Prosodic Markings of Complex NP Focus, Syntax, and the Pre-/Post-focus String

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1. Introduction

Focus refers to salient words or phrases in the discourse. The salient word or phrase can be an answer to a wh-question, as illustrated in (1). The domain of focus is marked here by a subscript *F*. In (1a), the subject noun is focused, and in (1b), the object noun is focused, while in (1c), the verb phrase is focused.

(1) a. Who likes phonetics?   [Peter]$_F$ likes phonetics.
     b. What did he buy?   He bought a [book]$_F$
     c. What did he do?   He [bought a book]$_F$

The prosodic realization of focus can vary depending on various factors such as type of focus (e.g., information focus, corrective focus), morphosyntax (whether or not a language has a morpho-syntactic marker of focus), and intonational phonology of language, and thus is language-specific. On one hand, head-prominence languages such as English, German, and Greek, mark prominence through the use of pitch accent (i.e., salient pitch movement on the stressed syllable), and the focused word receives a nuclear pitch accent, "deaccenting" the following word(s). On the other hand, edge prominence-languages such as Korean and Japanese mark prominence by manipulating the phrasing (i.e., grouping) of words, Lastly, languages such as Bengali and French, considered both head- and edge-prominence languages, prominence is marked by both pitch accent and phrasing (Jun 2005).

Prosodic realizations of focus also differ by domain (i.e., whether the focus domain is a single word or a phrase) and the syntactic type of constituent (i.e., whether it's an NP or VP). In the case of VP focus in English, e.g., (1c), studies have shown that nuclear pitch accent is given on the VP-final argument, thus similar to the case with the final argument having narrow focus (Gussenhoven 1983; Birch & Clifton 1995; Welby 2003), though more recent studies have revealed some differences in the pitch accent types and the realization of pre-nuclear pitch accent (Baumann, Becker, Grice, & Mücke 2008; Breen, Fedorenko, Wagner, & Gibson submitted; Jun in progress). In the case of VP focus in Korean, Jun, Kim, Lee, & Kim (2006) and Jun & Kim (2007) have shown that the VP-initial argument receives the strongest prominence, while all following lexical items, sometimes even the verb, still receive prominence. That is, no dephrasing happens after the initial argument. This differs from the case where the VP-initial argument receives narrow focus. In that case, a strong phrase boundary is inserted at the beginning of the focused argument, and all items after the focused argument are either dephrased (i.e., phrase boundaries are deleted) or realized in substantially reduced pitch range.

Prosodic realizations of NP focus differ from VP focus and also vary across languages. In Neapolitan Italian declaratives, each word in a focused NP is marked by a rising (L+H*) nuclear pitch

accent, but in yes/no-questions, it is the beginning and end of the focus domain that is prosodically marked (D'Imperio 2001). Figure 1 shows pitch tracks of three yes/no-questions with different focus domains: (a) "Will you see [mom]$_F$ tomorrow?";. (b) "Will you see [mom's hand]$_F$ tomorrow?", (c) "Will you see [mom's beautiful hand]$_F$ tomorrow?". Here, the L*+H pitch accent marks the beginning of focus domain and a falling (HL) tone marks the end of the domain. A similar phenomenon is found in NP focus in Kolkata Standard Bengali (Hayes & Lahiri 1991; Lahiri & Fitzpatrick-Cole 1999; Selkirk 2007), where a focused constituent is marked by a low pitch accent (L*) on the first stressed syllable and a high boundary tone (H$_P$ or H$_{FOC}$) at the end of the constituent. However, a somewhat different pattern is found in Bangladeshi Standard Bengali (Khan 2008). In this variety of Standard Bengali, two alternatives are seen: either each word bears a separate focus pitch accent (L*+H) or only the last word of the constituent bears the focus pitch accent, marking only the end of the focus domain.
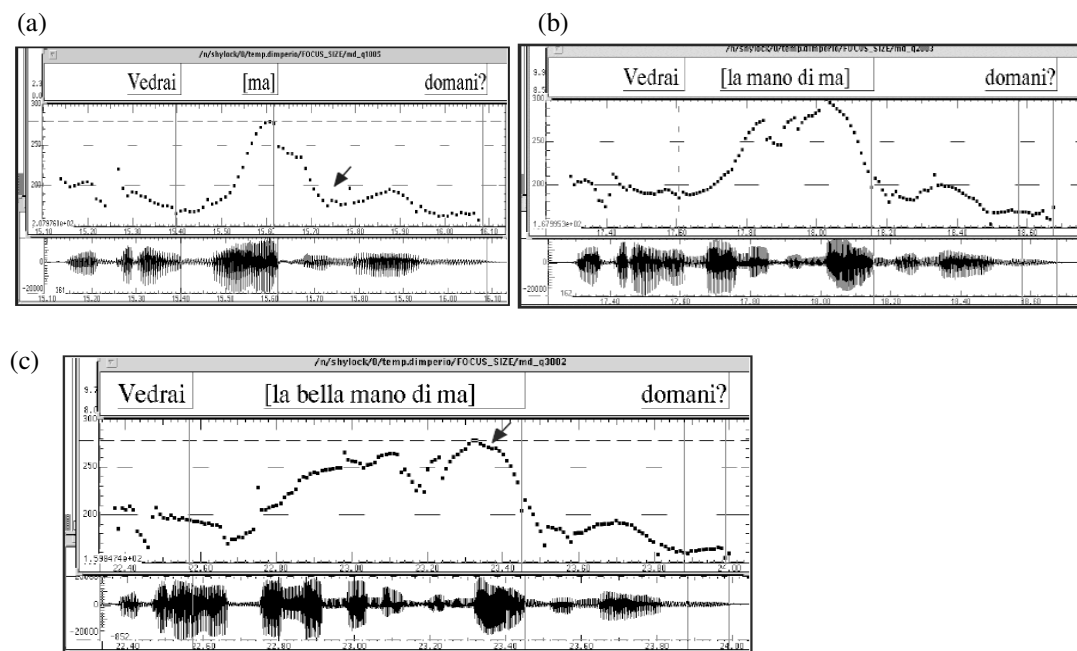
(a)

(b)

(c)

Figure 1. Pitch tracks of three yes/no-questions in Neapolitan Italian when an NP of varying size is focused: (a) *Will you see **mom** tomorrow*? [The arrow indicates the target of the HL tone.] (b) *Will you see **mom's hand** tomorrow*?, and (c) *Will you see **mom's beautiful hand** tomorrow*? [The arrow indicates the second pitch accent in the constituent.] (Figures from D'Imperio (2001))

For the current paper, the prosodic realization of NP focus in Korean is examined in sequences of genitive noun phrases such as *Mary's sister's boyfriend.* An example dialogue is given in (2).

(2) Focus on a multi-word NP in Korean
 Q: Who does Inho like?
  인호가 **누구를** 좋아하니?
  [inho-ga   nugu-lɨl   tʃoahani]
  Inho-nom   who-acc   like
 A: Inho likes [Mina's tutor's sister]F.
  인호는 **미나의 가정교사의 여동생**을 좋아해.
  [inho-nɨn   mina-ɛ   kadʒəŋgjosa-ɛ   jədoŋsɛŋ-ɨl   tʃoahɛ]
  Inho-top   Mina's   tutor's   sister-acc   like

Utterances were examined to see how the focused NP is prosodically realized. Is the whole NP marked prosodically? Or is the first or last word in the NP more prominent than the rest? Is the phrasing

influenced by focus? Is there dephrasing within or after the NP? If so, how is this dephrasing phonetically realized? The results show that the last word in the NP is the most prominent, and that this word begins an Intermediate Phrase, triggering dephrasing of the following words. Dephrasing, however, is interrupted by a major syntactic boundary, rendering a new type of dephrasing after focus, i.e., partial dephrasing. Two more types of dephrasing after focus are proposed: complete dephrasing and phonetic dephrasing.

The paper is organized as follows. Section 2 introduces the experiment where the prosodic realizations of complex NP focus in Korean are examined when three factors are manipulated: the domain/size of focus, the location of the focused NP, and the syntactic structure of the sentence. Section 3 reports the results and Section 4 discusses three topics: 1. the effect of focus on prosodic phrasing, 2. two types of Intermediate Phrases: prominence-marking vs. syntactic boundary-marking, and 3. prosodic phrasing before and after focus and the representation of the dephrased string in the prosodic structure of Korean. Section 5 concludes the paper.

2. Experiment
2.1. Method

Four speakers (2 male, 2 female) of Seoul Korean participated in the experiment. There were 123 target sentences which varied in the length of the NP (one to four nouns) and the structure of the sentence (see below in (3)). Each subject read target sentences out-of-the-blue (to collect broad focus data). Then, two subjects "acted out" a dialog displayed on a computer screen (to collect narrow focus data, an answer to a wh-question). An example of a dialogue is given in (4). Subjects later switched roles so that both roles were collected from each subject. Subjects wore a head-mounted microphone. Their speech was digitized directly into a computer into two channels at a 22kHz sampling rate using *PCQuirerX* (Scicon R & D). The prosodic phrasing and intonation of each sentence was analyzed following the revised model of Korean intonation (Jun 2006, 2007; see next section).

(3) Syntactic structure of target sentences (varying in simple/complex VP, matrix/embedded clause, subject/object NP); the target NP is in bold.

> i. **NP** + Verb
> ii. **NP** + VP (adverb + verb)
>
> iii. **NP** + embedded verb + main V
> iv. **NP** + embedded verb + main VP
>
> v. **NP** + Subj. noun + (embedded V) + main V
> vi. **NP** + Obj. noun + (embedded V) + main V
> vii. Subj. noun + **NP** + (embedded V) + main V
> viii. Obj. noun + **NP** + (embedded V) + main V

(4) A: [mina-ga [**nugu**-lɨl mannanɨn-gəl] [tʃɛil ʤoahani]]?
> 'Mina-nom **whom** meet-cl.marker   most like'
>   => 'Who does Mina like to meet the most?'

> B: [mina-nɨn [**NP**-lɨl mannanɨn-gəl] [tʃɛil ʤoahejo]].
> 'Mina-top **NP**-acc meet-cl.marker   most like'
>   => 'Mina likes to meet **NP** the most.'

>> **NP** = one word: Yeona (a girl's name)
>>   two words: Yeona's tutor
>>   three words: Yeona's tutor's sister
>>   four words: Yeona's tutor's sister's boyfriend

2.1.1. Intonation of Seoul Korean: Revised model (Jun 2006, 2007)

The revised model of Korean intonation is the same as the earlier model (Jun 1993, 1998, 2000) except for having an Intermediate Phrase (ip), which is larger than an Accentual Phrase (AP) and smaller than an Intonation Phrase (IP). The hierarchical organization of the prosodic units and the tonal affiliations are given in (5). An 'ip' is defined by pitch reset, either by higher AP-initial tone (+H) or by a high intermediate phrase boundary tone (H-), and minor phrase-final lengthening when marked by H-.

(5) Revised Intonation Model of Seoul Korean
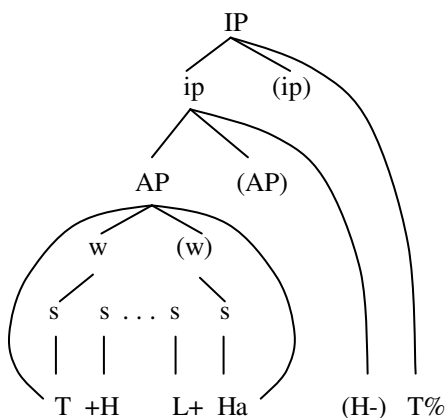
IP: Intonation Phrase; ip: Intermediate phrase; AP: Accentual Phrase
w: phonological word; s: syllable
T = H, when the AP-initial segment is aspirated or tense C or /h, s/; Otherwise, T = L
+H: H tone realized on the second syllable of AP
L+: L tone realized on the penultimate syllable of AP
Ha: an AP-final boundary tone.
(H-): an optional ip-final boundary tone
T%: an IP-final boundary tone (e.g., H%, L%, LH%, HL%, LHL%, HLH%)
(when boundary tones of different prosodic units are realized on the same syllable, the tone of a higher prosodic unit overrides that of a lower prosodic unit.)

2.2. Results

Not unexpectedly, the prosodic phrasing varied within and across speakers, influenced by length, syntax, and focus. In this section, the most common patterns of prosodic phrasing across speakers are described. The phrasing pattern for the broad focus condition is shown in section 2.2.1, and that of the focus condition is shown in section 2.2.2, grouped by the length of NP.

2.2.1. Broad focus

In the broad focus condition, prosodic phrasing was influenced by syntactic, rhythmic, and length factors. When a sentence is long, i.e., has more than five words (with each word having 3 or 4 syllables in general) and includes a heavy syntactic boundary such as a subordinate clause or a heavy NP, the end of these units was marked by a boundary tone of a bigger prosodic unit (ip or IP), realized on the last syllable (which is a case marker or postposition in the dataset) of the syntactic constituent. Figure 2 shows an example where a heavy subject NP is followed by an embedded verb, *mannanun-kel* 'to meet-clause marker', the last syllable of which is marked by an IP boundary tone, H% (i.e., NP-V // VP). Here, the sentence has six words and the end of a three-word heavy NP subject (i.e., the fourth word in the sentence), is not marked by a big prosodic break. However, as shown in Figure 3, in a

sentence of seven words, the end of a four-word heavy NP subject (i.e., *namjachingu-ka* 'boyfriend-nom') is marked by a big prosodic break, but the end of an embedded verb is not. This suggests that prosodic phrasing is also constrained by a rhythmic factor.
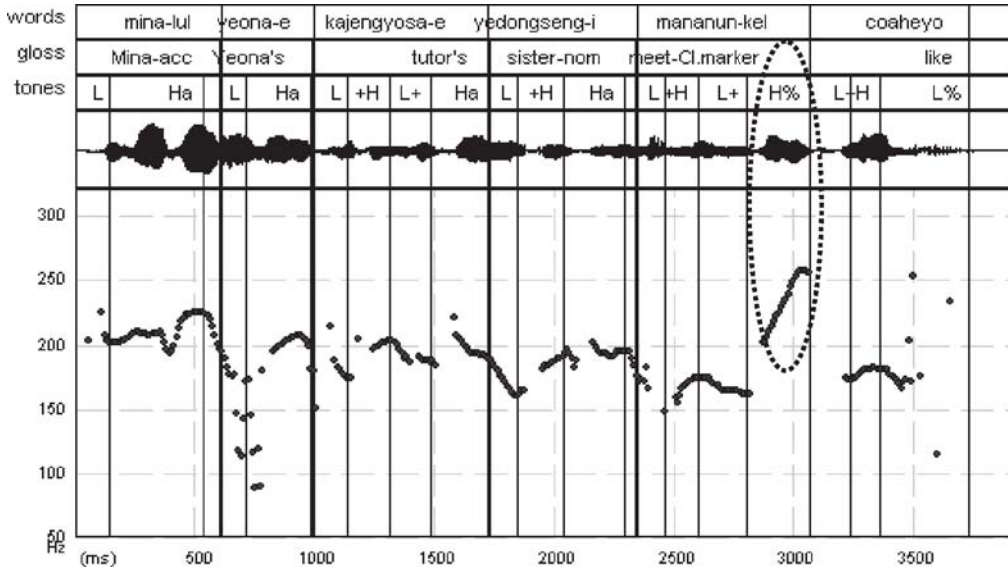

Figure 2. An example pitch track of a six-word sentence in broad focus shows a big prosodic break (IP-final H% boundary tone is circled) after the embedded verb, *mannanun-kel* "to meet-clause marker". The structure of the sentence: [(Mina-Acc)[(Yeona's)(tutor's)(sister-nom)]$_{NP}$(meet-clause marker)]$_S$(likes)] => 'Yeona's tutor's sister likes to meet Mina.' [This figure follows the Korean-ToBI transcription convention (Jun 2000). It shows three tiers (words, English gloss, and tones) above the waveform and pitch track. The same figure format is used for all following pitch track figures.]
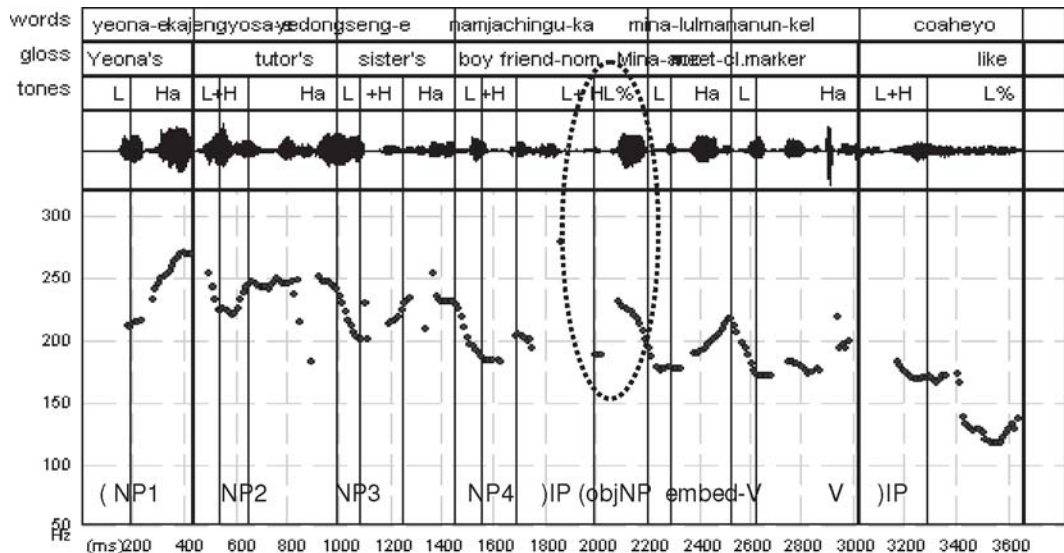

Figure 3. An example pitch track of a seven-word sentence in broad focus shows a big prosodic break (IP-final HL% boundary tone is circled) after the four-word heavy NP subject, *namjachingu-ga* "boyfriend-nom". The structure of the sentence: [[(Yeona's)(tutor's)(sister's)(boyfriend-nom)]$_{NP}$[(Mina-acc)(to meet-clause marker)]$_{VP}$]$_S$(likes)] => 'Yeona's tutor's sister's boyfriend likes to meet Mina.'

Another example of a rhythmic factor influencing prosodic phrasing is shown when a heavy four-word subject NP is phrased into two groups. Figure 4 shows that the first two words in the four-word subject NP forms one Intermediate Phrase (marked by Ha-ip in the tones tier), which is cued by the raised AP-initial peak (i.e., +H) on the third word, *yeodongseng-e* 'a sister's'.
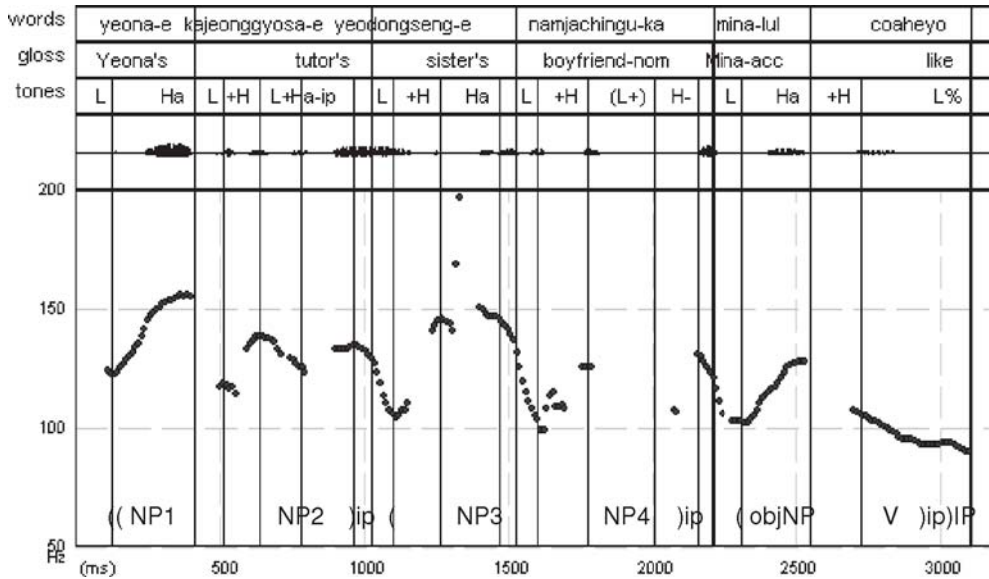

Figure 4. An example pitch track of a four-word subject NP in a six-word simple sentence in broad focus. Here, the first two words in the subject NP are grouped into one ip, cued by a higher pitch peak (+H), i.e., pitch reset, of the third word/AP, *yeodongseng-e* "sister's" than the peak of the second word/AP. The structure of the sentence: [[(Yeona's)(tutor's)(sister's)(boyfriend-nom)]$_{NP}$ [(Mina-acc)(likes)]$_{VP}$]$_S$ => 'Yeona's tutor's sister's boyfriend likes Mina.'
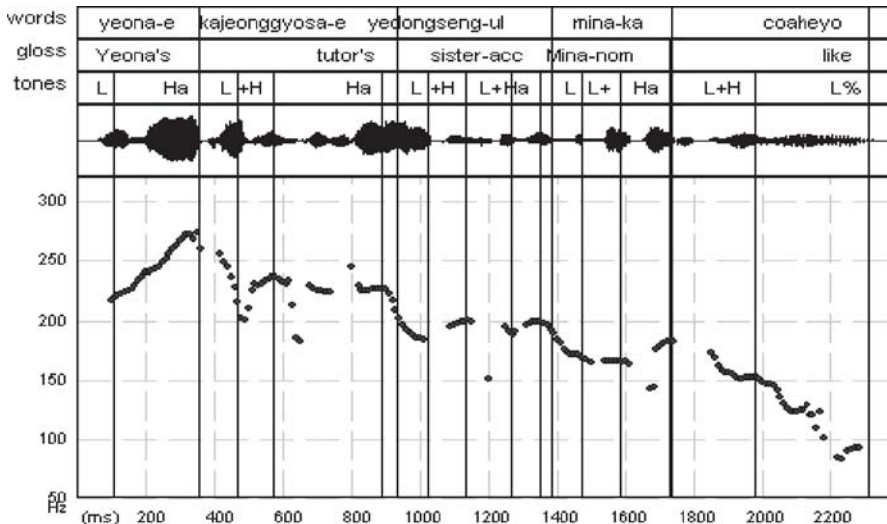

Figure 5. An example pitch track of a five-word sentence ("Mina likes Yeona's tutor's sister.") in broad focus. It shows a downtrend of APs even when the sentence has a heavy 3-word object NP.

When a sentence is shorter than six words, each word tends to form one AP, with f0 peaks decreasing over the utterance, regardless of the complexity of the structure. An example is shown in Figure 5. Here, the sentence, *yeona-e kajeonggyosa-e yedongseng-ul mina-ka coaheyo*, 'Mina likes

Yeona's tutor's sister', has a fronted, heavy three-word object NP followed by a subject NP, *mina-ka*, and a verb, *coaheyo*. Still, each word forms one AP and the peak f0 of each AP shows a downtrend.

In sum, the data show that prosodic phrasing of a sentence in broad focus is constrained by the length and syntactic structure of a sentence as well as by the rhythm.

2.2.2. Focus condition: Short NP (1 or 2 nouns)

When a complex NP is focused, each word in the NP is often prominent but the last word in NP is the most prominent, always starting a new Intermediate Phrase (ip). The prosodic phrasing of the whole NP and of the sentence, however, varied depending on their length. When a sentence is short (i.e., five words or fewer), the last word in the NP started a new ip and all the following words were "dephrased". Dephrasing was realized in three different ways: Complete dephrasing, partial dephrasing, and phonetic dephrasing.

"Complete dephrasing" happens when all AP boundaries after the focused word are deleted, thus forming one long AP starting from the focused word. That is, the new ip starting from the focused word is composed of only one AP. A formal representation of complete dephrasing is given in (6). This type of dephrasing was the most common when the sentence was short or when the focused word was followed by one or two words. An example pitch track of complete dephrasing is shown in Figures 6 and 7. Figure 6 shows a sentence with focus on the two-word object NP, "For Mina, (she) dislikes [**Yeona's tutor**]$_F$ the most". Here, the second noun in the object NP, *kajeonggyosa-lul* 'a tutor-acc.', begins an ip (cued by pitch reset), triggering dephrasing after the NP and across a VP boundary (= adv + main V), forming one long AP including the second noun of the object NP, the adverb, and the main verb. Figure 7 shows pitch track of a sentence, [(Mina-top)(Yeona-acc)(to meet-clause marker)]$_S$ [(a lot)(likes)]$_{VP}$ => "For Mina, (she) likes to meet [**Yeona**]$_F$ the most", with focus on the object noun, *Yeona*. In broad focus, each word tends to form one AP, but with narrow focus on *Yeona*, the word begins an ip and dephrases all the following words across an embedded clause boundary, forming one long AP.

(6) Complete Dephrasing: [(NP1 NP2 NP3) NP4]$_{NP\text{-}Focus}$ [(NP) …. V]
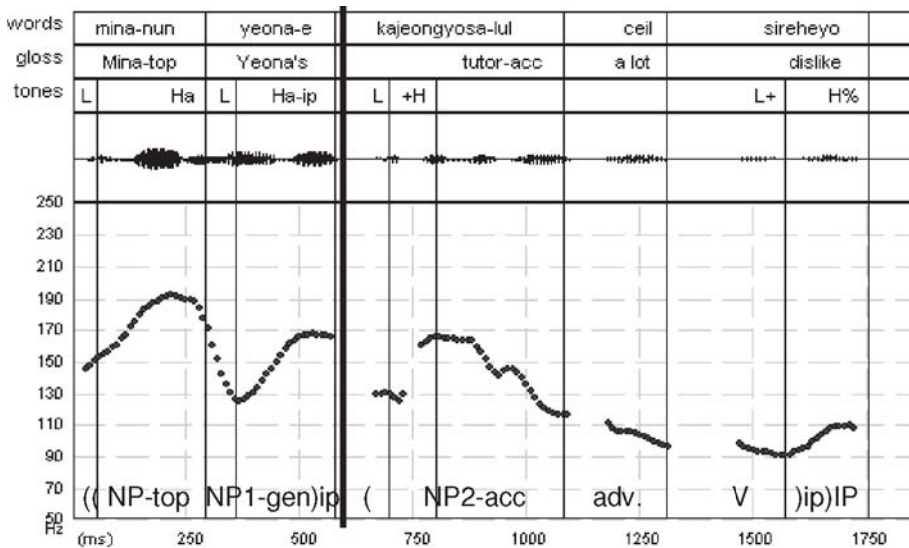$$=> ((… NP3)ip ((\textbf{NP4} … NP ... V …)_{AP})ip)IP$$

Figure 6. An example pitch track of a five-word sentence with focus on the two-word object NP, *yeona-e kajeonggyosa-lul* "Yeona's tutor-acc'. A new ip begins from the second noun in the object NP. This ip is composed of one AP, which includes the second noun of the object NP (*kajeonggyosa-lul*), the adverb (*ceil* 'a lot') and the main verb (*sireheyo* 'dislike'). That is, the items after 'tutor' are completely dephrased. This sentence means "For Mina, (she) dislikes **Yeona's tutor**".

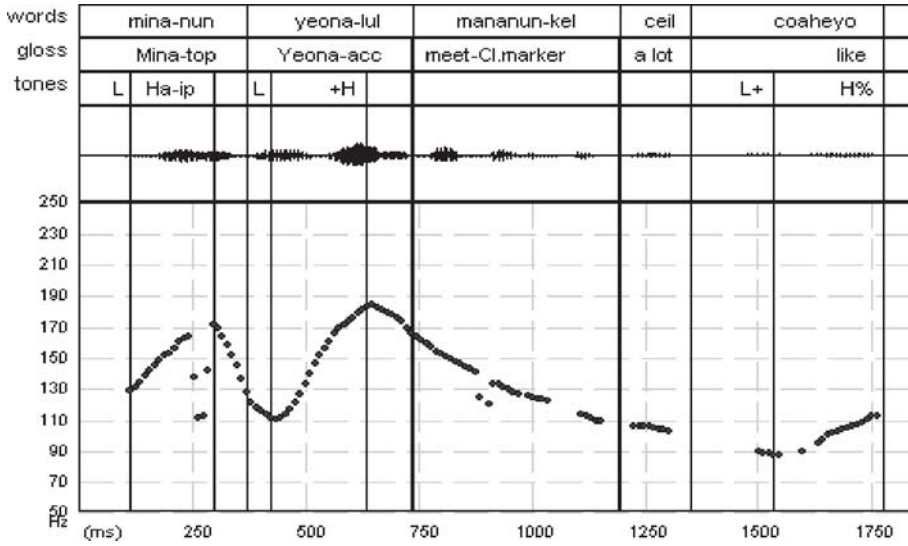| words	mina-nun		yeona-lul		mananun-kel	ceil	coaheyo
gloss	Mina-top		Yeona-acc		meet-Cl.marker	a lot	like
tones	L	Ha-ip	L	+H			L+ H%

Figure 7. An example pitch track of a five-word sentence with focus on the object NP, *yeona-lul* "Yeona-acc', illustrates complete dephrasing. The object begins an ip and dephrases all the following words, forming one long AP across an embedded clause boundary. This sentence means "For Mina, (she) likes to meet **Yeona** the most".
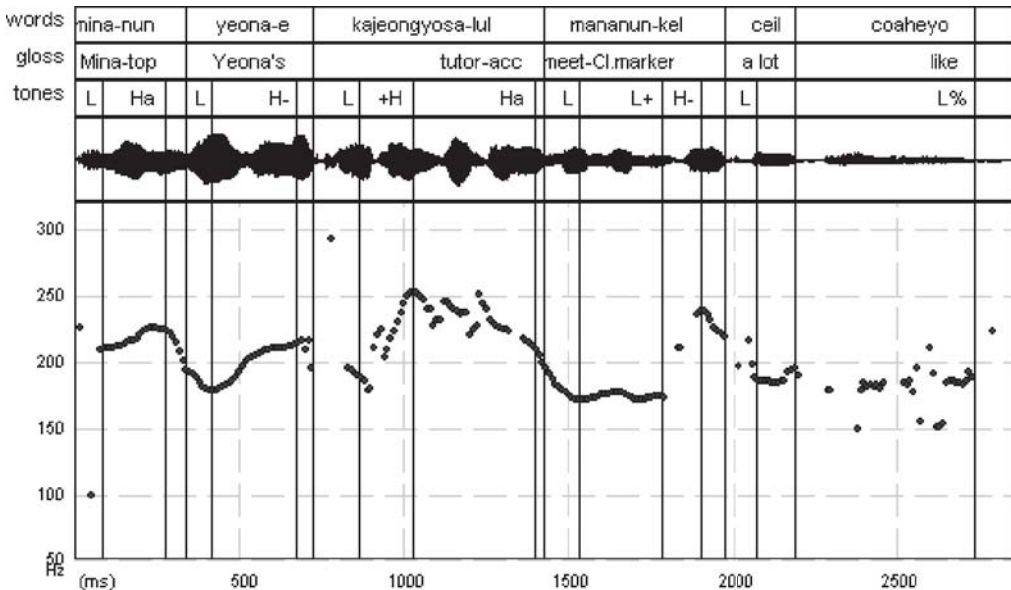

words	mina-nun	yeona-e	kajeongyosa-lul	mananun-kel	ceil	coaheyo
gloss	Mina-top	Yeona's	tutor-acc	meet-Cl.marker	a lot	like
tones	L Ha	L H-	L +H Ha	L L+ H-	L	L%

Figure 8. An example pitch track of a six-word sentence with focus on the object NP, *Yeona-e kajeonggyosa-lul* "Yeona's tutor-acc', illustrates "partial dephrasing". The second word in the object NP begins an ip (with higher +H), but the end of this word maintains an AP boundary, i.e., not including the following word into its own AP. The sentence means "For Mina, (she) likes to meet **Yeona's tutor** the most".

When a sentence is long (i.e., more than five words) and the focused NP is followed by an embedded verb, the last word of the focused NP is still produced as most prominent; this is marked by initiating a new ip. However, the end of embedded-clause was also marked by a big prosodic break,

illustrating the effect of syntax on phrasing as is the case of broad focus as well. In this case, the complete dephrasing of post-focal words was interrupted by a prosodic boundary. That is, post-focal words are not fully dephrased after the focused word, and this type of dephrasing is called 'partial dephrasing'. An example is shown in Figure 8. Here, an ip boundary is shown before the last word of the focused NP, *kajeonggyosa-lul* 'tutor-acc.'. However, unlike the prominent words shown in Figures 7 and 8, this word still maintains an AP boundary at the end of the word, not completely dephrasing the following word, i.e., the embedded verb *mannanun-kel* 'to meet-clause marker'. That is, the focused ip has more than one AP, illustrating 'partial dephrasing'. This example also illustrates that the effect of dephrasing can continue even across an ip boundary. The main VP (composed of two words) after the embedded clause shows a low flat f0 track and weak amplitude. This data shows that the effect of syntax on phrasing can interfere with the effect of focus.

2.2.3. Focus condition: longer NPs (3 or more nouns)

When the focused NP has more than two words, the prosodic juncture at the end of whole NP varies depending on the number of following items. If it is followed by a single word, i.e., a verb, the verb will be dephrased across the NP boundary, and forms one AP together with the last word of the NP, which begins an ip as the most prominent word. See Figure 9, where the NP-final word and the main verb form one ip and one AP together. However, if the NP is followed by more than one word, the right edge of the focused NP is often marked by a prosodic break, while still dephrasing the following word(s). That is, the post-focal string is *partially* dephrased. An example of this type is shown in Figures 10 and 11. In Figure 10, the last word of the focused subject NP, *namjachingu-ka* 'a boyfriend-nom', begins an ip but the end of this word is also marked by an ip boundary (cued by a H-boundary tone). The following two words form one AP in substantially reduced pitch range and amplitude. A similar phenomenon is shown in Figure 11, where the last word of the focused object NP, *cunggan pupun-ul* 'the center part-acc.', receives prosodic focus and begins an ip, but does not form one AP together with the three post-focal words. Instead, the three post-focal words form one AP by themselves in substantially reduced pitch range and amplitude, i.e., partially dephrased.
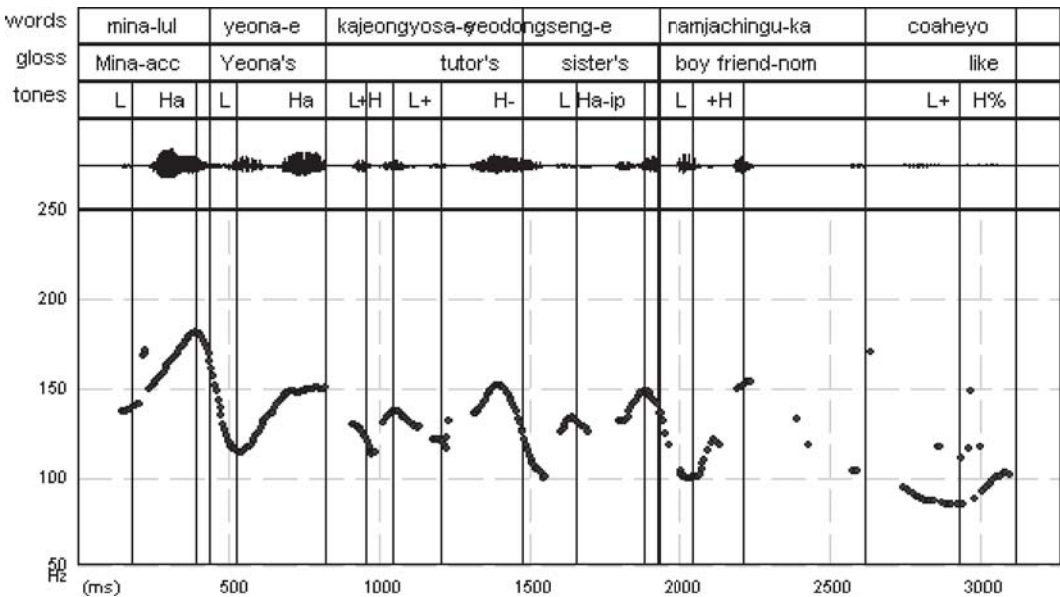

Figure 9. An example pitch track of a six-word sentence where the four-word subject NP is focused and is followed by one word, i.e., the verb. The last word of the subject NP and the following verb form one ip and AP, illustrating "complete dephrasing". The sentence means "**Yeona's tutor's sister's boyfriend** likes Mina".

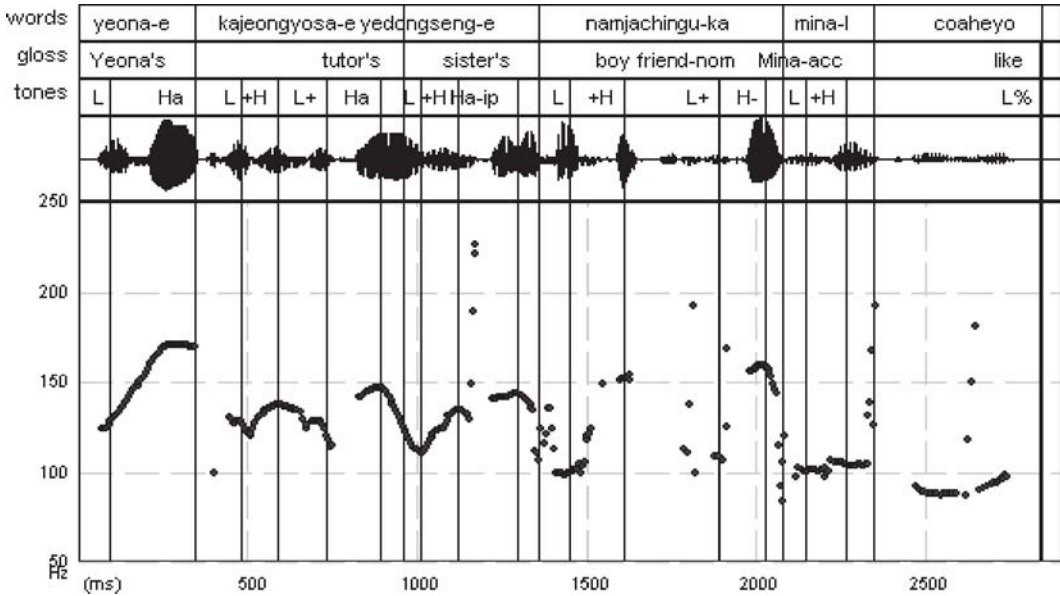| words	yeona-e	kajeongyosa-e yedongseng-e		namjachingu-ka	mina-l	coaheyo
gloss	Yeona's	tutor's	sister's	boy friend-nom	Mina-acc	like
tones	L Ha	L +H L+ Ha	L +H Ha-ip	L +H L+ H-	L +H	L%

Figure 10. An example pitch track of a six-word sentence where the four-word subject NP is focused and is followed by two words, i.e., the object NP and the verb. The last word of the subject NP initiates a new ip (with higher +H) but the end of the subject NP is marked by an ip boundary tone, H-, blocking complete dephrasing. The two words following the subject NP form one AP by themselves in reduced pitch range and amplitude, illustrating "partial dephrasing". The sentence means "**Yeona's tutor's sister's boyfriend** likes Mina".

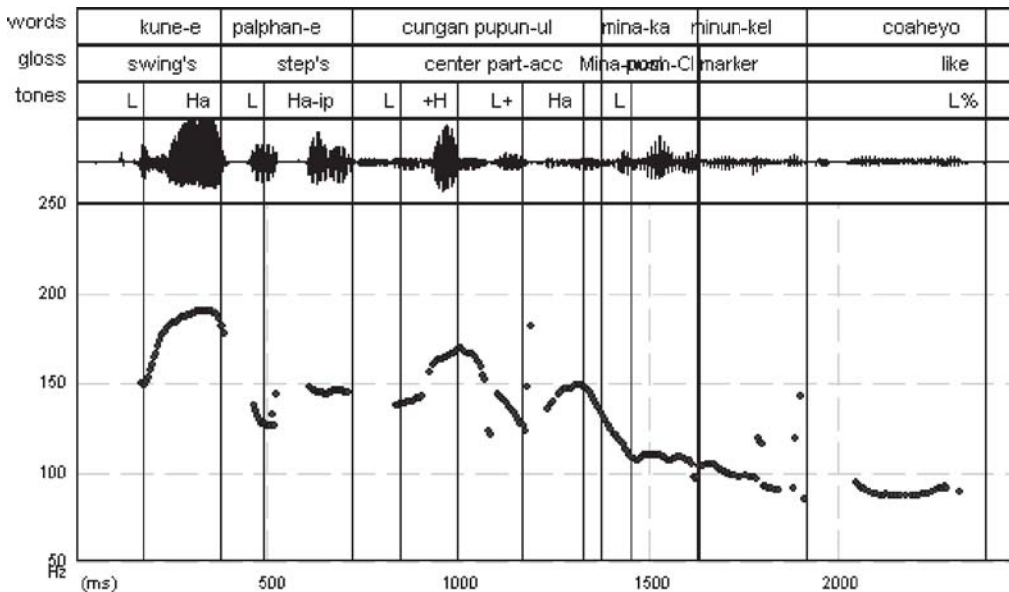| words	kune-e	palphan-e	cungan pupun-ul	mina-ka minun-kel	coaheyo
gloss	swing's	step's	center part-acc	Mina-posh-Cl marker	like
tones	L Ha	L Ha-ip	L +H L+ Ha	L	L%

Figure 11. An example pitch track of a six-word sentence where a three-word object NP is focused and followed by three words (i.e., subject NP, embedded verb, and main verb), meaning "Mina likes to push **the center part of the step of the swing**". The last word of the object NP receives prosodic focus and begins a new ip, but the end of this word/object NP is marked by an AP boundary and the following three words form one AP showing substantially reduced pitch range and amplitude, thus indicating partial dephrasing.

Though dephrasing (either complete or partial) is common after focus, a third type of dephrasing, "phonetic dephrasing", is also not uncommon. Phonetic dephrasing is characterized by post-focal items maintaining their accentual phrasing, but with reduced pitch range and amplitude. An example is shown in Figure 12, another pitch track example of the same sentence used in Figure 11. Here, the phrasing is the same as that in Figure 11, but the three post-focus words (subject NP, embedded verb, and main verb) each form a separate AP in a reduced pitch range and amplitude.

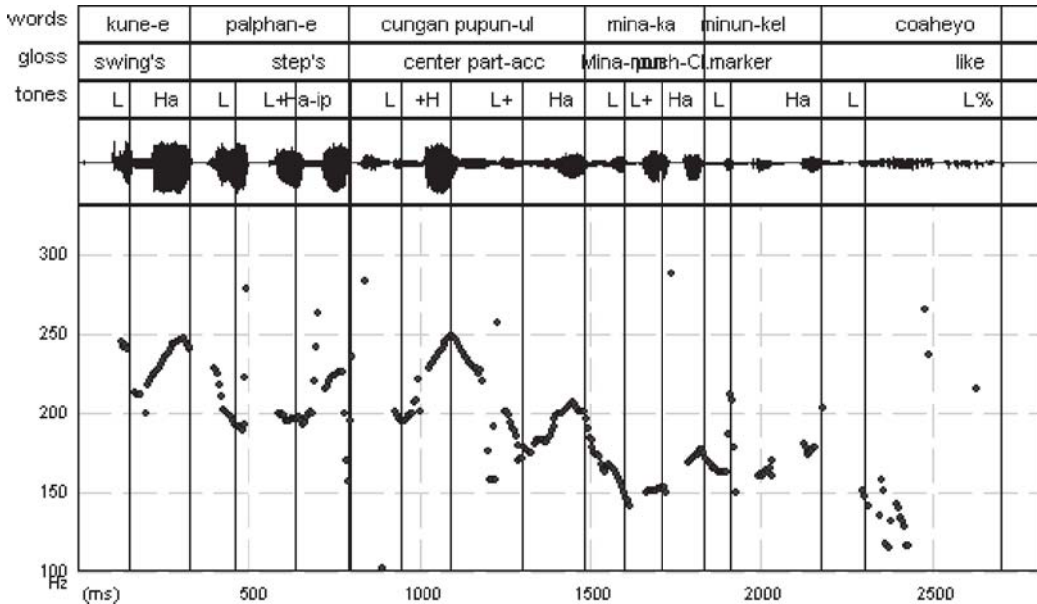| words	kune-e		palphan-e			cungan pupun-ul			mina-ka			minun-kel		coaheyo		
gloss	swing's		step's			center part-acc			Mina-noun-Cl			marker		like		
tones	L	Ha	L	L+H	a-ip	L	+H	L+	Ha	L	L+	Ha	L	Ha	L	L%

Figure 12. An example pitch track of the sentence used in Figure 11. The phrasing is the same as that in Figure 11 up to the focused subject NP. Unlike the partially dephrased post-focus words in Figure 11, the three post-focus words here (*mina-ka minun-kel coaheyo* 'subject noun-embedded verb-main verb) each forms one AP, with reduced pitch range and amplitude, illustrating "phonetic dephrsing".

3. Discussion

3.1. Effect of focus on prosodic phrasing

The data show that prosodic phrasing is influenced by the interaction of focus, syntax, and length. In the broad focus condition, a short sentence with a multi-word NP shows no big prosodic breaks sentence-medially. But sentences with more than five words show a big prosodic break at the end of multi-word NP and at a clause boundary. When a multi-word NP is focused, the NP-final word becomes the most prominent by starting a big phrase (i.e., an Intermediate Phrase) and dephrasing the following words. The exact type of dephrasing varies depending on the length and syntactic complexity of the post-focal string. If the post-focal string is short (i.e., one word), it is *completely* dephrased, but when the post-focus string has two or more words and includes a clause boundary or a phrasal boundary such as NP, the post-focus string is *partially* dephrased due to the prosodic juncture found at the end of the multi-word NP or at the syntactic boundary. That is, when the post-focal string is long, the right edge of a multi-word NP or clause is marked by a big prosodic break even after focus. This shows that the effect of focus on phrasing is dependent on both length and syntax.

3.2. Two types of ip

The current data have shown that there are two ways to realize an Intermediate Phrase (ip) in Seoul Korean. One is a prominence-marking ip cued by a raised initial high tone (+H) and the other is a syntactic boundary-marking ip cued by a high boundary tone (H-). The prominence-marking ip break

is found at the beginning of a word when the word is focused. In this case, the initial H tone (+H) of the word is higher than the f0 peak of the preceding Accentual Phrase (AP). Though an ip boundary is inserted at the left edge of a focused word, this does not affect the preceding phrase in that the final syllable of the preceding word is not lengthened and the boundary tone of the preceding phrase is not necessarily higher than the typical AP-final boundary (Ha). Thus, on the tones tier shown in the figures above (e.g., Figs. 6–12), the boundary of this type is labeled as "Ha-ip". On the other hand, the syntactic boundary-marking ip break is found at the end of a heavy syntactic constituent, and the last syllable of the constituent is slightly longer than an ip-medial AP-final syllable and is often marked by a boundary tone higher than the typical Ha. On the tones tier, this is labeled as H-, an ip boundary tone.

These two types of ip differ in the location in which they are marked: the prominence-induced ip marks the domain-initial boundary while the syntax-induced ip marks the domain-final boundary. They also differ in their sensitivity to semantic grouping. The syntax-induced ip marks the end of a syntactic constituent, thus the ip boundary matches the semantic group boundary. However, the prosodic boundary marked by a prominence-marking ip does not necessarily match a semantic group boundary. For example, in Figure 6 above, the topic NP and the first noun of the heavy object NP, *mina-nun yeona-e* 'Mina-top Yeona's", form one ip together because the word immediately after *yeona-e*, receives the strongest prominence as the last word of the object NP, *kajeonggyosa-lul* 'a tutor-acc.', and begins an ip. This shows that, unlike AP formation in Korean (Jun 1993) or Intonation Phrase formation in English (i.e., Sense Unit in Selkirk 1984) or Schafer's (1997) claim that the ip is the domain of interpretation, an ip in Korean can include words that do not form a semantic group. In Jun (1993), it was claimed that AP formation can be affected by a syntactic constraint: AP-final words cannot be the left element of a branching constituent, as shown in (7) below. However, an ip can include the two words as long as each word forms one AP.

(7) Syntactic constraint on AP formation

*AP(W1   W2)
ip(AP(W1   AP(W2))
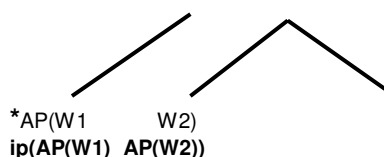
Thus, one might wonder if the prominence-induced ip boundary is in fact a prosodic boundary. A raised +H might just be a way to mark prominence, same as the 'boosting' effect of focus as claimed in Kubozono (1993) and Kubozono, Kitagawa, and Yoshida (2007). However, it is too early to come to this conclusion for Korean as this type of ip is also found when no focus is involved. As seen in Figure 4 where the prosodic phrasing of a four-word NP is shown in a broad focus context, the four words are grouped in two ips due to a rhythmic constraint. Here, the third word shows a raised +H and the end of the second word (ip-final) is not marked by a higher boundary tone or phrase-final lengthening. It is also common cross-linguistically that a prosodic unit can be defined by pitch range reset at the beginning of a unit. The Intermediate Phrase proposed in the intonation model of Tokyo Japanese (Beckman & Pierrehumbert 1986, Pierrehumbert and Beckman 1988) is defined by pitch range reset at its beginning (i.e., the domain of downstep) and is not marked by a final boundary tone. The effect of focus on prosodic phrasing is found in various languages (e.g., Chichewa (Kanerva 1990), Bengali (Hayes and Lahiri 1991, Khan 2008), Persian (Sadat-Tehrani 2008), Georgian (Vicenik & Jun to appear)) and it would be interesting to see if the prosodic boundary initiated by focus is the same as other types of prosodic boundaries in the language.

3.3. Prosodic phrasing before and after focus: an extraprosodic phrase

Phrasing data in the focus section showed that post-focus items can be partially or fully dephrased phonologically. When fully dephrased, there is no prosodic boundary between the focused word and the post-focal items. However, when post-focal items are partially dephrased, there does exist a prosodic boundary after focus. Then, the question is: what type of prosodic unit do the post-focal items

belong to? According to the Exhaustivity constraint in the Strict Layer Hypothesis (i.e., No C_i immediately dominates a constituent C_j, $j < i-1$, where C_n = some prosodic category; Selkirk 1984, 1996), all items in a sentence should be parsed exhaustively into a prosodic unit of the same rank in the prosodic hierarchy. Thus, if there is a C_i type prosodic break, the prosodic unit "before" as well as "after" the break should be a C_i type prosodic unit. This means that a partially dephrased post-focal string should form a prosodic unit of the same type as that found before the post-focal string, which can be either an ip (e.g., Fig. 10) or an AP (e.g., Fig. 11). However, as shown in the results section, the post-focal string is realized in substantially reduced pitch range and amplitude, and the segments in the string are also reduced in articulatory strength, much more so than those before the string. Although no quantitative data is available at this point, it is highly likely that the initial segment of post-focal string does not show any sign of initial strengthening appropriate for the ip or AP level (Cho & Jun 2000; Cho & Keating 2001; Keating, Cho, Fougeron, & Hsu 2003). This suggests that the post-focal string does not form a legitimate ip or AP. Instead, it seems that this string forms a 'deformed' AP and behaves as extraprosodic material, not visible in building the prosodic structure of an utterance.

The same phenomenon can be found right before a focused word when the pre-focal string is a single word and is in utterance-initial or Intonation Phrase (IP)-initial position. Since a focused word initiates an ip, the pre-focus material is expected to be an ip. However, as can be seen in Figure 13, the pre-focus material (i.e., *mina-lul* 'Mina-acc.') is in utterance-initial position (circled in pitch track) and is substantially reduced in every phonetic dimension; thus, it is not appropriate to analyze this string as a regular ip. An example of an expraprosodic pre-focal word in utterance-medial position can be seen in Figure 14, where the third word, *yedongseng-e* 'a sister's' (circled in pitch track), is found at the beginning of the second IP and immediately preceding a focused word, *namjachingu-lul* 'a boyfriend-acc.', and is realized weakly.

A fully legitimate ip would have an AP with clear articulation of segments realized in normal pitch range and amplitude, and a fully legitimate AP would have a clearly articulated word in normal amplitude. The extraprosodic phrase, on the other hand, includes a word with reduced articulation, pitch range, and amplitude. This prosodically- and segmentally-weak material, which is labeled "ap", a 'deformed' AP, acts like a prosodic proclitic or enclitic. When it comes before focus, it is directly dominated by an Intonation Phrase (IP), as a sister of a prominence-marking ip, 'focused ip' (= ipF), but when it comes after focus, it can be dominated either by an ip or an IP. The representation of an extraprosodic phrase before and after a focused word in the prosodic structure of Korean is shown in (8) below. 'ap' is written in parentheses because the extraprosodic material is optional. Only one ap can come before an ip but more than one ap can occur post-focally, as a sister of ip or AP, thus a superscript '0' is written on (ap). Multiple ap's can be seen in the phonetically dephrased post-focal words in Figure 12.

The structure (8) is justified in Korean because a focused ip is projected from a focused word which forms a legitimate AP. An ip then, by the headedness constraint (i.e., any C_j must dominate a C_j-1 (except if $C_j = \sigma$), Selkirk 1996), dominates an AP. The ap, not dominated by an ip, is directly dominated by IP. The prosodic affiliation of extraprosodic phrase after a focused word is less strict because the end of a focused word can be marked either by an ip (e.g., Figure 10) or an AP boundary (e.g., Figures 11, 12). Alternatively, an ap can come after a syntax boundary-marking ip (e.g., Figure 8). Thus, when an ap follows a focused AP, it is dominated by an ip, but when it follows an ip boundary, it is dominated by an IP. Since an ap does not include a focused word, it is not required to be dominated by an ip. An IP directly dominating an extraprosodic ap violates the exhaustivity constraint, but this constraint has also been shown to be weaker than other constraints of Prosodic Domination in English (Selkirk 1996). Given this representation, partial dephrasing is formalized in (9).
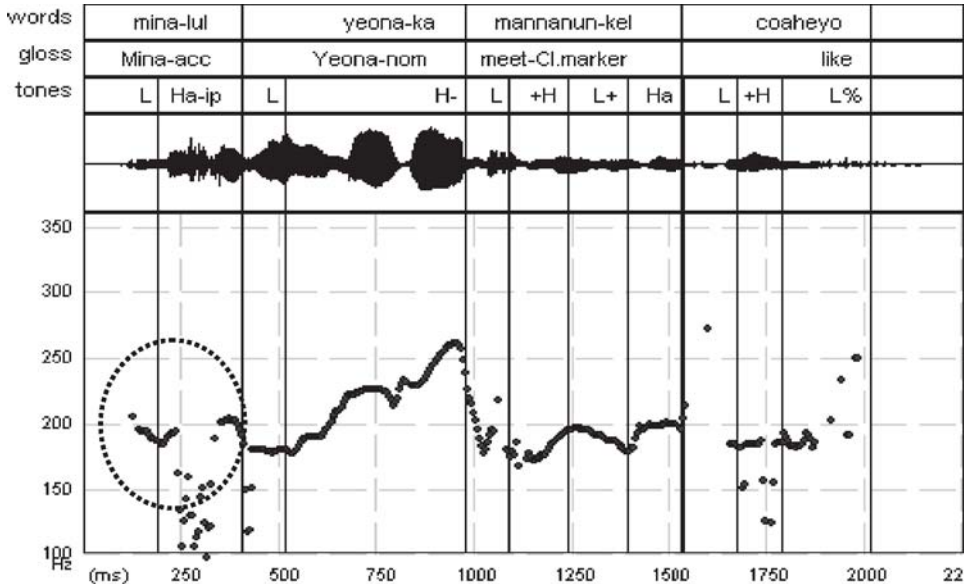
Figure 13. Example pitch track of a sentence showing extraprosodic material at the beginning of utterance. This includes only one word, *mina-lul* 'Mina-acc.', and is immediately followed by a focused word, *yeona-ka* 'Yeona-nom'.
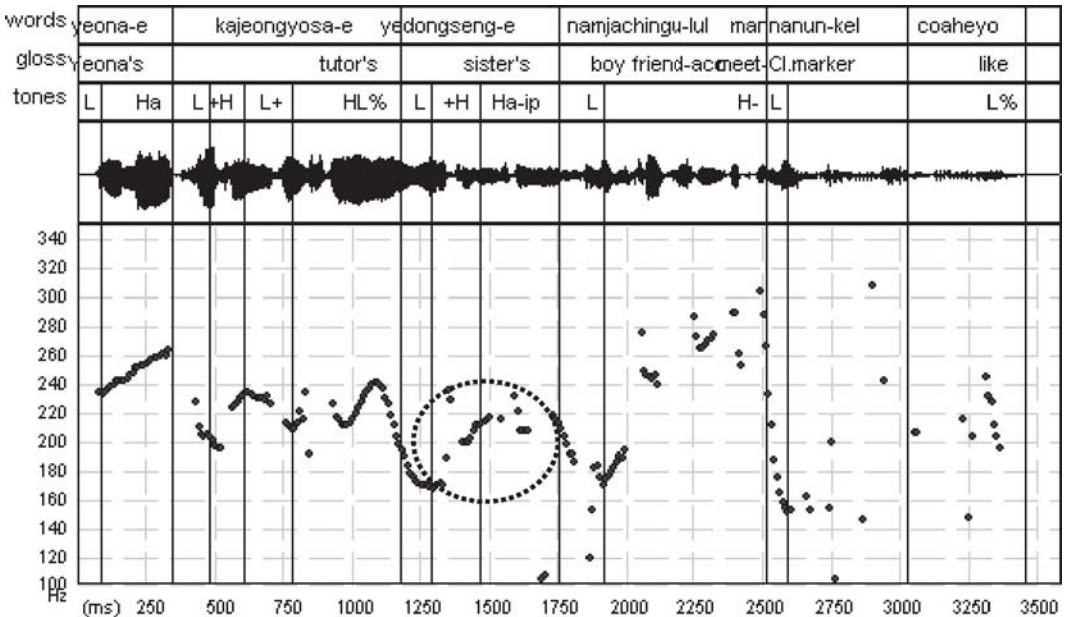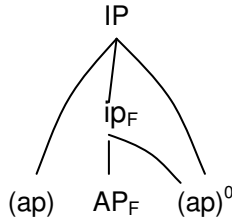

Figure 14. Example pitch track of a sentence showing a degenerated ip (circled in the figure) at the beginning of utterance-medial IP-initial position. This ip includes one word (*yedongseng-e* 'sister's') immediately followed by an ip boundary initiated by focus.

(8) Representation of extraprosodic material ('deformed' AP = ap) before and after focused word

$$IP$$

$$ip_F$$

$$(ap) \quad AP_F \quad (ap)^0$$

(9) Partial dephrasing: [(NP1 NP2 NP3) NP4]$_{NP\text{-}Focus}$ [(NP) …. V]

                  => (((… NP3)$_{AP}$)ip ((**NP4**)$_{AP}$ …)ip (... V)ap)IP

     or   => (((… NP3)$_{AP}$)ip ((**NP4**)$_{AP}$ (… V)ap)ip)IP

    The prosodic structure of the pre-focus ap in (8) is similar to that of non-phrase-final weak function words in English (Selkirk 1996) where a monosyllable (e.g., an unstressed function word) is directly dominated by PPh (Phonological Phrase), as a sister of PWd (Prosodic Word) (e.g., *the weather, can paint*). Selkirk analyzes this function word as prosodic clitic, not Prosodic Word, and shows that in English, the Exhaustivity constraint is ranked lower than the other constraints of Prosodic Domination.

    Examples of extraprosodic phrases can also be found in tag questions or in 'afterthought' phrases in English. In a typical tag question (e.g., *Willie is coming, isn't he?*), a tag phrase comes after an Intermediate Phrase but all items in a tag question are not prominent, so, in Pierrehumbert (1980), a tag phrase does not receive any pitch accent. Similarly, an 'afterthought' phrase (e.g., *John leaves tomorrow, probably.*) is often produced after an Intermediate Phrase but in a reduced pitch range and amplitude, without pitch accent.
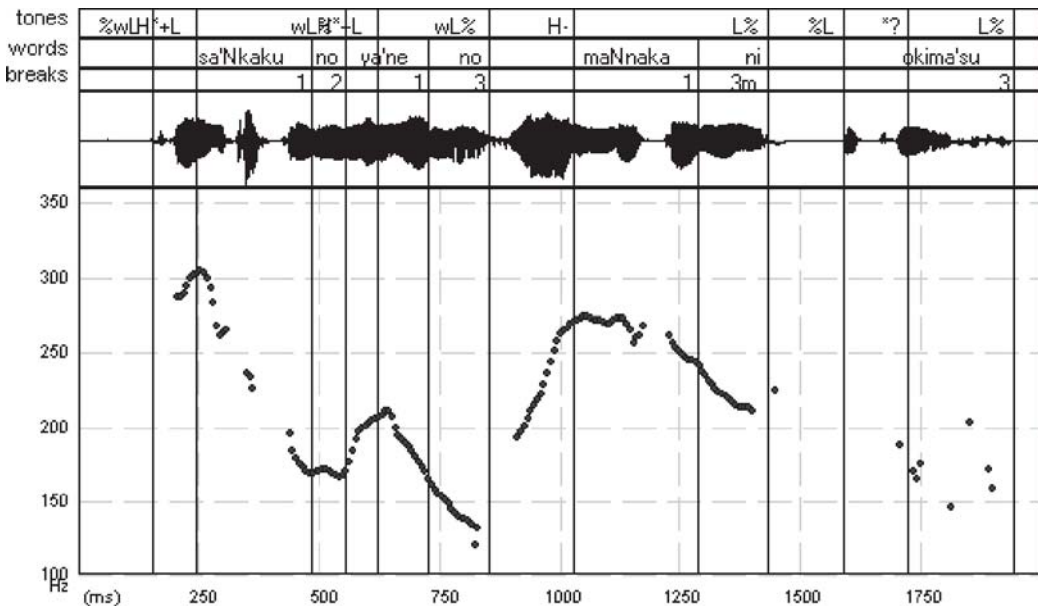

Figure 15. A pitch track of 'sankaku' example in J_ToBI (data from Venditti 1997). The sentence final accented verb, *okima'su* 'to put', is not realized with pitch accent, probably due to the focus on the preceding word, *maNnaka-ni* 'in the center-loc.'.

    A further example of extraprosodic phrase can be found in Japanese post-focus string. In one of the J_ToBI training examples ('sankaku'; Venditti 1997) shown in Figure 15, the sentence-final

accented verb, *okima'su* 'to put', does not show any trace of pitch accent. The break index 3m given at the end of *maNnaka-ni* 'triangle-gen' suggests that the juncture is bigger than an Accentual Phrase. Native speaker consultants claim that the pre-verbal word, *maNnaka-ni* 'in the center-loc', is emphasized in this utterance, suggesting that the accented verb is in post-focal position. The sentence means 'I will place it right in the center of the triangle roof' (sa'Nkaku-no 'triangle-gen', ya'ne-no 'a roof-gen'; the sound file can be retrieved in http://web.mac.com/jen.venditti/iWeb/Site/Japanese%20 ToBI.html).

4. Conclusion

This paper describes the prosodic marking of complex (i.e., multi-word) NP in Korean in both broad and narrow focus conditions. The data show that prosodic phrasing is influenced by focus, length, syntactic structure, and their interactions. Unlike the focus phrasing of a verb phrase where the VP-initial item is the most prominent, the NP-final item is realized the most prominent when a multi-word NP is focused: the Intermediate Phrase (ip) boundary is inserted before the NP-final word by raising the phrase-initial high tone (+H). Regardless of focus, however, the end of a heavy syntactic constituent is prosodically marked by an ip-final high boundary tone (H-), suggesting that there are two types of ip: prominence-marking ip vs. syntactic boundary-marking ip. These two types of ip differ in their function and sensitivity to syntactic/semantic grouping.

The data also show that post-focal and/or pre-focal material can be dephrased. Dephrased material is produced with a substantially reduced pitch range and amplitude with weak articulation, but the phrasing of the post-focal string varies in three ways: complete dephrasing occurs when there is no prosodic boundary after a focused word; partial dephrasing occurs only when there is a prosodic boundary right after a focused word or at a major syntactic boundary; phonetic dephrasing occurs when multiple AP boundaries exist after a focused word. The dephrased material is analyzed as an extraprosodic phrase (labeled as 'ap', a deformed AP) and the prosodic affiliation of ap is proposed: before focus, it is dominated by an Intonation Phrase (IP), as a sister of an ip, but after focus, it is dominated either by an ip or an IP.

More research is needed to learn how prosodic phrasing interacts with various syntactic structures and how focus affects the phrasing, and if focus-induced prosodic phrasing is the same as syntax-induced prosodic phrasing.

References

Baumann, Stefan, Johannes Becker, Martine Grice, and Dorice Mücke. (2008). "Tonal and articulatory marking of focus in German", *Proceedings of the XVIth International Congress of Phonetic Sciences*, 1029–1032.

Beckman, Mary and Janet Pierrehumbert (1986). "Intonational structure in Japanese and English,". *Phonology Yearbook* 3, 255–309.

Birch, Stacy and Charles Clifton, Jr. (1995). "Focus, accent and argument structure: Effects on language comprehension. *Language and Speech*, 38: 365–391.

Breen, Mara E. Fedorenko, Michael Wagner, & Edward Gibson. (submitted). "Acoustic correlates of information structure", *Language and Cognitive Processes*.

Cho, Taehong and Sun-Ah Jun (2000). "Domain-initial strengthening as enhancement of laryngeal features: Aerodynamic evidence from Korean", in Akira Okrent and John P. Boyle (eds.), *Chicago Linguistic Society* 36: 31-44 [also in *UCLA Working Papers in Phonetics*. 99:57–69].

Cho, Taehong and Pat Keating (2001). "Articulatory strengthening at the onset of prosodic domains in Korean". *Journal of Phonetics,* 28:155–190.

D'Imperio, Mariapaola. (2001). "Focus and tonal structure in Neapolitan Italian", *Speech Communication* 33: 339–356.

Gussenhoven, Carlos. (1983). "Focus, Mode, and the Nucleus," *Journal of Linguistics* 19: 377–417.

Hayes, Bruce and Aditi Lahiri. (1991). "Bengali intonational phonology". *Natural Language and Linguistic Theory* 9: 46–99.

Jun, Sun-Ah. (1993). *The phonetics and phonology of Korean prosody*. Ph.D. dissertation, Ohio State University.

Jun, Sun-Ah. (1998). "The Accentual Phrase in the Korean prosodic hierarchy," *Phonology* 15(2): 189–226

Jun, Sun-Ah. (2000). K-ToBI labeling conventions (version 3). *Speech Sciences* 7: 143–69.

Jun, Sun-Ah. (2005). "Prosodic Typology," in S.-A. Jun, ed., *Prosodic typology: Phonology of intonation and tone*. 410–58. New York: Oxford University Press.

Jun, Sun-Ah. (2006). "Intonational Phonology of Seoul Korean Revisited", *Japanese-Korean Linguistics 14*, Stanford: CSLI. [Also printed in *UCLA Working Papers in Phonetics*, No.104: 14–25, 2005]

Jun, Sun-Ah. (2007). "The Intermediate Phrase in Korean Intonation: Evidence from Sentence Processing", in *Tones and Tunes: Studies in Word and Sentence Prosody*, eds. by C. Gussenhoven and T. Riad. Mouton de Gruyter

Jun, Sun-Ah (in progress) "Focus: domains, types, and realizations", Ms. UCLA.

Jun, Sun-Ah. and Hee-Sun Kim (2007). VP focus and Narrow focus in Korean. In t*he Proceedings of 2007 ICPhS*, Saarbrücken, Germany

Jun, Sun-Ah., Hee-Sun Kim, Hyuck-Joon Lee, and Jong-Bok Kim (2006). "An experimental study on the effect of argument structure on VP focus', *Korean Linguistics* 13: 89–112.

Kanerva, Joni. (1990). "Focusing on Phonological Phrases in Chichewa" in Sharon Inkelas and Draga Zec (eds.) *The Phonology-Syntax Connection*, 145–161, Chicago: University of Chicago Press.

Keating, Pat, Taehong Cho, Cécile Fougeron, and Chaisune Hsu. (2003). "Domain-initial articulatory strengthening in four languages" in *Phonetic Interpretation (Papers in Laboratory Phonology 6)*, edited J. Local, R. Ogden, R. Temple, Cambridge University Press, pp. 143–161.

Khan, Sameer ud Dowla. (2008). *Intonational Phonology and Focus Prosody of Bengali*. Ph.D dissertation. UCLA.

Kubozono, Haruo. (1993). *The Organization of Japanese Prosody*, Kurosio Publishers, Tokyo.

Kubozono, Haruo, Yoshihisa Kitagawa, and Kenji Yoshida (2007). Prosodic Domain of Wh-questions in Japanese. Paper presented at the Workshop on Prosody, Syntax, and Information Structure 3, Indiana Univ.

Lahiri, Aditi and Jennifer Fitzpatrick-Cole (1999). "Emphatic Clitics and Focus Intonation in Bengali", in R. Kager & W. Zonneveld (eds.) *Phrasal Phonology*, 119–144. Nijmegen: University of Nijmegen Press.

Pierrehumbert, Janet. (1980). *The Phonology and Phonetics of English Intonation*. Ph.D. diss. MIT.

Pierrehumbert, Janet and Mary Beckman (1988). *Japanese Tone Structure*. Cambridge, MA: MIT Press.

Sadat-Tehrani, Nima. (2008). The Intonational Grammar of Persian. Ph.D dissertation. University of Manitoba. Canada.

Schafer, Amy. (1997). *Prosodic parsing: The role of prosody in sentence comprehension*. Ph.D. dissertation. University of Massachusetts.

Selkirk, Elizabeth. (1984). *Phonology and syntax: The Relation between sound and structure*. Cambridge, Mass.: MIT Press.

Selkirk, Elizabeth. (1986). "On derived domains in sentence phonology" *Phonology* 3: 371–405.

Selkirk, Elizabeth. (1996). "Prosodic Structure of Function Words", in James L. Morgan and Katherine Demuth (eds.) *Signal to Syntax*, p.187-213. Mahwah, NJ: Lawrence Earlbaum Association.

Selkirk, Elizabeth. (2007). "Bengali Intonation Revisited: An OT analysis in which FOCUS Stress Prominence Derives FOCUS phrasing" in Chungmin Lee, Matthew Gordon, and Daniel Büring (eds.) *Topic and Focus: Cross-Linguistic Perspectives on Meaning and Intonation*, 215–244. Springer.

Venditti, Jennifer. (1997). "Japanese ToBI Labeling Guidelines", *Ohio State University Working Papers in Linguistics*, 50: 62–72.

Vicenik, Chad and Sun-Ah Jun (to appear). "Intonational Phonology of Georgian", in Sun-Ah Jun (ed.) *Prosodic Typology II: The Phonology of Intonation and Phrasing*. Oxford University Press.

Welby, Pauline. (2003). "Effects of pitch accent position, type, and status on focus projection", *Language and Speech* 46(1): 53–81.

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