same as that in the unfocused condition. The differences in pitch range between focused and pre-focus FINAL words are shown in Table 3. As before, the negative values (shaded) indicate a case of pitch range reduction. Unlike in Table 2, negative values dominate in Table 3, though the amount of pitch range reduction is quite small. Three subjects, KTJ, LIH and HJ, show no indication of either positive or negative values.

Table 3: Pitch range differences between focused vs unfocused word1

word1	word2	JH	HY	LSH	KTJ	LIH	HJ
FINAL	INITIAL	-11	-14	-2	-12	-4	0
	PENULT	-16	1	-4	2	1	8
	FINAL	-18	-5	-7	2	10	4
	DOUBLE	-25	-12	0	-5	0	-6
	Mean	-17.5	-7.5	-3.25	-3.25	1.75	1.5

Next, when the FINAL word was focused, the post-focus pitch accent was neither downstepped nor deaccented, but upstepped. The peak of post-focus word was *higher* than that of focused FINAL word with no exception. This was the opposite of patterns found in focused non-FINAL words. Table 4 shows the mean of the differences in peak f0 value between focused word1 and post-focus word2:

Table 4: Mean and standard deviation (in parenthesis) of peak f0 difference from focused word1 minus post-focus word2

	HJ	JH	LIH	KTJ	HY	LSH
mean	-124.5 (63.6)	-91.3 (19.1)	-51.8 (12.8)	-51.0 (14.5)	-48.3 (22.6)	-14.8 (9.3)

These results are mostly consistent with previous studies, except for FINAL-DOUBLE sequences. As shown in (2), FINAL-DOUBLE sequences have been claimed to show a higher peak in word1 [4, 5]. However, this was not found in the current study. Instead, we found a simpler pattern: if word1 = FINAL, word2 has a higher peak, regardless of word2's classes. This discrepancy in data may be due to the difference in generations or dialects. Further data need to be examined.

The phenomenon of pitch range expansion of post-focus word2 after focused FINAL word1 was proposed in Kenstowicz and Sohn [4] as upstep triggered by H pitch accent of FINAL word1 (after L tone deletion). On the other hand, G-R Kim [5] proposed High tone deletion in FINAL word1. However, the current data show that the f0 value of the final syllable of the FINAL word, though not high, is still higher than the f0 of the preceding syllable(s) of the word, suggesting the existence of H tone.

Further observation of the data shows that the peak value of the post-focus word2 after FINAL word1 is as high as the peak of focused non-FINAL word1. In addition, the f0 value of the initial low boundary tone (%L) of word2 is always higher than, or at least equal to, that for the accent peak of FINAL word1. This suggests that what is upstepped is %L and the accent peak, i.e., the H part of the pitch accent. The L part of the pitch accent (when the word following the FINAL word is a non-FINAL word) is not influenced by upstep, reaching the bottom of the speaker's pitch range.

When a FINAL word comes after a FINAL word within the same Intermediate Phrase, a chain of upstep happens as shown in Figure 5, but the upstep chain is broken if the second FINAL word is focused. Upstep is also blocked if a FINAL word is followed by an ip boundary. This indicates that an ip is the domain of upstep as well as downstep. A sequence of downstep and upstep can occur in the same ip if tonal conditions are met. Figure 6 shows an example. The FINAL word2 [mintillé] is significantly lower after the focused non-FINAL word1 [ménuri], but the pitch peak of word3 [mənɲinteje] is upstepped after the FINAL word2.

The tone interaction of NKK provides unique data in intonational phonology in that the same underlying pitch accent H\*+L can trigger downstep or upstep depending on the realization of the L tone. If L is realized, the bitonal pitch accent triggers downstep, but if not, a single H tone triggers upstep. When L is not realized due to a lack of material, i.e., FINAL, the peak of the accent is also reduced probably because there is no need to produce contrast between H and L. Reducing the pitch range of focused FINAL word also provides unique data in prosodic typology of focus.

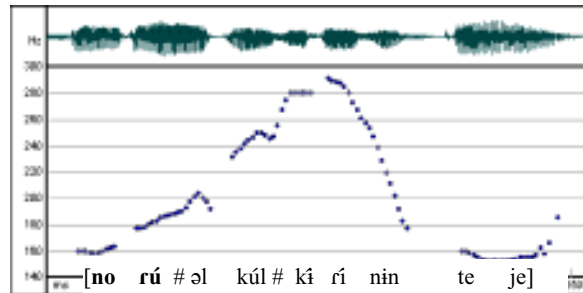


Figure 5: Upstep chain (subject JH)

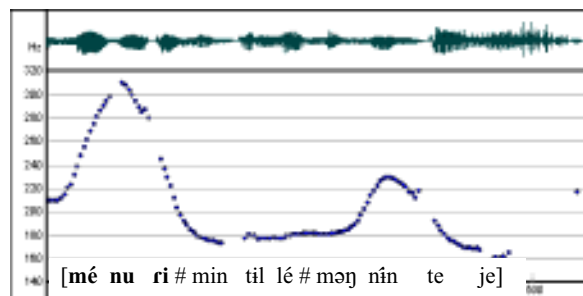


Figure 6: Downstep-upstep chain (subject HJ)

### 3.4 The Prosodic Structure of NKK

In NKK, we have found that the largest prosodic unit is an Intonation Phrase (IP) which is marked by phrase final lengthening and a boundary tone, e.g., L% in Fig.2 and LH% in Fig. 5. The ip in NKK is a prosodic unit larger than the Prosodic Word and smaller than an IP, thus corresponding to the Accentual Phrase in Seoul Korean [3]. Our ip is the domain of upstep and downstep, and corresponds to the phonological phrase proposed in [4, 6], but differ from it by not having the phrase initial boundary tone. Unlike Tokyo Japanese, each lexical word in NKK is accented (H\*+L pitch accent) and each accented word forms one Prosodic Word which is marked by the initial L boundary tone.

## 4. References

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