

# KOREAN PROSODIC STRUCTURE AND FOCUS

Mira Oh

*Yejoo Institute of Technology, KOREA*

## ABSTRACT

There seems to be some relation between meaning and intonation. In particular, that the semantic notion of focus can determine prosodic phrasing is by now well documented. In this paper, the effects of focus on prosodic phrasing, f0, and duration are investigated paying attention not only to the target of focus but also to those constituents that are outside the domain of focus. We find that the constituents preceding and following the focused word tend to be dephrased. Dephrasing does not always cover up to the intonational phrase boundary. Syntactic constituency also plays a role in prosodic phrasing. It was shown that dephrasing caused by focus is a main factor determining f0 and durational difference between focused and neutral sentences.

## 1. INTRODUCTION

The semantic notion of focus is proposed to play a crucial role in prosodic phrasing [5, 9, 14]. Kenesei and Vogel [10] argue that when some word bears focus, the remaining phrases can be restructured depending on their branchingness. Cho [2] proposes the focus restructuring rule in Korean within the relation-based prosodic phonology framework. On the other hand, Jun [7] rejects all syntax based phrasing accounts and argues for intonation phonology in terms of the notion “accent” in Korean based on [1]. Previous literature on phonological phrasing in Korean has discovered three major effects of focus. First, focus boosts the peak of Intonational Phrase. Second, focus introduces an Accentual Phrasal boundary to the left of the focused element. Third, a focused word always initiates an Accentual Phrase and all the following nonfocused words are dephrased up to the Intonational Phrase boundary [7].

This paper investigates the effects of focus on prosodic phrasing, f0, and duration paying attention not only to the target of focus but also to those constituents that are outside the domain of focus. We will examine the degree of dephrasing before and after focus. We will also examine the degree of prominence of the focused word relative to the neutral word with respect to f0. The durational patterns of each syllable in a focused word, and the duration of the pre- and post-focus sequences will also be investigated. We will show the effect of morphosyntactic structure on phrasing.

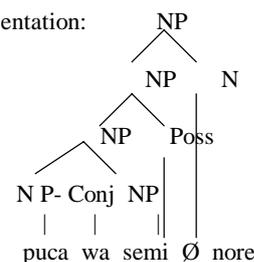
## 2. EXPERIMENT

The data consists of the sentences in (1) to examine the durational pattern and phrasing of a focused word and pre- and post-focus constituents.

- (1) a. /nanin - pakmariae - noreril - silðhe/  
 ‘I(Topic)’ ‘Pakmaria’s’ ‘song(obj)’ ‘dislike’  
 b. /nanin - pucawasemi - noreril - silðhe/  
 ‘I(Topic)’ ‘Puca and Semi’s’ ‘song(obj)’ ‘dislike’

Each constituent underlined is focused in turn and compared with the analogous constituent in neutral focus. These two sentences have the same number of syllables but differ in morphosyntactic structure of the modifier of an object. The modifier in (1a) is NP[pakmariae]<sub>NP</sub> and that in (1b) is NP[NP [puca-wa]<sub>NP</sub> NP[semi]<sub>NP</sub>]<sub>NP</sub>. As Ladd [11] suggests, there exists some essential difference between syntax and prosodic structure which gives rise to mismatch between prosody and syntax. The coordinated structure shown in (1b) may show incongruent phrasing between syntactic and prosodic phrasings as illustrated in (2).

- (2) a. Syntactic representation:



[ [ [pucawasemi]<sub>NP</sub> ]<sub>NP</sub> [nore]<sub>N</sub> ]<sub>NP</sub>  
 ‘Puca and Semi’s’ ‘song’

- b. Prosodic phrasing: {pucawa} <sub>AP</sub> {seminore} <sub>AP</sub>

For example, /seminore/ neither constitutes any syntactic constituent nor a sense unit, while it may constitute an accentual phrase on its own.<sup>1</sup> Such a mismatch between syntactic representation and prosodic representation asks for more information in determining prosodic phrasing.

Two male and two female subjects participated in this experiment producing 5 repetitions of each of the 8 test sentences. The sentences were digitized using CSL and f0 tracks and duration were analyzed using Multi-speech. Duration was measured by referring to a spectrogram and a waveform. Accentual Phrase boundaries and the location of the peak were labeled based on f0 tracks and audio.

## 3. RESULTS AND DISCUSSION

### 3.1. Sentence prosody

Since all subjects show similar tonal patterns and do not show

consistent differences, pooled data are considered. Table 1-2 show the sentences in (1) but with the phrasing information.

Sentences with phrasing:		
1	a. {nanin} {paŋmariae noreril} {silðhe}	(18)
	b. {nanin} {paŋmariae} {noreril} {silðhe}	(1)
	c. {nanin} {paŋmariae} {noreril silðhe}	(1)
2	a. {nanin} { <b>paŋmariae</b> noreril} {silðhe}	(16)
	b. {nanin} { <b>paŋmariae</b> noreril silðhe}	(4)
3	a. {nanin} {paŋmariae} { <b>noreril</b> silðhe}	(13)
	b. {nanin} {paŋmariae} { <b>noreril</b> } {silðhe}	(7)
4	a. {nanin} {paŋmariae noreril} { <b>silðhe</b> }	(20)

Table 1. Phrasings realized by 4 subjects for the model sentence in (1a). In parenthesis is indicated the number of repetitions (out of 20) using this phrasing. Focused constituents are bold-faced. Braces indicate boundaries of accentual phrase.

Sentences with phrasing:		
1	a. {nanin} {pucawa} {semi noreril} {silðhe}	(13)
	b. {nanin} {pucawa semi noreril} {silðhe}	(5)
	c. {nanin} {pucawa} {semi noreril silðhe}	(2)
2	a. {nanin} { <b>pucawa semi</b> noreril} {silðhe}	(13)
	b. {nanin} { <b>pucawa semi</b> noreril silðhe}	(4)
	c. {nanin} { <b>pucawa</b> } { <b>seminoreril</b> } {silðhe}	(3)
3	a. {nanin} {pucawa semi} { <b>noreril</b> silðhe}	(7)
	b. {nanin} {pucawa} {semi} { <b>noreril</b> silðhe}	(7)
	c. {nanin} {pucawasemi} { <b>noreril</b> } {silðhe}	(4)
	d. {nanin} {pucawa} {semi} { <b>noreril</b> silðhe}	(2)
4	a. {nanin} {pucawa semi noreril} { <b>silðhe</b> }	(13)
	b. {nanin} {pucawa} { <b>seminoreril</b> } { <b>silðhe</b> }	(7)

Table 2. Phrasings realized by 4 subjects for the model sentence in (1b). In parenthesis is indicated the number of repetitions (out of 20) using this phrasing. Focused constituents are bold-faced.

A few facts are apparent in the realization of prosodic phrasing. First, /nanin/ 'I (topic)' always constitutes an accentual phrase on its own indicating that the topic marker, /nin/, is a strong boundary marker. Second, the words preceding and following the focused word tend to be dephrased: when /silðhe/ is focused, the number of accentual phrases in the preceding constituents is smaller than in the neutral sentence (compare the sentence type 1 with the sentence type 4 in Table 1 & 2). /silðhe/ is more likely to be a part of a preceding accentual phrase when it is put right after the focused word (compare the sentence types 1 and 2 with the sentence type 3 in Table 1 & 2). Jun [7] claims that the effect of focus is to dephrase all the following words within the same Intonational Phrase unless one of those following words itself is focused. However, (2a, 3b) in Table 1 and (2a, 2c, 3c) in Table 2 illustrate the point that dephrasing does not always cover up to the Intonational Phrase boundary [3, 8]. Finally, morphosyntactic constituency also plays a role in prosodic

phrasing. When /noreril/ is focused, the preceding phrases are of two types: One is a single NP and the other is a branched NP. The former is NP [pakmariae] NP and the latter is NP[NP[puca-Conj] NP NP[semi] NP] NP. /pakmariae/ and /pucawasemi/ have the same number of syllables but they are different from each other in terms of morphosyntactic constituency. As Kenesei and Vogel [10] argue, when some word bears focus, the remaining phrases are restructured depending on their branchingness. As can be seen in the sentence type 3 of Table 1 and 2, the branched NP is produced more variously than a single NP. It suggests that accentual phrases can also be predicted on the basis of syntactic information.

In sum, the prosodic phrasings for the 8 sentences indicate that the constituents in pre- and post-focus positions tend to be dephrased. However, it turns out that dephrasing does not always cover up to Intonational Phrase boundary [3]. Morphosyntactic constituency also plays a role in prosodic phrasing: phrases in pre-focus position are restructured depending on their morphosyntactic branchingness [10].

### 3.2. F0

We measured f0 value of the first and second syllables in focused words and corresponding words in a neutral condition when the focused word is not intonational phrase-final. The f0 value is taken out of the first syllable when contrastive focus is given onto the last word of the final intonational phrase. Table 3 shows the measurement results.

	paŋ	ma	pu	ca
focused	195.049	218.299	225.583	235.520
neutral	175.558	203.62	186.097	226.647
t-test(P)	0.2151	0.3305	0.068	0.3724
	no	re	si	
focused	177.382	218.690	199.770	
neutral	151.284	153.353	170.341	
t-test(P)	0.018	2.16E-06	0.020	

Table 3. The averaged values (Hz) of f0 in focused and neutral positions and t-test results for 4 speakers.

The results of the experiment regarding f0 values reveal that f0 value is a function of prosodic structure. f0 value for the focused word is higher than that for the neutral word but the difference between them is not significant when both are accentual phrase-initial. As seen in Table 1 & 2, /nanin/ always forms an accentual phrase on its own. It means that /pakmariae/ and /pucawasemi/ always initiates a new accentual phrase regardless of focusedness. On the other hand, /nore/ and /si/ are in accentual phrase-initial position when focus is given to them, while they may be located in accentual phrase-medial position in the neutral sentence. Thus, the difference in f0 values between focused and neutral words in accentual phrase-initial position and in utterance later position results from different prosodic structure. Likewise, prosodic phrasing should be taken into consideration when comparing f0 values of focused and neutral words since phrase-initial position is stronger than phrase-medial position. Due to accentual phrase initial strengthening,

f0 values of both focused and neutral words in accentual phrase-initial position are relatively high but they are not significantly different from each other. However, the f0 values of focused words in accentual phrase-initial position and neutral words in accentual phrase-noninitial position are significantly different from each other. Thus, prosodic phrasing should be considered when comparing f0 values of focused and neutral words since phrase-initial position is stronger than phrase-medial position.

### 3. 3. Duration

There have been two approaches with regard to the effect of focus on the duration of adjacent words. Unidirectional approach presumes that focus only affects the part of utterance following the focused constituent [13] or that preceding the focused constituent [6]. The other is bidirectional approach where focus is claimed to affect the duration of both pre-focused constituents and post-focused constituents [8, 12]. In this study, we measured the duration of phrases in the pre-focus, under-focus, and post-focus positions. Table 4 shows the duration ratio of each constituent averaged over 4 speakers as a function of focal conditions.

	paŋmariae	noreril	silðhe
(1a)	*121	*146	*114
	pucawasemi	noreril	silðhe
(1b)	*114	*123	*113

Table 4. Duration of an under-focus sequence (in percentage relative to Neutral) in the model sentences in (1a) and (1b) \*=*significant at <.005.*

All focused constituents are significantly longer than analogous non-focused constituents at the  $p<.005$  level of confidence. It is important to note that the effect of focus on duration is not localized upon the focused constituent, but spreads over the pre-focused and post-focused phrases. Maekawa [12] reports that when a target phrase is focused, durations of the preceding and/or following the phrases are deduced and contribute to the decrease in the overall utterance duration in Japanese. However, Table 5-6 illustrate that shortening of constituents adjacent to focused constituent is due to dephrasing.

	3 syllables	6 syllables
(1a)	101	95
(1b)	116	95

Table 5. Duration of a post-focus sequence (in percentage relative to Neutral) in the model sentences in (1a) and (1b), for two different number of syllables

	2 syllables	7 syllables	10 syllables
(1a)	103	114	98
(1b)	105	103	99

Table 6. Duration of a pre-focus sequence (in percentage relative to Neutral) in the model sentences in (1a) and (1b), for three different number of syllables

When the sequence in pre- and post-focus positions is not long

enough, it may not be shortened. However, when dephrasing occurs in post-focus and pre-focus positions, the duration is shortened. The reduction rate seems to increase as the number of syllables increases. If dephrasing does not occur, duration shortening of the pre-focus sequence is not observed. For instance, the duration of /nanin/ in pre-focus position is rather longer than that in a neutral condition. Likewise, different phrasing strongly affects the duration of sequences adjacent to a focused constituent. Constituents adjacent to a focused constituent are shortened only when they are dephrased. These results suggest that prosodic phrasing difference resulting from dephrasing should be taken into consideration when comparing durations of constituents.

Different morphosyntactic structure also enhances such an effect of prosodic structure on duration. For instance, /naninpaŋmariae/ (7 syllables in pre-focused position) is significantly longer at the 0.001 level but /naninpucawasemi/ (7 syllables in pre-focused position) is not significantly longer compared to the correspondent in the neutral sentence. Such a difference may result from different morphosyntactic structure between them. /paŋmariae/ is a single syntactic constituent, while /pucawasemi/ is a branched constituent. /nanin/ and /paŋmariae/ themselves constitute an accentual phrase on their own when /noreril/ is focused, while /paŋmariae/ is almost always put accentual phrase-medial position in the neutral sentence. That is why such a significant durational difference in the pre-focused constituent is made when /noreril/ is focused as for the sentence in (1a). On the other hand, as for the sentence in (1b), the sequences preceding the focused constituents are not dephrased as frequently as those in the sentence (1a) and the constituents preceding the focused constituents in (1b) are not significantly longer than those in the neutral sentence. Likewise, different morphosyntactic structure gives rise to the different realization of prosodic phrasing which in turn results in durational difference.

Table 7-8 show that the focused word-initial syllable, which is also an accentual phrase-initial syllable, is always significantly lengthened compared to the word-initial syllable in a neutral condition [8].

paŋ	ma	no	re
*171	104	*222	105

Table 7. Duration of a syllable (in percentage relative to Neutral) in the model sentence in (1a). \*=*significant at <.05.*

pu	ca	no	re
*159	98	*173	103

Table 8. Duration of a syllable (in percentage relative to Neutral) in the model sentence in (1b). \*=*significant at <.00001.*

Jun and Lee [8] contend that the lengthening of the focused accentual phrase-initial syllable is due to the lengthening of the initial consonant as opposed to the initial vowel.<sup>2</sup> We measured the initial consonant of /silðhe/ in the model sentences in (1a) and (1b). Table 9 shows the result.

	s
(1a)	*132
(1b)	*127

Table 9. Duration of /s/ (in percentage relative to Neutral) in the model sentences in (1a) and (1b). \*=significant at <.01.

Table 9 supports the claim made in [8].

To summarize, the prosodic structure rather than a simple location of constituents with respect to focused words plays a crucial role in the duration of sequences adjacent to focused constituents. Sequences adjacent to focused constituents are shortened only when they are dephrased. Thus, higher-level prosodic organization is an important determinant of segmental duration.

#### 4. CONCLUSION

We have examined the effects of focus on prosodic phrasing, f0, and duration focusing not only on the target of focus but also on those constituents that are outside the domain of focus. A variety of prosodic phrasings indicate that the constituents preceding and following the focused word tend to be dephrased. Dephrasing does not always cover up to the intonational phrase boundary. Morphosyntactic constituency also plays a role in prosodic phrasing. It was shown that dephrasing caused by focus is a main factor determining f0 and durational difference between focused and neutral sentences.

#### ACKNOWLEDGMENTS

This paper was supported by NON DIRECTED RESEARCH FUND, Korea Research Foundation, 1997.

#### NOTES

1. An accentual phrase can have more than one phonological word and is marked by a phrase-final rising tone in Seoul Korean, LHLH [7].
2. Jun & Lee [8] interpret acoustic strengthening at the beginning of prosodic domain as an extra phonetic strengthening of the accentual phrase-initial boundary.

#### REFERENCES

- [1] Beckman, M. and J. Pierrehumbert. 1986. Intonational structure in Japanese and English. *Phonology Yearbook*, 3, 255-309.
- [2] Cho, Y.Y. 1990. Syntax and phrasing in Korean. In Inkelas, S. and Zec, D. (eds.), *The Phonology-Syntax Connection*, 47-62. Chicago: University of Chicago Press.
- [3] Chung, S. and M. Kenstowicz. 1997. Focus expressions in Seoul Korean. *Harvard Studies in Korean Linguistics*, 93-105.
- [4] Fougeron, C. and P. A. Keating. 1996. Articulatory strengthening in prosodic domain-initial position. *UCLA Working Papers in Phonetics* 92, 61-87.
- [5] Hayes, B. and A. Lahiri. 1991. Bengali intonational phonology. *Natural Language and Linguistic Theory*, 9, 47-96.
- [6] Jun, E. 1991. *An Experimental Phonetic Study of 'Focus' of Current Korean*. Seoul National University.
- [7] Jun, S. 1993. *The Phonetics and Phonology of Korean*. PhD dissertation, The Ohio State University.
- [8] Jun, S. and H. Lee. 1998. Phonetic and phonological markers of contrastive focus in Korean. ICSLP 98.
- [9] Kanerva, J. 1990. Focusing on phonological phrases in Chichewa. In S. Inkelas and D. Zec. (eds.) *The Phonology-Syntax Connection*, 145-161. Chicago: University of Chicago Press.
- [10] Kenesei, I. and I. Vogel. 1993. Focus and phonological structure. Ms.
- [11] Ladd, D. 1996. *Intonational Phonology*. Cambridge University Press.
- [12] Maekawa, K. 1996. Effects of focus on duration and vowel formant

frequency in Japanese. In Sagisaka et al. (eds.) *Computing Prosody*. Springer.

[13] Pierrehumbert, J. and M. Beckman. 1988. *Japanese tone structure*. MIT Press.

[14] Poser, W. 1984. *The Phonetics and Phonology of Tone and Intonation in Japanese*. Cambridge, MA: MIT dissertation.