

# Intonational Phonology of Seoul Korean Revisited

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## 1. Introduction

An autosegmental-metrical model of intonational phonology, developed by Pierrehumbert and her colleagues (Pierrehumbert 1980, Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988; see Ladd 1996 for review), analyzes a pitch contour in terms of two distinct tonal targets (High and Low) and their combinations (e.g., LH for a rising contour and HL for a falling contour). Furthermore, each tone is associated with either a metrically prominent syllable or the edge of a prosodic unit. Thus, an intonation structure captures the prominence relation among words and the hierarchical structure of prosodic units. Though languages vary in the number of prosodic units above the Word, ranging from one to three, prosodic units higher than a Word are often marked by tone, pitch range, and/or final lengthening. Observations of cross-linguistic data (Jun 2005b) suggest that the highest prosodic unit marked by intonation is an Intonation Phrase (IP). Below this unit is an Intermediate Phrase (ip), which in turn is higher than an Accentual Phrase (AP), a unit slightly larger than a Word.

An intonational phonology of Seoul Korean adopting the same frame-

work was proposed in Jun (1993, 1998, 2000, 2005a). This model proposed two tonally defined prosodic units above the Word: Intonation Phrase and Accentual Phrase. Both levels have been shown to be psychologically real in studies of sentence processing and word segmentation. Korean listeners are sensitive to AP boundary cues in parsing the ‘Adjective + Noun1 + Noun2’ structure (e.g., wise baby’s daddy; from Schafer & Jun 2002) as well as IP boundary cues in parsing a complex sentence (e.g., Kang & Speer 2003, Kim 2004). Sensitivity to IP boundary cues by children has also been shown in processing data (Choi & Mazka 2003).

However, prosodic analysis of attachment data (Jun & Kim 2004) suggests that Korean has a prosodic unit lower than an IP and higher than an AP, which I call an Intermediate Phrase (ip). The prosodic criteria defining the ip are not localized as in the IP. The boundary of an ip is perceived either by pitch reset at ip-initial or by a higher boundary (Ha) at ip-final. Unlike an IP, it does not show substantial phrase-final lengthening. It either has no lengthening or only a slight degree of final lengthening. In this paper, I will propose a revision of the intonational phonology of Seoul Korean by discussing the motivations of adding this prosodic unit.

The organization of the paper is as follows. In Section 2, the IP and the AP in Korean are briefly described. In Section 3, three motivations of adding the new prosodic unit, ip, are given. Section 4 proposes a revised model, and Section 5 discusses difficulties of defining the ip and proposes further research.

## **2. Intonation Phrase and Accentual Phrase in Seoul Korean**

An Intonation Phrase (IP) can have one or more Accentual Phrases and is marked by a boundary tone (%) which is realized on the phrase-final syllable. Nine boundary tones have been identified so far: L%, H%, LH%, HL%, LHL%, HLH%, LHLH%, HLHL%, LHLHL%. In addition, an IP is marked by phrase-final lengthening. The phrase-final syllable is about twice as long as the same syllable in the middle of an IP. Finally, an IP is optionally followed by a pause. An Accentual Phrase (AP) can have one or more Words and is marked by a tonal pattern, phrase-initial rise and phrase-final rise, i.e., LH-LH or HH-LH. The phrase-initial tone is High (H) if tense, aspirated consonants, /s/, or /h/, but Low, otherwise. Typically, an AP does not show any phrase-final lengthening and is not followed by a pause.

The four tones marking an AP are associated with certain locations within an AP. The first two tones (HH or LH) are associated with the first two syllables of an AP and the last two tones (LH) are associated with the last two syllables of an AP. When an AP has four or more syllables, all four tones are realized, but when an AP has fewer than four syllables, the second

or third tone (H and L), or both, is often not realized, i.e., undershot. It is not clear yet what determines which tone to undershoot. Schematic contours of common AP tonal patterns when an AP has fewer than four syllables are shown in (1). The tones undershot are in parentheses. The first three contours are when an AP begins with a Low tone, and the other two are when it begins with a High tone. The AP-final tone is, however, sometimes realized as a Low tone, i.e., La, due to the tonal context or its location within an IP. The La tone occurs most commonly when a short AP beginning with a High tone is followed by a High-tone initial AP. Kim (2004: 48) shows that H-initial APs have a higher percentage of La tones than L-initial APs (28.9% vs. 11.1%).

(1) Common AP tonal patterns when AP has fewer than 4 syllables



Example pitch tracks of Seoul intonation are shown in Fig. 1. Fig. 1a and 1b show one IP forming three APs, one AP per word: Topic-Object-Verb. The sentences are: Fig. 1a, *yEQmaninenIN yEQarIR miwEhAyo* ‘Youngman’s family hates YoungAh’; Fig. 1b, *hyEQmininenIN yEQarIR miwEhAyo* ‘Hyungmin’s family hates YoungAh’. The words in the words tier are written in Korean romanization used in Korean ToBI (Jun 2000).

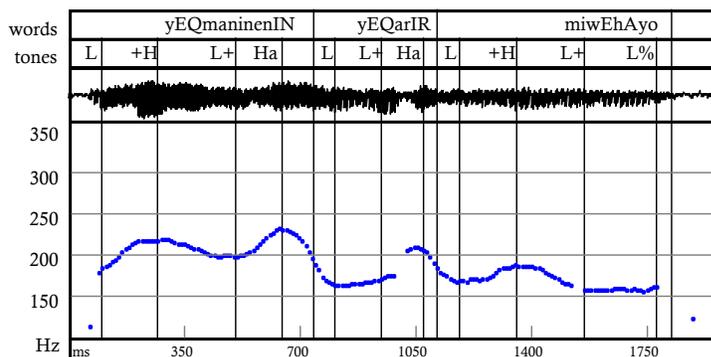


Figure 1a. Pitch track example of the sentence, *yEQmaninenIN yEQarIR miwEhAyo* ‘Youngman’s family hates YoungAh’. The first AP (*yEQmaninenIN*) shows an LHLH pattern.

A major difference between Fig. 1a and 1b is in the tonal contour of the first AP and their pitch ranges. The AP beginning with [h] (Fig. 1b) has an HHLH pattern and the  $f_0$  value of the initial High tone is much higher than that of the LHLH pattern AP in Fig. 1a. However, this pitch range difference due to an AP-initial segment disappears at the end of the AP as shown in these figures (see Lee 1999 for a detailed description of AP tone realizations). The second AP in Fig. 1a/1b, being three syllables long, shows an LH or LLH pattern. The third, IP-final, AP shows an LHL pattern (L, +H, (L+), L%) because it is four syllables long (+H on the second syllable of the AP). The final tone is not H because the AP-final syllable is also IP-final; hence, the H tone (Ha) is overridden by the IP-final Low boundary tone (L%), which marks a declarative meaning.

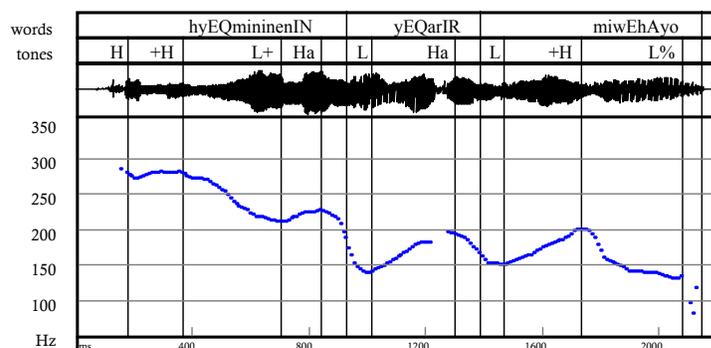


Figure 1b. Pitch track example of the sentence, *hyEQmininenIN yEQarIR miwEhAyo* ‘Hyungmin’s family hates YoungAh’. The first AP shows an HHLH pattern.

### 3. Proposal: Intermediate Phrase

In this paper, I am proposing a third prosodic unit above the Word in Seoul Korean. Since this unit is smaller than an IP and larger than an AP, it will be called an Intermediate Phrase (ip). This prosodic unit serves as the domain of “phonetic” downstep. This is different from the Intermediate Phrase proposed for English and Japanese in Beckman & Pierrehumbert (1986) where the Intermediate Phrase is the domain of downstep triggered by a phonological tone, i.e., bitonal pitch accent. In Korean, a sequence of APs (when all APs begin with the same type of initial tone; see Section 5 for more discussion on AP-initial tone types) shows a downstep-like  $f_0$  lowering within a domain which forms a coherent unit of meaning and/or syntactic structure. Pitch range is reset across this domain, an ip, and the reset in pitch can be cued by more than one way. Three motivations of adding this new prosodic unit are given below.

### 3.1 Motivation of Revision 1

The first motivation comes from the difference between a focused AP and a default AP. A focused word in Korean is realized with expanded pitch range and the lengthening/strengthening of a word-initial segment (Jun & Lee 1998), providing a larger disjuncture from the previous AP than the juncture of a default AP boundary. In K-ToBI (Korean ToBI), the break index before a focused word would be lower than ‘3’ (corresponding to the IP juncture) and higher than ‘2’ (corresponding to the AP juncture).

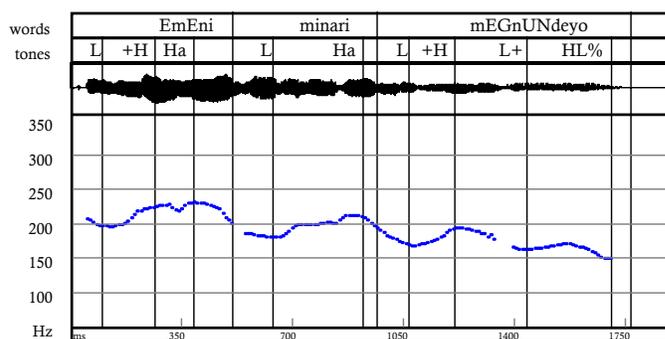


Figure 2a. Pitch track of the sentence *EmEni minari mEGnUNdeyo* ‘Mother eats dropwort’ without focusing any word. F0 peaks show a downstep-like lowering over the sentence.

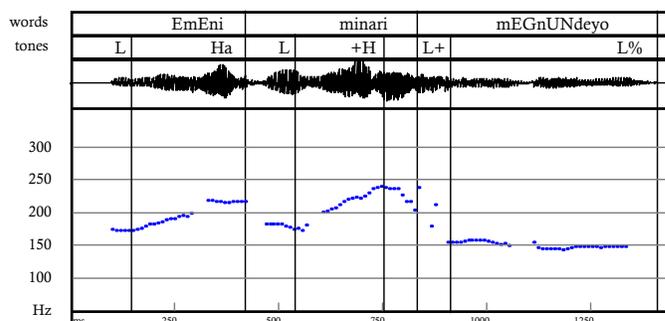


Figure 2b. Pitch track of the same sentence as in Fig. 2a, but focusing the object *minari* ‘dropwort’. The focused AP shows a higher f0 peak than the preceding AP and includes the focused word and the following word, Verb.

The size of an AP also differs between a focused AP and a default AP. Typically one AP contains one word (Schafer & Jun 2002, Kim 2004, Jun

2005b), but a focused phrase can include multiple words, with post-focus words being dephrased or phrased in a very reduced pitch range. Fig. 2 shows pitch tracks of a sentence produced without focusing any word (Fig. 2a) and focusing the object noun, *minari* ‘dropwort’ (Fig. 2b): *EmEni* ‘mother’, *minari* ‘dropwort’, *mEGnINdeyo* ‘eat-ending’. Fig. 2a shows a downstep-like lowering of f0 peaks over the sentence. The focused AP in Fig. 2b, however, breaks this downstep-like chain and shows a higher pitch range than that of the preceding AP, thus higher than the corresponding second AP in Fig. 2a. The focused AP is also larger than the neutral AP by including two words (‘eat dropwort’). Therefore, categorizing a focused AP as the same unit as the default AP would not reflect their acoustic and perceptual correlates.

### 3.2 Motivation of Revision 2

A boundary of a syntactic clause or a complex syntactic phrase is often marked by a larger boundary than an AP. For example, in the “Relative clause (RC) + NP1 + NP2” structure, the end of the RC is often marked by an IP-final boundary tone (%) and phrase-final lengthening. Fig. 3 shows an example pitch track showing an HL% boundary tone after an RC and pitch reset at NP1: RC (*byEQwEne ibwENhan* ‘who is hospitalized’) + NP1 (*doQryoU* ‘colleague’s’) + NP2 (*buinIN* ‘wife-TOP’). The phrase shown in Fig. 3 is taken from the sentence, *byEQwEne ibwENhan doQryoU buinIN ne doQseQU dehaG doQchaQiEDda* ‘(My) colleague’s wife who is hospitalized was my younger sibling’s college classmate’.

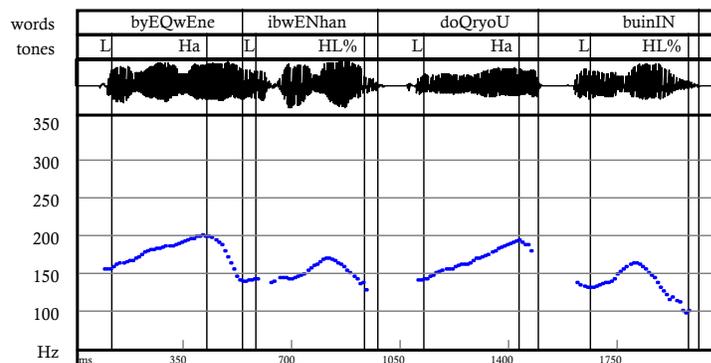


Figure 3. Pitch track showing an IP boundary (HL%) after the relative clause, *byEQwEne ibwENhan* ‘who is hospitalized’. Pitch is reset at NP1.

But, sometimes, we observe no IP boundary tone, nor lengthening at the end of RC, even though we perceive a larger juncture than the default

AP boundary. In this case, we observe a higher AP-final Ha boundary at the end of the RC or pitch reset at NP1. A pitch track example of an RC boundary marked by a higher AP-final boundary tone but no lengthening is shown in Fig. 4. Compare Fig. 4 with the pitch track of the same phrase shown in Fig. 5 where the RC boundary is marked by an AP. In Fig. 5, each word forms one AP, and the first AP-final H tone is higher than the second AP-final H tone (marking the end of an RC), which in turn is higher than the third AP-final H tone (marking the end of NP1). The last AP, an IP-final AP, shows an HL% tone, another type of declarative marking IP-boundary tone in Korean.

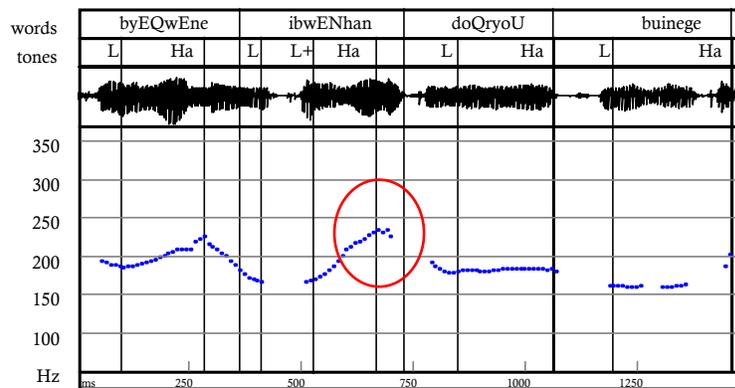


Figure 4. Pitch track of the same phrase as in Fig. 3. The RC final syllable is not lengthened but the juncture after the RC is perceived to be bigger than the default AP because the AP-final tone (circled), marking the end of the RC, is higher than the preceding AP.

A pitch track example of a larger-than-AP juncture after an RC, marked by pitch reset at NP1 and no lengthening, is shown in Fig. 6. The phrase shown in the figure is “RC (*sENgEe* ‘in the election’ *chuRmahhaN* ‘who runs’), NP1 (*sENbeU* ‘senior’s’), NP2 (*chiNgunIN* ‘friend’)”. Since all AP-initial segments are [s] or aspirated affricates, each AP begins with a High tone. Here, the end of the RC is not marked by a higher Ha boundary tone as in Fig. 4. Instead, the beginning of the third AP, which contains NP1, is higher than that of the second AP (marking the end of the RC), thus cueing a bigger juncture than AP after the RC.

The same phenomenon is found in Chonnam dialect whose prosodic structure is the same as that of Seoul but has a different AP tonal pattern from Seoul’s (Jun 1993, 1998). A pitch track example of the same phrase as in Fig. 4 is shown in Fig. 7. As seen in the figure, the tonal pattern of the AP is LHL (it would be HHL if the AP-initial segment is an H-tone trigger

as in Seoul). Here, the boundary after the RC is perceived to be bigger than the default AP. That is, a bigger juncture after the RC is cued by pitch reset at NP1.

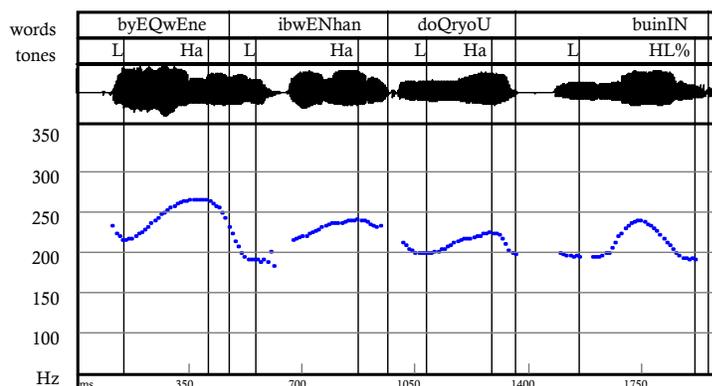


Figure 5. Pitch track of the same phrase as in Fig. 4 (except for NP2's post-position, *-ege* 'LOCATIVE' vs. *-IN* 'TOPIC'). Each word is produced in one AP, thus the juncture after the RC is not perceived to be bigger than the default AP. The f0 peak of each AP is lowered throughout the phrase (except for the HL% boundary tone).

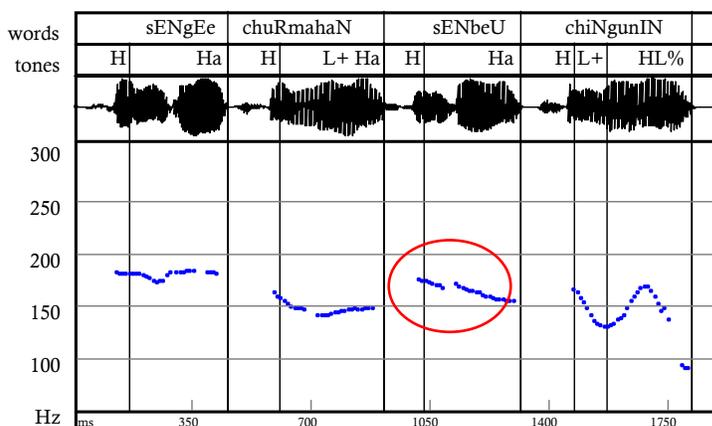


Figure 6. Pitch track of the RC+NP+NP2 structure (*sENgEe chuRmahaN sENbeU chiNgunIN* 'My senior's friend who runs in the election'). The RC final syllable is not lengthened but the juncture after the RC is perceived to be bigger than the default AP because the pitch is reset at NP1 (*sENbeU*). The AP-initial High tone (circled) is higher than that of the preceding AP.

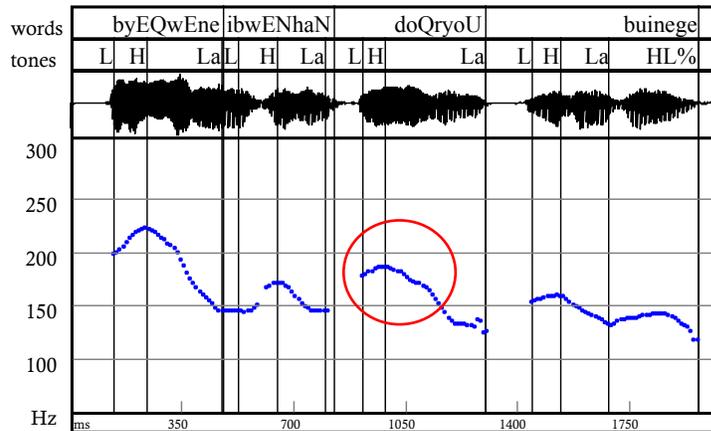


Figure 7. Pitch track of the same phrase as in Fig. 4 in Chonnam dialect. The RC-final syllable is not lengthened but the juncture after the RC is perceived to be bigger than the default AP because the AP-initial tone of NP1 (circled) is higher than that of the preceding AP.

### 3.3 Motivation of Revision 3

The next motivation is from sentence processing data, which suggest that the presence of an intermediate prosodic unit between an IP and an AP is psychologically real.

In the ‘RC NP1’s NP2’ structure, Korean speakers tend to prefer high attachment of the RC, i.e., RC modifies NP2 (Jun & Kim 2004). Production data show that the most common prosodic phrasing of this structure is {RC} {NP1 NP2}, i.e., a bigger boundary after the RC than after the NP1. In this case, the RC was marked by an IP or an ip, and the NP1 was marked by an AP. When the RC was longer, more IP or ip breaks were found after the RC, and listeners interpreted them as high attachment more often (see Jun 2004 for more detail). A similar phenomenon was found in Japanese (Jun & Koike 2003).

### 4. Intonation of Seoul Korean - Revised

In sum, the prosodic structure of Seoul Korean proposed in Jun (1993, 1998, 2000, 2004) does not distinguish the difference in juncture between the default AP and the focused AP, and it does not capture the prosodic cues used to disambiguate syntactically ambiguous structures. These problems would be solved if we assumed an intermediate prosodic unit between an IP and an AP. That is, an Intermediate Phrase (ip) in Seoul Korean is the domain of focus and the domain of phonetic downstep. It often marks the edge of a syntactic clause or a complex phrase structure. Phonetically, ei-

ther the beginning or the end of an ip boundary is marked. The end of an ip is marked by a higher AP-final tone (which could be interpreted as a boundary tone of an 'ip') than the preceding AP-final tone. The beginning of an ip is marked by 'higher initial pitch' than the preceding AP. The 'higher initial pitch' can come from either the beginning or the end of the ip-initial AP. The revised prosodic units above the Word in Seoul Korean, from the highest to the lowest, are shown in (2).

(2) Three tonally defined prosodic units above the Word in Seoul Korean  
Intonation Phrase (IP) > Intermediate Phrase (ip) > Accentual Phrase (AP)

## 5. Problems and Future Research

Pitch range related phenomena such as downstep and pitch reset have been used as a criterion to define a prosodic unit in other languages (e.g. Intermediate Phrase in English and Japanese). Then, why was pitch range ignored before in defining a prosodic unit in Korean? One of the main reasons is that, as mentioned earlier, pitch range can change in Korean depending on the segmental property at the beginning of a phrase. APs beginning with a tense or aspirated consonant, /s/, or /h/ have a higher pitch range than those beginning with other segments. An example pitch track showing a higher pitch range due to an H-initial AP, but not marking the beginning of a larger prosodic unit, is shown in Fig. 8 -- *maIR saraMdlri* 'the village people', *sirhEhanIN* 'hate-RC marker', *mudaQU* 'the exorcist's', *goyaQinIN* 'the cat-TOP', meaning 'The cat of the exorcist that the village people hate ...'. Here, due to the [s] sound, the AP containing the predicate of the RC (*sirhEhanIN*) begins with a higher pitch than the preceding AP, which is the subject of the RC. However, as the tonal transcription suggests, the juncture between the subject and the predicate is not bigger than an AP.

It is difficult, therefore, to define an ip based on only pitch range when a sentence has words whose initial segment is a different tone trigger<sup>1</sup>, especially when a Low-beginning AP is followed by a High-beginning AP. In this case, the initial High tone of a High-beginning AP either keeps the same f0 height as the preceding Ha of the Low-beginning AP or starts higher than the preceding Ha value (as in Fig. 8). An informal observation suggests that we need to consider the speaker's pitch range to decide an ip boundary. If an AP-initial H tone value belongs to the top of the speaker's pitch range, the AP begins a new ip. We need more data to define an ip when an utterance has APs with mixed initial tone triggers.

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<sup>1</sup>For this reason, all RC + NP1 + NP2 structures examined in this paper were chosen because they contain words whose initial segments are either all H-tone triggers or all L-tone triggers.

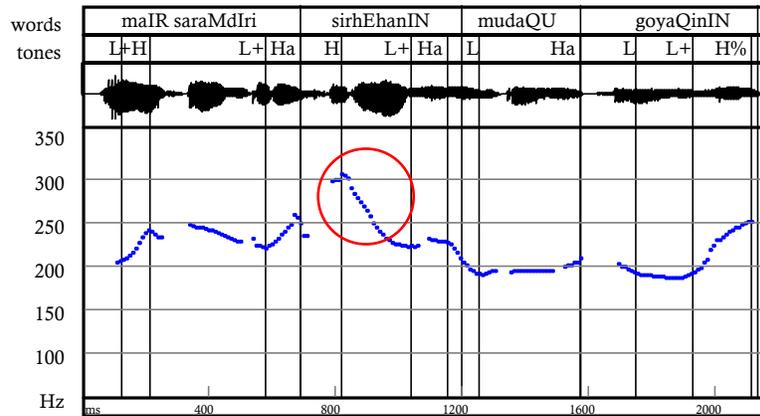


Figure 8. Pitch track of a phrase, RC (*maIR saraMdIri sirhEhanIN*) + NP1 (*mudaQU*) + NP2 (*goyaQinIN*). The predicate of the RC (*sirhEhanIN*) forms one AP, but its beginning pitch (circled) is higher than the preceding AP due to the AP-initial segment, [s].

The next question concerns if an IP is exhaustively parsed in ips and an ip is exhaustively parsed in APs. This would be true if we assume the Strict Layer Hypothesis (SLH, Selkirk 1986). But, it is not easy to answer this question straightforwardly. It seems that there exist some constraints on the realization of an ip. Data (used in Jun, 1993, 2000, and Jun & Kim 2004) suggest that some ips (e.g., ips containing only a short, monosyllabic, pronoun or a short adverb) are not fully realized but degenerated before a main/full ip, similar to a pro-clitic or an extrametrical segment in segmental phonology. A similar phenomenon seems to be found in the last ip of an IP. It is not clear if this small phrase should be analyzed as an ip. If not, the SLH would be violated. Another interesting tendency observed in the data is that, when the syntactic structure is the same, a sequence of L-initial APs showed a chain of downstep more often than a sequence of H-initial APs. This implies that there is an interaction between the tone type and the phrasing: H-initial APs tend to begin an ip more often than L-initial APs.

Finally, the degree of phrase-final lengthening is another issue that needs to be examined. As mentioned earlier, most ip-final syllables are not lengthened, similar to AP-final syllables. But there are some cases where the final syllable is slightly longer than the AP-level duration (though clearly shorter than the IP-level duration). It is possible that an ip has a small degree of final lengthening. A perception experiment should be performed to confirm a qualitative difference between the prosodic units.

## References

- Beckman, M. E. & J. Pierrehumbert. 1986. Intonational Structure in Japanese and English, *Phonology Yearbook* 3: 255-309.
- Choi, Y. & R. Mazuka. 2003. Young Children's Use of Prosody in Sentence Parsing, *Journal of Psycholinguistic Research*, 32. 2: 197-217.
- Jun, S.-A. 1993. The Phonetics and Phonology of Korean Prosody. Doctoral diss., OSU. Columbus, Ohio. [Published in 1996 by Garland Publishing Inc., NY]
- Jun, S.-A. 1998. The Accentual Phrase in the Korean Prosodic Hierarchy, *Phonology*, 15.2: 189-226.
- Jun, S.-A. 2000. K-ToBI (Korean ToBI) Labelling Conventions: Version 3, *Speech Sciences*, 7: 143-169. [V.3.1 in *UCLA WPP* 99:149-173]
- Jun, S.-A. 2004. The Intermediate Phrase in Korean Intonation: Evidence from Sentence Processing Data, a talk given at the International Conference on Tone and Intonation in Europe, Santorini, Greece, 9-11 September, 2004.
- Jun, S.-A. 2005a. Korean Intonational Phonology and Prosodic Transcription. *Prosodic Typology: The Phonology of Intonation and Phrasing*. ed. S.-A. Jun. pp.201-229. Oxford, England: Oxford University Press.
- Jun, S.-A. 2005b. Prosodic Typology. *Prosodic Typology: The Phonology of Intonation and Phrasing*. ed. S.-A. Jun. pp.430-458. Oxford, England: OUP.
- Jun, S.-A. & S. Kim. 2004. Default Phrasing and Attachment Preference in Korean, *INTERSPEECH 2004-ICSLP*, Jeju, Korea.
- Jun, S.-A. & C. Koike. 2003. Default Prosody and RC Attachment in Japanese, *Proceedings of the 13<sup>th</sup> Japanese-Korean Ling. Conference*, CSLI, Stanford.
- Jun, S.-A. & H.-J. Lee. 1998. Phonetic and Phonological Markers of Contrastive Focus in Korean, in *Proceedings of the 5th ICSLP*, 4:1295-1298. Sydney.
- Kang, S. & S. Speer. 2003. Prosodic Disambiguation of Syntactic Clause Boundaries in Korean, a paper presented at WCCFL XXII. San Diego.
- Kim, S. 2004. The Role of Prosodic Phrasing in Korean Word Segmentation. Doctoral dissertation, UCLA
- Ladd, R. 1996. *Intonational Phonology*, Cambridge, MA: CUP.
- Lee, H.-J. 1999. Tonal Realization and Implementation of the Accentual Phrase in Seoul Korean. MA thesis, UCLA.
- Pierrehumbert, J. 1980. The Phonology and Phonetics of English Prosody, Doctoral dissertation, MIT.
- Pierrehumbert, J. & M. E. Beckman. 1988. *Japanese Tone Structure*, Cambridge, MA: MIT Press.
- Schafer, A. & S.-A. Jun. 2002. Effects of Accentual Phrasing on Adjective Interpretation in Korean, *East Asian Language Processing*, ed. M. Nakayama, .223-255. Stanford: CSLI.
- Selkirk, E. 1986. On Derived Domains in Sentence Phonology. *Phonology Yearbook*, 3: 371-405.