Tone, pitch accent and intonation of Korean

- A synchronic and diachronic view-

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1. Introduction

1.1. Korean language

1.1.1. History and regional varieties

Korean is a particularly interesting language in terms of intonational phonology: It was a tone language up until about 500 years ago, and has since became an intonation language. There are other languages of the world which have lost lexical tones fairly recently in the history, notably, Swahili. However, Korean is unique in that the gradual change from the lexical tones to intonation is relatively well documented in various written works, and the process is still on-going in some dialects. The documentation of the lexical tones and their loss covers just about 150 years from the mid 15th to the late 16th century, by which time the tonal marking ceased to be used in the orthography. This documentation provides valuable information on how the use of the lexical tones changed over those years, as well as details as to nature of the changes. The evidence indicates that tonal sequences were simplified by emphasising the first H tone and reducing the tones towards the end of a phrase to low. That is, the phrases began to have rising-falling patterns.

Today, at least in South Korea, most of the regional varieties are intonational. However, a few still have lexical tones -or pitch accents- depending on the analysis (see the map in Figure 1.1 for the distribution of the tone dialects). These dialects are characterised by varying rising-falling phrase tone patterns and contours. That is, Middle Korean phrases began to develop into rising-falling patterns with a peak or plateau on the lexical part. The present day tone (or pitch accent) dialects also have such distinct rise-falls. There are indications that these dialects are losing the tonal contrasts and are developing a tendency towards preferring specific phrase tone patterns.

The pitch contours of the dialects (see chapter 2) are actually very similar to those of standard Seoul intonation. In particular, North Kyungsang contours are virtually identical in short phrases of up to three syllables. In longer phrases, they are largely similar, but distinct in two respects. First, while the peak of Seoul rise-falls is very restricted in its location to the second or third syllable, the peak in North Kyunsang may occur on any syllable but the final. Second, while Seoul phrases may have the (second and) final peak or rise, North Kyungsang does not allow a peak or rise in the final syllable even in

questions. That is, while Seoul allows rise-fall-rises and rises with a sustained peak or plateau, North Kyungsang does not.

It should be noted that the tone dialects are like the missing link between Middle Korean lexical tones and present-day Seoul intonation, completing a sketch of how the lexical tones became post-lexical and were reorganised into the tonal events of intonation. As a matter of fact, varying evidence indicates that the dialect tones and/or pitch accents are closely related to Seoul post-lexical tones. Considering the fact that the transformation from lexical to post-lexical tones was fairly recent, the tonal events of Seoul intonation may well have some characteristics of the tones and/or the dialect tones. As will be shown below, the accentual phrasing of Seoul has some unusual, but interesting, characteristics, and the dialect tones/pitch accents may provide some clues or explanations for these.

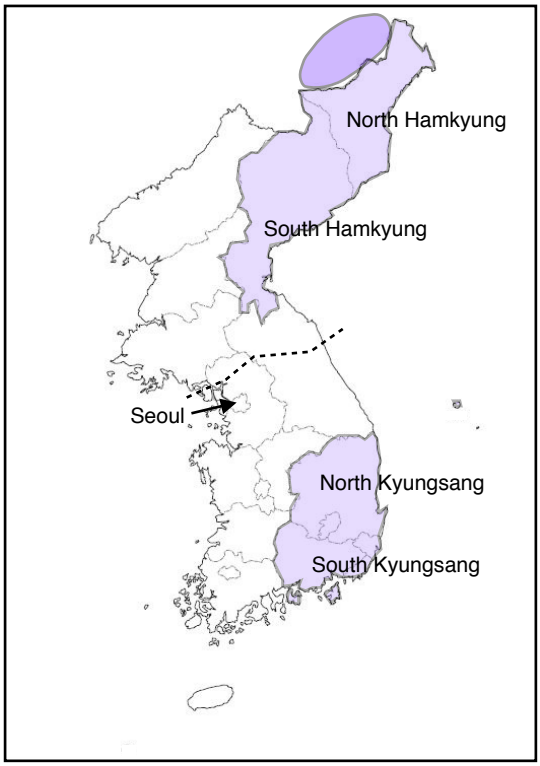

Figure 1.1. The distribution of the tone (or pitch accent) dialects. The dialects are mainly spoken in the south and north eastern corners of the Korean peninsula: South and North Kyungsang in South Korea and South and North Hamkyung in North Korea. Another tone dialect is spoken in China just across the border, where a large number of ethnic Koreans reside (indicated with a filled oval near the top).

1.1.2. Intonation of Seoul Korean

1.1.2.1. Accentual phrasing, stress and accent

One of the interesting facts about Korean[1] intonation is that accentual phrasing, i.e., the division of utterances into a prosodic unit called Accentual Phrase (AP), functions like stress and accent in languages like English. Consider the following examples.

(1.1)

a. [tsal]$_{AP}$ [mot^{h}ada]$_{AP}$ ‘cannot do well’, ‘(be) not good at’
well not good at

b. [tsal.mo.t^{h}a.da]$_{AP}$ ‘to err’

* This example is adapted from H.-Y. Lee (1990:15)

(1.2)

ˈblack ˈbird vs. ˈblackbird

The examples (1.1-a) and (1.1-b) are made up of identical segmental strings. However, the meaning differs depending on the accentual phrasing, i.e., whether the strings contains an AP boundary or not. /tsal.mo.t^{h}a.da/, when produced with two APs as in (1.1-a), is analysed as a sequence of an adverb /tsal/ ‘well’, negation /mot/ ‘cannot’ and a verb /ha.-da / ‘do’-$_{\text{infinitive ending}}$ meaning ‘cannot do well’ or ‘to be not good at’. When / tsal.mo.t^{h}a.da/ is produced as one AP as in (1.1-b), it is a lexical unit meaning ‘to err’ (derived from (1.1-a), obviously). The contrast created by the accentual phrasing (or the AP boundary placement) is very similar to the English example in (1.2) where the distinction is made with word stress.

(1.3)

a. [na]$_{AP}$ [s^{h}a.dzaŋ.-i-n.de]$_{AP}$ ‘It’s me, the president (of the company) and...’
I president-am-$_{\text{conj. ending}}$

b. [na.-s^{h}a.dzaŋ.i-n.de]$_{AP}$ ‘(This is) president Na and...’
Na (a family name)-president-am-$_{\text{conj. ending}}$

[1] Henceforth, ‘Korean’ refers to Seoul Korean, unless otherwise stated.

(1.4)

a. MAY gave JANE and RANdy AULL, your LAWyers, good iDEAS.

b. MAY gave JANE and RANdy all your LAWyer's good iDEAS.

* This example is from Price et al (1991:2968)

(1.3) is a real-life incident put up in the internet as a funny mistake by a secretary. She answered a phone call one day and the person on the other end said (1.3-a), which is the first part of 'It's me, the president (of the company). Let me talk to your boss (who is one of the company's executives)'. The secretary thought that she heard (1.3-b), 'This is president Na. Let me talk to your boss.', which prompted her to ask 'President Na of which company, Sir?'. Note that the utterances are distinguished in terms of different accentual phrasing; (1.3-a) is phrased (and produced with two APs), while (1.3-b) is not. Note also that this is comparable to the disambiguation of (1.4) by accenting; 'Aull' is accented in (1.4-a), while 'all' is not in (1.4-b).

In Korean, contextually and situationally given information is usually omitted. The extent of the omission varies slightly, there being fewer omissions in polite and formal language. On the whole, the use of pro-forms is fairly limited resulting in utterances that frequently lack subjects and/or objects. Note, for instance, that A's remark in (1.5) does not contain information as to the recipient (see the gloss), which is included in the translation. As a rule of thumb, items that are not accented in languages like English are not included in the utterances. When given information is included, it is commonly the repetition of a verb, which reflects much of the relative social status between the interlocutors through the choice of synonyms[2] and the use of different honorific endings. Given information is included, often, as a part of an existing AP rather than a separate AP, in particular, when it is short. Note that in (1.6)[3], firstly, 'your' in A's 'your elder sister' is dropped and becomes 'elder sister' in B's remark, as it is clear from the context whose elder sister they are talking about. Secondly, the AP 'name' in A's question is dephrased and forms an AP together with 'elder sister' in B's, as it is already mentioned and, therefore, given information. (In fact, B's question may be reduced further to [su.ni.-dʑi]$_{AP}$ by omitting both 'elder sister' and 'name'.)

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[2] /tɯl.-da/ and /mʌg.-t'a/ 'to eat (and/or drink)' is an example of honorific and non-honorific synonyms.

[3] Examples (1.6) and (1.8) are adapted from S.-A. Jun (1996:7-8) and S.-A. Jun (2006:19), respectively.

(1.5)

A: [mi.ɾa.n-i.ga]$_{AP}$ [sʌn.mul. dzwʌt.-ts'i]$_{AP}$
Miran-$_{subject\ particle}$ present gave-$_{ending}$[4]

'Miran gave (you) a present. (I know she did.)'

B: [mi.ɾa.n-i.ga]$_{AP}$ [sʌn.mul]$_{AP}$ [pa.dat.-ts'i]$_{AP}$
Miran-$_{subject\ particle}$ present received-$_{ending}$

'(No,) Miran received a present.'

(1.6)

A: [ni.-ne. ʌn.ni]$_{AP}$ [i.ɾɯ.m-i]$_{AP}$ [mwʌ.-ni]$_{AP}$
your elder sister name-$_{subject\ particle}$ what-$_{question\ ending}$

'What is your elder sister's name?'

B: [ʌn.ni i.ɾɯ.m-i]$_{AP}$ [su.ni.-dʑi]$_{AP}$
elder sister name-$_{subject\ particle}$ Suni-$_{ending}$

'(Your) elder sister's name is Suni, right?'

C: [a.ni-jo]$_{AP}$ [sʌn.hi.-jo]$_{AP}$
no-$_{honorific\ particle}$ Sunhee-$_{honorific\ particle}$

'No, it's Sunhee.'

(1.7)

A: (Mary was here, but doesn't seem to be around any more.) 'Where is Mary?'

B: [tsi.b -e. ga.s' ʌ]$_{AP}$
house-$_{locative\ particle}$ went
'(She) has gone home.'

[4] /-tsi/ is voiced in intervocalic position, but becomes a fortis when preceded by a lenis as in (1.5). It is used to seek confirmation for what the speaker already knows (Yonsei dictionary of Korean http://kordic.britannica.co.kr).

(1.8)

a. broad focus

[ʌ.mʌ.ni]$_{AP}$ [mi.na.ɾi]$_{AP}$ [mʌg.nɯn.de.-jo]$_{AP}$
mother dropwort eat-$_{honorifc\ particle}$

'Mother eats dropwort'

b. narrow focus on 'dropworts'

[ʌ.mʌ.ni]$_{AP}$ [mi.na.ɾi. mʌg.nɯn.de.-jo]$_{AP}$
mother dropwort eat-$_{honorifc\ particle}$

A similar accentual phrasing pattern is also observed, when the information is predictable or highly probable. Short and frequently used verbs, such as, /ka-da/ 'to go' and /o-da/ 'to come', are more likely to be produced as an AP together with the preceding adverbial phrase. Take (1.7) for instance and assume that A, who asked the question, missed or misheard the verb 'went' in B's answer. Even then, the situation and context indicates that the verb is very likely to be 'went'. That is, the situation that Mary was present and then absent, and 'house' and, particularly, the locative particle (the context) suggests strongly that the following verb should be 'went'. In such a case, the verb is likely to form an AP with 'house'-$_{locative\ particle}$ in Korean.

In (1.5), the predictability of the verb 'gave' (in the context of talking about presents) causes it to form an AP together with the object 'present'. However, in the following utterance by B, the verb 'received' forms a separate AP from 'present' despite that it is also predictable, because it contradicts A's assumption that the present was given to B, contrasting with 'gave'. The phrasing indicates that 'received' is the information which requires listener's attention. That is, accentual phrasing reflects the informativeness (or newness) of information and it places (narrow contrastive) focus on 'received'. This function is similar to the function of accenting in English.

As a matter of fact, narrow focus is sometimes achieved by using phrasing and dephrasing, very much analogously to accenting and deaccenting (S. Chung and Kenstowicz 1997, S-A. Jun and H.-J. Lee 1998). Take (1.5) and (1.8) for instance. In (1.5), on the one hand, 'received', which is not usually expected to be phrased is narrowly focused by being phrased and forming an AP on its own. In (1.8), on the other hand,

‘dropwort’ is focused by dephrasing ‘eat’, which is an AP in broad focus, so that ‘dropwort’ starts the final AP of the utterance. It should be noted that, here, dephrasing has practically the identical effect as deaccenting in languages like English. Accentual phrasing and dephrasing is comparable to accenting and deaccenting in that the items that would be accented are phrased into APs and the items that would be deaccented are dephrased.

It should be noted that dephrasing inevitably results in longer phrases. However, it is reported that the Korean AP contains five or fewer syllables at a normal speech rate and up to seven at a fast rate (S.-A. Jun 2003). APs as short as one syllable are not common, partially due to the particles. APs normally range between two to four syllables and tend to occur at regular intervals, similarly to stress.

This raises the question as to what characterises the AP(s) in the post-focal position or the APs with less informative or given information. For instance, unlike the short ‘gave’ in (1.5), verbs with longer stems and/or strings of endings do not usually make up an AP with the preceding phrase, as the phrase can easily become longer than five syllables. This suggests that it should be a separate AP, however, it should not be as prominent as the APs with new information[5]. S-A. Jun and H.-J. Lee (1998) report that this is achieved by means of expansion and reduction of the F0 span. The focused AP is produced with expanded F0 range and the following AP(s) with drastically narrowed F0. Informativeness is conveyed by greater tonal movement(s) in the AP contours and predictability with smaller or fewer movement(s).

1.1.2.2. Variation in the Accentual Phrase (AP) contours

APs display varying shapes of contours. Intonation models (see chapter 3) assume different numbers of contours; H.-Y. Lee (1990, 1996) assumes four and S.-A. Jun (2000), at least, 14 different contours. They also make very distinct assumptions about the variation of the AP contours. H.-Y. Lee assumes that different AP contours have different attitudinal meanings and the AP contours alternate according to the speaker’s choice of meaning. However, the meanings do not relate directly to linguistic categories. He argues that a rise-fall is ‘emphatic’ and ‘weighty’; a rise ‘lively’ and ‘light’; a fall ‘uninvolved’ and

[5] It is interesting to note that this is analogous to the verbs in English. The verbs may well be stressed and have some degree of prominence, but they do not usually bear nuclear accent, unless narrowly focused (Ladd 2008).

‘relaxed’; a level is ‘less lively and lighter than a rise, but ‘more involved and less relaxed than a fall’ (H.-Y. Lee 1990:131). It is also regarded as ‘perfunctory’ (H.-Y. Lee 1996:225).

On the contrary, S.-A. Jun assumes that different contours *do not have different meanings*, even though it is assumed that the varying contours result from deletion (‘undershoot’ in her terms) of AP tones, TH-LH (T=L or H). It is assumed that either or both the tones in the middle, i.e., T**H-L**H (the middle tones in bold face), are deleted, when an AP is shorter than four syllables. That is, the variation of AP contours is determined by the number of syllables in an AP. To some extent, the deletion is clearly affected by the AP length. For instance, a simple rise (i.e., T(H-L)H, when T=L and the middle tones (in brackets) ‘undershoot’) does not occur in APs that are longer than three syllables. However, other contours are not as strongly restricted by the length and seem to occur freely.

1.1.2.3. Intonation models and problems with the models

The difference discussed in the previous section can be ascribed to the distinct points of view and purposes of the intonation models as well as the different theoretical backgrounds of the authors. H.-Y. Lee’s work (1990, 1996) reflects the mechanism of intonation production and focuses on how to assign neutral intonation to a sentence. This involves predicting accentual phrasing and the variation of the AP contours. That is, it has to be clear how accentual phrasing is determined (i.e., where and why an AP boundary is placed), why the AP contours alternate and what the consequences of the contour variation are. H.-Y. Lee approaches and settles the issues by faithfully following the British school analysis. He assumes different levels of prominence, ‘stress’ and ‘accent’ (i.e., metrical strength and pitch prominence) and a hierarchical tree structure (see 3.1 for details). An AP is initiated when ‘accent’ falls on a ‘stressed’ syllable. That is, the AP initial syllable (sometimes, the second syllable) is regarded as ‘stressed’ and ‘accented’, allowing accentual phrasing to have the functions of stress and (pitch) accent just like English. H.-Y. Lee also assumes that intonation is made up of meaningful levels and contours which cannot be decomposed. In his approach, different AP contours convey different meanings and variation is determined by the speaker’s choice of meaning.

However, the meanings put forward by H.-Y. Lee seem more gradual than categorical (see 1.1.2.2 and 3.1.2). In addition, the contour analysis presents problems in specifying the alignment of the peaks and valleys in the contours and explaining the alignment characteristics. In rising-falling contours, the peak alignment is confined to the second and third AP syllables, but still varies within this limited range. The contour analysis cannot account for the restriction or the variation of alignment.

Contrary to H.-Y. Lee, S.-A. Jun's intonation model (1996, 1998, 2000, 2005) is more concerned with the decomposition of an utterance into smaller prosodic units and defining these units, APs and IPs, in terms of tones (see 3.2), and identifying the tones and their variants in the utterances. It is important to note that it is largely due to this analytic point of view that S.-A. Jun's model is not concerned with providing explanations for the AP boundary related phenomena in 1.1. 2.1, despite the fact that she emphasises the importance of accentual phrasing (most notably, S.-A. Jun 1998). The definitions of prosodic units are effective and useful in detecting the prosodic boundaries and, additionally, specifying the association and alignment relations of tones and segments. However, they explain neither why the AP boundary placement functions like stress and pitch accent placement (see 1.1.2.1) nor as to what determines the AP contour variation (see 3.2.1). Recent work has called into question the definition of AP in terms of tone TH-LH (Ko 2013) and question arises whether individual tones have an independent function.

1.2. Aims of this dissertation

The brief descriptions given above of the diachrony and synchrony of the lexical tones in Korean and the characteristics of Seoul intonation and intonation models suggest that Seoul intonation evolved from strings of lexical tones and might have some residual traces of the tones. As a matter of fact, Seoul intonation is unusual, in that accentual phrasing (i.e., AP boundary placement) has functions comparable to stress and accent of a language like English, and this might be related to the function and/or structure of the lexical tones in earlier varieties of the language (Middle Korean). The influence of the old lexical tones has not yet been taken into consideration in the investigation of Seoul intonation. However, the fact that the lexical tones were lost relatively recently and the

dialectal tones are closely related to both Middle Korean tones and the post-lexical tones of Seoul (see chapter 2) suggests that they might have exerted some influence on Seoul intonation. Also, it should be noted that the problems of the Seoul intonation models (see above 1.1.2.3) are essentially reduced to the interpretation and analysis of AP contours; whether the 'accentual' functions of accentual phrasing is created by the AP tones; whether the varying AP contours convey different meanings and how they are represented in terms of tones. Considering that the AP tones were historically sequences of lexical tones, investigating the process of tonal loss should provide valuable information and clues to the tonal structure and representation of APs. One of the goals of this work is to reconstruct the process and estimate the present state of AP tones, based on the trends in tonal change. That is, we define the general characteristics of APs as directed by the trend. These issues are addressed in Part I.

Another goal is to identify the tone or tonal sequences which minimally constitute an AP. We assumed that the realisations of these AP tones should not be affected by the lack of tonal space, e.g., in utterance final APs where tones of different prosodic units are accumulated (see 3.2), and they should be constantly present in F0 contours as F0 peaks and valleys, or F0 turning points, albeit with reduced scale and magnitude. We located F0 turning points in utterance final APs and identified them as tonal targets. In addition, we attempted to find out the function(s) and structure(s) of the AP tone(s) by examining the scaling and alignment characteristics of their tonal targets, and the factors affecting them. Based on the outcome of the investigation, an attempt will be made to redefine the prosodic units of Seoul Korean and also to analyse the intonation and intonational phenomena in terms of these new definitions. These are addressed in Part II and III.

In doing so, we will strive to embrace the different approaches and theories of H.-Y. Lee and S.-A. Jun. It should be noted that the models have distinct merits which complement each other; while H.-Y. Lee predicts neutral accentual phrasing and readily explains the functions of the AP boundary placement, S.-A. Jun specifies the alignment and associations of tones. Ultimately, we aim to integrate the two intonation models in Part IV.

Part I

Lexical tones and intonation of Korean

2. Lexical tones in Korean

나랏말ᄊᆞ미中듕國귁에달아
文字ᄍᆞᆼ와로서르ᄉᆞᄆᆞᆺ디아니ᄒᆞᆯᄊᆡ
이런젼ᄎᆞ로어린百ᄇᆡᆨ姓셩이
니르고져ᄒᆞᆷ배이셔도
무ᄎᆞᆷ내제ᄠᅳ들시러펴디
:몯ᄒᆞᄂᆞ미하니라
·내이를爲윙ᄒᆞ야:어엿비너겨
·새로스믈여듧字ᄍᆞᆼ를밍ᄀᆞ노니
·사ᄅᆞᆷ마다:히여:수ᄇᆡᆼ니겨날로ᄡᅮ메
便뼌安안·킈ᄒᆞ·고져ᄒᆞᆷᄊᆞᄅᆞ·미니라

"Because the language of this country is different from that of China, it does not match the Chinese letters [we borrow to write]. Therefore, even if unlearned laymen want to communicate, they in the end cannot state their concerns. With compassion, I have created 28 letters in the hope of letting everyone and anyone learn this alphabet easily and use it conveniently for everyday life." King Sejong in the preface of 'Hunminjeongeum'.

Figure 2.1. The portrait of King Sejong who created the Korean alphabet (left) and the preface of 'Hunminjeongeum' professing the motivation for the creation of the alphabet [6].

Present day standard Seoul Korean is an intonation language, however, in the 15th century it was a tone language. This is well documented in, particularly, 'Hunminjeongeum' and '(translation) Nogeoldae'. 'Hunminjeongeum' was published in 1446 with the official announcement of the creation of the Korean alphabet by King Sejong (pictured above) providing all the information relevant for the creation of the alphabet: the king's motivation for the alphabet creation (given above with the translation), the principles and system of the alphabet, the explanation of the shapes of the individual alphabet symbols (i.e., the reasons for assigning a specific symbol to represent a certain sound, e.g., 'ㄱ' for /k/) etc. The book also teaches reading and writing by listing the alphabet symbols with a brief articulatory description of the sound they represent and practical examples (along the lines of /k^h/ is the first sound of 'cat') and showing how the symbols can be combined to form a syllable. It is stated that different numbers of dots are added on the left of each syllable to indicate different tones. One dot indicates a high tone (H), two dots a rise (R) and the absence of dots a low tone (L). An identical description of the tones is found in

[6] The translation is from http://en.wikipedia.org/wiki/Hunminjeongeum and modified by the author.

‘Hunmongtsahoi (1527)’. In ‘Nogeoldae’, a Chinese language textbook for Korean learners translated in 1512 by Sejin Choi (a professional interpreter and linguist), Chinese tones are described by comparing them to Korean tones.

There is evidence that the tonal system was already disintegrating toward the end of the 16th century. The tone markings became noticeably inconsistent in ‘Sohakeonhae (1587)’. When ‘Nogeoldae’ was published again in 1670 with a new translation, it lacked the orthographic representation of the lexical tones entirely. Nonetheless, the lexical tones are not completely absent in varieties of Korean. Some regional varieties spoken in the eastern half of the Korean peninsula, notably, South and North Kyungsang and South and North Hamkyung, still have lexical tones. These dialect tones are closely related to the Middle Korean tones. They have a correspondence to the Middle Korean tones (see 2.2.1.) and display essentially identical tonal variation in the inflection/conjugation as Middle Korean (Heo 1963, C. Kim 1973, Y. Kim 1986 and Cha 1999 for the comparison).

The dialect tones are also closely related to the post-lexical tones in standard Seoul Korean. The South and North Kyungsang tones which correspond to the Middle Korean R(ise) tone have inherently longer duration, creating a contrast in vowel lengths as well as tones (see 2.2 below). These tones are strictly restricted in distribution limiting the length contrast to the phrase initial position. In the intonational Seoul, the old R tone syllables typically have a long vowel creating the contrast between long and short vowels, e.g., /nu:n/ ‘snow’ (R) and /nun/ ‘eye’ (H) (the Middle Korean tones in brackets). The length contrast is also restricted to the phrase initial syllable, which is assumed to be primarily associated with a L tone (see 3.2.). That is, the vowel length is a feature associated with the Middle Korean lexical tones and it is found only in the phrase initial syllable in the tonal and non-tonal dialects alike.

In the following section, we will provide an overview of the lexical tones and the phrase tone patterns in Middle Korean and the two regional varieties of present day Korean, South and North Kyungsang, by surveying various works on Korean tones. This will be followed by the description of Seoul intonation models proposed by H.-Y. Lee (1990, 1997) and S.-A. Jun (1996, 2000, 2005) in the next chapter. This will allow for a better understanding of tone and intonation, particularly, how lexical tones developed into intonation, and their influence on the tonal specification of Seoul intonation.

2.1. Middle Korean tones

Research into Middle Korean tones assumes that the tone markings reflect the spoken language faithfully. This assumption is well supported. First, the publication process described in 'Neungeomgyung (1461)', a translation of a Buddhist text, recounts that the text was read out for correction during and after the translation before it was sent for printing (W. Kim 1960, Cha 1999). Since virtually all the literature was issued by the publication bureau of the central government, it is believed that other books were produced following a similar process, whether they required a translation[7] or not. Second, until the early 16th century, the tonal labeling was consistent with little fluctuation or irregularity not only within a book, but among different works written by different authors. Third, the Middle Korean tones are congruent with the dialect tones. Heo (1954, 1963) reported that the regional variety spoken in South Kyungsang (SK) is a tone language with three contrasting tones L(ow), M(id) and H(igh). These tones correspond to the Middle Korean tones.

(2.1) Tonal correspondence between Middle Korean and South Kyungsang

Middle Korean	South Kyungsang
R	L
L	H
H	M

Heo (1963) surveyed the Middle Korean tones in the 15 different literary works (27 books) from the period between 1445 and 1527 and compared them with South Kyungsang. The comparison revealed that the Middle Korean tones, R, L, H, have a one-to-one correspondence to South Kyungsang L, H, M respectively, accounting for about 95% (215 out of 226[8]) of the monosyllabic nouns. In two syllable nouns, the correspondence is approximately 88% (248 out of 281). It also showed that Middle Korean

[7] Much of the Middle Korean literature is actually translation from Chinese, as people spoke Korean but wrote in Chinese before the creation of the Korean alphabet, and this 'habit' lasted for long among the learned. 'Seokbosangjeol (1447)', for instance, was first written in Chinese by a royal prince and his father, King Sejong, had it translated and published.

[8] The number does not include the obsolete nouns.

and SK have essentially identical tonal systems[9]. Some H toned one syllable nouns became L tone in Middle Korean when they are followed by the locative particle /-e/. For instance, the H tone of /nun/ 'eye' became L before /-e/. In South Kyungsang, /nun/ 'eye' has a M tone, which corresponds to the Middle Korean H (see (2.1) above), and alternates with H, which corresponds to the Middle Korean L, when followed by the locative /-e/. On the other hand, in Middle Korean /mɯl/ 'water', H did not alternate with L and the corresponding South Kyungsang /mul/ 'water' which has a M tone does not alternate either (see (2.2) and (2.3) below). In addition, Middle Korean verbs/adjectives[10] with one syllable roots were categorised into five different types according to the tonal alternation of the stems ('sémantème' in Heo's terms) and each type had a correspondence in SK verbs/ adjectives (see 2.2.1).

(2.2) Middle Korean tones

/nu.n-i/ eye -$_{\text{subject particle}}$ HH → /nu.n-e/ eye -$_{\text{locative particle}}$ LH
cf. /mɯ.ɾ-i/ water -$_{\text{subject particle}}$ HH → /mɯ.ɾ-e/ water -$_{\text{locative particle}}$ HH

(2.3) South Kyungsang tones

/nu.n-i/ eye -$_{\text{subject particle}}$ MM → /nu.n-e/ eye -$_{\text{locative particle}}$ HM
cf. /mu.ɾ-i/ water -$_{\text{subject particle}}$ MM → /mu.ɾ-e/ water -$_{\text{locative particle}}$ MM

Heo's study was followed by more detailed investigations and analyses of the Middle Korean tones, notably W. Kim (1973). While Heo (1963) was restricted to the classification and the comparison of the Middle Korean and SK tone patterns to examine if and how the tones are related, W. Kim focused on the investigation of the underlying tones of the individual morphemes and the rules and constraints that yield and govern the surface tonal patterns. He groups morphemes into four different categories according to their tonal characteristics; (i) morphemes with fixed tones; (ii) those with a 'decomposing R

[9] See Cha (1999:26-27) for more on the identical tonal phenomena in Middle Korean and the contemporary tone dialects, including Hamkyung.

[10] In Korean, adjectives conjugate as well as verbs and for that reason, the adjectives and verbs are often placed under one category.

tone[11]'; (iii) morphemes that copy the preceding tone; and (iv) those that alternate L~H according to the following ending type[12]. He also proposed three 'Rhythm rules' that regulate the surface phrase tone patterns by replacing H tones with L tones. The rules were applied in the order given in (2.4).

(2.4) Rhythm rules[13]

- Rhythm rule 1

  H' → L / TH_HH#

  H' = -kʌ/ʌ-, -nɒ-, -sɒp-, -sʰi-

  T= L, H or R

- Rhythm rule 2

  {R, H} → L / {R, H}_H

  application: iteratively from right to left

  H = H or R

- Rhythm rule 3

  H → L / {H, R}_#

  application: optional

The Rhythm rules are applied within a 'breath group' (W. Kim 1973) or 'Phonological Phrase' (S. Lee 1978) and the hash in (2.4) represents the end of the prosodic unit. The

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[11] There are two types of R tones, so called, 'fixed and decomposing R tones'. Unlike the 'fixed' R tone, the 'decomposing R tone' alternates (R~L) depending on the initial segment of the following syllable. When the following syllable starts with a consonant, the tone is realised as R. When the syllable begins with a vowel, the tone is realised as L. See W. Kim (1973) and Cha (1999) for further details.

It is worth noting that the morphemes in (ii) are one syllable verb/adjective stems which frequently have a sonorant coda and (iv) are without a coda, even though not all one syllable stems without a coda fall under this category. As a matter of fact, evidence suggests that the syllable structures and consonant types are closely related to the lexical tones in Middle Korean (Y. Chung 1963, Cha 1999). It should be also noted that (iii) are all functional morphemes.

[12] W. Kim (1973) assumes that the distinction is made between two types of endings, strong and weak, after certain one syllable verb/adjective stems. These stems have an underlying L tone which changes to H before a strong ending. That is, the tone of the stem is determined by the following ending type. Similar assumptions were made in Heo (1955) and C. Kim (1989). However, this assumption is still very much disputed. See Y. Chung (1963), S. Lee (1978) and Cha (1999) for different analyses.

[13] The rules are taken and modified from Cha (1990:176). Cha's rules are formulated based on W. Kim (1973) and S. Lee (1978).

application of Rhythm rule 1 is very much restricted, due to the morphological constraint on the target H tone, even though it is first to be applied, when the condition is satisfied. The Rhythm rule 2, so called 'H (and R) tone restriction', applies to any strings of three H/R tones within a 'breath group' from right to left iteratively and replaces the penultimate H (or R) with L (e.g., HHRHHH → HHRHLH → HHLHLH) at the final stage of the tonal derivation. The application of Rhythm rule 3, also known as the 'phrase final H lowering[14]', is optional. The phenomenon was first reported in Heo (1963). Middle Korean phrases usually end with H, as the grammatical morphemes typically have H tones (W. Kim 1973). Heo noted that verbal/adjectival modifiers, which also serve as the verbs in the relative clauses, sometimes have the L final tone rather than the usual H. He also noticed that in 'Dushieonhae (1481)', the phrase final L tone is observed more frequently and, more importantly, also in noun phrases, which invariably had the H final tone in the earlier literature. The 'phrase final H lowering' came to be applied more liberally and widely in the 16th century, and it is believed that the generalisation of the rule was to a large extent responsible for the loss of lexical tones.

It is interesting to note that the tonal phrases in (2.5), which are frequently observed in Middle Korean, appear to be affected by the Rhythm rule 2 and they can be predicted with the location of the first H (or R) tone and the number of syllables (S. Kim 1994). After the first H/R tone, the phrases invariably have a sequence of alternating L and H (or R) ending with a H tone. This suggests that the tones following the first H/R are predictable, whereas the location of the first H/R tone is not. This is shown in (2.6). The phrases in the left column of (2.6) have tones specified only up to the first H/R tone, which is collectively represented with X, in different locations of a phrase: the first, second or third syllable. The rest of the syllables are left unspecified (represented with ○). The right column shows the phrase tone patterns predicted with the alternating L and H/R and the final H tone. Note that they match the tonal sequences in (2.5), when X is replaced with H. This suggests that tones could be predicted with the location of the first H/R tone and the number of syllables in a phrase.

[14] The terms 'phrase final H lowering' and 'H (and R) tone restriction' (below in the next paragraph) are my translation of 'Eomalpyungseonghwa' and 'Geoseongbulyeonsam'. They are literary translated as the 'phrase final (H tone) becoming L tone' and 'no three consecutive H tones', respectively.

(2.5) Phrase tone patterns in Middle Korean

H H	L H	
H L H	L H H	
H H L H	L H L H	L L H H
H L H L H	L H H L H	L L H L H

(2.6)

X ○	→	X X
X ○ ○	→	X L X
X ○ ○ ○	→	X X L X
X ○ ○ ○ ○	→	X L X L X
L X ○	→	L X X
L X ○ ○	→	L X L X
L X ○ ○ ○	→	L X X L X
L L X ○	→	L L X X
L L X ○ ○	→	L L X L X

* ○ indicates a syllable without tonal specification. X stands for H or R.

	book1	book2	book3	book4	book5	book6	book7	book8	book9	book10	Total
HHH	69	186	98	226	92	24	135	86	145	109	1170
HHL	19	8	5	6	3	14	15	4	24	4	102
HLL	14	3	5	2	2	11	3	1	23	3	67
LHL	78	17	7	32	11	39	23	17	68	6	298
RHH	43	102	128	201	75	28	130	150	111	105	1073
RHL	29	2	2	3	3	21	7	8	24	4	103
RLL	21	1	2	2	2	10	2	0	8	2	50
LHLL	1	1	0	6	4	2	1	3	8	5	31
LLHL	9	1	1	7	1	13	3	4	8	3	50
LHHH	5	15	50	30	19	16	30	33	40	17	255
LHHL	10	4	0	2	1	9	2	1	18	0	47
sub-total											3246 (37.7%)
LHH	202	267	525	457	68	143	193	299	549	201	2904
HLH	151	23	171	51	28	101	30	35	245	24	859
RLH	162	15	102	21	8	69	39	30	129	17	592
LHLH	42	57	90	86	49	47	36	43	89	37	576
LLHH	23	27	74	53	8	33	58	45	82	30	433
sub-total											5364 (62.3%)
Total											8610

Table 2.1. Phrase tone patterns in Middle Korean (compiled and modified from S. Kim 1994). The table shows the result of S. Kim's survey of Middle Korean tone patterns. The upper half of the table lists the tone patterns which are not predicted with the location of the first H tone and the number of syllables. That is, they are not found in the list of phrase tone patterns in (2.5) above. The lower half of the table lists the patterns (in bold face) which are accounted for by the tone patterns in (2.6). Even though there are only five, they amount to 62.3% of the data.

Using the data presented in S. Kim (1994), we investigated how frequently the tonal phrases can be predicted with the location of the first H/R tone and the number of syllables, that is, how much of the data is accounted for by the phrase tone patterns in (2.5). The result (see Table 2.1) shows that the patterns constitute 62.3% (5364 of 8610) of the three and four syllable phrases[15]. This suggests that, often, tonal phrases could actually be predicted with the location of the first H tone. It also suggests that, considering the morpheme lengths and the morphological structure of Korean phrases, the H tone should be located in the lexical part of a phrase. In Korean, morphemes are usually one to two syllables long and three syllable morphemes are not very common. The phrases

[15] S. Kim's data also contained a large number of two syllable phrases (total 6126). The two phrase data was not complete lacking the patterns LH and LL and included only HH, RH, HL and RL. For that reason, the two syllable phrases are not included in Table 2.1. However, it is highly unlikely that the entirety (or partiality, for that matter) of the two phrase data would have produced a contradicting result. The number of HH phrases reaches 2951 and that of RH 2689. They are overwhelmingly larger than HL (547) and RL (398). On top of that, LH is fairly common, while LL is uncommon. For instance, the verb data in Cha (1999:244-325) contains only 36 LL sequences out of total 2837 verb phrases.

require at least one lexical morpheme at the beginning, and the morpheme(s) may be followed by grammatical morpheme(s), such as, particles or (verbal and adjectival) endings. These functional morphemes[16] generally have H tones and frequently occur in succession, resulting in the strings of consecutive H tones. This suggests that Rhythm rule 2, i.e., the H/R restriction, applied largely to the functional part (S. Lee 1978) yielding the alternating sequences of H and L. In other words, the tone of the grammatical part was predictable (Y. Chung 1969, S. Kim 1994), while that of the lexical part was unpredictable and distinctive for containing the first H/R tone of the phrase.

S. Kim (1994) tested this hypothesis and investigated the characteristics and extent of Rhythm rule 2 (i.e., the H/R restriction) application. He surveyed 10 books from five different literary works from the years between 1512 and 1518, which is approximately 60 years after the creation of the Korean alphabet. He examined three and four syllable phrases starting with H/R or LH (e.g., HHH, HLH, HHHH, LHHH, LHLH etc.), which possibly contain three consecutive H tones. The result revealed that 51.2% (2495 out of total 4878) actually contains HHH and 40.6% (1982 out of 4878) displays the alternating tone pattern indicating the application of Rhythm rule 2. Exceptional tone patterns, such as, LHHL or LHLL, account for 8.2% (401 out of 4878). S. Kim examined the tonal phrases which Rhythm rule 2 was not applied to and, thus, contain the HHH sequence. He noticed that the phrases have very distinct patterns. First, the phrases contain compounds where the individual elements retained their tones, e.g., /nuns-mɯl.-lo/ 'eye'-'water'-$_{\text{instrumental particle}}$ HHH → 'with tears'. Second, some functional morphemes derived from lexical morphemes, such as /-sɒp-/, kept the tones of the original morphemes, yielding exceptions to the alternating patterns and Rhythm rule 2. However, these morphemes are observed to lose their tonal identity and to comply with the H/R tone restriction later in the 16th century. Third, some particles, /-bɯ.tʰʌ/ 'from', /-dzo.tsʰa/ 'even', /-spun/ 'only', /-kʰwa/ 'and' etc., and suffixes, /-dah/ (plural suffix), /-nim/ (honorific suffix) etc., block the application of the rule 2, producing irregular tonal sequences.

Cha (1999) claims that these exceptions arise when an incorrect domain is assumed for Rhythm rule 2. She argues that the domain of the H/R restriction is actually a

[16] The term morpheme follows the tradition in the Korean literature. It is used in this work in a pre-theoretical sense without any commitment to a particular model of morphology, e.g., morpheme based vs. realisational morphology (Anderson 1992, Stump 2001, Halle and Marantz 1993). In this sense, the morpheme is a bound marker used to express lexical or morpho-syntactic properties, which I refer to as lexical vs. functional morphemes.

Phonological Word (Selkirk 1978, Y. Kim 1986) rather than a phrase or 'eojeol', which corresponds approximately to a Phonological Phrase (Selkirk 1978, Nespor and Vogel 1986) or an Accentual Phrase (Jun 1996). Cha explains that lexical morphemes/stems may form a Phonological Word (PW) on their own, while endings, most suffixes and particles form a PW together with the preceding lexical morpheme. Therefore, the rule does not apply to /nuns-mɯl.-lo/ 'with tears' HHH, as it contains a compound noun /nuns-mɯl/ ('eye'-'water') 'tear' and, consequently, is analysed as two PWs, /nuns=mɯl.-lo/ (PW boundary indicated with =). However, Rhythm rule 2 does apply to /kjʌ.dzi.b-i/ 'woman'-$_{\text{subject particle}}$ RLH (<RHH), as the phrase contains one PW. Cha's analysis requires reanalysis and special treatments of some dependent elements allowing them to form separate PWs from the preceding lexical stem. Suffixes like /-dah/ and /-tʰɯɾet/ (plural suffix) have to be reanalysed (probably correctly) as dependent nouns and suffixes, such as /-ne/ (suffix indicating someone's family or home), /-nim/ (honorific suffix), and particles, e.g., /-(k)wa/ 'and', require a specification in the lexicon that they constitute a separate PW or a Clitic group (Selkirk 1978). Nonetheless, Cha's analysis provides explanations not only for the varying application of Rhythm rule 2, but also for the systematic exceptions in S. Kim (1994) and W. Kim (1973).

Additionally, S. Kim (1994) investigated the application of Rhythm rule 3 (phrase final H lowering) in the two to four syllable phrases with HH and HL final tones, e.g., LHH (and LHL) and LLHH (and LLHL). The result shows that 12.7% (1320 out of total 10397) of the target phrases has the L final tone indicating the application of the rule 3. Differently from W. Kim (1973), S. Lee (1978) and S. Kim (1994), Cha (1999) assumes, and argues, that Rhythm rule 3 applies to the HH at the end of a Phonological Word rather than a Phonological Phrase (or an Accentual Phrase). In her investigation[17] of Rhythm rule 3 application, she focused on the two types of phrases, /(verbal stem)-ɾjʌ. (ha.-ʃja)/ V-$_{\text{adverbial ending}}$ ('do') and the verbal modifiers, where the rule is more regularly applied. She noted that the phrases are always PW final, but not necessarily phrase final, and have to be followed by another H tone for the application of Rhythm rule 3. She hypothesises that Rhythm rule 3 was brought about by the misinterpretation and generalisation of an older rule (shown in (2.7)) which had more restricted environment, and reformulates Rhythm rule 3 in (2.4) to (2.8).

[17] Her data is from 1440 to 1460 (cf. S. Kim's is from 1512 to 1518).

(2.7) {H, R} → L / $_{PW}$[... {H, R}_]$_{PW}$ $_{PW}$[{H, R} …]$_{PW}$

(2.8) {H, R} → L / $_{PW}$[... {H, R}_]$_{PW}$

* (2.7) and (2.8) are taken and modified from Cha (1999:210 and 1999:224).

Cha's theory has a great influence on the analysis of the tonal phrases which were considered simply as exceptions to Rhythm rule 2 (S. Kim 1994), and it also provides a better explanation for how the lexical tones were lost. Unlike Rhythm rule 3 in (2.4), which is based on W. Kim (1973) and S. Lee (1978), Cha's rule allows the H tone lowering to occur phrase medially as well as phrase finally. This provides explanations for some phrase internal H/R~L alternations which created L tone sequences. For instance, /saɾɒm/ 'person' RH becomes RL in /saɾɒm-dɒɾjʌ/ 'person'-$_{\text{dative particle}}$ RLLH. In Cha, /-dɒɾjʌ/ is a particle which forms a PW on its own (for being derived from a verbal stem) and /saɾɒm-dɒɾjʌ/ contains two PWs, /saɾɒm/ and /-dɒɾjʌ/, respectively. Since the H (of /saɾɒm/) is PW final, (2.8) is applied resulting in RLLH. The number of the tonal phrases containing consecutive L tones, such as HLLH or LHLL, increased notably in the early 16th century and it has been simply attributed to the alteration of the Rhythm rules without any detailed explanations (S. Kim 1994:125). Cha's rule allows for more systematic explanations for the liberal application of Rhythm rule 3 and the emergence of the L tone sequences.

It is not clear what changes the lexical tones and the phrase tone patterns actually underwent to be lost after 1520, as the tone markings grew increasingly inconsistent and no other information is available. However, the evidence clearly indicates that the tonal content of the phrases became simpler since the late 15th century. Phrases frequently contrasted in terms of the first H tone in the lexical stem and the H tone was made more prominent by lowering the other H tones. That is, the H tones of the functional morphemes were replaced with L tones and phrases began to have rising-falling patterns. It is believed that this led to the loss of tonal contrast at the end of a phrase and, eventually, to the loss of the lexical tones.

2.2. Lexical tones in contemporary varieties of Korean

"Don't you know you just have to raise the end in Seoul?" [18]

-A South Kyungsang native to a fellow South Kyungsang friend of his about how to speak Seoul in 'Seoul mate', a vignette in 'Gag concert' (a sketch comedy show by KBS), about three South Kyungsang men trying to be Seoulites -

The lexical tones have been lost in standard Seoul Korean, however, they are still found in the regional varieties of South and North Kyungsang in South Korea. Even though these varieties are generally assumed to have lexical tones, research into the tones is made in terms of the phrase tone patterns rather than morphemes or syllables. The distribution of the dialect tones is so restricted that they contrast fully only in the phrase initial syllable, posing difficulties for investigating the underlying tones of the individual morphemes or syllables. For that reason, South and North Kyungsang varieties are sometimes viewed as pitch accent languages like Japanese. This opinion is partially supported by the report that the rise of the North Kyungsang rising-falling F0 contours is aligned consistently with the 'accented' H tone syllable (Utsugi et al 2007) suggesting that North Kyungsang has a rising accent (see 2.1.2 for more details). Here, however, we discuss the phrase tone patterns of the Kyungsang varieties specifying the tones of all of the syllables. This not only provide a clear picture of the pitch levels and contour shapes, but also a better understanding of the dispute whether the regional varieties have lexical tones or pitch accents, by showing that South and North Kyungsang phrases are characterised by a H peak or plateau and the low final tone. That is, the phrases have rising-falling tone patterns similar to Dutch pointed and flat hat patterns (see Figure 2.2). These patterns are congruent with the historical change (see 2.1 above) observed in standard Seoul Korean suggesting that Kyungsang lexical tones (or pitch accents) are closely related to both Middle Korean tones and Seoul intonation.

[18] This remark describes the most distinct characteristics of Seoul intonation from a South Kyungsang speakers' point of view: the phrase final rise. South and North Kyungsang varieties lack the phrase final rise and the native speakers of these varieties find the phrase final rise, e.g., the abrupt final rise in yes-no questions, difficult to produce when learning to speak Seoul Korean.

Figure 2.2. Schematised contour shapes of Dutch pointed (on the left) and flat (on the right) hat patterns (Cohen and 't Hart 1967).

2.2.1. South Kyungsang

It was first reported in Heo (1954::1963) that South Kyungsang (SK) has lexical tones. He describes that SK has three tones L, M and H (one of the minimal triplets shown in (2.9)). However, the distribution of the L tone is severely restricted that the tone occurs only in phrase initial position. As a result, L, M and H contrast only in the phrase initial syllable, and in the non-initial position the tonal contrast is restricted to M and H. In addition, the L tone has an inherently longer duration than M or H and its limited distribution indicates that the length contrast[19] is restricted to the phrase initial syllable.

(2.9) Lexical tones in South and North Kyungsang

		SK	NK	Seoul
/ma:l/	'language, word(s)'	L	M:	NA
/mal/	a unit of weight/volume	M	M	NA
/mal/	'horse'	H	H	NA

Heo classified nouns according to the number of syllables and tones. The tones of the nouns remain relatively stable when inflected and are not usually affected by the following particle(s). However, some particles cause the tonal alternation of monosyllabic nouns. The locative particles, /-e/ and /-e.s^{h}ʌ/ (also /-e.-do/ $_{\text{locative particle}}$-'too'), change the M tone of some monosyllabic nouns, e.g., /non/ 'rice field', /tam/ 'wall', /t'aŋ/ 'ground, earth', /

[19] Seoul Korean speakers, particularly, young people, often treat the three lexical items simply as homophones, as the length contrast is being rapidly lost. Here longer length is indicated with ' : ' in both segmental and tonal representations as in (2.9).

It is interesting to note that some minimal pairs and triplets of South Kyungsang are not homophones in Seoul, due to the different segmental phonology and morphology. Nonetheless, the L tone word in South Kyungsang has a long vowel in Seoul. For instance, /ki/ is a minimal triplet in SK and has three different meanings depending on the tones: /ki:/ L 'crab', /ki/ M 'ear' and /ki/ H 'flag'. In Seoul, they are /ke:/, /kwi/ and /kitp'al/, respectively. Note that /ke:/ 'crab' still has a long vowel in Seoul.

ip/ ‘mouth’ etc., to H tone, while they do not affect the others, e.g., /pul/ ‘fire’ and /pʰa/ ‘leek’ (see (2.10) and also (2.3) above). In addition, the auxiliary particles[20], such as, /-tɕo.tɕʰa/ ‘even’, /-k’a.dʑi/ ‘till, to’, /-pu.tʰʌ/ ‘from’ and /-ma.n-ɯn/ ‘only’-subject particle alter the M tone of the preceding one syllable noun to H and the H to M.

(2.10)

/tam/ ‘wall’ M

→ /ta.m-i/ MM wall-(thematic) subject particle
→ /ta.m-e/ HM wall-locative particle

(2.11)

/k’um/ ‘dream’ M

→ /k’u.m-i/ MM dream-(thematic) subject particle
→ /k’u.m-dʑo.tɕʰa/ HHM[21] dream-even

/tɕip/ ‘house, home’ H

→ /tɕi.b-i/ HM house-(thematic) subject particle
→ /tɕip-pu.tʰʌ/ MHM house-from

Adjectives and verbs are classified according to the length and tonal alternation of stems. Monosyllabic stems have varying alternation, which is characteristically affected by the length of the following endings, and are categorised into five groups, Type I-A, B, C, D and E (see (2.11) and Table 2.2). By contrast, two and three syllable stems have consistent tones without alternation (see Table 2.3) except for some irregular verbs/ adjectives, e.g., /a.pʰu.-da/[22] MHM ‘to hurt, (to be) in pain’, /hɯ.ɾɯ.-da/ MHM ‘to flow’, /

[20] Particles are mostly functional and for that reason, they are frequently omitted in spoken language, unless they are narrowly focused or required to clarify the situation or context. However, the auxiliary particles have distinct meanings and cannot be omitted without altering the semantics.

[21] Voiceless lenis obstruents are voiced between sonorants, e.g., /p/, as in /tɕi.b-i/.

[22] /-da/ indicates that the word is a verbal/adjectival infinitive. The transcriptions /a.pʰu.-da/, /hɯ.ɾɯ.-da/ and /mo.ɾɯ.-da/ are based on the orthographic representation in Heo (1963: 292). However, /mo.ɾə.-da/ and /hə.ɾə.-da/ is probably a more realistic and accurate transcription than /mo.ɾɯ.-da/ and /hɯ.ɾɯ.-da/, as South Kyungsang lacks high back unrounded vowel /ɯ/ and SK speakers usually replace /ɯ/ of standard Korean with /ə/.

mo.ɾɯ.-da/ MHM ‘to have no knowledge of, (to be) unaware of’. These stems sometimes lose the final vowel, /u/ or /ɯ/, when conjugated, and this causes tonal alternation. For instance, when /a.pʰu-/ MH is followed by the causative ending /-ʌ.sʰʌ/~/-a.sʰʌ/, /u/ is dropped, resulting in, e.g., /a.pʰ-a.sʰʌ/ HMM ‘(it) hurts’-‘because’. While the stems have MH with the vowel present, they have different tones when the vowel is elided; /a.pʰ-a.sʰʌ/ and /hɯl.l-ʌ.sʰʌ/ have HMM and /mol.-la.sʰʌ/ becomes LMM (see (2.12)). Heo (1963) classifies them separately as irregular verb/adjective Type II-A (e.g. /a.pʰu.-da/, /hɯ.ɾɯ.-da/) and Type II-B (e.g., /mo.ɾɯ.-da/). Table 2.43.

(2.11)

Type 1-C	Type 1-D
/sʰum.-t’a/ MM ‘to hide‘	/ət.-t’a/ LM ‘to get’
/sʰum.-k’o/ MM ‘hide-and‘	/ət.-k’o/ LM ‘get-and’
/sʰum.-k’et.t’a/ HHM ‘hide-would‘	/ət.-k’et.t’a/ LMM ‘get-would’
/sʰum.-t’ə.ɾa.do/ HHMM ‘hide-even though’	/ət.-t’ə.ɾa.do/ LMMM ‘get-even though’

(2.12)

/a.pʰu.-da/ MHM ‘to hurt, (to be) in pain’

→ /a.pʰu.-dʌ.ɾa/[23] MHHM (I can tell you that) it hurt
→ /a.pʰ-a.sʰʌ/ HMM because (it) hurts

/hɯ.ɾɯ.-da/ MHM ‘to flow’

→ /hɯ.ɾɯ.-dʌ.ɾa/ MHHM (I can tell you that) it flows
→ /hɯl.l-ʌ.sʰʌ/ HMM because (it) flows

/mo.ɾɯ.-da/ MHM ‘to have no knowledge of’

→ /mo.ɾɯ.-dʌ.ɾa/ MHHM (I can tell you that he/she) has no idea
→ /mol.-la.sʰʌ/ LMM because (he/she) has no knowledge of

[23] /-dʌ.ɾa/ indicates that what is said comes from the speaker’s experience or recollection, and /a.pʰu.-dʌ.ɾa/ is translated approximately ‘(I can tell you from my experience that) it hurt’

	Length of the following ending(s)	
	one syllable	two syllables or longer
Type I-A	H	H~M
Type I-B	H~M	H~M~L
Type I-C	M	H
Type I-D	L	L
Type I-E	L~H	L~M~H

Table 2.2. The tonal alternation of the one syllable verb/adjective stems. The stems are divided into five different categories according to alternation pattern. Note that the length (or the number) of the endings has an influence on tonal alternation. (The table is taken and modified from Heo 1963:290)

two syllable stems	three syllable stems
HM	HMM
MH	MHM
HH	HHM
LM	MHH
	LMM

Table 2.3. Tonal alternation of the two and three syllable verb/adjective stems.

Type	Tonal alternation
Type II-A	MH~HM
Type II-B	MH~LM

Table 2.4. Tonal alternation of the two syllable irregular verbs and adjectives (see (2.12) above).

Even though Heo investigated SK tones in terms of lexical stems (or 'sémantème'), he argues that the unit of tone investigation should be bigger than lexical stems or morphemes and proposes that it should be an 'eojeol' (1954: 506-507), which corresponds to a Phonological Phrase (Nespor & Vogel 1986). He points out that a 'word[24]' cannot be taken as a unit, because the tones of certain nouns alternate depending on the following particle. He also points out that lexical stems or morphemes are merely abstract grammatical units which are seldom uttered on their own and cannot be used separately from the preceding or following element(s). For instance, verb/adjective stems cannot stand alone without ending(s) and some morphemes, such as, endings, particles and copula, require a preceding lexical element, e.g., noun and verb/adjective stems. They all have to form a phrase or 'eojeol'.

Heo's proposal was taken up by C. Kim (1973, 1977) and he surveyed the 'eojeol' tone patterns regardless of the phrase structure or grammatical categories of the lexical stems. C. Kim's tone patterns (2.13) show that the tonal sequences are restricted in such a way that they have distinct patterns comparable to 'Dutch flat (and pointed) hat patterns'. The phrase, or 'eojeol', tone patterns indicate that short phrases typically have the patterns which yield rising (e.g., LMM, MH) and level contours (e.g., L, MM, HH), particularly in Goseong, and longer phrases have the 'hat pattern' which give different rising-falling contours (with a peak or plateau) and falling contours. That is, the contours are described primarily as variants of a rise-fall containing a varying number of H tones.

(2.13) Tonal patterns in Southern Kyungsang (Changwon and Goseong)[25]

L	M	H
LM	MM MH	HM HH
LMM*	MHM MHH*	HMM HHM
LMMM*	MHMM MHHM MHHH*	HMMM HHMM
LMMMM*	MHMMM MHHMM MHHHM	HMMMM HHMMM

* are not common in Goseong.
* The examples are taken and modified from C. Kim (1973, 1977, 2001).

[24] Heo's examples suggest that the 'word' denotes lexical items.

[25] The SK phrase tonal patterns are found in the sub-varieties of Changwon and Goseong (C. Kim 1973, 1977, 2001). C. Kim (2001:36) notes that MHH and MHHH are rarely found in Goseong (and the neighbouring area, such as Jinju and Tongyoung) and instead MHM and MHHM are used. His data suggest that MHHH is not frequent in Changwon, either. It should be also noted that Heo's data (1963) of Kimhae, which is classified as the same sub-dialect with Changwon, does not include the pattern. Further, Heo (1963: 279ff) notes that MHH is very rare and replaced with MHM.

It is important to note that different authors (C. Kim 1973, M. Lee 2000) report that the 'flat and pointed hat patterns' are becoming more dominant in South Kyungsang, as the L tone phrases (e.g., LM, LMM) become lost and merge with the M tone phrases. The phrase tone patterns in (2.13) are largely from Changwon (C. Kim 1977), which is spoken in the south-eastern corner of South Kyungsang province. C. Kim (1973) notes that the phrase tone patterns vary slightly in different sub-varieties and Goseong (a sub-variety spoken in the west of South Kyungsang province) is characterised by the the restricted use of the L tone phrases as well as MHH and MHHH. While the LM sequence, e.g., /sʰaɾam/ LM 'person', /malˑsʼɯm/ LM 'words', is found equally in Changwon and Goseong, longer L tone phrases, such as, LMM, LMMM and so on, are not common in Goseong, as they are usually replaced with M tone phrases. For instance, /sʰaɾam-dɯɾ-i/ 'person'-$_{\text{plural suffix}}$-$_{\text{subjective particle}}$ is produced with LMMM in Changwon, but MHMM in Goseong. M. Lee (2000) makes a similar observation.

It should be noted that the 'hat patterns' are in line with the characteristics of the Middle Korean tone phrases (see 2.1). It should be remembered that during 15~16th century the phrases went through some notable changes. The first H tone of a phrase became functionally significant and the final H tone was replaced with a L tone, due to the generalisation of Rhythm rule 3 (also known as, the final H tone lowering). This suggests that the phrases typically had a rise to the first H tone at the beginning and a fall to the final L tone at the end, similarly to the 'hat patterns'. These 'hat patterns', or rising-falling phrase tone patterns, are characteristic of North Kyungsang as well as South Kyungsang. The North Kyungsang pattern (see 2.2.2) is simpler, allowing only one H tone between the rise and fall. That is, North Kyungsang only has the 'pointed hat pattern', while South Kyungsang has both the 'flat and pointed hat patterns'.

2.2.2. North Kyungsang

The number of lexical tones in North Kyungsang is still a matter of dispute. Different authors assume a different number of tones, varying between two and three, and some even assume that North Kyungsang does not have lexical tones, but a pitch accent (G. Kim 1988, Kenstowicz and Sohn 1997, N. Kim 1997, J. Jun et al 2006, Utsugi et al 2007).

In the two tone view, it is assumed that North Kyungsang (NK)[26] has M and H, and the M tone syllables has a vowel length contrast as a lexical feature (C. Kim 1977, D. Lee 1990). That is, M contrasts with H in terms of pitch, and it contrasts with M: in terms of vowel lengths (: indicates the length). In the three tone view, M: is considered a separate tone and represented with R(ise), i.e., M, R and H.

The three tone view is strongly supported by the academics who are the native speakers of North Kyungsang. They argue that M: does not only have a longer duration than M, but also different pitch and tonal behaviour, suggesting that it is phonologically distinct from M. They explain that M: rises toward the end of a syllable unlike the level M tone. This is supported by the fact that M: has H: and H as variants in different sub-varieties of North Kyungsang. Notably, the northern varieties of North Kyungsang spoken in Andong and Uljin have H: in the place of M: of the southern varieties such as Daegu. That is, they have M, H: and H, while Daegu has M, M: and H. Also, Daegu is reported to be losing the vowel length contrast (M. Lee 2000) as in the other varieties of Korean. When M: loses the length, it would be realised as M, if it differs from M purely in terms of duration. However, it is realised as H rather than M, which suggests that M: is actually distinct from M despite the low pitch. Most importantly, M: is governed by different tonal constraints. The occurrence of M: is restricted to phrase initial position (cf. L tone in South Kyungsang) and followed uniquely by H tone. On the contrary, the occurrence of M is not restricted and followed (and/or preceded) by either M or H (see (2.14)).

(2.14) Phrase tone patterns in Northern Kyungsang (Cheongdo and Daegu)[27]

M(:)*	H
M(:)M* M(:)H	HM HH
M(:)HM MMH	HMM HHM
M(:)HMM MMHM MMMH*	HMMM HHMM
M(:)HMMM MMHMM MMMHM	HMMMM HHMMM

*M(:) stands for M or M:.
*M, MM and MMMH are not found in Cheongdo.

[26] In the discussion of North Kyungsang, the tones are represented from the viewpoint that NK has two contrasting lexical tones and the vowel length contrast, as it allows for the better understanding of the three tone and pitch accent views. Additionally, even though the tones are usually described as L and H, I will refer to them as M and H in order to indicate that the pitch level of NK tones corresponds to the South Kyungsang M and H tones, not L and H.

[27] The NK tone patterns are modified from the list of Cheongdo phrase tone patterns in J. Lee (1999) and Daegu data is from M. Lee(2002, 2006). J. Lee reports that M, MM and MMMH patterns are not found in Cheongdo, but M. Lee reports that these three patterns are found in Daegu.

(2.15)

$M{:}HM_0$ + X → $M{:}HM_0$
[k'a.tɕʰi] M:H 'magpie' + [sʰo.ɾi] HM 'sound' → M:HMM 'the sound of magpie'

M_0HM_0 + X → M_0HM_0
[pa.ɾam] MH 'wind' + [sʰo.ɾi] HM 'sound' → MMHM 'the sound of wind'

HHM_0 + X → HHM_0
[mo.gu] HH 'mosquito' + [sʰo.ɾi] HM 'sound' → HHMM 'the sound of mosquito'

* X indicates any tone pattern type.
** The rules and examples are modified from M. Lee (2000: 3)

The assumption that M: is a distinct tonal entity from M is further supported by the tonal patterns of compounds and phrases. Adopting the method proposed in C. Kim (1973), M. Lee (1998) reduces the NK tone phrases to three types by representing the sequences of optional tones with numbers: $M{:}HM_0$ (e.g., M:H, M:HM, M:HMM etc.), M_0HM_0 (e.g., HM, HMM, MH, MMHMM etc.) and HHM_0 (e.g., HH, HHM, HHMM etc.). Using these types, he investigated the tone patterns of compounds (and phrases) and found out that the phrase tone type of a compound is determined by the first element. The compounds often have distinct tonal sequences, even if the first element has perceptually similar tonal strings, e.g., M:H and MH, M:HM and MHM etc. For instance, M:H and MH may sound similar in isolation, however, in compounds, the M:H has the H peak consistently in the second syllable, while the MH may have the peak shifted to different locations. This is shown in (2.15). The compounds have the identical second element [sʰo.ɾi] HM 'sound' with the first element of distinct tone types: $M{:}HM_0$, M_0HM_0 and HHM_0. Note that the H peak of [k'a.tɕʰi] M:H 'magpie' remains in the second syllable, while that of [pa.ɾam] MH 'wind' shifts to the third syllable.

As pointed out earlier, North Kyungsang has also been argued as having a pitch accent similarly to Japanese (Kenstowicz and Sohn 1997, G. Kim 1988, N. Kim 1997, J. Jun et al 2006). As a matter of fact, the tone phrases in (2.14) indicate that NK has the characteristics of a pitch accent language in that different phrases contrast primarily in terms of the H location, particularly when the M: (or R) and M contrast is not taken into consideration. It is reported that North Kyungsang (notably, in Daegu) phrases become

reduced to M_0HM_0 and HHM_0, as $M{:}HM_0$ merges with HHM_0 (M. Lee 2000), and the pitch accent view assumes only two types of NK phrases, M_0HM_0 and HHM_0, which are referred to as 'Class A' and 'Class B'.

While it is usually assumed that North Kyungsang has a falling (HL) accent based on the occurrence of downstep (Kenstowicz and Sohn 1997, G. Kim 1988, N. Kim 1997), Utsugi et al (2007) suggests that it has a rising (LH) accent. Utsugi and colleagues investigated the alignment of the tonal targets in the 'Class A' phrases, which display rising-falling contours. They located the tonal targets in the F0 contours with a similar procedure adopted in D'Imperio (2000) and Welby (2003); they fitted two straight lines to the F0 stretch surrounding an inflection point and calculated the intersection of the lines as the tonal target (see 6.2.1 for the detailed description of the procedure.).

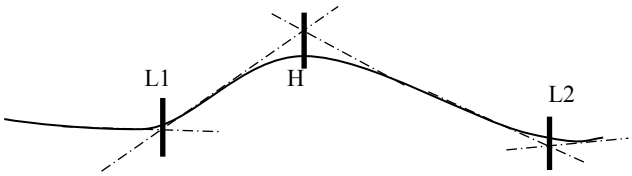

Figure 2.3. Locating the F0 turning points in the rising-falling contours of North Kyungsang. Two dashed lines are fitted to the F0 segment containing an inflection point. The F0 turning points, i.e., the intersections of the lines, are labelled 'L1', 'H' and 'L2' (the representation is modified from Welby 2003b: 69).

The results indicate that the beginning of the rise to the F0 peak (L1 in Figure 2.3) is consistently aligned immediately before the 'accented' H tone syllable and the end of the rise, i.e., the peak (H in Figure 2.3), near the end of the 'accented' syllable, though inconsistently. On the contrary, the beginning and the end of the fall (H and L2 in Figure 2.3) did not have constant alignment. The alignment of the end of the fall was particularly inconsistent and, in some cases, the turning point could not be located at all. Based on the results, Utsugi and colleagues (2007) suggest that the 'Class A' phrases of North Kyungsang has a rising (LH) accent.

Despite the dispute whether South and North Kyungsang have lexical tones or a pitch accent, it is important to point out that they are, in any case, tone languages in the sense of Yip (2002). In terms of their characteristics, Kyungsang tones can be placed

between the lexical tones of Middle Korean and the post-lexical tones of Seoul. When the four varieties are arranged in the order of Middle Korean - South Kyungsang - North Kyungsang - Seoul, the sequence is very much suggestive of the process how the Middle Korean lexical tones became Seoul post-lexical tones. It should be reminded that Middle Korean phrases began to develop rising-falling patterns similar to South Kyungsang, when the first H tone of a phrase became distinctive and the final H tone was lowered by being replaced with L tone (see 2.1). The rising-falling patterns, as well as the tonal inventory, might have been simplified further to contain one H tone, as in North Kyungsang, which displays the characteristics of a pitch accent. North Kyungsang phrase tone patterns are superficially similar to Seoul intonation phrases (see chapter 3), and differ only in the H peak location and the lack of the final rise (i.e., no double peak patterns). While the peak may occur on practically any syllable but the last in North Kyungsang (e.g., HMM, MH, MMMHM), it is strictly restricted to the second or third syllable in Seoul. This suggests that Middle Korean lexical tones are likely to have become post-lexical by concentrating the distinctive function to certain tone(s) of a tone sequence and by losing the distinctiveness, when the location of the distinctive tone has become predictable.

3. Intonation of Seoul Korean

The previous chapter provided arguments for the lexical tones in Middle Korean being lost and becoming post-lexical tones in present day standard Seoul Korean. It was pointed out in 2.1 that the loss of the tonal contrast started from the end of a phrase with the lowering of the phrase final H tone (i.e., the phrase final H tone lowering) when the first H tone of a phrase became distinctive. That is, one phrase was distinguished from another by means of the location of the first H tone, and the content of the following tonal string became less significant. Similar characteristics are also observed in the contemporary regional varieties of South and North Kyungsang. Kyunsang phrases are characterised by rising-falling patterns, which led to the debate as to whether they have lexical tones or pitch accents (see 2.2).

It was argued that the tones of Middle Korean and Kyungsang varieties are closely related to the post-lexical tones of Seoul, as indicated by the vowel length contrast in the phrase initial syllable. After all, they are all related diachronically and synchronically, and this suggests that the tones are organised and/or structured in a similar way, despite the fact that they are functionally distinct (i.e., lexical vs post-lexical).

In this section, we examine Seoul intonation by reviewing the intonation models proposed by H.-Y. Lee (1990, 1996) and S.-A. Jun (1996, 2000, 2005). The models are built from very different theoretical perspectives; H.-Y. Lee's model is based on the works of the British School represented by O'Connor and Arnold (1973) and Crystal (1969) focusing on the default production of intonation, i.e., how to assign broad focus intonation to a sentence; S.-A. Jun's is built on the autosegmental framework of Pierrehumbert (1980), Beckman and Pierrehumbert (1986), and Pierrehumbert and Beckman (1988), and is more concerned with the analysis of intonation into smaller component parts. A comparison of these approaches should provide us with better insights into Seoul prosody.

3.1. H.-Y. Lee (1990, 1996, 1997)

3.1.1. ‘Stress’, prosodic phrase structure rules and ‘accent’

In the British tradition, ‘stress’ is a pre-condition for potential ‘accent’ (Cruttenden 1986) in that pitch prominence falls on a ‘stressed’ syllable which has lexical prominence. Following the British tradition, H.-Y. Lee assumes that, in Korean, too, a syllable which receives sentence-level prominence has a word-level ‘stress’; a ‘stressed’ syllable may receive pitch prominence and ‘accented’ (see below). However, differently from English, his ‘stress’ has no phonetic realisation, unless it receives higher level prominence; he notes “... ‘stress’ that is not accented is not realised phonetically (1997:49; my translation)”. H.-Y. Lee argues that ‘stress’ is assumed, because “it [stress] enables us to give a neat explanation of a part of the mechanism involved in accent placement (1990:20)”. That is, in H.-Y. Lee’s model, the term ‘stress’ is used specifically to denote the syllables which may receive pitch prominence in broad focus utterances. H.-Y. Lee’s description suggests that his ‘stress’ refers to a privileged position that attracts tone. In this work, we retain the word ‘stress’ when referring to H.-Y. Lee’s model, but take it to mean abstract metrical strength.

H.-Y. Lee’s ‘stress’ rule in (3.1) assigns ‘stress’ primarily on the first syllable of a morpheme excluding ‘clitics’ (see also the discussion of ‘stress’ assignment in 3.1.3). Clitics, which includes morphemes such as endings, (most) prefixes and suffixes, postpositions (i.e., particles), bound nouns and bound predicates, do not have a stress of their own and form a phonological unit together with the preceding (or, in the case of prefixes, the following) morpheme(s) which contains stress. The rule basically assigns ‘stress’ to the initial syllable of a Phonological Word (PW) which is the prosodic unit just below the Accentual Phrase (AP) in S.-A. Jun’s model (see 3.2.3).

(3.1) The Korean Stress Rule (H.-Y. Lee 1990:50) [28]

- Two syllable morphemes:

  Stress falls on the first syllable

- Three or more syllable morphemes:

  If the first syllable is heavy[29], stress falls on that syllable. Otherwise, either on the first or on the second syllable with no important linguistic difference implied.

According to H.-Y. Lee, a 'stressed' syllable may receive pitch prominence and be 'accented' when it starts a 'Phrasal Tone' which is associated[30] with a 'Rhythm Unit' (i.e., AP). H.-Y. Lee claims that 'accent placement', i.e., accentual phrasing, is governed by the prosodic structure of a sentence as well as other factors, such as, the scope of focus, speech rate and style. The prosodic structure represents 'prosodic constituency and prosodic strength relations (different degrees of stress)' (H.-Y. Lee 1990:72) and it is hierarchical in that the node branching from higher in the structure tree is more likely to be 'accented' than the node lower in the tree. H.-Y. Lee proposes eight prosodic phrase structure rules which assign prosodic structures to phrases and sentences referring to 'syntactic categories and sometimes to semantic relationships' (H.-Y. Lee 1990:75): Compound Rule, Multiple Head Rule, Noun Phrase Rule, Prosodic Reanalysis, Predicate Rule, Verb Phrase Rule and Sentence Rule. These rules assign a binary-branching and left-headed tree structure which determines the 'accent placement' in broad focus. For example, /ma.ɾi. ma:.nɯn. sa.ɾam/ '(A) talkative person' has a prosodic structure shown in Figure 3.1 which is assigned by the Noun Phrase Rule. It has three Phonological Words, /ma.ɾ-i./ 'language, word'-$_{\text{subject particle}}$, /ma:.n-ɯn/ 'many' and /sʰa.ɾam/ 'person'. /ma.ɾ-i./, a strong node branching directly from the top node, is most likely to be accented when

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[28] It should be noted that the second part of the stress rule allows 'accent' (i.e., pitch prominence) to fall on the second syllable of a morpheme. This is possible, as a 'Rhythm Unit', AP level prosodic unit in H.-Y. Lee's model, may contain anacrusis, unstressed syllable(s) preceding a stress. A rhythm unit is defined as having optional anacrusis, an obligatory stressed/accented syllable and following (optional) unstressed syllables. See also 3.1.3. for further discussion of 'stress' and 'stressed' syllables.

[29] H.-Y. Lee (1990:39) defines heavy and light syllables as follows (optional sound in brackets);
heavy syllables: (C)V:, GV:, C(G)V:, C(G)V:C, (C)VC, C(G)VC
light syllables: (C)V, C(G)V, GV

C: consonant, V: vowel, G: glide

[30] 'Association' is my expression, H.-Y. Lee describes that a 'Phrasal Tone' is "overlaid" on a 'Rhythm Unit'. (1990:133).

uttered, followed by /ma:.nɯn/. /sʰa.ɾam/ is least likely to be ‘accented’, as it is a weak node branching from another weak node.

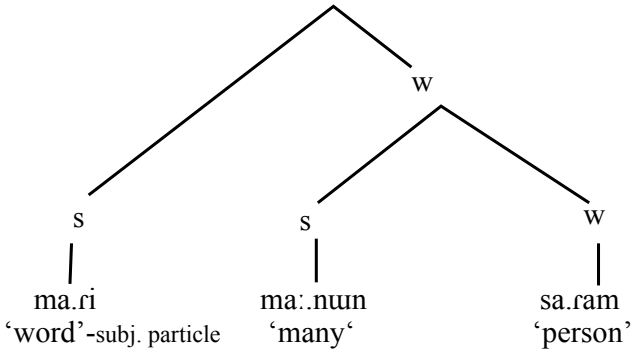


Figure 3.1. Prosodic structure of /ma.ɾi. ma:.nɯn. sa.ɾam/ ‘(A) talkative person’ (H.-Y. Lee 1990:72)

3.1.2. ‘Phrasal Tones’ and ‘Boundary Tones’

An ‘accented’ syllable marks the beginning of a ‘Phrasal Tone’ associated with an AP level prosodic unit called ‘Rhythm Unit’. Four different ‘Phrasal Tones’ are proposed and assumed to convey different meanings: a rise is ‘lively and light’; a fall sounds ‘uninvolved and relaxed’; level is ‘less lively and lighter than a rise, but ‘more involved and less relaxed than a fall’; a rise-fall sounds ‘emphatic and weighty’ (H.-Y. Lee 1990:128-131). However, H.-Y. Lee also notes that they only convey limited attitudinal and stylistic meanings and intonational meaning is conveyed largely by the ‘Boundary Tone’ which indicates the end of an ‘Intonation Group’ (H.-Y. Lee 1990:119-122).

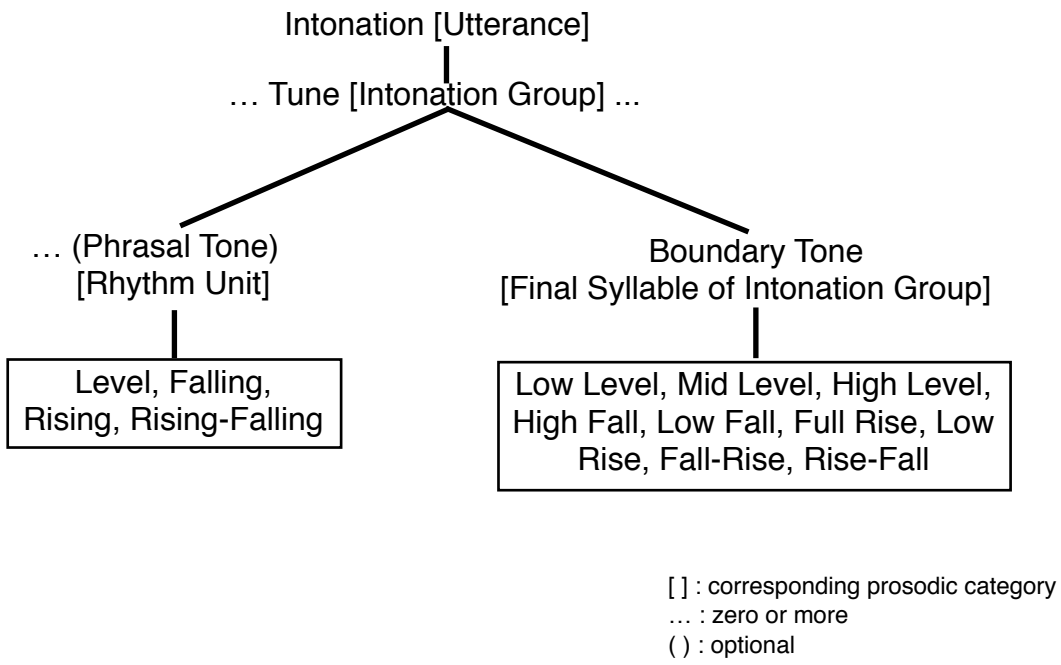


Figure 3.2. The intonation system of Korean (H.-Y. Lee 1990:139).

An ‘Intonation Group’ is the upper level prosodic unit which contains zero or more ‘Rhythm Units’ (see Figure 3.2.) and indicated by the obligatory ‘Boundary Tone’ on the final syllable. Nine different ‘Boundary Tones’ are proposed all conveying different meanings: low level, mid level, high level, high fall, low fall, full rise, low rise, fall-rise, rise-fall. It should be noted that, differently from S.-A. Jun’s intonation model (see 3.2), H.-Y. Lee’s does not assume the Strict Layer Hypothesis (Selkirk 1980) and higher level constituents are not necessarily parsed into the immediately subordinating components exhaustively. That is, an ‘Intonation Group’ may or may not contain ‘Rhythm Unit(s)’. As a result, a ‘Tune’, the pitch contour on an ‘Intonation Group’, is analysed as a sequence of optional ‘Phrasal Tone(s)’ and a compulsory ‘Boundary Tone’ and consists minimally of a ‘Boundary Tone’. It should be also noted that the ‘Phrasal Tone’ extends only up to the penultimate syllable in the ‘Intonation Group’ final position, as the final syllable is taken up by a ‘Boundary Tone’.

H.-Y. Lee notes that ‘Boundary Tone’ is comparable to English ‘nuclear tone’ in that “[the tone] conveys the greater part of the intonational meaning of a tune, and that it is often realised as a kinetic tone and thus often heard as the most prominent” (H.-Y. Lee 1990:121). His description of ‘Phrasal Tones’ and ‘Boundary Tone’ strongly suggests that

they are viewed as the Korean equivalent[31] of the ‘head’ and ‘nuclear tone’ in English (O’Connor and Arnold 1973). Nonetheless, he analyses the ‘Boundary Tones’ merely as boundary tones unlike the English ‘nuclear tone’, even though he describes the ‘Phrasal Tones' as accents[32] as in English. This analysis is based on the fact that ‘Boundary Tones’ occur on the ‘unstressed’ syllables and functional items. Korean phrases typically consist of lexical morpheme(s) and the following functional (and dependent) morpheme(s), e.g., a noun and particle(s), a verbal stem and endings etc, and the ‘Intonation Group’ final syllable belongs to a functional morpheme with a few exceptions, such as citation forms.

3.1.3. ‘Sress’ in H.-Y. Lee (1990, 1996, 1997)

H.-Y. Lee’s model is very faithful to the works of the British school which suit essentially West Germanic languages. While it may be argued that H.-Y. Lee’s adaptation is too strictly British, it should not be overlooked that his model provides some insights into Korean intonation, in particular, the coherence with Middle Korean lexical tones, metrical structure and contrast of AP contours (see also chapter 6). Here we discuss H.-Y. Lee’s ‘stress’ briefly in the view of diachrony as well as matrix.

3.1.3.1. Morpheme types and ‘stress’

There is some evidence that H.-Y. Lee’s ‘stress’ (i.e., abstract metrical strength) as attractor of pitch prominence is related to the morphemes which had distinctive tones in Middle Korean (see 2.1) and these morphemes should have a place in the prosodic structure today. It should be remembered that in Middle Korean, content morphemes and some functional morphemes derived from nouns and verbal stems, such as, /-bɯ.tʰʌ/ ‘from’, /-dzo.tsʰa/ ‘even’, /-spun/ ‘only’, were free from the application of Rhythm rule 2 and Rhythm rule 3 and kept their distinct tones. It should be also remembered that, for this reason, Cha (1999) assumes that these functional morphemes, called auxiliary particles, form separate Phonological Words from the preceding noun. It is interesting to note that auxiliary particles tend to attract pitch peak or movement, even though H.-Y. Lee assumes

[31] This is more evident when the Korean expression for ‘Boundary Tone’ is taken into consideration. It is translated literally as ‘nuclear intonation’. (H.-Y. Lee 1996)

[32] Note that the initial syllable of a ‘Rhythm Unit’ is described as having the word-level ‘stress’ (i.e., abstract metrical strength) and sentence-level stress (i.e., pitch prominence) as accent in English. That is, the syllable has the culmination of prominence. See 3.1.1.

that only lexical morphemes have ‘stress’. The experimental results in chapter 4 (see 4.2.2.) show that in an AP with a noun and particle, the AP peak occurs at the beginning of the particle, when the noun is followed by an auxiliary particle. The AP is also observed to vary in contour shapes, occasionally, ending with a rise (i.e., rise-fall-rise). By contrast, the AP peak occurs near the end of the noun when the noun is followed by a dative particle which is omissible. The AP consistently displays a rising-falling contour and no variation in the contours is observed. This suggests that auxiliary particles still attract prominent pitch affecting the F0 configuration.

3.1.3.2. ‘Stress’ assignment

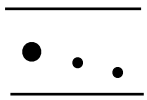
H.-Y. Lee (see (3.1) above) assumes that ‘stress’ may fall on either the first or the second syllable of a lexical morpheme ‘with no important linguistic difference implied’, when the initial syllable is light. It is not clear what he indicates with ‘important linguistic difference’, however, his examples of the different ‘stress’ patterns suggest that they reflect different focus types (see (3.2) reproduced from H.-Y. Lee (1990:47)). Comparing the two possible stress patterns of /tsa.doŋ.tɕʰa/ ‘automobile, car’, he describes that placing ‘stress (and accent)’ on the second syllable, i.e., (3.2-b), makes the word sound ‘emphatic’, which suggests that (3.2-a) has broad focus and (3.2-b) narrow focus. As a native speaker of Seoul Korean, my impression is that (3.2-a) sounds neutral, whereas (3.2-b) is more likely to be perceived as having a metalinguistic focus on the second syllable, e.g., /tsa.doŋ.tɕʰa/ opposed to /tsa.dzʌn.tɕʰa/ ‘(old fashioned word for) bicycle’, due to the rhythmic beat and high pitch.

It is important to note, however, that H.-Y. Lee’s examples in (3.2) are analysed to have different Phrasal Tones in his model; (3.2-a) has a falling tone and (3.2-b) a rising-falling tone. It should be reminded that in H.-Y. Lee, different tones are assumed to convey different meanings (see 3.1.2), which suggests that the difference between (3.2-a) and (3.2-b) could be due to the different tones. The question is, then, how different (3.2-b) is from (3.3) which has an identical rising-falling tone but different stress location; (3.2-b) has ‘stress’/accent in the second syllable, while (3.3) has it in the first. In my opinion, (3.3) is perceived as having a narrow (or contrastive) focus on the whole word as in an answer to a quiz question (or saying ‘automobile’ opposed to ‘train’). That is, the entire word is focused in (3.2-a) and (3.3). In contrast, only the second syllable is in focus in (3.2-b). This

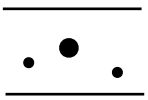
suggests that the location of H.-Y. Lee's 'stress'/accent affects the scope of focus. It also suggests that, contrary to H.-Y. Lee's assumption, 'stress'/accent should be in the first syllable regardless of the weight of the initial syllable.

(3.2)

a. 'stress'/accent on the first syllable



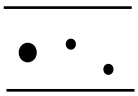
b. 'stress'/accent on the second syllable



* Examples are from H.-Y. Lee (1990:47)

(3.3)

'stress'/accent on the first syllable with a rising-falling tone



3.1.3.3. Phonetic correlates of H.-Y. Lee's 'stress'[33]

There are indications that what H.-Y. Lee refers to as 'stress' might in fact have phonetic correlates after all. Cho and Keating (2009) report that prominence effects are encoded differently from domain initial strengthening effects. Prominence strengthening effect are reflected in the vowel measurements, e.g. duration and formant frequency, while positional strengthening effects are found primarily in initial consonants. It should be pointed out that H.-Y. Lee's 'stressed' syllable is assumed to have low level prominence (for being metrically strong) and, at the same time, it is domain initial (for being the initial syllable of a Phonological Word (PW)[34]), which suggests that a 'stressed syllable' should show strengthening effect on the vowel, e.g., longer duration, as well as the onset consonant.

[33] For further discussion, see also 6.3.1.

[34] The prosodic units of H.-Y. Lee's model, 'stress domain', 'Rhythm Unit' and 'Intonation Group', are comparable to S.-A. Jun's 'Phonological Word', 'Accentual Phrase' and 'Intonation Phrase'. In this paper, I will adopt S.-A. Jun's terms, which are better known.

Cho and Keating (2001) investigated domain initial strengthening in Korean by examining a number of articulatory and acoustic parameters of alveolar consonants /n/, /t/, /t'/, /t^h/, /ts/, /ts'/, /ts^h/. They report generally strong effects of positional strengthening. In particular, their results indicate that the onsets of the initial syllables of Phonological Words are produced with greater peak linguopalatal contact (in /n/), longer stop seal duration (in /n/ and /t/) and longer VOT (in /ts^h/), than those of the syllables located Phonological Word medially. That is, H.-Y. Lee's 'stressed' syllables, i.e., initial syllables of Phonological Words, are characterised by stronger onset consonant than non-initial syllables.

In addition, Seong's study (1992) suggests that H.-Y. Lee's 'stressed' syllables might also have longer vowel duration than 'unstressed' syllables. Seong performed a perception experiment with /mal/ and /ma/ as a heavy and light syllable (see footnote 29) and tested the assumption that the perception of a prominent syllable[35] is affected by the syllable weight (H.-B. Lee 1973, Yu 1988, H.-Y. Lee 1990). He also investigated acoustic correlates of prominence by measuring the duration, F0 and intensity of the syllables which are perceived as prominent. The result of Seong's perception test is presented in Table 3.1, and the measurements of the syllable duration, F0 and intensity in Table 3.2.

Syllable weight	Prominent AP syllable		
	1st σ	2nd σ	other
heavy / heavy	19	7	2
heavy / light	23	5	0
light / heavy	0	28	0
light / light	19	4	5
Subtotal	61(54.46%)	44 (39.29%)	7 (6.25%)
	105 (93.75%)		7 (6.25%)
Total	112 (100%)		

Table 3.1. The perception of the prominent syllables in Seoul Korean APs (modified from Seong 1992: 57-59).

[35] Here 'prominent syllable' is used to cover the 'accented' syllable in H.-B. Lee (1973), Yu (1988) and H.-Y. Lee (1990).

• Duration (ms)

Syllable Speaker\	1st σ heavy		2nd σ heavy		1st σ heavy		2nd σ light		1st σ light		2nd σ heavy		1st σ light		2nd σ light	
A	208.1	(32.0)	184.0	(6.7)	200.2	(10.1)	168.0	(18.5)	135.3	(6.7)	158.3	(17.0)	158.7	(10.4)	151.4	(12.6)
B	230.9	(12.3)	214.2	(11.0)	230.5	(10.3)	180.6	(6.7)	175.8	(6.2)	192.5	(9.5)	189.3	(6.4)	171.2	(4.7)
C	210.4	(8.0)	189.6	(6.9)	208.3	(14.1)	160.4	(8.3)	177.6	(9.0)	177.8	(10.8)	185.3	(7.3)	156.4	(7.9)
D	250.7	(10.7)	241.0	(27.2)	261.0	(16.6)	175.8	(10.9)	181.7	(9.8)	216.6	(5.6)	191.6	(3.9)	162.8	(12.7)
mean	225.0	(17.3)	207.2	(22.6)	225.0	(23.6)	171.2	(7.7)	167.6	(18.8)	186.3	(21.3)	181.2	(13.2)	160.5	(7.4)

• F0 (Hz)

Syllable Speaker\	1st σ heavy		2nd σ heavy		1st σ heavy		2nd σ light		1st σ light		2nd σ heavy		1st σ light		2nd σ light	
A	92.6	(0.8)	99.9	(1.6)	93.2	(0.4)	100.0	(2.4)	91.6	(0.8)	98.0	(1.2)	91.6	(0.5)	96.4	(1.5)
B	101.3	(0.6)	108.4	(0.7)	100.3	(0.5)	107.9	(1.4)	100.4	(0.9)	107.5	(1.0)	100.6	(1.0)	107.2	(2.0)
C	98.6	(1.5)	107.0	(2.5)	97.5	(2.3)	107.8	(4.0)	97.3	(1.8)	104.6	(2.2)	96.5	(1.0)	104.3	(2.8)
D	109.4	(2.0)	117.3	(3.7)	109.2	(4.0)	114.1	(4.5)	105.2	(1.8)	115.5	(2.7)	104.9	(1.8)	114.3	(3.0)
mean	100.47	(6.0)	108.1	(6.2)	100.07	(5.8)	107.467	(4.9)	98.614	(4.9)	106.39	(6.2)	98.37	(4.9)	105.5	(6.3)

• Intensity (db)

Syllable Speaker\	1st σ heavy		2nd σ heavy		1st σ heavy		2nd σ light		1st σ light		2nd σ heavy		1st σ light		2nd σ light	
A	59.5	(1.0)	59.5	(0.9)	60.0	(0.6)	60.0	(0.3)	61.3	(1.1)	61.3	(0.8)	60.6	(0.6)	60.6	(0.5)
B	57.5	(0.7)	57.2	(1.1)	57.0	(0.7)	56.8	(1.1)	56.4	(0.5)	58.2	(0.5)	57.3	(0.9)	58.2	(1.0)
C	62.4	(0.2)	61.4	(0.4)	62.1	(1.1)	60.8	(0.8)	61.8	(0.5)	61.7	(0.4)	61.5	(0.1)	60.9	(0.3)
D	58.1	(0.8)	58.6	(0.8)	58.5	(1.2)	57.7	(1.5)	57.3	(1.2)	58.3	(1.2)	57.1	(1.1)	57.6	(1.8)
mean	59.367	(1.8)	59.214	(1.5)	59.392	(1.8)	58.825	(1.6)	59.203	(2.3)	59.864	(1.6)	59.09	(1.9)	59.33	(1.4)

* Each value is the mean of seven measurements.
* Standard deviation in brackets.

Table 3.2. Duration, F0 and intensity measurements of the two AP initial syllables (referred to as 1st σ and 2nd σ) in Seong's experiment (modified from Seong 1992: 60-72).

Three distinct patterns are observed in Table 3.1. First, the phrase initial syllable is perceived as predominantly prominent when the first syllable is heavy or the first and the second syllables have identical syllable weight. Second, the second syllable is perceived as prominent only when the initial syllable is light and the second is heavy. Third, syllables other than the two initial syllables are rarely perceived as prominent.

Table 3.2 suggests that duration is the most significant factor affecting the perception of prominence, followed by F0 height. The prominent syllable is longer in

duration, but not necessarily higher in F0. Table 3.2 shows that the first syllable is longer than the second, when the two syllables have identical syllable weight (i.e., heavy-heavy and light-light syllables). This suggests that the phrase initial position increases the syllable duration. Note also that the initial syllable is about 20 ms longer than the second. The degree of increase strongly suggests the lengthening of vowel, rather than the initial consonant (the consonant being typically lengthened in domain initial position). If Cho and Keating's (2009) analysis extends to languages other than English, this suggests that initial syllables could have prominence.

3.2. S.-A. Jun (1996,1998, 2005) and K-ToBI (S.-A. Jun 2000)

3.2.1. Accentual Phrase (AP) and the variation of AP contours

S.-A. Jun's model is built on the framework of autosegmental metrical phonology by Pierrehumbert (1980), Beckman and Pierrehumbert (1986) and Pierrehumbert and Beckman (1988). Prosody is hierarchically structured following the Strict Layer Hypothesis (Selkirk 1980) and intonation contours are analysed as a series of tonal events (e.g., pitch accents and boundary tones) and represented by interpolating the (component) tones of the events. In Korean, the tonal pattern, or strings of tones, which define an Accentual Phrase (AP) constitute 'tonal events'. S.-A. Jun (2000) states "…in Korean, distinctive pitch events do not come from an individual phrasal tone but as a set of tones forming an AP".

An AP is defined by the LH-LH or HH-LH pattern. The two initial tones, TH (T=L or H), are assumed to be associated with the two initial syllables of an AP and the two final tones, LH, the two final syllables, respectively. The initial tone alternates L~H depending on the absence or presence of the segmental feature [stiff vocal cords] in the onset of the AP initial syllable. [+stiff vocal cords] groups fortis, /p', t', ts', k'/, strongly aspirated obstruents, /p^h, t^h, k^h, ts^h/, and fricatives, /s^h, s', h/ together, whereas [-stiff vocal cords] includes (voiceless) lenis obstruents, /p, t, k, ts/, and nasals /n, m/[36]. Thus, an AP has the LHLH pattern, unless its initial segment is one of the following consonants: /p', t', ts', k', p^h, t^h, k^h, ts^h, s^h, s', h/.

[36] /ŋ/ and /l/ are also [-stiff vocal cords]. However, /ŋ/ does not occur in the onset position. /l/ may occur as [l] as coda or a geminate with a syllable boundary in between, i.e., /l.l/, otherwise, it is replaced with the allophone [ɾ]. In standard Korean, /ɾ/ is not allowed in word initial position, except for foreign loanwords.

In S.-A. Jun's earlier work (S.-A. Jun 1996, 1998), it was assumed that the AP tones are mapped and allocated to individual Tone Bearing Units (i.e., syllables) by a series of 'Tone Mapping Rules (TMR)'. Three Tone Mapping Rules were assumed: Final Two tone Mapping (FTM), Initial Two tone Mapping (ITM) and Default L, applied in that order. FTM assigns the two final tones of TH-LH to the two final syllables of an AP and ITM the two initial tones to the two initial syllables. Default L assigns a L tone to the remaining syllables after the application of FTM and ITM. When an AP contains two syllables, only FTM is applied, and the syllables are associated with LH, generating a rising contour. When an AP contains three syllables, both FTM and ITM are applied, and the second syllable is associated with the two middle tones of T**H-L**H (tones associated with the second syllable in bold), as FTM allocates the L and ITM the H. Nonetheless, the AP does not have a rising-falling-rising contour, because either one or both of the two tones associated with the center syllable are 'undershot'. It is important to note that S.-A. Jun's 'tonal undershoot' is in effect the 'deletion' or 'delinking' of a tone(s) in that the 'undershot' tones are "not realised" (S.-A. Jun 1998, 2006). The tonal undershoot results in LH, LLH or LHH, or alternatively, HH, HLH or HHH, when the AP starts with a [+stiff vocal cords] consonant (see the schematic representation of the AP contours in Figure 3.3). When an AP contains more than four syllables, all three TMR are applied and Default L subsequently allocates L tone(s) by default. This results in TH(L…)LH (the L tones allocated by Default L are shown in brackets). The strings of L tones are not realised as a low plateau between TH and LH, but rather as a gradual fall between the H and the penultimate L (S.-A. Jun 1998). In more recent works (S.-A. Jun 2000, 2005), these L tones are no longer part of the representation, the fall being accounted for by interpolation. Instead, only TH-LH are associated with the two initial and the two final syllables of an AP. The association and realisation of the initial H tone differs from those of the other AP tones in that the H peak may occur either on the second or third syllable and for that reason, the H is assumed to be "loosely associated" with the second AP syllable (S.-A. Jun 1996, 2005). This suggests that the different alignment of the H peak is considered to be a merely a matter of phonetic variation.

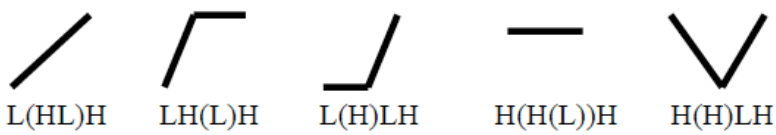


Figure 3.3. Schematic representations of the AP contours resulted from tonal undershoot (reproduced from S.-A. Jun 2006:17). The undershot tones are shown in brackets.

It is important to note that, in S.-A. Jun's model, the variation of AP contours is assumed to occur mostly in the short APs with less than four syllables. The 'tonal undershoot', which is responsible for the generation of the varying contours in Figure 3.3, occurs when there are not enough syllables for the TH-LH tones to associate. This indicates that short APs have varying contours generated by the 'tonal undershoot' and the alternation of the phrase initial tone. However, longer APs with four syllables or more are expected simply to alternate between rise-fall-rise and fall-rise (i.e., LH-LH and HH-LH), according to the onset of the initial syllable, as all four tones of TH-LH are associated and realised. It is unclear how S.-A. Jun's model can explain the emergence of other contour shapes in the long APs (see Figure 3.4 for different AP contours). Furthermore, despite the importance of the 'tonal undershoot', little is known of the undershoot except that its occurrence may be triggered by the lack of TBUs. It is not at all clear if the undershoot is also conditioned by other factors, such as, information status. It is also unclear what determines which tone(s) to undershoot and whether the undershot tones do not have phonetic realisations at all. That is, APs are assumed to have varying tonal patterns derived from TH-LH, but we do not know what causes the variation or how the variation is actually created. As S.-A. Jun (2000) notes, "[the various AP tonal patterns] do not seem to be predictable". In addition, she notes that "different AP tonal patterns do not seem to contrast" (S.-A. Jun 2000), which suggests that the variation is simply phonetic. This is contrary to H.-Y. Lee who assumes that varying AP contours convey different meanings (see 3.1).

Nevertheless, S.-A. Jun leaves open the possibility that AP contour variation is systematic or semantic. As a matter of fact, she expands the K-ToBI to add a 'phonetic tone tier' on top of the existing 'phonological tone tier'. On the 'phonetic tone tier', the F0 contour shapes are recorded by specifying the F0 levels and peaks and valleys up to four different locations (see the labelled contours in Figure 3.4), while only the end of an AP is indicated with LHa on the original 'phonological tone tier'. S.-A. Jun (2000) explains that the decision was made "in order to describe surface tonal patterns which are not predictable from the underlying tones" and "to investigate if there is any meaning difference among [the varying contours]".

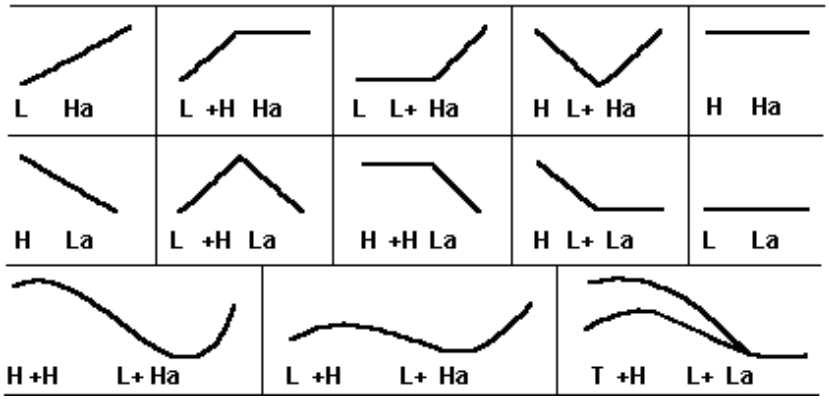


Figure 3.4. Schematic representations of varying AP contours (reproduced from S.-A. Jun 2000). The contours are labelled and described following the convention of the 'phonetic tone tier' added in the revised version of K-ToBI (S.-A. Jun 2000). F0 levels and/or peaks and valleys are indicated maximally in four different locations: L and H specifies low/high F0 level at the beginning; +H the peak on the second (or third) syllable; L+ the F0 valley in the penultimate syllable; La and Ha the F0 level (or the absence/presence of the peak) in the final syllable.

3.2.2. Intermediate Phrase (ip) and Intonation Phrase (IP)

In the prosodic hierarchy, an AP(or sequence of APs) is dominated by higher level prosodic units, the Intermediate Phrase (S.-A. Jun 2006) and Intonation Phrase (IP). One or more APs are immediately dominated by an ip and ip(s) by an Intonation Phrase (IP). An Intermediate Phrase (ip) is indicated by a tonal downtrend, unlike an AP and IP which are tonally defined (see 3.2.1 for APs and the next paragraph for IPs). The beginning and end of an ip is indicated by the change in the pitch trend, such as pitch reset and a higher AP final H peak (i.e., the peak labelled with 'Ha' in Figure 3.4). S.-A. Jun suggests that an ip is possibly marked by a high boundary tone, which raises the AP final peak.

The Intonation Phrase (IP) is marked by a boundary tone (%). Nine distinct simple and complex IP boundary tones are proposed: H%, L%, HL%, LH%, HLH%, LHL%, HLHL %, LHLH%, LHLHL% (see Figure 3.5). The tone is associated with the last syllable of an IP and, when an AP is IP final, the final syllable is pre-empted by the IP boundary tone. The final H of the TH-LH is not associated with the final syllable, but, instead, an IP boundary tone is associated with this syllable. For instance, if the IP final AP contains four syllables and displays, say, the tonal pattern of LHLH, it is analysed as AP tones, LH-L (without the final H), followed by the IP boundary tone, H%, giving LH-L H%. The IP final

syllable is also indicated by final lengthening. It is reported that the syllable is about 1.8 times longer than the phrase initial syllable (H.-B. Lee and Seong 1996).

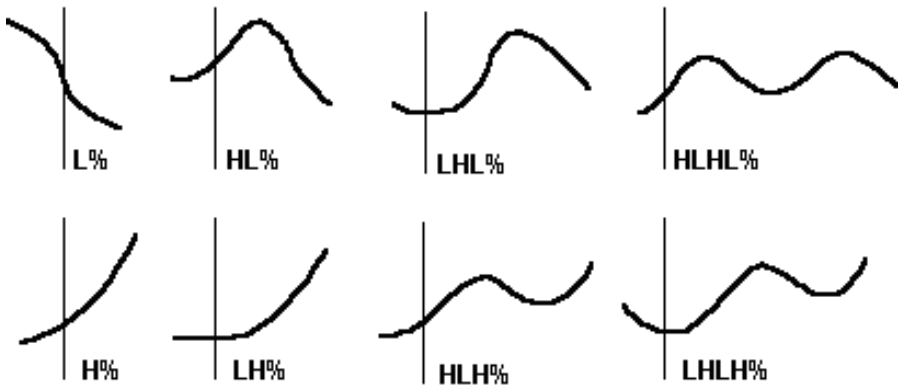
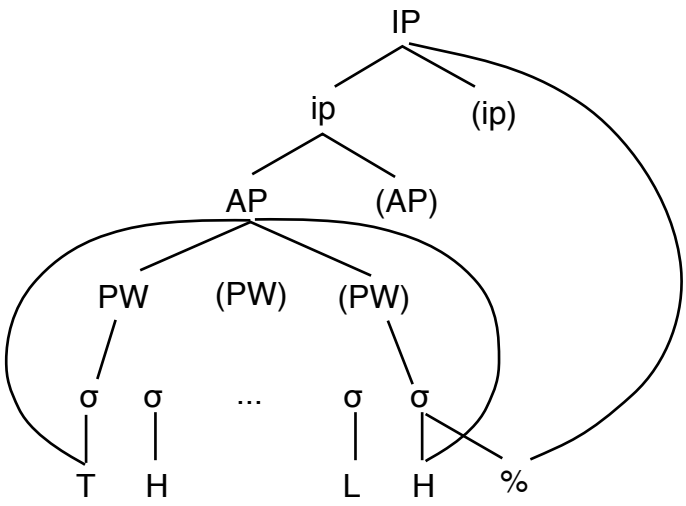


Figure 3.5. Schematic representation of F0 contours of eight IP boundary tones (reproduced from the K-ToBI website http://www.humnet.ucla.edu/humnet/linguistics/people/jun/ktobi/K-tobi.html last accessed April 3rd 2013)

It is important to note that the IP penultimate syllable must have distinctly low pitch regardless of the number of AP syllables in well-formed Korean intonation. In an attempt to define the occurrence of different AP contours, H.-Y. Lee (1997) notes that "The rising 'Phrasal Tone' does not occur on the last 'Rhythm Unit' [i.e., AP] of an 'Intonation Group' [i.e., IP] (1997:225; my translation)", which stresses the presence of low pitch on the IP penultimate syllable. In fact, by excluding the rising contour on the IP final AP, H.-Y. Lee effectively and efficiently achieves the necessary pitch valley before the IP boundary tone in his intonation model. S.-A. Jun, too, assumes a low starting point for IP tones as reflected in the schematic representation of IP boundary tones (see Figure 3.5). This suggests that the AP contours in Figure 3.3 should be found primarily in non-final positions[37], as they all end with the AP final H tone, or high F0. At the same time, it suggests that the AP contours with low ending, such as, rising-falling and low level contours (see the contours labelled with 'La' in Figure 3.4), should be found predominantly in the IP final APs where the final H is not realised. Considering the suggestion of the high ip boundary tone (see above), the constant low F0 before the IP boundary tone may as well be another indication of the ip boundary tone.

[37] S.-A. Jun (2000, 2005) notes that the AP final tone can be a low tone, however, "This is a less common AP final tone, sometimes seen when the following AP begins with a H tone" (S.-A. Jun 2000).



IP: Intonation Phrase, ip: Intermediate Phrase,
AP: Accentual Phrase, PW: Phonological Word, σ: syllable
T= H, when the syllable initial segment is aspirated/tense, otherwise, T= L
%: Intonation phrase boundary tone

Figure 3.6. Intonational Structure of Seoul Korean (modified from S.-A. Jun 2000 to include ip). The figure shows the prosodic hierarchy and the intonation structure of Seoul Korean. The hierarchy shows that the highest level prosodic constituent, IP, consists of one or more ips, an ip one or more APs, an AP one or more Phonological Words and a Phonological Word of one or more syllables. The TH of the TH-LH is represented to be associated with the two initial syllables of an AP and the LH with the two final syllables, respectively. The other syllables are shown without tonal specifications. As represented in the figure, tones may be assigned to the syllables that belong to different Phonological Words within the AP.

3.2.3. Prominence in S.-A. Jun

In S.-A. Jun, intonation is represented in terms of boundary tones, which suggests that prominence is by virtue of being an edge. H.-Y. Lee, on the other hand, assumes that pitch prominence falls on a metrically strong syllable, i.e., the first syllable of a lexical morpheme (see 3.1.1), and such pitch prominence is distinguished from the prominent pitch or pitch movement which indicates the end of a prosodic unit (i.e., 'Boundary Tone'). That is, S.-A. Jun and H.-Y. Lee are similar in the assumption that syllables at the edges of prosodic units have a special status to be associated with tones. At the same time,

however, they differ as to what makes the edge syllables special; for S.-A. Jun, it is being at a boundary, while for H.-Y. Lee, it is metrical strength.

One drawback in S.-A. Jun's assumption is that it requires a separate mechanism which determines and predicts accentual phrasing, while H.-Y. Lee is allowed to use the relative strength relation among PWs. So far, however, it has not yet been accounted for what causes or determines one PW to be associated with AP tones and become prominent in terms of pitch, while preventing others from the tonal association.

Part II

Studies on AP structure and peak alignment

4. AP Structure and alignment of the AP peak[38]

In the phonological model of Korean intonation (see 3.2), intonation has mainly been discussed in terms of two tonally defined prosodic units, Accentual Phrase (AP) and Intonation Phrase (IP). The AP is demarcated by the tonal pattern THLH (T=L or H) and IP by one of the nine boundary tones. The AP contours contain, as a rule, a F0 peak which is assumed to be the phonetic reflex of the initial H tone associated with the second syllable of an AP. The peak is phonetically aligned with either the second or the third syllable in the AP. Deviant peak alignment may be perceived as dialect coloured or slightly unnatural in certain contexts. However, alignment variation is treated as purely phonetic as long as it is within the limited range of the second and the third syllables. It is not yet known what conditions or affects the precise alignment of the peak.

Recent research in a range of different languages has shown that various factors may influence the alignment of F0 peaks and valleys, such as, focus type, the location of the tonal event in a prosodic unit and the structure of a prosodic unit. Focus type is reported to affect the peak alignment of the nuclear fall in European Portuguese (Frota 2002). The declarative contour in European Portuguese is made up of an initial rise and a fall (HL) in the last stressed syllable of the intonational phrase with a high plateau in between. Frota shows that the beginning and the end of the fall (i.e., H and L) are aligned later in narrow focus than in broad focus. In broad focus, the fall starts in the syllable immediately preceding the stressed syllable and ends in the stressed syllable. On the other hand, in narrow focus the fall starts in the stressed syllable and ends in the following unstressed syllable. Peak alignment is also affected by the location of the fall in the intonational phrase. When an intonational phrase starts with the nuclear fall [39], the peak

[38] Earlier version of this chapter was published as K. Kim (2011).

[39] Frota (2002) provides the following examples of the neutral and the focal falls in intonational phrase initial position. The stressed syllable is in capitals, the narrowly focused item in bold and the expected intonational phrasing is indicated with square brackets and 'I'.

Neutral : [As angoLAnas]I [ofereceram especiarias aos jornalistas]I
Focal : [**As angoLAnas** ofereceram especiarias aos jornalistas]I

'The Angolans gave spices to the journalists'

alignment is delayed by one syllable; in the neutral fall, the peak is placed in the stressed syllable, and in the focused fall, it is located in the post-stressed syllable[40].

Focus type is also reported to affect accent peak alignment in German (Baumann et al 2007, Braun 2007). The nuclear accent peak is aligned later in contrastive accent than in non-contrastive accent; the peak is aligned later in contrastive focus than in broad focus or narrow focus. That is, broad <contrastive and narrow<contrastive. In Baumann et al (2007) there was a strong tendency that the peak latency increases in the order of broad < narrow < contrastive, indicating that, possibly, different focus structures are reflected in the different degrees of peak latency. However, it was not found to be statistically significant (Baumann et al 2007). Similar reports are made on German pre-nuclear accents: contrast leads to later peak alignment (Braun 2006, 2007).

Whereas narrow (and contrastive) focus causes later peak alignment in European Portuguese and German, it is reported that the rising accent in European Spanish shows earlier peak alignment in narrow focus than in broad focus. Face (2001) shows that the peak in the rising accent occurs in the stressed syllable in narrow focus, whereas it occurs in the syllable following the stressed syllable in broad focus. He also notes that the accent location affects the speaker's decision on how to express narrow focus. The earlier peak alignment is more frequently used for the focus distinction in utterance initial accent. In non-initial accents, speakers tend to opt for raising the peak height rather than varying the peak alignment.

On the other hand, the alignment of the F0 turning point is affected by the structure of a prosodic unit. In French intonation, the AP tonal pattern is defined as LHiLH (Jun and Fougeron 2000). The initial L has been assumed to be associated with the initial syllable of the first content word (opposed to e.g., articles, prepositions) in an AP. However, Welby (2003) finds that the beginning of the AP initial LH rise may be aligned earlier. The initial low pitch elbow (created by the LHi) occurs at the boundary between the function word and the content word when the word is preceded by a function word.

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[40] It is worth noting that this delay in the peak alignment has a distinct effect on the alignment of the low end (i.e., L) in the neutral and focal falls. In the neutral fall, the peak latency does not affect the L alignment and the fall starts and ends in the stressed syllable. In the focal fall, the L alignment shifts to the next syllable together with the peak, and the fall occurs after the stressed syllable.

In this study, we hypothesise that the variation in the alignment of the AP peak in Korean is systematic and linguistically conditioned, and investigate if the peak alignment is affected by different linguistic factors. In the first production experiment, we test the three factors that have been reported to affect the alignment of peaks and valleys in other languages, namely, the AP location (represented by the presence/absence of the preceding AP), the AP structure (represented by the presence/absence of the second Phonological Word) and focus type. In the second experiment, based on the outcome of the first experiment, we examine the possible effect of the morpheme boundary and the presence of semantic content in the second morpheme on the peak alignment.

In 4.1, we will first give a brief description of Korean ToBI which this work is based on and examine the Korean AP structures and the peak alignment. This is followed by a detailed report of two production experiments where the variation in the AP peak alignment was investigated by measuring the distance from the beginning of the second AP syllable to the AP peak. In 4.3, the findings of the experiments and their theoretical implications are discussed.

4.1. Background

Here we briefly recap Korean ToBI (S.-A. Jun 2000) described in 3.2. We adopt the labeling conventions of the K-ToBI phonetic tone tier to describe AP contours, as they provide faithful representations of the contours without losing details, such as the syllable location of peaks and valleys. In addition, we discuss how the AP structure in Welby (2003) is applied in the investigation of the AP peak alignment in Korean and how it affects the AP peak alignment.

4.1.1. K-ToBI and the labeling conventions

Korean ToBI (S.-A. Jun 2000) is based on S.-A. Jun (1996, 1998) and assumes intonational units of two different levels, Intonation Phrase (IP) and Accentual Phrase (AP), which are tonally defined (see 3.2). Unlike other ToBI systems, K-ToBI (S.-A. Jun 2000) has two different tone tiers, a phonological tone tier and a phonetic tone tier. On the phonological tone tier, an AP is indicated with LHa at the boundary, since different AP

contours are assumed to be mere variants of the underlying TH-LH, and an IP with one of the nine boundary tones. On the phonetic tone tier, on the other hand, the AP contour shapes are precisely described by specifying F0 levels and turning points at up to four different locations: the F0 valley or peak in the AP initial syllable is labelled with L(ow) or H(igh); the high turning point on the second (or the third) syllable with +H; the low turning point in the AP penultimate syllable with L+; and the F0 target in the final syllable with La or Ha (see Figure 3.4 for the labelled contours).

In this paper, we adopt the labelling conventions of the K-ToBI phonetic tone tier to describe the AP contours for their faithful depiction of the contours. We adopted the use of La to describe the continuous F0 fall in the final syllable, even if the falling portion of the contour has no F0 valley in the final syllable of that AP. For that reason, the rising-falling contour is represented as L+H La even if the low F0 turning point is in the following AP.

4.1.2. AP structure and peak alignment

4.1.2.1. The structure of Korean APs

Research on a number of languages indicates that focus type, the location of pitch accent and the structure of a prosodic unit affect the alignment of the F0 peaks and valleys (see above). It is not difficult to find equivalent to the location of pitch accent and focus type in the investigation of the AP peak alignment in Korean. It was explained earlier in 1.1.2 that accentual phrasing (i.e., the placement of AP boundary) has identical functions to pitch accent in languages such as English. Thus, in many cases we can place an AP boundary in Korean where a pitch accent is used in English. However, the structure of a prosodic unit in Welby's (2003) investigation requires some explanations. In her investigation of French, Welby varied the number of function words (e.g., et, le) in the target APs, so that a content word was preceded by either one or two function words. A function word-content word sequence in French has two possible equivalents in Korean: a sequence of Phonological Word-Phonological Word and lexical morpheme-functional morpheme.

In Korean intonation models (H.-Y. Lee 1990, 1997, S.-A. Jun 1996, 2000, 2005), an AP is analysed as a lower level prosodic unit, Phonological Word (PW). In H.-Y. Lee's

model (1990, 1997), in particular, PW initial syllables (i.e., his 'stressed' syllables) are assumed to have a place in the prosodic structure as attractor of pitch prominence (see 3.1). There is some evidence that these initial syllables should be more receptive to tones and tonal movements. Lexical morphemes, which are placed at the beginning of PWs, had distinctive lexical tones in Middle Korean (see 2.1). By contrast, the following functional morphemes had predictable tones and their tonal contrast was lost first, eventually leading to the loss of the lexical tones in Seoul. It should be remembered that this is also characteristic of Korean tone dialects, South and North Kyungsang (see 2.2). One of the principle assumptions in the investigation of the dialects is that functional items have neutral tones (lexical tone view) or no tones (the pitch accent view). In addition, it was explained earlier in chapter 2 that vowel length is a rapidly disappearing trace of the Middle Korean lexical tones, and underlyingly long vowels are short in PW initial positions, but realised long in AP initial positions, where tones are assumed to be assigned and associated with syllables (see chapter 3). These may be taken as the indications that, as H.-Y. Lee assumes, PW initial syllables have 'potentials' (i.e., metrical strength) to attract pitch prominence (or tones). At the same time, these may well be taken as the indications that the underlying representation of lexical morphemes includes tonal specification. Either way, this suggests that PW initial syllables possibly influence the alignment of tonal targets.

In addition, it should be noted that the alignment characteristics of the French AP initial rise becomes distinct when a function word precedes a content word, which suggests that the alignment demarcates the content word and is affected by the difference in the semantic weight or the presence/absence of semantic content. The function word-content word boundary of French is comparable to the lexical morpheme-functional morpheme boundary of a Korean AP. Since Korean is an agglutinative language, the elements corresponding to the French 'function words' are all postpositional and dependent morphemes, and they form a PW together with the preceding lexical morpheme. An AP contains, as a rule, one or two PWs and possibly more. However, it rarely contains more than one PW, when a PW has dependent positional elements, such as, case markers (see (4.1) below), which are usually referred to collectively as 'particles'.

(4.1)

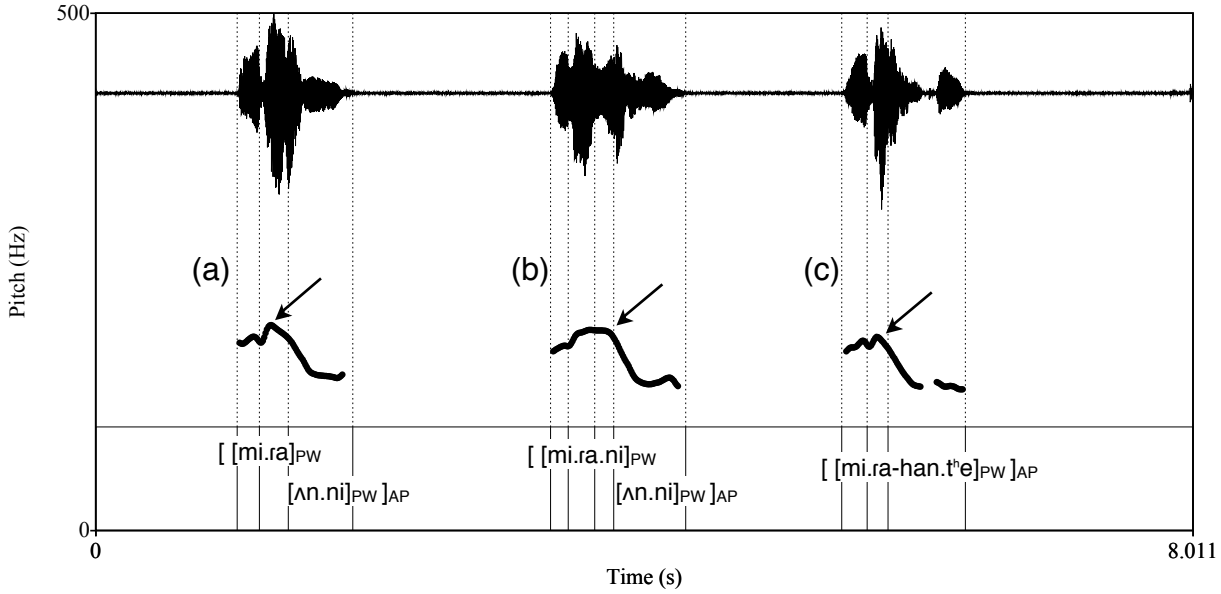
/paŋ.-e.s^{h}ʌ/ ‘room’-‘in‘	‘in the room’
/paŋ.-e.s^{h}ʌ.-do/ ‘room’-‘in’-‘too‘	‘in the room, too’
/a.gi.-e.ge/ ‘baby’-$_{\text{dative case marker}}$	‘to the baby’
/a.gi.-e.ge-man/ ‘baby’-$_{\text{dative case marker}}$-‘only’	‘only to the baby’

It would not be surprising if, similarly to French, the AP peak alignment demarcates the end of a lexical morpheme in Korean, and/or it is affected by the difference in the semantic weight or the presence/absence of the semantic content.

4.1.2.2. Phonological Words and the AP peak alignment

An AP usually contains one or two Phonological Words with five syllables or less. In an AP with two Phonological Words, the first word is typically two or three syllables long. Note that the AP peak (i.e., the first H peak of the TH-LH pattern) falls in the second or the third syllable of an AP, which suggests that the presence of the Phonological Word is likely to affect the alignment of the AP peak. Even though PW initial syllables are assumed to be metrically strong and attract pitch prominence, the peak does not seem to fall on the initial syllable of the second PW. Rather, it seems that the AP peak is aligned immediately before the second PW. Consider [[mi.ɾa]$_{PW}$ [ʌn.ni]$_{PW}$]$_{AP}$ and [[mi.ɾa.n-i]$_{PW}$ [ʌn.ni]$_{PW}$]$_{AP}$, for instance. The two APs are very similar segmentally and structurally. They both consist of two Phonological Words; a girl’s name /mi.ɾa/, or /mi.ɾan/, and the following /ʌn.ni/ ‘elder sister’ meaning ‘elder sister Mira’ and ‘elder sister Miran’, respectively. The difference lies in the number of syllables in the first Phonological Word. [mi.ɾa.n-i]$_{PW}$ in the second AP contains three syllables, as the suffix /-i/, which helps the pronunciation (Yonsei Institute of Language and Information Studies 1998), causes the resyllabification of /ɾan/ to /ɾa.n-i/. Note that the AP peak occurs at the end of the first Phonological Word in both the APs (see the illustration in (4.2) below). The peak (indicated with an arrow) is aligned in the second syllable in (4.2-a) where the first word contains two syllables. On the other hand, it is aligned in the third syllable in (4.2-b) where the first word contains three syllables. Also consider (4.2-c) the one-word AP [[mi.ɾa.-han.t^{h}e]$_{PW}$]$_{AP}$ ‘Mira’ -$_{\text{dative case marker}}$, which has the peak in the second syllable.

(4.2)



The alignment of the AP peak in Korean is similar to that of the beginning of the AP initial LH rise (LHi) in French in that it is near/at the word level unit boundary. It is particularly so, when the different word order and morphology[41] is taken into consideration. The F0 valley created by the LHi of a French AP is aligned at the beginning of a content word when the content word is preceded by a function word, and Welby (2003) assumes that the initial L (of the LHi) is associated with the edge of a content word rather than the initial syllable of the first content word of an AP (Jun and Fougeron 2000). The similar alignment characteristics the AP peak in Korean (cf. (4.2) above) suggests that the AP initial H tone, too, is possibly associated with the edge of a prosodic unit or a morpheme rather than a specific syllable.

The 'function word-content word' structure of the French APs is comparable to the 'Phonological Word-Phonological Word' structure of the Korean APs in the sense that they contain a sequence of word level units. At the same time, the structure is also comparable to a Korean one-word AP with a 'lexical morpheme-functional morpheme' in the sense that one element has semantic content and the other is functional. This suggests that the AP

[41] Note that, contrary to French, functional (and dependent) elements, such as particles, follow content word(s) in Korean. That is, French has a function word-content word sequence, while Korean has content word-function word

peak alignment in Korean is also likely to be affected by the boundary location between the lexical and functional morpheme (see 4.1.2.1 for the details on the AP structures) as much as by the presence of the second PW (see (4.2), for instance)

We assume that prosody is more likely to be affected by the presence of a second PW in the AP, than the morphological structure of words within an AP. We start the production experiment by testing this assumption. We assume that the AP peak is by default aligned with the second AP syllable which the H tone is associated with (see 3.2). It is also assumed that the peak is aligned at the end of the first word, when an AP contains two Phonological Words (or more). We assume that the initial syllable of the second PW attracts the peak to be aligned in this syllable but the alignment is restrained by the Phonological Word boundary. This assumption on the peak alignment will be tested together with the assumption that the peak alignment is also affected by sentence length (i.e. the presence/absence of the preceding AP) and focus type.

4.2. Production experiment

Under the assumption that variation of the AP peak alignment is systematic and linguistically conditioned, we attempted to seek the answer to the question what conditions the peak alignment in Korean. As the F0 peak is assumed to be the phonetic reflex of the H tone associated with the second syllable of an AP, we measured the distance from the beginning of the second syllable to the peak and examined if the AP peak alignment is affected by the following factors; the AP structure, which is varied with the number of Phonological Words in an AP; the AP location in an utterance, varied by the presence or absence of the preceding AP; and focus type, varied between broad and narrow focus. Following the results of the investigation, we additionally examined the effect of the morpheme boundary location and the presence of semantic content in the second morpheme in Experiment 2.

In constructing the test material, constraints were imposed by the testing factors placing restrictions on the morpheme boundary location and the use of the particles. The material in Experiment 1 was constructed primarily considering the factors in Welby's work

on French (2003, see also 4.1.2.), namely, the presence of the second Phonological Word or the morpheme boundary. This means that the initial Phonological Word of the two-word AP cannot contain more than one morpheme, if we are to investigate the effect of the second Phonological Word on the AP peak alignment without morpheme boundary as a confounding factor.

At the same time, the first word has to be longer than two syllables in order to demonstrate the effect of the PW on peak alignment. It should be noted that we assume that the second AP syllable is the default location of the AP peak and that the presence of the second PW causes the peak to be aligned at the word boundary (see 4.2.1 below). If the first PW of the two-word AP contains only two syllables, then, according to this assumption, the peaks in both the one-word and the two-word APs would be placed equally in the second AP syllable, and the effect of the second PW cannot be identified. Therefore, the first PW in the two-word AP has to be a single morpheme and contain three syllables or more, if the influence of the second PW is to be investigated. Therefore, for instance, /mi.ɾa.n-i/ in [[mi.ɾa.n-i]$_{PW}$ [ʌn.ni]$_{PW}$]$_{AP}$, 'Miran' (a girl's name)-$_{suffix}$ 'elder sister' (meaning 'elder sister Miran') cannot be employed as the first Phonological Word of the target two word AP, as it contains the suffix /-i/.

Korean morphemes as long as three syllables are not common. Furthermore, the 'one morpheme' condition restricts the use of Sino-Korean words, which constitute up to approximately 50~60% of the Korean vocabulary (Sohn 2001). In theory, individual syllables of Sino-Korean words may be regarded as separate morphemes as well as the whole or parts of the words. For that reason, by nature, morphemes and morpheme boundaries are not clear in Sino-Korean words and different speakers may interpret the morphological structure of the identical word differently. For instance, /tsa.doŋ.tɕʰa/ 'automobile, car' may be interpreted as one morpheme. It may also be interpreted as /tsa.doŋ.-tɕʰa/, since /tsa.doŋ/ 'automatic' and /tɕʰa/ 'car' are frequently used on their own, too (cf. /tsa.doŋ.mun/ 'automatic door' possibly as /tsa.doŋ.-mun/ and /kjʌŋ.tɕʰal.tɕʰa/ 'police (patrol) car' as /kjʌŋ.tɕʰal.-tɕʰa/).

Contrary to the two-word AP, the one-word AP may contain a morpheme of any length as well as clitics, as it is assumed that the peak is aligned with the second syllable regardless of the morphological structure of the PW/AP. However, if the morpheme is

longer than two syllables, but shorter than three in the two-word AP, and if the AP peak is not aligned in the default second AP syllable, but, nonetheless earlier than in the two-word AP, then, the earlier peak alignment should be attributed to the shorter length of the morpheme. That is, by placing the morpheme boundary inside the third syllable in the one-word AP, we can try out if a morpheme boundary affects the peak alignment. For the sake of convenience, I will refer to the morpheme length simply as '2½ syllable'.

While the morpheme restriction on the two-word phrase requires a long phrase for Korean, the test factor focus type allows only a limited use of particles, which essentially shortens the length of the one word phrase. Particles in Korean are all bound morphemes, and they specify and/or emphasise the grammatical functions (e.g., case) and/or the meaning of the item which they are attached to. The target phrases have to be restricted in the use of particles in order to be employed as the answers to both the broad and narrow focus inducing questions. For instance, the target one-word phrase in (4.3) can be easily made into a five syllable phrase by adding a particle -ɾo[42] 'to', i.e., /mi.ɾa.n-i.ne.-ɾo/ instead of /mi.ɾa.n-i.ne/, so that the number of syllables in both one and two-word phrases are equal. However, in that case, the one-word sentence can be used only as the answer to the question that specifically asks for the direction, as -ɾo induces narrow focus on the target phrase.

Since the target APs in Experiment 1 differed in the numbers of syllables, four and five syllables, respectively, we restricted our investigation of the peak alignment to one type of AP contour, L+HLa (see Figure 3.4 and also 4.1.1 for the use of La in this chapter), for its lack of apparent final tonal targets[43]. In S.-A. Jun's intonation model (see 3.2), which provides the theoretical basis for this work, it is hypothesised that all the varying pitch contours shown in Figure 3.4 are mere phonetic variants of the identical AP tonal pattern TH-LH. However, the alignment of peaks and valleys may vary due to the realisation of different tonal targets. For instance, all else being equal, the AP peak (i.e., +H) alignment in L+H L+ Ha may be earlier than in L +H Ha due to the realisation of the second L tone. Unlike in L +H Ha where only three of the four tones are realised, in L+HL+Ha all four are

[42] /-ɾo/ simply adds directionality to the meaning of the lexical item it is attached to and may actually be translated as any preposition (or, in certain cases, adverb) in English that indicates direction, e.g. /wi-ɾo/ "up"-"to" meaning "upward" or "up".

[43] Also, the speakers employed L+HLa far more consistently than L+HL+Ha, for instance. Targeting L+HL +Ha frequently resulted in the use of other contour shapes, notably, L+HHa and L+HLa.

realised. The presence of the pitch valley (i.e., L+) may force the initial peak, +H, to be earlier than in L +H Ha, as the realisation of the second L tone requires more room. By opting for a contour shape that lacks final tonal targets, it was intended to reduce the influence of the tonal space on the peak alignment.

4.2.1. Experiment 1

In Experiment 1, following assumptions are made and tested. We assume that the peak alignment is affected by the AP structure (i.e., the number of Phonological Words in an AP), sentence length (i.e., the presence or the absence of an AP before the target AP) and focus type. We assume that the AP initial H tone is associated with the second AP syllable and the AP peak is aligned with the syllable as default. However, when an AP contains two Phonological Words (or more), the peak is aligned at the end of the first word, because the initial syllable of the second PW (see 4.1.2) attracts the peak to be aligned in the syllable, but the alignment is blocked by the PW boundary. We also assume that the alignment of the AP peak is affected by the presence/absence of the preceding AP and its presence causes later peak alignment in the following target AP. That is, the AP peak is earlier in short sentences where the target AP is in utterance initial position than in long sentences where the AP is preceded by another AP. In addition, we look into focus intonation by hypothesising that narrow focus in Korean is marked by later peak alignment and higher tonal scaling than in broad focus.

ASSUMPTIONS

① The AP peak is aligned with the default second AP syllable. However, when an AP contains more than one PW, the peak is aligned at the end of the first word, due to the influence of the word boundary and the initial syllable of the second word (see 4.1.2.2).

② The AP peak is aligned later, when there is a preceding AP.

③ Narrow focus is marked by later peak alignment and higher tonal scaling.

4.2.1.1. Procedure

Material The material consists of sets of casual conversational style questions and answers. The questions were constructed to induce different focus types, broad or

narrow focus, in the answers. To induce broad focus, questions such as, ‘what happened?’ and ‘what’s new?’ are commonly used in focus investigations. However, in this study ‘What did you do?’ was used instead, since the questions ‘what happened?’ and ‘what’s new?’ require a subject and the thematic subject particle, /-(i)ga/ in the answers, which places emphasis on the subject. The questions in the material should induce focus on the target phrase, the first phrase of the sentences (4.3) and (4.4), regardless of the focus type (The target phrase is in bold face in the gloss).

The base sentences are presented in (4.3) and (4.4); ‘I’ve been to Miran’s (home)*’* and ‘I saw ‘Princess Aurora*’* (the title of a movie)’. The expected accentual phrasing is represented with square brackets and ‘$_{AP}$’, e.g., [mi.ɾa.n-i.ne]$_{AP}$, in the transcription. The sentences differ mainly in the structure of the target first phrase; the initial phrase contains one Phonological Word in (4.3) and two PWs in (4.4). The one-word phrase consists of a content morpheme (opposed to the largely functional clitics) /mi.ɾan/ ‘Miran (a girl’s name)’ and a suffix /-i.ne/ ‘(someone’s) home, family’, meaning ‘Miran’s home’. ‘Miran’ contains two syllables, however, the boundary is placed in the third syllable due to resyllabification. On the other hand, the two-word phrase contains /o.ɾo.ɾa/ ‘Aurora’ and /koŋ.dʑu/[44] ‘princess’, i.e., ‘Princess Aurora’ (the title of a well-known movie). Phonological Words are marked with square brackets and ‘$_{PW}$’, e.g., [o.ɾo.ɾa]$_{PW}$, in the transcription.

(4.3)

[[mi.ɾa.n-i.ne]$_{PW}$]$_{AP}$ [ka.s’ʌ.s’ʌ.jo]$_{AP}$
Miran-home went

‘I’ve been to Miran’s.’

(4.4)

[[o.ɾo.ɾa]$_{PW}$ [goŋ.dʑu]$_{PW}$]$_{AP}$ [pwa.s’ʌ.jo]$_{AP}$
Aurora **princess** saw

‘I saw ‘Princess Aurora.’

[44] The lenis voicess velar plosive in the initial syllable (i.e. the onset consonant) of /koŋ.dʑu/ becomes voiced in /o.ɾo.ɾa.goŋ.dʑu/, as it is in intervocalic position.

The location of the target phrases was varied between the sentence initial and medial position by placing a phrase at the beginning of the base sentences. The target one word phrase (marked in bold face in the gloss) was preceded by /sʰim.sʰi.mɛ.sʰʌ/ ‘(because I was) bored’ in the long one-word sentence, (4.5). The sentence was used as the answer to both the broad and narrow focus inducing questions.

(4.5)

[sʰim.sʰi.mɛ.sʰʌ]$_{AP}$ [mi.ɾa.n-i.ne]$_{AP}$ [ka.s’ʌ.s’ʌ.jo]$_{AP}$
bored **Miran- home** went

‘I was bored, so I’ve been to Miran’s.’

(4.6)

[jʌ.dza.tɕʰin.gu.- ɾaŋ]$_{AP}$ [[o.ɾo.ɾa]$_{PW}$ [goŋ.dʑu]$_{PW}$]$_{AP}$ [pwa.s’ʌ.jo]$_{AP}$
girlfriend-with **Aurora** **princess** saw

‘With my girlfriend I saw ‘Princess Aurora’.

(4.7)

[ʌ.dze.nɯn]$_{AP}$ [[o.ɾo.ɾa]$_{PW}$ [goŋ.dʑu]$_{PW}$]$_{AP}$ [pwa.s’ʌ.jo]$_{AP}$
yesterday -$_{particle}$ **Aurora** **princess** saw

‘Yesterday I saw ‘Princess Aurora’.

The target two-word phrase was preceded by different phrases, /jʌ.dza.tɕʰin.gu.-ɾaŋ/ ‘with (my) girlfriend’[45] in the broad focus sentence (4.6) and /ʌ.dze.nɯn/ ‘yesterday’ in the narrow focus sentence (4.7). The dialogues containing the long two-word sentences are shown in (4.8) and (4.9) and the target two-word phrase is shown in bold face in the gloss (see the Appendix I for the full material). In the long broad focus sentence (A in (4.8)), ‘with (my) girlfriend’ is new information, as it is newly introduced into the conversation. In the long narrow focus sentence (A in (4.9)), on the other hand, ‘yesterday’ is given information, as it was already mentioned in the question. Therefore, unlike the long one-word sentences, the focus type distinction is aided by the information status of the sentence initial phrase in the long two-word sentences. If the narrow focus intonation displays

[45] This was replaced with ‘with (my) boyfriend’ for female speakers.

distinct characteristics in the long two-word sentences from the long one word sentences, the distinction may be attributed to the different information structure of the initial phrase.

(4.8)

TWO WORD - LONG BROAD FOCUS

(Situation: On Monday, during a coffee break at work, you are having a chat with a colleague/friend.)

Q: What did you do at the weekend?

A: [jʌ.dza.tɕʰin.gu.- ɾaŋ] [[o.ɾo.ɾa]$_{PW}$ [goŋ.dʑu]$_{PW}$]$_{AP}$ [pwa.s'ʌ.jo]
girlfriend - with Aurora princess saw

'With my girlfriend I saw 'Princess Aurora'.

(4.9)

TWO WORD - LONG NARROW FOCUS

(Situation: On Monday, during a coffee break at work, you are having a chat with a colleague/friend.)

Q: What movie did you see yesterday?

A: [ʌ.dze.nɯn] [[o.ɾo.ɾa]$_{PW}$ [goŋ.dʑu]$_{PW}$]$_{AP}$ [pwa.s'ʌ.jo]
yesterday -$_{particle}$ **Aurora princess** saw

'Yesterday I saw 'Princess Aurora'.

Speakers and recording Six native speakers of Seoul Korean (four male and two female) in their late 20s and 30s participated. They were all residents of Germany at the time of the experiment and the duration of their stay ranged from six months to four years. They all reported speaking Korean daily.

The recording was made in the sound attenuated booth at IfL-Phonetics. The target sentences were embedded in eight dialogues (see the Appendix I). They were quasi-randomly ordered with fillers and presented on the cards with the participant's lines highlighted. The author took up the role of the second speaker and asked the focus inducing questions. The participants were instructed to 'answer' the questions with the

provided sentences rather than to read out. Other than that no further instructions were given. Approximately 10 repetitions for each condition[46] per speaker (10 x 8 x 6) were recorded directly on to a computer disk in 16 bit at the sampling rate of 44100 Hz.

Prosodic analysis We expected that short sentences (4.3)~(4.4) would be produced typically with two APs and long sentences (4.5)~(4.7) with three. We also expected L +H La and L La pitch contours for the APs in the target base sentences. The majority of the utterances were produced with the anticipated phrasing and AP contours. Some speakers, however, and one of the female participants (LSE), in particular, occasionally produced the long 'Miran' sentence (4.5) with two APs, when it was in narrow focus. These were excluded from further analysis. This provided 471 utterances for labeling and analysis.

Measurements Using Praat (Boersma and Weenink 2010), the beginning and the end of each AP and syllable were labelled. The F0 maximum in the target AP was located and the distance from the beginning of the second syllable, which is hypothesised to be associated with the AP initial H tone, to the peak was measured (represented in Figure 4.1). The measured distance was then divided by the duration of the second syllable and represented as a ratio of the second syllable for the comparison between different target sentences and speakers (see Table 4.1 for the normalised peak distance). The calculated value smaller than 1 indicates that the peak occurs in the second syllable and the value greater than 1 indicates that the peak is located in the third syllable. For instance, the normalised peak distance 0.75 indicates that the peak is found about three quarters into the second syllable. Values above 1 indicate that the peak is in the third syllable.

[46] There were total of eight conditions, two conditions for each of the three control factors; Number of Phonological Words × AP location × focus type (2 x 2 x 2).

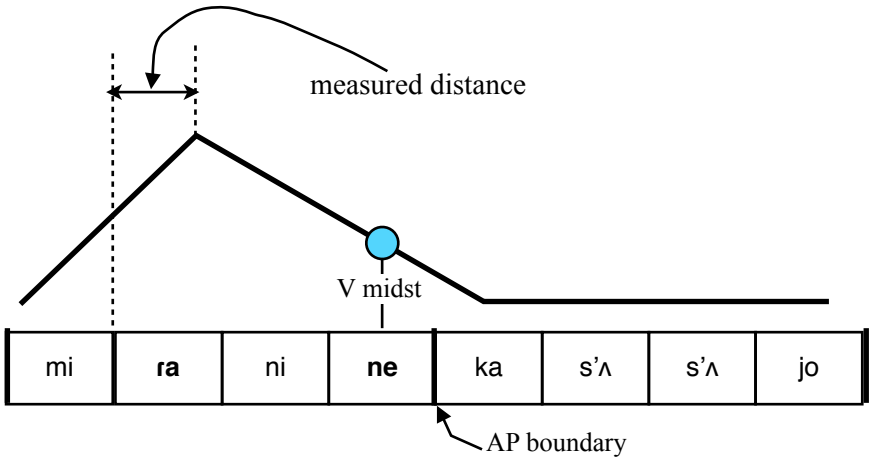


Figure 4.1. Measures for the AP peak distance.

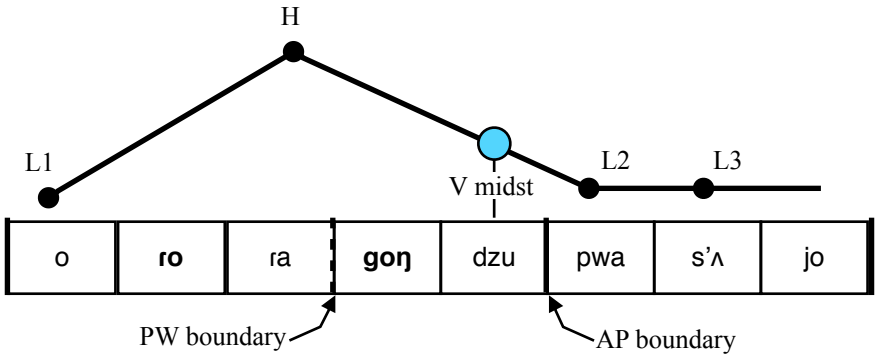


Figure 4.2. Locations for F0 extraction.

For tonal scaling, F0 values were measured at the vowel centre of the assumed L tone syllables in the AP initial and the IP penultimate positions, as well as the peak F0 value (H in Figure 4.2). In addition, F0 values were extracted at the vowel centres of the syllables /goŋ/ (in (4.4), (4.6) and (4.7)) and /ne/ (in (4.3) and (4.5)) to investigate the influence of the AP structure on the focus intonation. /goŋ/ starts the second Phonological Word of the two-word AP [[o.ɾo.ɾa]$_{PW}$ [goŋ.dʑu]$_{PW}$]$_{AP}$ 'Princess Aurora' and /ne/ is in the corresponding location in the one-word AP [mi.ɾa.n-i.ne]$_{AP}$ 'Miran's home'. The F0 values were measured at the following locations:

- at the F0 peak of the target AP (e.g., H in Figure 4.2)
- at the vowel centre of the assumed L tone syllables L1, L2 and L3 (in bold face below in the phonetic transcription. See also, e.g., in Figure 4.2) ;

  mi, ka, s'ʌ in one word sentence [mi.ɾa.n-i.ne]$_{AP}$ [ka.s'ʌ.s'ʌ.jo]$_{AP}$
  o, pwa, s'ʌ in two word sentence [o.ɾo.ɾa.goŋ.dʑu]$_{AP}$ [pwa.s'ʌ.jo]$_{AP}$

- at the vowel centre of the initial syllable of the second Phonological Word in (4.4), (4.6) and (4.7) and the corresponding syllable in (4.3) and (4.5);

  /ne/ and /goŋ/

The F0 values of L1, L2, L3 and H were normalised in semitones for the comparison of the intonation in broad and narrow focus sentences. The reference value was the mean F0 value of the L1, i.e., the F0 of /mi/ and /o/, in long broad focus sentences and it was calculated for individual speakers (see Appendix II). However, the syllables /ne/ and /goŋ/ were scaled against the initial syllables of the APs that they belong to and their reference values differed in each category and individual (see Appendix II). The syllable /ne/ was scaled against /mi/, which is the AP and Phonological Word initial syllable. The syllable /goŋ/, the initial syllable of the second Phonological Word in the AP [[o.ɾo.ɾa]$_{PW}$ [goŋ.dʑu]$_{PW}$]$_{AP}$, was scaled against the initial syllable of the first Phonological Word, /o/, which is, at the same time, the AP initial syllable.

4.2.1.2. Results

Peak alignment The measured peak distance (see Figure 4.1) was normalised and represented as a ratio of the second syllable (see Table 4.1). The normalised values were subjected to a repeated-measures ANOVA with the factors NO. OF WORDS, SENTENCE LENGTH and FOCUS TYPE. There is a significant main effect of NO. OF WORDS ($F(1, 5)=8.021$, $p<0.05$) on peak alignment: The peak is aligned earlier in one-word APs than in two-word APs. There is also a significant main effect of SENTENCE LENGTH ($F(1, 5)=7.879$, $p<0.05$) : The AP peak is aligned earlier in short sentences than in long sentences. That is, the peak was earlier when the AP is in utterance initial position, in other words the presence of a preceding AP leads to later peak alignment. However, no effect of FOCUS TYPE was reported.

There is an interaction SENTENCE LENGTH × FOCUS TYPE ($F(1, 5)=10.847$, $p<0.05$). This indicates that the focus type has a different effect, depending on sentence length. Comparison of the mean peak location shows that narrow focus leads to earlier alignment in short sentences. The two-way interaction indicates that the early alignment in short narrow focus sentences is statistically significant. However, the interaction NO. OF WORDS × SENTENCE LENGTH × FOCUS TYPE ($F(1, 5)=7.298$, $p<0.05$) indicates that this is actually due to the early peak alignment in the narrowly focused short two-word sentences. In two-word APs, narrow focus has a distinct effect on peak alignment in short and long sentences. In short sentences, the peak is aligned earlier in narrow focus than in broad focus, whereas in long sentences it is aligned later in narrow focus than in broad focus. In one-word APs, narrow focus has a similar effect in long and short sentences and the peak is aligned later in narrow focus.

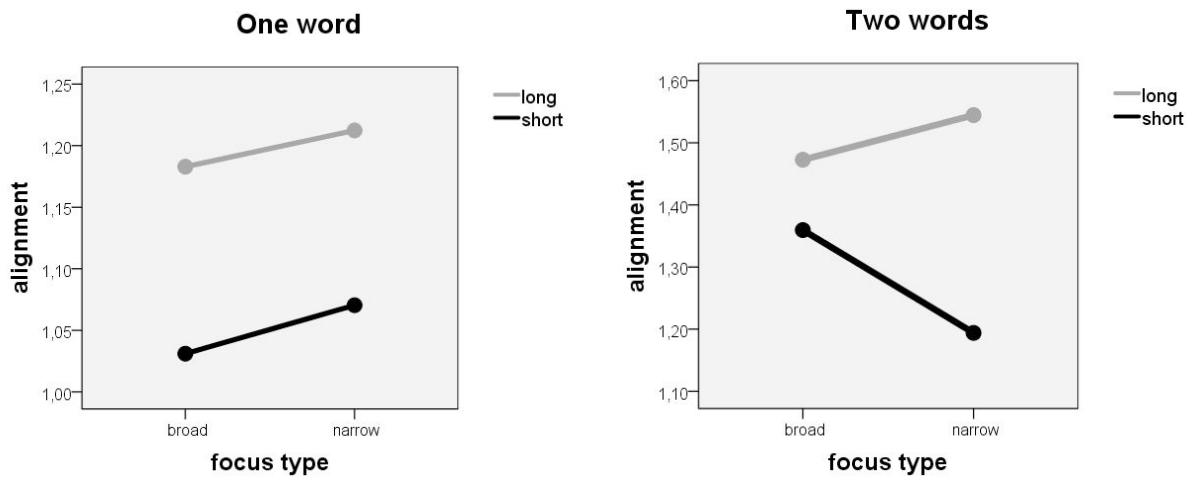


Figure 4.3. Interaction graphs of NO. OF WORDS × SENTENCE LENGTH × FOCUS TYPE. *The interaction* SENTENCE LENGTH × FOCUS TYPE *is presented in separate graphs according to the number of Phonological Words in an AP.*

	one -word AP (Miran)				two -word AP (Aurora)			
	long		short		long		short	
Speaker	broad	narrow	broad	narrow	broad	narrow	broad	narrow
M1	1.11	1.16	0.90	0.98	1.39	1.34	1.17	0.85
M2	0.93	0.97	0.58	0.78	1.36	1.62	0.85	0.82
M3	1.38	1.51	1.46	1.33	1.43	1.46	1.34	1.13
M4	1.25	1.19	1.19	1.28	1.40	1.65	1.61	1.50
F1	1.09	0.96	0.86	0.86	1.65	1.63	1.55	1.41
F2	1.35	1.49	1.20	1.19	1.61	1.57	1.63	1.45
Mean	1.18 (0.07)	1.21 (0.1)	1.03(0.13)	1.07 (0.09)	1.47 (0.05)	1.55 (0.05)	1.36 (0.12)	1.19 (0.13)

Table 4.1. Normalised peak distance. The table presents the peak distance for each speaker in each category. The measured peak distance (see Figure 4.1) was normalised by dividing it with the duration of the second AP syllable. The mean and the standard error (in brackets) is presented for each individual in the bottom row.

Scaling of the AP peak A three-way ANOVA (repeated-measures) with factors NO. OF WORDS, SENTENCE LENGTH and FOCUS TYPE shows that there are main effects of SENTENCE LENGTH ($F(1,5)=9.522$, $p<0.05$) and FOCUS TYPE ($F(1,5)=58.959$, $p<0.01$). The peak is scaled higher ($F(1,48)=9.928$, $p<0.01$) in short sentences than in long sentences and in narrow focus than in broad focus. The interaction of NO. OF WORDS × FOCUS TYPE is reported ($F(1,5)=7.708$, $p<0.05$). The effect of narrow focus is bigger in the one-word sentences and the pitch peak is scaled higher in the one-word sentences than in the two-word sentences. There also was a three-way interaction of NO. OF WORDS × SENTENCE LENGTH × FOCUS TYPE ($F(1,5)=26.105$, $p<0.01$). This indicates that SENTENCE LENGTH affected NO. OF WORDS × FOCUS TYPE differently. The interaction graph (Figure 4.4) shows that the effect of narrow focus was weaker in two-word sentences than in one-word sentences; in short two-word sentences, the peak is barely affected by narrow focus and scaled approximately the same in broad and narrow focus sentences. Contrary to the short two-word sentences, the peak in long sentences is affected by narrow focus and scaled higher in narrow focus (see the right panel of Figure 4.4). The three-way interaction indicates that the higher peak scaling in long two-word narrow focus sentences is statistically significant.

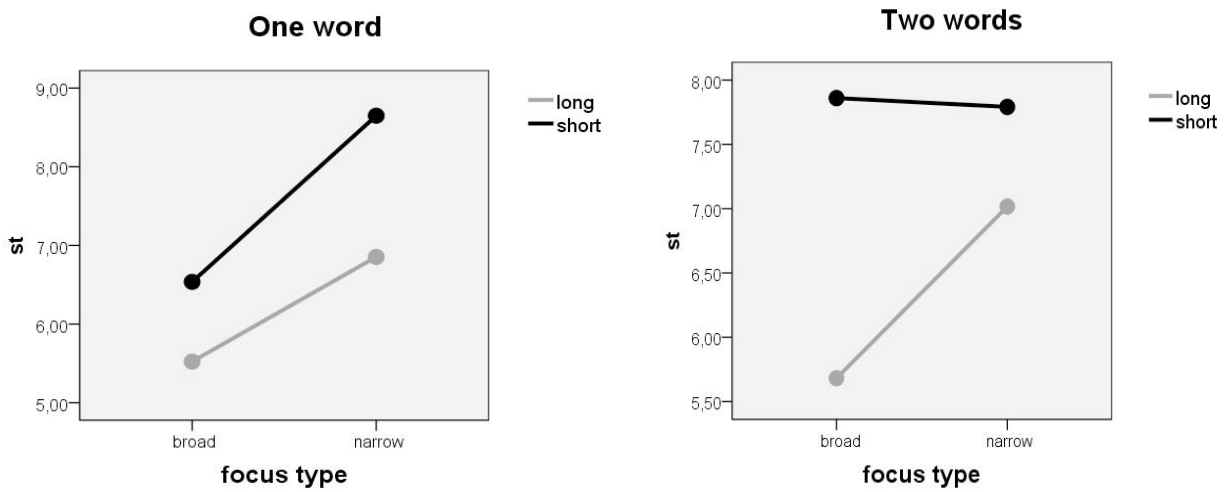


Figure 4.4. Interaction graphs of NO. OF WORDS × SENTENCE LENGTH × FOCUS TYPE *in AP peak scaling.*

Scaling of the L tones Since the distance between L2 and L3 was different in the the one-word and the two-word sentences, the one-word and the two-word sentences were subjected to a repeated-measures ANOVA separately with factors SENTENCE LENGTH, FOCUS TYPE and L-TONE LOCATION to understand the L tone scaling better. In one-word sentences, only the main effect of L-TONE LOCATION was reported significant ($F(2,10)=3.603$, $p<0.001$). L-TONE LOCATION interacted with SENTENCE LENGTH ($F(2,10)=4.153$, $p<0.05$). The scaling difference among L tones is greater in short sentences than in long sentences and this is largely due to the high L1 in the short sentences. The L-TONE LOCATION × SENTENCE LENGTH interaction indicates that higher L1 scaling in the short sentences is significant. L-TONE LOCATION interacted with FOCUS TYPE ($F(2,10)=6.575$, $p<0.05$), too. The L tones in narrow focus sentences are scaled higher than in broad focus. The interaction plot (the left panel in Figure 4.5) shows that the L tones in broad focus sentences fall in equal steps, that is, the difference between L1 and L2 is approximately the same as L2 and L3. However, in narrow focus, they fall steeper between L2 and L3, and L3 is scaled at a similar level in both broad and narrow foci. The L-TONE LOCATION × FOCUS TYPE interaction indicates that the higher scaling of L1 and L2 is significant in narrow focus sentences.

In the two-word sentences, too, only the main effect of L-TONE LOCATION ($F(2,10)=39.431$, $p<0.001$) was significant. FOCUS TYPE was not significant ($p=0.05$), and the L tones are scaled higher in narrow focus. The interaction effect of SENTENCE LENGTH × FOCUS TYPE was reported ($F(1,5)=13.587$, $p<0.05$). Narrow focus raises the L tone scaling

in long sentences, whereas it barely affects the L tones in short sentences. The two-way interaction indicates that the higher tonal scaling in the long narrow focus sentences is significant. There were interaction effects of L-TONE LOCATION × SENTENCE LENGTH ($F(1.032, 5.161) = 15.952$, $p<0.05$, Greenhouse-Geisser corrected) and L-TONE LOCATION × FOCUS TYPE ($F(2,10) = 12.513$, $p<0.01$). L1 is scaled higher in the short sentences than in the long sentences and in the narrow focus sentences than in the broad focus. On the other hand, L2 and L3 were affected little by the sentence length and the focus type and remained constant (see the right panel of Figure 4.5). The interactions L-TONE LOCATION × SENTENCE LENGTH and L-TONE LOCATION × FOCUS TYPE indicate that the higher scaling of L1 is statistically significant in the short and the narrow focus sentences, respectively.

It should be noted that L-TONE LOCATION × FOCUS TYPE is reported significant in both one-word and two-word sentences. Nevertheless, the interaction has a very distinct effect (see Figure 4.5); in the one-word sentences, narrow focus raises the scaling of L1 and L2, whereas in the two-word sentences, only L1 is scaled higher in narrow focus.

No. of words	length	focus type	L-tone location	Mean (st)	Std. error
one word (Miran)	long	broad	L1	0.43	0.22
			L2	-0.91	0.48
			L3	-2.85	0.42
		narrow	L1	1.04	0.28
			L2	-0.24	0.47
			L3	-2.63	0.40
	short	broad	L1	1.47	0.22
			L2	-0.94	0.81
			L3	-3.06	0.49
		narrow	L1	2.21	0.17
			L2	0.93	0.77
			L3	-2.66	0.45
two words (Aurora)	long	broad	L1	-0.49	0.24
			L2	-2.23	0.31
			L3	-2.94	0.47
		narrow	L1	0.41	0.30
			L2	-1.86	0.30
			L3	-2.72	0.44
	short	broad	L1	1.50	0.41
			L2	-1.71	0.67
			L3	-2.84	0.67
		narrow	L1	2.32	0.34
			L2	-2.14	0.61
			L3	-3.13	0.67

Table 4.2. Scaling of the L tone syllables in each category. The mean is in semitone (see also the Appendix II for the reference Hz values and the L and H tone scaling of the individual speakers).

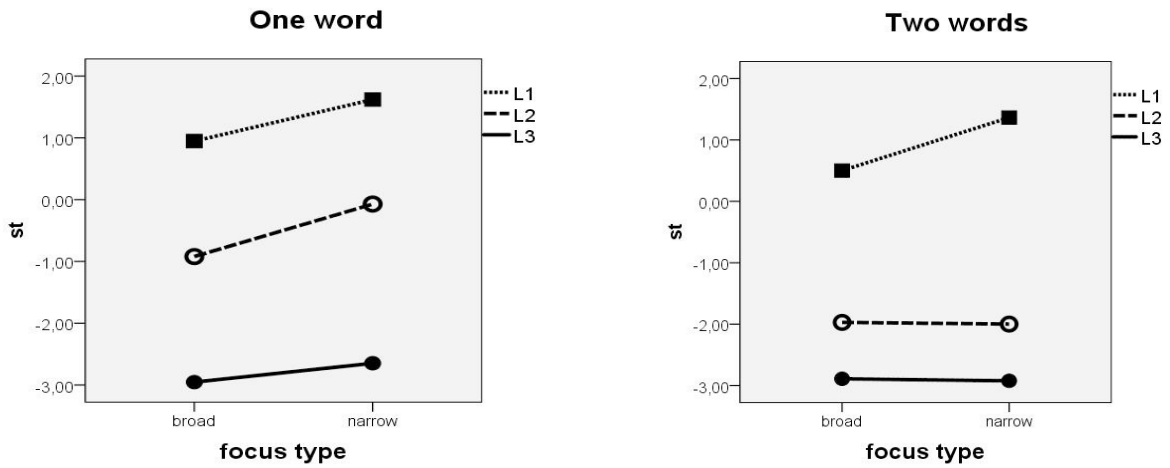


Figure 4.5. Interaction graphs of L-TONE LOCATION × FOCUS TYPE *in the one-word sentences (on the left) and the two-word sentences (on the right).*

Scaling of the syllables /ne/ and /goŋ/ The syllable /ne/ was scaled against its PW initial syllable /mi/ in [mi.ɾa.n-i.ne]$_{AP}$. The syllable /goŋ/, which is the initial syllable of the second PW in the AP [[o.ɾo.ɾa]$_{PW}$ [goŋ.dʑu]$_{PW}$]$_{AP}$, was scaled against the initial syllable of the first PW, /o/. It should be noted that the reference syllables /mi/ and /o/ are both the initial syllables of the APs that the target syllables /ne/ and /goŋ/, respectively, belong to, and the results only reflect the relative pitch heights of the target syllables within the APs.

We ran two separate ANOVAs (repeated-measures, factors SENTENCE LENGTH and FOCUS TYPE) on /ne/ and /goŋ/, respectively. No significant main or interaction effects is reported in the scaling of /ne/ ($p=0.53$). On the other hand, main effects of SENTENCE LENGTH on the syllable /goŋ/ is reported ($F(1,5)=7.867$, $p<0.05$) and the syllable is scaled higher in long sentences. The interaction SENTENCE LENGTH × FOCUS TYPE is significant ($F(1,5)=52.490$, $p<0.01$), indicating that the effect of focus type is different in long and short sentences. The interaction graph in Figure 4.6 shows that narrow focus raises the scaling of /goŋ/ in the long sentences, while it lowers the scaling in the short sentences. The two-way interaction indicates that the lowering of /goŋ/ in the short sentences is significant.

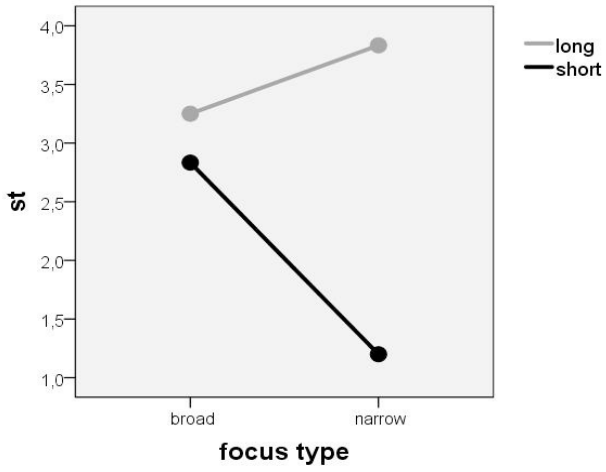


Figure 4.6. Interaction of SENTENCE LENGTH *and* FOCUS TYPE *in the scaling of the syllable /goŋ/ in the two-word sentences.*

4.2.1.3. Discussion

AP peak alignment The alignment results indicate that the alignment of the AP peak is, as a whole, affected by the test factors; the number of words in the target APs, sentence length and focus type. The number of Phonological Words in the target APs affected peak alignment and the peak is aligned significantly earlier in the one-word APs than in the two-word APs. However, the peak is consistently in the third AP syllable.

It was explained earlier that the alignment of the AP peak is similar to that of LHi (AP initial rise) in French (see 4.1.2.2). We assumed that, analogously to French, the AP peak alignment in Korean is affected by either the number of Phonological Words in an AP or the location of a morpheme boundary (see the beginning of 4.2). On the one hand, it was assumed that the AP peak is placed in the final syllable of the first PW in the two-word APs marking the word boundary. It should be reminded that the first Phonological Word in the target two-word AP had to be a three syllable morpheme in order to investigate the effect of the number of PWs without the influence of a morpheme boundary. On the other hand, it was assumed that the peak is located, by default, in the second syllable in one-word APs. Because of these assumptions, the target one-word AP was constructed to contain the morpheme boundary in the middle of the third syllable. That is, the morpheme boundary is located in the third syllable in both the target APs, but it is earlier in the one-word AP than in the two-word AP. The alignment results show that the AP peak occurs equally in the third syllable in the one-word and the two-word APs. Yet, the peak is aligned earlier in the one-word AP where the initial morpheme is shorter, and this is statistically significant. The results suggest that the *morpheme boundary location* rather than the number of PWs affects the AP peak alignment.

The results indicate that sentence length has an effect on the AP peak alignment, too, and the peak is aligned later when the target AP is preceded by another AP. Narrow focus generally causes later peak alignment (see Figure 4.3). Nonetheless, the statistical analysis shows that the effect of narrow focus is significant only in the short two-word sentences, where the peak is aligned earlier.

Narrow focus and the scaling of tones and syllables Focus type is one consistent factor that affects the scaling of the tones and syllables /ne/ and /goŋ/. Narrow focus generally raises the scaling, even though the effect differs depending on the number

of PWs and sentence length (i.e., the presence/absence of the preceding AP). In one-word sentences, narrow focus leads to higher scaling of L1 and L2, but only L1 in the two-word sentences (compare the interaction graphs in Figure 4.4). It also leads to higher scaling of the AP peak in the one-word sentences and long two-word sentences. However, AP peak scaling is not affected by narrow focus in the short two-word sentences.

The effect of narrow focus is also manifested very differently on the scaling of the syllables /ne/ and /goŋ/ (i.e., the first syllable of the second PW in the AP). /ne/ in the one-word APs is not affected by focus type. Interestingly, the scaling of /goŋ / is completely different in the long and the short sentences; in the long sentences, the syllable is scaled higher in narrow focus, and in the short sentences, on the contrary, it is significantly lower in narrow focus.

Narrow focus intonation The effects of narrow focus on peak alignment and tonal scaling are illustrated with schematised pitch contours in Figure 4.7 in comparison with broad focus. The contours in Figure 4.7 show that narrow focus intonation is characterised primarily by higher tonal scaling in the target AP rather than a difference in alignment of the peak. They indicate that narrow focus is manifested prosodically in two different ways. In long sentences (i.e., when the narrowly focused AP is preceded by another AP), the whole of the target AP is produced with higher pitch than in broad focus regardless of the number of PWs in the target AP. In short sentences (i.e., when the AP is placed utterance initially), the manifestation of narrow focus differs according to the AP structure. The whole of the target AP is produced with higher pitch when the AP contains one PW, similarly to long sentences. However, when the AP contains more than one word, only the first PW is made prominent with high pitch. It is important to note that this prominence is achieved with the early alignment of the AP peak as well as higher L1. The early alignment lowers the pitch on the (following) initial syllable of the second PW, /goŋ/, creating a pitch level difference between the first and the second Phonological Word. This indicates that that the alignment of the AP peak has an accentual function to bring prominence on to the first word. It is also important to note that, even though only the first PW receives pitch prominence, the whole of the target AP is narrowly focused in short two-word sentences. This suggests that the first PW functions as a ‘focus exponent’ (Selkirk 2000) projecting focus on to the entire AP.

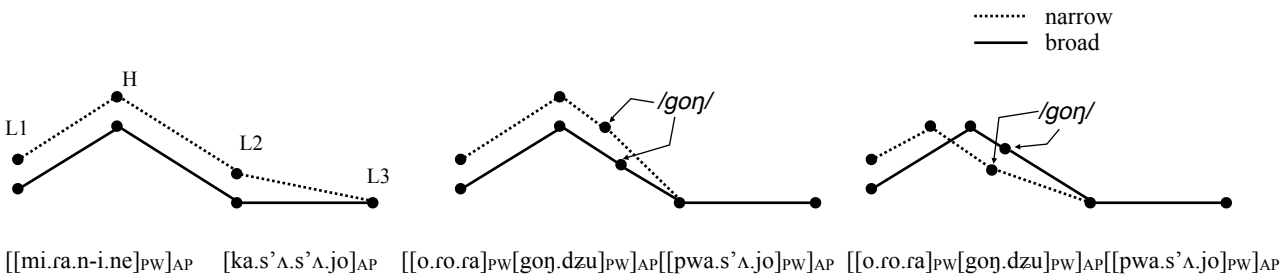


Figure 4.7. Comparison of narrow and broad focus intonation. The effect of narrow focus (dotted line) is represented in the schematised pitch contours in comparison with broad focus (solid line). Separated circles represent statistically significant differences in the scaling (vertical) or in the alignment (horizontal). In the short two-word sentence, narrow focus intonation is marked with earlier alignment and the constant scaling of the AP peak. The initial syllable of the second Phonological Word /goŋ/ is scaled lower than in broad focus.

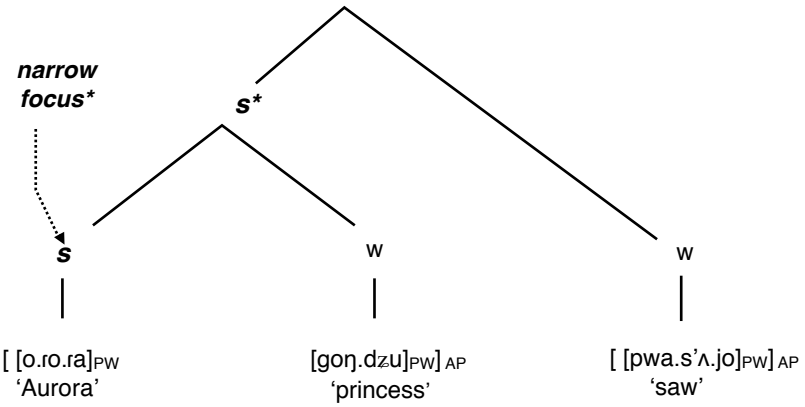


*Figure 4.8. Narrow focus and the strength relation in the short two-word sentence. The tree shows the hierarchical structure and the strength relations among the constituents. It also illustrates that narrow focus affects the strong node of the AP 'Princess Aurora' (the node is in bold italics) bringing prominence on to the entire node (in bold italics with *).*

In the short sentences, the prosodic manifestations of narrow focus are particularly interesting in that they are related to different AP structures. As a matter of fact, the different realisations of narrow focus reflect the strength relation of the component constituents that are immediately below AP, the Phonological Words. The two PWs in the target two-word AP represent strong-weak relation and, when the AP is in narrow focus, only the strong node, i.e., first word, is made prominent in terms of prosody. In a one-word AP, the whole AP is made prominent, as it contains only one word which is a strong node.

That is, narrow focus brings prominence onto the target AP by emphasising the strength relation of the word level constituents (see Figure 4.8). Theoretically, an AP may contain an unlimited number of PWs, however, in practice, it rarely contains more than two words. According to H.-Y. Lee's Korean intonation model (see 3.1.), a metrically strong word initiates an AP and the first PW is always metrically stronger than the following word(s), if there is any. By highlighting the first word in the two-word AP, the strong node becomes stronger relative to the weak node. By amplifying the strength relation in two-word APs, the speaker signals that there is another piece of information on the same prosodic level, which is less important.

Long narrow focus sentences are actually not very common in Korean. Long sentences are typically in broad focus, and narrow focus sentences are created by omitting redundant information from the long sentences (see 1.1.2). Given or shared information (or rather the information assumed to be shared) is not usually included in Korean utterances. The use the pro-forms, which would lead to longer sentences, is uncommon. A verb or verbal phrase is placed at the end of a sentence, or, as is frequently the case, omitted. In other words, the items that are unaccented/deaccented in languages like English are simply dropped in Korean. For that reason, prosody is not usually required to make a focus distinction in long sentences. However, in short sentences, a focus distinction is often made using prosody. A narrow focus inducing question, such as, 'What movie did you see?', may be answered with (4.10)~(4.12).

(4.10)
[o.ɾo.ɾa.goŋ.dʑu] 'Princess Aurora' (the title of a movie).

(4.11)
[o.ɾo.ɾa.goŋ.dʑu.-jo] 'Princess Aurora' - honorific particle

(4.12)
[o.ɾo.ɾa.goŋ.dʑu] [pwa.s'ʌ.jo] '(I) saw 'Princess Aurora'

(4.10)~(4.12) reflect different degrees of politeness in casual and conversational speech in the order of (4.10) < (4.11) < (4.12). A higher degree of politeness and the use of honorifics than in (4.12) is very formal. Evidently, (4.10) and (4.11) can only be used in

narrow focus context. However, (4.12) may also be used in the broad focus context (as in this experiment) and the use of prosody is required in order to make the broad and narrow focus distinction (see the Appendix I for the full material). That is, the focus type distinction is more important in short sentences like (4.10)~(4.12) than long sentences and, consequently, the distinction has to be made more distinctively. This explains the use of more complex focus strategy in short sentences, which reflects the target AP structures.

In sum, the experimental results only partially confirm our assumptions (see the beginning of 4.2). The results indicate that the AP structure (i.e., the number of PW in an AP) affects the AP peak alignment, however, the peak occurred in the third syllable regardless of the AP structure. The results also indicate that sentence length affects the AP peak alignment. Alignment is later in the long sentences (with non-initial target AP). They also show that narrow focus affects tonal scaling and that the tones are scaled higher in narrow focus than in broad focus. The effect of focus type on peak alignment differs depending on sentence length and AP structure. Narrow focus causes earlier peak alignment in the short two-word sentences, but later alignment in the others.

4.2.2. Experiment 2

The results of Experiment 1 show that, contrary to the initial assumption (see 4.2.1), the peak in the one-word APs is located in the third syllable as in the two-word APs. However, the peak alignment is earlier in the one-word APs than in the two-word APs. Since the one-word AP has a shorter content (or lexical) morpheme than the two-word AP, the location of a morpheme boundary may also have an effect on peak alignment here. Thus, the AP peak appears to mark the end of the content (or lexical) morpheme, the following functional morpheme having no influence on peak. While functional morphemes typically lack semantic content, some known as ‘auxiliary particles’ have high semantic weight, with content that is often conveyed by lexical words in other languages, such as ‘only’, ‘every’, ‘too’ etc. It is also of relevance here that auxiliary particles were derived from lexical morphemes and displayed identical tonal behavior as content/lexical morphemes in Middle Korean (see 2.1). It would therefore be unsurprising if auxiliary particles behaved differently from other functional particles in terms of their intonation.

In Experiment 2, we investigate if peak alignment is affected by the location of a morpheme boundary and the presence/absence of semantic content in the following morpheme. We assume that the morpheme boundary restricts the peak location, so that the peak is aligned at the end of the first morpheme. We also assume that this restriction may be overridden and the peak may occur in the first syllable of the second morpheme crossing the morpheme boundary, when the second morpheme is not functional (e.g., case markers) and has semantic content.

ASSUMPTIONS

① The AP peak is aligned at the end of the first morpheme, when the following morpheme is functional.

② The AP peak is aligned in the first syllable of the second morpheme, when the second morpheme has semantic content.

4.2.2.1. Procedure

Material As in Experiment 1, the material consists of casual conversational style question and answer sets. The target sentences (4.13) and (4.14) were the answers to questions that were intended to induce narrow and contrastive focus[47] on the target initial phrases. The phrases are in bold face in the gloss. The expected phrasing is represented with square brackets in the transcription.

(4.13)

[mi.na.-e.ge]$_{AP}$	[tɕul.k'ʌ.je.jo]$_{AP}$
Mina- dative case marker	will give/present

'(I) will present (it) to Mina.'

[47] It should be noted that, on strict terms, (4.13) and (4.14) differ in focus type (see the Appendix I for the full material). Unlike (4.13), the target initial phrase in (4.14) is in contrastive focus as it contrasts with /mɛ.il/ 'daily, everyday' in the question. Nonetheless, it is not likely that contrastive focus brings prominence only on to /tɕu.mal/ 'weekend' in /tɕu.mal.ma.da/'every weekend', as the contrast is in the semantics not segments. The contrast is analogous to 'daily' and 'every weekend' in English.

(4.14)

[tɕu.mal.-ma.da]$_{AP}$ [man.na.jo]$_{AP}$
weekend-every meet

‘(I) see (him/her) every weekend.’

The target phrases are made up of two morphemes, a two-syllable noun and a two-syllable particle. The particles in (4.13) and (4.14) contrast in that, contrary to the dative case marker /-e.ge/ in (4.13), the auxiliary particle /-ma.da/ in (4.14) adds the meaning ‘every’ to the preceding noun, e.g., /sʰa.ɾam.-ma.da/ ‘person’-‘every’ meaning ‘every individual’. In Korean, particles are bound morphemes grouped into four subcategories (Heo 1983); case markers, auxiliary particles, conjunctional particles and special particles. With the exception of auxiliary particles, they are mainly functional. It is important to note that the use of the case markers is not obligatory and they may be dropped, when the case information is retrievable from the context. For instance, the absence of the dative case marker /-e.ge/ in (4.13) does not affect the meaning of the sentence, since the sentence is an answer to the question ‘To whom are you going to present this beautiful necklace?’. The question particularly requires the information on the recipient, which indicates clearly that the noun ‘Mina’ (a girl’s name) should be dative. Auxiliary particles, on the other hand, do have semantic content and add various meanings to the preceding noun[48]. Without the auxiliary particle /-ma.da/ ‘every’, the initial phrase of (4.14) ‘every weekend’ becomes simply ‘weekend’.

Speakers and recording 18 native speakers of Seoul Korean (six male and 12 female speakers) in their 20s and 30s participated. They were all residents of Germany at the time of the recording and the duration of their stay ranged from three months to five years.

The recording was made in the sound attenuated booth at IfL-Phonetics. The question and answer sets containing the target sentences were quasi-randomly ordered with filler question-answer sets and presented on the the cards with the participant’s lines highlighted. The author took up the role of the second speaker and asked the questions. The participants were instructed to ‘answer’ the questions with the provided sentences

[48] Heo (1993: 204) states “… [auxiliary particles] add special, refining meaning [to the noun which they attach to].” (my translation)

rather than to read out. Total of 216 utterances (6 repetitions x 2 target sentences x 18 speakers) were recorded directly on to a computer disk in 16 bit at the sampling rate of 44100 Hz.

Prosodic analysis The utterances were first checked for irregularities in the F0 contours (for F0 measurements) and then subjected to prosodic analysis. They were produced with two APs with L +H La and L La, respectively. However, three speakers (two male and one female) produced the target auxiliary particle phrase with different contour shapes, notably, L +H L+ Ha. The utterances of the three speakers were not included in the investigation (see the beginning of 4.2.). This left 188 utterances for further examination.

Peak distance measurement Syllables and phrases were annotated using Praat and the distance from the beginning of the second syllable to the F0 peak in the target AP was extracted (see Figure 4.1)

4.2.2.2. Results

Case marker vs. auxiliary particle As in Experiment 1, the peak distance was normalised by dividing the measurements with the duration of the second AP syllable. The calculated mean is smaller than 1 in the AP with case marker, indicating that the AP peak occurs in the second syllable, whereas in the AP with auxiliary particle, it is slightly above 1, indicating that the peak occurs in the third syllable near the beginning, crossing the morpheme boundary (see Table 4.3). A paired t-test indicates that the peak is aligned significantly earlier in the case marker phrase than in the auxiliary particle phrase ($t(15) = -7.387$, $p<0.001$).

Speaker	Peak location	
	case marker (Mina)	auxiliary particle (weekend)
F1	1.05 (0.22)	1.40 (0.10)
F2	0.94 (0.11)	1.33 (0.08)
F3	0.63 (0.08)	1.34 (0.14)
F4	0.93 (0.09)	0.98 (0.20)
F5	0.73 (0.06)	0.91 (0.15)
F6	0.87 (0.07)	1.14 (0.17)
F7	0.79 (0.10)	1.04 (0.17)
F8	0.82 (0.15)	1.07 (0.32)
F9	0.80 (0.14)	0.85 (0.07)
F10	0.83 (0.10)	1.08 (0.22)
F11	0.50 (0.15)	0.96 (0.12)
F12	0.67 (0.12)	1.22 (0.16)
M1	0.79 (0.14)	1.18 (0.18)
M2	0.56 (0.04)	1.05 (0.16)
M3	0.49 (0.07)	0.84 (0.24)
M4	0.51 (0.17)	0.76 (0.08)
Mean	0.75 (0.17)	1.07 (0.19)

Table 4.3. Peak location in the APs with particles. The peak location is calculated in terms of the second AP syllable duration. Each value is a mean of average five repetitions and standard deviation is give in brackets. The mean values in the bottom row indicate that the AP peak is located late in the second syllable in the AP with dative case marker, whereas it is early in the third syllable in the AP with auxiliary particle.

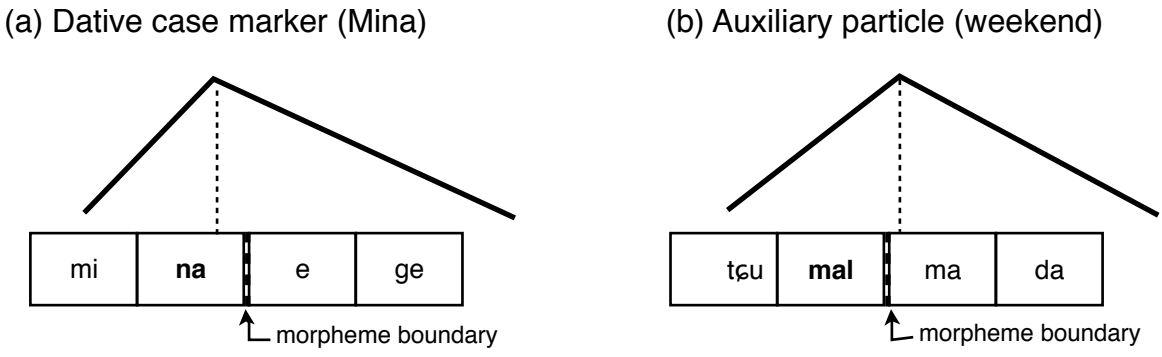


Figure 4.9. Schematic representation of AP peak alignment in the target APs. (a) contains the dative case marker /-e.ge/ and (b) the auxiliary particle /-ma.da/ 'every'. The representation is based on the mean values in Table 4.3..

4.2.2.3. Discussion

The result shows that the AP peak is placed in different syllables in the two target APs. In the AP with the dative case marker, the peak is aligned in the second syllable, whereas in the AP with auxiliary particle, it is in the third syllable, crossing the morpheme boundary. It should be noted that the peak is aligned consistently later in the 'weekend' AP with auxiliary particle, even though some speakers, notably, F1 and M3, place the AP peak in the same syllable in both the target APs (see Table 4.3). This strongly suggests that peak alignment is affected by the presence/absence of semantic content in the following second morpheme.

The syllable before the particle (shown in bold face in Figure 4.9), has different structure across the two conditions. It has CV structure before the case marker /-e.ge/ and CVC before the auxiliary particle /-ma.da/. The CV syllable /na/ has a shorter duration (average 174 ms) than the CVC /mal/ (average 180 ms). This syllable is assumed to be associated with the AP initial H tone, and if the H peak is anchored to (or aligned with reference to) a specific point in the syllable, e.g. a vowel, the difference in phonological structure may be responsible for a difference in peak alignment. However, it should be noted that the alignment result would have been the opposite, if the phonological (or phonetic) length of the second syllable had affected the peak alignment. This suggests that the structure of the second AP syllable does not affect the AP peak alignment and, more importantly, the AP peak is not aligned relative to the second syllable.

In Table 4.4, the result of Experiment 2 is presented with the alignment result of Experiment 1 in the corresponding short narrow focus sentences for comparison. Before the comparison, it should be pointed out that, unlike the other APs, the Aurora AP (bottom row of Table 4.4) contains two Phonological Words and narrow focus has distinct effects on the alignment of AP peak depending on the number of PWs. Narrow focus has a tendency to lead to later peak alignment in one-word APs (see 4.2.1.2), indicating that the whole of PW/AP is made perceptually prominent. On the contrary, it leads to early alignment in two-word AP, which strengthens the perceptual prominence on the first PW by weakening the saliency of the second PW (see 4.2.1.3). This suggests that in narrow focus, the peak alignment in two-word AP is unlikely to reflect the influence of a morpheme boundary or the characteristics of morphemes, and, for that reason, we also take the peak location in broad focus into consideration in the following discussion.

	Narrow focus		Broad focus
AP types	peak location in σ2 (Stdev.)	peak location in σ3 (Stdev.)	peak location in σ3 (Stdev.)
case marker (Mina)	0.75 (0.17)	-	-
auxiliary particle (weekend)	-	0.09 (0.25)	-
one-word (Miran)	-	0.10 (0.13)	-
two-word (Aurora)	-	0.02 (0.01)	0.31 (0.11)

Table 4.4 Peak location in the APs with different morphological and prosodic structures. The peak location is calculated in terms of the syllable where the peak is placed. For instance, in weekend AP (with auxiliary particle), the peak is located in the third syllable, σ3, and the peak location is represented as ratio of the syllable.

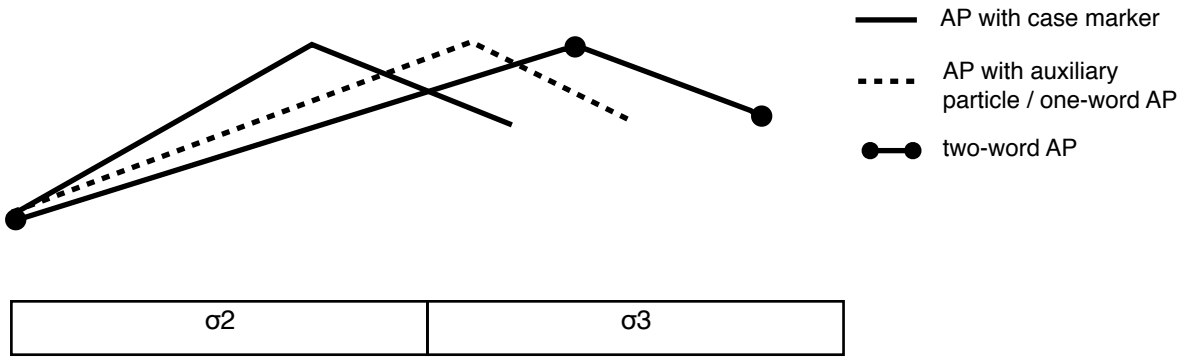


Figure 4.10. Alignment of AP peak. The peak location is based on the values in Table 4.4. The peak alignment of two-word AP represents the value in broad focus condition (See above).

In Table 4.4, the APs are presented according to the length of the content morpheme. The case marker and auxiliary particle AP has a two syllable content morpheme, the one-word AP (see the beginning of 4.2) has a 2½ syllable morpheme and the two-word AP a three syllable morpheme. The table shows that the peak is located in the second syllable in the case marker AP, at the beginning of the last quarter, to be exact, and it is near the beginning of the third syllable in the others (see the two columns in the middle of the table). When we take the peak alignment of the two-word AP in broad focus into consideration (see the previous paragraph for the reasons), however, the peak is aligned later in the order of case marker > auxiliary particle/one-word AP > two-word AP (see Figure 4.10), reflecting the increasing length of the AP initial morpheme. The different number of speakers in Experiment 1 and Experiment 2 does not allow a statistical analysis

on the pooled data. However, it should be remembered that peak alignment was already reported to be statistically significant in individual experiments, which suggests that the length of the AP initial morpheme should be significant. That is, the statistical analysis in 4.2.1.2 indicates that the alignment is significantly earlier in the one-word AP (with a 2½ syllable morpheme) than in the two-word AP (with a three syllable morpheme) in Experiment 1. The analysis in 4.2.2.2 indicates that the peak alignment is significantly earlier in the case marker AP than in the auxiliary particle AP. Since peak alignment is almost identical in the one-word AP (Experiment 1) and the auxiliary particle AP (Experiment 2), we may assume with reasonable confidence that the alignment difference between the case marker and the one-word AP is statistically significant. That is, peak alignment is significantly different among the three AP categories: the case marker, the one-word and the two-word APs. This suggests strongly that the AP peak alignment is affected by the length of the AP initial (content) morpheme.

The comparison indicates that the alignment of an AP peak in Korean is affected by the location of the initial morpheme boundary. The occurrence of the peak is confined to the AP initial (content) morpheme and the peak is aligned later as the length of the morpheme increases. The importance of the morpheme boundary location for peak alignment suggests that speaker's interpretation, or conception, of a morpheme should influence the AP peak alignment and result in alignment variation among different speakers. When the location of a morpheme boundary is not clear or may be conceived differently among different speakers, as it may with some compounds, foreign loan words or Chino-Korean words (e.g., /tsa.doŋ.tɕʰa/ 'automobile' or /tsa.doŋ.-mun/ 'automatic door', and see also the beginning of 4.2.), the AP peak alignment may vary according to the location of the conceived morpheme boundary.

The comparison also suggests that, as we assumed, peak alignment should be constrained by the initial morpheme boundary. At the same time, the alignment difference in the AP with case marker and the auxiliary particle suggests that this constraint may be overridden by the high semantic weight of the following morpheme. In addition, it should be noted that, unlike the case marker phrase, the auxiliary particle phrase displayed varying contour shapes, notably, L +H L+ Ha (see 3.2.1 and 4.1.1) with the final rise (i.e., L + Ha) in the particle /-ma.da/ 'every', and the movement made the particle perceptually

prominent. This indicates that speakers may employ a different AP contour, as well as AP peak placement, to bring prominence onto the semantically important part(s) of an AP.

4.3. General discussion

In the Korean intonation model which provides the theoretical basis for this study, it is assumed that an AP is defined by the tonal pattern TH-LH (T= L or H). The phonetic variants of the AP tone pattern usually contain a peak either on the second or the third syllable, which is assumed to be the phonetic exponent of the initial H tone. In this study it was investigated if the following factors affect the peak alignment; the number of Phonological Words, sentence length (i.e., the presence/absence of the preceding AP), focus type, the location of a morpheme boundary and the presence of semantic content in the following morpheme.

The results indicate that the peak alignment is primarily affected by the morpheme boundary. The peak is aligned at the end of the first morpheme and its alignment becomes later as the length of the initial morpheme increases. However, the peak occurs in the second morpheme when the morpheme has semantic content. This indicates that the occurrence of the peak is restricted to the initial morpheme, however, this restriction may be overridden by the presence of the semantic content in the following morpheme. The influence of the morpheme boundary on the AP peak alignment suggests that the AP initial H tone should be associated with an edge of a morpheme (Welby 2003). We may assume that the H is, as a rule, associated with the right edge of the first morpheme of an AP, but it gets associated with the left edge of the second morpheme when the second morpheme has semantic content.

It should be noted that the alignment of the AP peak varies within a very limited range of the second and the third AP syllable and, most importantly, the peak never occurs later than the third syllable. This indicates that there has to be yet another constraint which limits the occurrence of the peak to the beginning of an AP and that the H tone is associated with an edge of a morpheme under this constraint. The constraint cannot be the H tone's association to the second AP syllable as assumed in S.-A. Jun (1996, 2000). The experimental results show that the peak alignment is not affected by the phonetic or

phonological duration of the second AP syllable, which indicates that the peak is not aligned relative to the syllable.

Since the results do not support the assumption that the AP initial H tone is associated with the second AP syllable, we propose that the H tone should be analysed as a component tone of the TH associated with the AP initial syllable. That is, the AP initial TH is analysed as a single tonal event similarly to a bitonal pitch accent in English. We also assume that the H tone is simultaneously associated with the right edge of the first morpheme in an AP. However, when the second morpheme has semantic content, the H is associated with the left edge of the second morpheme. That is, the H tone is doubly associated with the AP initial syllable (as a component tone of TH) and an edge of a morpheme (see Figure 4.11). However, this proposal is merely a tentative analysis and requires further studies.

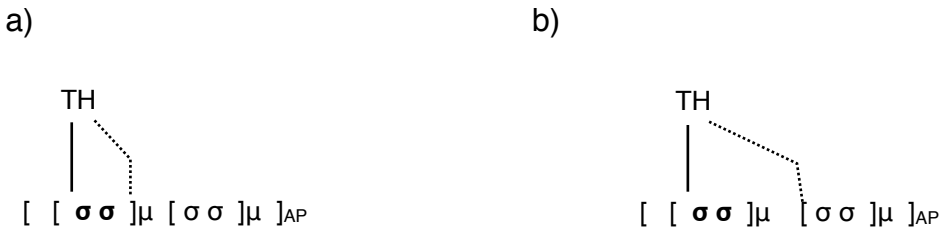


Figure 4.11. The association of the two AP initial tones. (a) represents the association of the two AP initial tones, TH, when the AP contains two morphemes and only the first morpheme has semantic content (content morpheme in bold face). (b) represents the tonal association when the AP contains two content morphemes.

4.4. Conclusions and summary

At the beginning, we hypothesised that the peak alignment in Korean APs is systematic and linguistically conditioned. The experiment results show that the alignment of the AP peak is indeed systematic, and the alignment is affected by the presence of a preceding AP, the location of a morpheme boundary and the presence of semantic content in the second morpheme. The AP peak is aligned earlier in the initial AP than non-initial AP. The alignment of the AP peak is restricted by a morpheme boundary. The peak occurs at the end of the first content morpheme. Thus, peak alignment is later, as the morpheme

becomes longer. However, the peak is aligned at the beginning of the following morpheme when it has semantic content. This suggests that peak placement may have a prominence-lending function: Just as function words are rarely accented, the peak is rarely (if ever) placed on functional morphemes (excluding those with semantic content). Thus, peak placement in Korean has a similar function to pitch accents in languages like English.

The influence of the morpheme boundary on AP peak alignment suggests that the H tone is associated with the edge of a morpheme. At the same time, the fact that the variation in the peak alignment is restricted to the second and the third AP syllable suggests that there should be another constraint on the peak alignment, which restricts the occurrence of the peak to the beginning of an AP. Since the results do not support the assumption that the AP initial H tone is associated with the second AP syllable, we proposed to analyse the AP initial TH as a tonal unit similar to a bitonal pitch accent in languages such as English. The TH is assumed to be associated with the AP initial syllable and the H is simultaneously associated with an edge of a morpheme separately from the initial T (see Figure 4.11).

In general, narrow focus leads to later alignment of the AP peak and higher scaling of tones, which makes the target AP prominent. However, narrow focus has a distinct effect in the short two-word AP and causes earlier alignment. The earlier peak alignment lowers the pitch of the second Phonological Word creating a pitch level difference between the words. This makes the first word perceptually prominent, while making the second word less conspicuous. This can be interpreted as follows: The whole of the AP is made prominent by making the first PW pitch prominent, and the first Phonological Word functions as a focus exponent projecting focus on to the entire AP.

Part III

Studies on the realisation of tones in the IP final AP

5. Realisation of L tones[49]

5.1. Variation of the AP contours in the IP final position

Different intonation models attribute the variation of AP contours to different factors. H.-Y. Lee (1990, 1997) explains that different contours convey different 'attitudinal and stylistic meanings' and they vary accordingly. S.-A. Jun (1996, 2000, 2006) assumes that the variation is determined by the number of AP syllables. Either or both of the middle tones of the AP defining TH-LH pattern 'undershoot' (see 3.2 for the 'tonal undershoot' in S.-A. Jun's model) and are therefore not realised, creating varying tone patterns and contour shapes as in Figure 3.3 when there are less than four syllables.

However, interestingly enough, the variation of AP contours is very simple in the IP final position. Before the IP boundary tone (T%) in final syllables, AP contours alternate between a rise-fall and low level, when the AP initial syllable has a low tone, and a (high) level-fall and fall, when the initial syllable has a high tone[50]. That is, the contours consistently end with low pitch in the penultimate syllable, and the alternation does not seem to be affected by AP length (i.e., the number of syllables).

The low pitch in the IP penultimate syllable[51] is identified as a dip (or valley) in the F0 contours, when followed by a high (or rising) IP boundary tone, e.g., H%. The F0 valley (or low pitch) is so constant that H.-Y. Lee (1990, 1996) claims that "the rising Phrasal Tone [i.e., AP contour] does not occur on the last Rhythm Unit [i.e., AP] of an Intonation Group (1996: 225; my translation)", restricting a rising contour in the IP final AP. This excludes high pitch in IP penultimate syllables in his Korean intonation model. S.-A. Jun (1996, 2000) also assumes low pitch in the IP penultimate syllables as reflected in the low starting point of the IP boundary tones in Figure 3.5. Note that the beginning of an IP boundary tone (indicated with a straight line) is always low. She describes that H% is distinguished from LH% with the timing of the rise, and notes that "the rise [i.e., H%] is earlier than that in LH%" and "by comparison to H%, this [LH%] is a sharper later rise,

[49] Earlier version of this chapter was published as K. Kim (2006).

[50] The description of AP contours is based on S.-A. Jun's intonation model. The reader is referred to 3.2. for S.-A. Jun's model.

[51] This was also discussed in detail in 3.2.2.

starting after the onset of the final syllable", which suggests that the IP penultimate syllable should have low pitch before H% and LH%.

H.-Y. Lee and S.-A. Jun appear to agree on the presence of low pitch in the IP penultimate syllable. However, they are not clear about whether it is regarded as a tonal target and, if it is, how it is analysed in their intonation systems. H.-Y. Lee (1990,1996) simply prohibits high pitch in the penultimate syllable by placing a constraint on the occurrence of the rising AP contour without giving any further explanations. In S.-A. Jun (1996, 2000), it is analysed as the penultimate L tone of the AP tone pattern TH-LH. In IP final position, the final syllable is occupied by an IP boundary tone depriving the AP final H of a syllable to be associated with. As a result, the final H is not realised. Therefore, the F0 valley immediately before the IP boundary tone should be analysed as the AP penultimate L tone (see 3.2). However, this analysis holds only when there is a visible F0 valley before a high IP boundary tone. It is not clear if the L tone should also be assumed before L% where the F0 valley cannot be identified. That is, a rising-falling AP contour and L% may be represented tonally either as **LHL** L% or **LH** L% (AP tones in bold face) and a low level contour and L% as **LL** L% or **L** L%.

5.2. Experiment

We conducted an experiment to investigate if a low tone should be constantly assumed in the IP penultimate syllable, even when there is no distinct F0 valley in the F0 contours. We examined how the realisation of the penultimate syllable is affected by different IP locations and utterance types.

For the investigation, we varied the IP locations between utterance medial and final position. In the final position, we varied the utterance types among wh-questions, yes-no questions and statements, which were produced with LH%, ^H% and L%, respectively. In addition, we used the identical material in yes-no questions and statements, so that the utterance types distinction is made purely in terms of intonation. We examined if and how the question intonation differs from the statements, and vice versa, other than the obviously different IP boundary tones.

In the material, the onset of the AP initial syllables was restricted to [-stiff vocal cords] consonants to ensure the association of L tone (see 3.2). The association and realisation of L tone is clearly identified in the F0 contours as the beginning of the rise to the following syllable.

We extracted F0 values at the lowest point in the IP penultimate syllables and examined if the syllables have a consistent F0 target and if the target follows the general L tone trend created by AP initial syllables. We assumed that if there is a L tone target, it should be as low as the preceding L tone or lower (unless pitch is reset). That is, we define a L tone with reference to the preceding L tone(s).

5.2.1. Procedure.

Material The material was created to represent IP final APs in different IP locations and utterance types. The location was varied between utterance medial and final position and, in the utterance final position, the utterance type was varied among statement, yes-no question and wh-question. There was a total four different categories; non-final phrases, statement, yes-no question and wh-question.

The target phrases all contain five syllables. Thus, the target IP penultimate syllable is separated from the initial syllable by two syllables. To facilitate F0 measurements, voiceless consonants were avoided, and sonorants and vowels were used as much as possible.

(5.1)
Statement/Yes-no question:
'This is used for Tanchong, too/ Is this used for Tanchong, too?'

[[i.gʌ.-t'o]$_{AP}$	[tan.ts^{h}ʌŋ.-e]$_{AP}$	[s^{h}a.joŋ.dwe.nɯn]$_{AP}$	[**mu**.njaŋ.-i.**je**.-jo]$_{AP}$]$_{IP}$
this-too	Tanchong-for	used	pattern-is-$_{\text{honorific particle}}$

(5.2)

Wh-question: ‘Where did elder sister go?’

[[mi.jʌŋ.-i.-ʌn.ni]$_{AP}$ [**ʌ**.di.-ga.**s’ʌ**.-jo]$_{AP}$]$_{IP}$
Miyoung-$_{suffix}$-elder sister where-went-$_{honorific\ particle}$

(5.3)

Non-finality:

And this is called ‘water lily’ pattern, and it is based on (the shape of) water lilies.

[[kɯ.ɾi.go]$_{AP}$ [i.gʌ-n.]$_{AP}$ [**jʌn**.mu.n-i.**ɾa**.go]$_{AP}$]$_{IP}$
and this water lily pattern-called

[jʌ.nɯl] [ki.bo.nɯ.ro.han] [mu.njaŋ.-i.je.-jo]
water lily-$_{accusative\ particle}$ based on pattern-is-$_{honorific\ particle}$

* The syllables where the F0 is calculated are represented in bold face. See also **Measurements** below.

Identical sentences were used for statement and yes-no questions, so that utterance types are distinguished purely in terms of intonation. Interrogativity can be morphologically marked (question verbal ending at the end of an utterance) in combination with intonation (typically with rising or high ending pitch). However, it is often marked with intonation alone, especially in casual speech, where question and statement endings are identical in form. The honorific particle /-jo/, for instance, is used both in statements and questions alike, and /tsi.b-e ka.-jo/ ‘home’-$_{locative\ particle}$ ‘go’-$_{honorific\ particle}$ can be either a statement, ‘(I am) going home’, or a question, ‘(Are you) going home?’, depending on the intonation; the statement has a rise-fall and the question a rise-fall-rise. Accentual phrasing is relevant for distinguishing indefinite questions from wh-question distinction (Jun and Oh 1998), but not for the statement - yes-no question distinction.

The wh-question in this dataset is not related to the statement/yes-no question, neither segmentally nor semantically. Wh-words do not have to be fronted in Korean; they have identical word order to statements and are thus ‘in situ’. For instance, a statement ‘Miyoung (girl’s name) likes Cheolsu (boy’s name)’ is converted to the corresponding wh-question ‘Whom does Miyoung like?’ by replacing ‘Cheolsu’ with /nugu/ ‘who’ (see below).

• statement: ‘Miyoung (girl’s name) likes Cheolsu (boy’s name)’

mi.jʌŋ.-i.-nɯn	tsʌl.s’u-ɾɯl	tso.a.hɛ.-jo
Miyoung’-$_{\text{suffix-subj. particle}}$	Cheolsu-$_{\text{obj. particle}}$	like-$_{\text{honorific particle}}$

• wh-question: ‘Whom does Miyoung like?’

mi.jʌŋ.-i.-nɯn	nugu-ɾɯl	tso.a.hɛ.-jo
Miyoung-$_{\text{suffix-subj. particle}}$	who-$_{\text{obj. particle}}$	like-$_{\text{honorific particle}}$

Speakers There were two speakers of Seoul Korean, one male (LCJ) and one female (KJI), in their 30’s with university level education. They were both born and brought up in Seoul and currently live in the outskirts of the city.

Recording The sentences (5.1)~(5.3) were embedded in the sets of short dialogues and recorded in a role play where the author took up the role of the second speaker. The dialogues were presented on cards with the participant’s lines highlighted. They were quasi-randomly ordered with filler dialogues. After a session of approximately 50 repetitions the roles were switched and another session of 50 repetitions followed. The recording was preceded by a brief practice session and the entire session took about an hour including a five minute break. The recordings were first made on to audio cassette tapes in a quiet setting and later digitalised in 16 bit at the sampling rate of 44100Hz.

Prosodic analysis The utterances were subjected to prosodic analysis following the intonation model proposed by S.-A. Jun (1996, 2000). Different utterance types were indicated by the different IP boundary tones in the final syllable. Statements were analysed with L%, non-final phrases and yes-no questions ^H% and wh-questions LH%. The female speaker’s statements were produced with identical accentual phrasing and contour shapes as yes-no questions. However, the male speaker’s statements were not. They were produced with identical phrasing to the yes-no questions, but the contour shape of the third AP was different. The AP had a falling-rising contour (i.e., HH-LH pattern) in all his statements, but a falling contour in yes-no questions.

Measurements 20 utterances were randomly selected in each of the four categories for the F0 measurement. When the F0 of the target IP penultimate syllable contained irregularities and was not smooth, the utterance was discarded in favour of an alternative repetition. The contour shape of the target AP was also taken into consideration and all the selected utterances have a visible F0 peak in the second AP syllable. That is, they all had a rising-falling contour before the IP boundary tone.

Using Praat (Boersma and Weenink 2005), the utterances were labeled at syllable and phrase boundaries. F0 was extracted and smoothed at 10Hz bandwidth. The F0 values were measured at the lowest F0 point of the initial and penultimate syllables of the target APs. The target syllables are shown in bold face below.

- Statements/Yes-no questions: [**mu**.njaŋ.-i.j**e**.-jo]$_{AP}$]$_{IP}$
- Wh-questions: [**ʌ**.di.-ga.**s'ʌ**.-jo]$_{AP}$]$_{IP}$
- Non-final phrases: [**jʌn**.mu.n-i.**ɾa**.go]$_{AP}$]$_{IP}$

In the statements and yes-no questions, F0 measurements were also made in the initial syllable of other APs to investigate of the L tone downtrend (The AP initial syllable and the utterance penultimate syllable in bold face below.). It should be noted that the initial syllable of the third AP in the statements/yes-no question was not included. The syllable onset is [+stiff vocal cords] and the syllable has a H tone rather than a L tone (see 3.2.). In the male speaker's yes-no questions, F0 was also measured in the penultimate syllable (i.e., /dwe/) as well as the initial syllables, as the AP was produced with a falling-rising contour (i.e., HH-LH pattern).

- Statements/Yes-no questions:

[[**i**.gʌ.-t'o]$_{AP}$ [**tan**.ts^{h}ʌŋ.-e]$_{AP}$ [s^{h}a.joŋ.dwe.nɯn]$_{AP}$ [**mu**.njaŋ.-i.**je**.-jo]$_{AP}$]$_{IP}$

5.2.2. Results and discussion

The F0 target of the IP penultimate syllable The mean F0 values of the IP/ utterance penultimate syllable are presented in Table 5.1 together with those of phrase initial syllables. The values suggest that the penultimate syllable should have a stable F0

target regardless of the following IP boundary tone type. Table 5.1 shows that the penultimate syllables have mean F0 values with a fairly small standard deviation. This indicates that the F0 does not deviate much from the mean value in each measurement suggesting that the penultimate syllable has a constant F0 target. It is important to note that the scale of standard deviation is not affected by the proximity to the end of an utterance. F0 measurements tend to show smaller or little variation near or at the end, as the measurements are made near the bottom of the speaker's pitch range. However, Table 5.1 shows that the non-utterance final phrases (i.e., the category 'Non-finality') have a similar magnitude of F0 variation to the utterance final phrases in wh-questions, yes-no questions and statements. Furthermore, the phrase initial syllable, which is associated with the AP initial L tone and realised as a low F0 turning point at the beginning of the AP initial rise, shows a comparable magnitude of F0 variation.

Category	KJI			LCJ		
	Initial σ (Hz)	penultimate σ (Hz)	difference (semitone)	Initial σ (Hz)	penultimate σ (Hz)	difference (semitone)
Non-finality	159.03 (6.67)	161.95 (4.80)	0.31	110.37 (3.07)	107.55 (4.46)	-0.45
Wh-questions	150.77 (4.83)	161.16 (7.99)	1.15	125.38 (4.63)	124.56 (5.09)	-0.11
Yes-no questions	178.36 (4.33)	168.02 (4.46)	-1.03	124.17 (3.62)	115.87 (4.82)	-1.2
Statements	171.20 (5.90)	148.12 (3.44)	-2.5	113.14 (2.07)	101.92 (2.64)	-1.81

Table 5.1. The F0 values of the initial and penultimate syllable of the IP final APs. The values are the mean of 20 measurements in Hz and the standard deviation is given in brackets. The height difference is provided in semitones relative to the initial syllable.

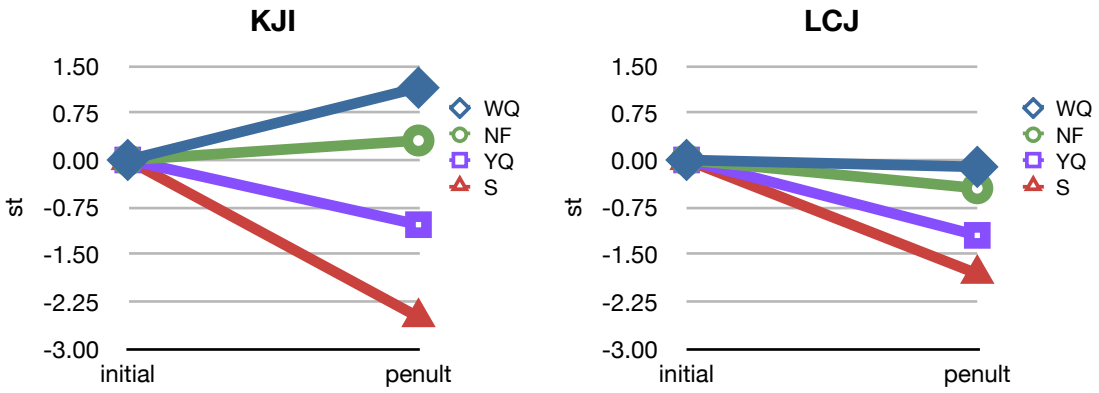


Figure 5.1. The height of the IP penultimate syllable relative to its preceding AP initial syllable.

A very distinct pattern is observed in Figure 5.1; the highest are wh-questions, followed by utterance medial IP (NF), then yes-no questions and statements. A one-way ANOVA reveals that there is a significant effect of utterance types (for KJI $F(3,76)=90.992$, $p<0.001$ and for LCJ $F(3,76)=37.296$, $p<0.001$). Each utterance type is significantly different from the others ($p<0.05$) except LCJ's NF and WQ. The pattern clearly reflects the utterance types. Whereas it was expected that statements would have the lowest relative value, it is interesting that wh-questions should show the highest one. For the female speaker the utterance penultimate L tone has a higher F0 than the preceding AP initial tone, despite the fact that the wh-word constitutes a morphological cue to interrogativity.

Category	KJI			
	Initial σ1	Initial σ2	Initial σ3	Penultimate σ
Yes-no questions	194.9	181.3	178.4	168
Statements	178.6	172.7	171.2	148.1

Table 5.2. The F0 values of AP initial syllables and utterance penultimate syllables in the female speaker KJI's yes-no questions and statements. The values are in Hz and shown on as a plot in Figure 5.2 (on the left).

Category	LCJ				
	Initial σ1	Initial σ2	AP penultimate σ	Initial σ3	Utterance penultimate σ
Yes-no questions	138.4	131.5	n.a.	124.2	115.9
Statements	115.5	108.4	106.1	113.1	101.9

Table 5.3. The F0 values of AP initial syllables and utterance penultimate syllables in the male speaker LCJ's yes-no questions and statements. The values are in Hz and shown on as a plot in Figure5.2 (on the right). LCJ's statements contains non-initial L tone in the third AP shown as 'AP penultimate syllable' (see 5.2.1.). Pitch was reset at the beginning of the following AP and this is indicated with a gray colored cell.

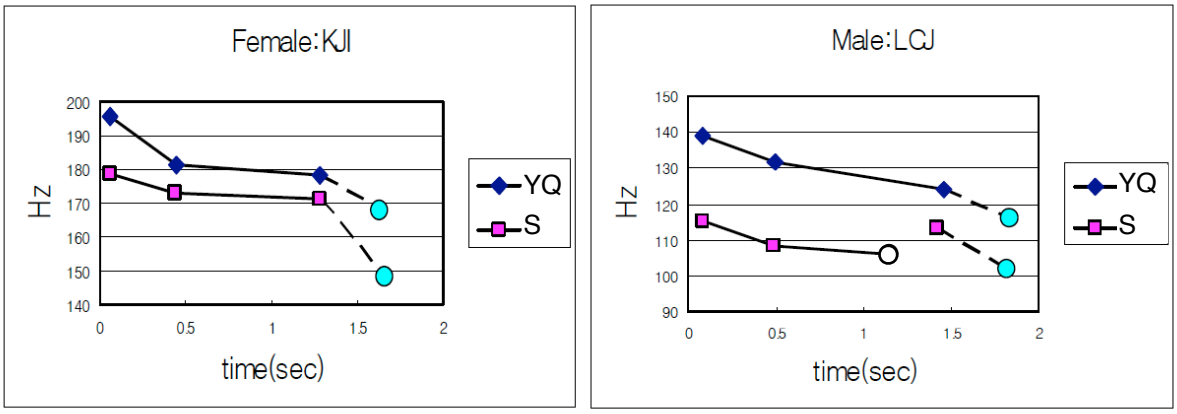


Figure 5.2. Mean F0 values of L tone syllables in the statement and yes/no question data. Phrase initial L tones are represented with diamonds and squares, and L tones in penultimate syllables with circles. LCJ's statements (lower line in the right plot) contains an extra L tone (a white circle) which is the penultimate syllable of the third AP (see (5.1) above).

Declination of L tones and final lowering Figure 5.1 suggests strongly that the utterance penultimate syllable suffers from final lowering in yes-no questions and statements. To examine the effect of declination and final lowering separately, the mean measurements of all L tone syllables (i.e., phrase initial syllables) in yes-no questions and statements are plotted in Figure 5.2 together with penultimate syllables. Phrase initial L tones are represented with diamonds in yes-no questions (YQ) and squares in statements (S), and penultimate syllables with circles. The results in Figure 5.2 show that yes-no questions are produced higher than the corresponding statements, but they display essentially the identical downtrend pattern. The downtrend is not constant and after a large

initial lowering the pitch level is kept very steady until just before the final fall. The utterance penultimate syllables are lower than would be accounted for by the effect of declination alone. This suggests that the penultimate L tone of a yes-no question (the rightmost circles of YQ) undergoes final lowering. It also suggests that the penultimate syllable of statements, too, undergoes final lowering indicating the presence of a low tone in the syllable. It has been argued for Japanese that final lowering is present in statements, but absent in yes-no questions (Pierrehumbert and Beckmann 1988). For Korean, yes-no questions do indeed undergo final lowering, but to a lesser degree than statements (see Figure 5.1).

It should be noted that the plots in Figure 5.2 show that pitch is reset at the beginning of the last AP in LCJ's statements[52]. Nonetheless, the low tones before the reset show identical characteristics to those in KJI's statements, and the L tone declination in statements is shallower than in yes-no questions in the speech data of the two participants. The shallower declination in statements may be ascribed to a greater degree of final lowering, as steeper and deeper final lowering would leave less room for declination. This assumes a high degree of preplanning, particularly, for the female speaker KJI. At the same time, this assumes less careful preplanning for LCJ and that pitch reset was required at the beginning of the final AP in statements in order to achieve a larger fall (or lowering) than in yes-no questions. It would have been practically impossible for LCJ to create a 1.8 semitone fall at the end of statements otherwise. This strongly suggests the importance of final lowering in the distinction of the utterance types. It also suggests that the penultimate syllable of statements should have a low tone target similar to yes-no questions and the L tone undergoes a greater degree of final lowering than in yes-no questions.

5.3. Conclusion and summary

Varying observation indicates the constant presence of a low tone in the IP penultimate syllable. The syllable is described to have consistently low pitch restricting the

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[52] In S.-A. Jun (2006), pitch reset is an indication of the beginning of a new Intermediate Phrase (ip) and LCJ's statement is analysed as containing two ips. See below for the analysis.

[[[i.gʌ.t-to]$_{AP}$ [tan.ts^{h}ʌŋ.-e]$_{AP}$ [s^{h}a.joŋ.dwe.nɯn]$_{AP}$]$_{ip}$ [[mu.njaŋ.-i.je.-jo]$_{AP}$]$_{ip}$]$_{IP}$

variation of AP contours in the IP final position and displays a distinct F0 valley, when followed by, for instance, H% or HL% in the final syllable. In this study, experimental evidence was sought as to whether a low tone was present in the IP penultimate syllable, regardless of the IP location and utterance types.

We measured the F0 value in the penultimate syllable of IPs in varied locations and utterance types, which are produced with different IP boundary tones, and examined how far the syllable is scaled in relation to AP initial L tone syllables. Results show that IP penultimate syllables have a consistent F0 target, and are scaled differentially in relation to the phrase initial L tone syllables. While the penultimate syllable does not show the effect of lowering in wh-questions, it undergoes different degrees of lowering in yes-no questions and statements. Statements are characterised with distinctly lower scaling of the penultimate syllable than yes-no questions. This strongly suggests the constant presence of a L tone in the IP penultimate syllable. Theoretically, the IP penultimate L tone is analysed as the penultimate L of the AP defining TH-LH pattern (T=L or H), and the experimental results indicate that the occurrence of the L tone is predictable in the IP final AP unlike the APs in other locations.

6. Alternation of AP peak and the tonal structure of APs

Various works on Korean intonation have based their studies on the intonation systems proposed by S.-A. Jun (1996, 2000, 2005) and Lee (1990, 1996). Jun's system is developed in the autosegmental-metrical framework (Pierrehumbert 1980, Beckman and Pierrehumbert 1986 and Pierrehumbert and Beckman 1988) and H.-Y. Lee's the British school (O'Connor and Arnold 1973 and Crystal 1969). Despite their different perspectives, S.-A. Jun and H.-Y. Lee share similar views on intonation structure and analysis. They both analyse the intonation as a sequence of pitch levels and movements that represent AP(s)[53] and/or mark the end(s) of IP(s)[54]. They also give introspective arguments that the configuration of the AP tones is not contrastive. S.-A. Jun (2000) notes that "different AP tonal patterns do not seem to contrast". She assumes that the different AP contours are simply variants of the underlying AP tone pattern TH-LH (T=L or H) which result from the tonal undershoot caused by the lack of Tone Bearing Units in an AP (see 3.2.1). H.-Y. Lee remarks that "...these Phrasal Tones [i.e., rising, falling, rising-falling and level AP contours] convey limited attitudinal and stylistic information..." (1990:129) and that different Phrasal Tones have "slightly different intonational meanings" (1996:225; my translation). The meanings are largely gradient rather than categorical, e.g., "emphatic" - "more emphatic", "lively" - "more lively" / "less lively", suggesting that the difference is not phonological. However, at the same time, H.-Y. Lee's meanings suggest that the Phrasal Tones at the ends of the spectrum should contrast and he places a rise-fall and a fall at the extremes. He explains that a rise-fall conveys the sense of importance and emphasis ("emphatic", "weighty"), while a fall expresses the speaker's lack of interest ("uninvolved").

In S.-A. Jun's framework, H.-Y. Lee's rising-falling and 'falling' tones differ only in the presence (or the absence) of the AP initial H peak in the IP final position[55], which suggests that the meaning contrast is created by the realisation of the second tone of the T**H**-LH

[53] H.-Y. Lee (1990, 1996) assumes two prosodic units 'Rhythm unit' and 'Intonation Group' which correspond to Jun's 'Accentual Phrase' and 'Intonation Phrase'. In this paper, I will adopt Jun's terminology to refer to the prosodic units, as it is more widely used.

[54] It is important to note that, unlike S.-A. Jun, H.-Y. Lee does not assume Strict Layer Hypothesis (Selkirk 1984) and intonation does not necessarily contain an AP. That is, in H.-Y. Lee, AP is optional and intonation consists minimally of an IP boundary tone (Lee 1990:139). On the other hand, in Jun, AP is obligatory and intonation consists minimally of an AP which is at the same time an IP, following Strict Layer Hypothesis.

[55] The discussion of the rising-falling and 'falling' tone alternation is restricted to the IP final APs. In this location, rising-falling tones display three distinct tonal targets before the the IP boundary tone in the final syllable, and this leaves no doubt on the tonal representation (see also chapter 5).

(the second tone in boldface) pattern. S.-A. Jun represents H.-Y. Lee's rising-falling tone as LH-L(H) (see 3.2.1 and S.-A. Jun 2005). She represents his 'falling' tone chiefly as L(H)-L(H) (unrealised tones in brackets), a low level, sometimes H(H)-L(H).

The grounds for this seemingly unlikely interpretation of the 'falling' tone lie in the way in which the tonal contours are described and the fact that H.-Y. Lee's model did not include final lowering. H.-Y. Lee's Phrasal Tones are described in terms of the relative pitch height at the beginning and the end of a tone, with the exception of rise-falls, and the description refers to neither the preceding pitch peak or valley nor the speaker's pitch range. For instance, a level tone simply indicates that the tone starts and ends at the approximately same level and it is not specified if the tone is produced at a similar level as the preceding pitch peak or valley, or high or low in the speaker's pitch range. That is, H.-Y. Lee's level tone equally refers to a low level (e.g., LL) and a high level (e.g., HH). By the same token, a fall refers to a high fall (e.g., HL) as well as a low fall (e.g., LL). In Seoul Korean, the occurrence of high levels and high falls is relatively restricted, as high initial F0 requires a [+stiff vocal cords] onset in the AP initial syllable, and this suggests that H.-Y. Lee's level and falling tones should indicate principally low levels and low falls. In addition, the lack of final lowering suggests that a low fall in the utterance final position should actually be analysed as a low level. That is, a low fall and a low level are, in fact, the identical tone and a low fall should merely refer to the variant of a low level affected by final lowering. This assumption is supported by H.-Y. Lee's description that the "falling tone occurs primarily in the IP final APs" (Lee 1996:226; my translation) and the report that the realisation of the IP penultimate L tone (in the IP penultimate syllable) is significantly affected by final lowering in statements and yes-no questions (Kim 2006).

If H.-Y. Lee's rising-falling and 'falling' tones are correctly interpreted in the framework of autosegmental intonation phonology, the 'emphatic' - 'uninvolved' contrast should also be found in the newly analysed rising-falling and level tones, and empirical evidence suggests that it is indeed the case (see 6.1.1). The evidence indicates that the alternation between rise-fall and low level in the IP final AP is conditioned by information status, creating the contrast comparable to H.-Y. Lee's 'emphatic' and 'uninvolved' or H* and L* in American English (Pierrehumbert & Hirschberg 1990). This suggests strongly that the contrast should be created by the presence (and the absence) of the H peak, i.e., LH-L contrasts with L(H)-L.

The hypothesis that the presence/absence of the H peak is phonological and is affected by information status goes against some of the basic claims in S.-A. Jun (2005); In her model of Korean intonation (see 3.2.1), the presence/absence of the AP peak in the AP contours is simply a phonetic variation conditioned by the number of syllables in an AP and the absence of the peak is analysed as the absence/deletion of the H tone in LH-L. However, the F0 contours in Figure 6.1, for instance, suggest that the lack of TBU does not necessarily lead to tonal deletion, particularly, in the IP final AP. This is clearly indicated by the distinct rising-falling F0 contour (i.e., LHL) on two syllables before H% or L% (see the F0 tracks of the first and last name in Figure 6.1). It also suggests that the undershoot tones may not be without phonetic realisation, but simply drastically reduced in realisation (see the F0 contours indicated with the arrows). In this chapter, we aim to clarify whether the presence/absence of the AP peak is phonological, and affected by information status and/or the number of syllables in an AP, and whether undershot tones are realised or deleted.

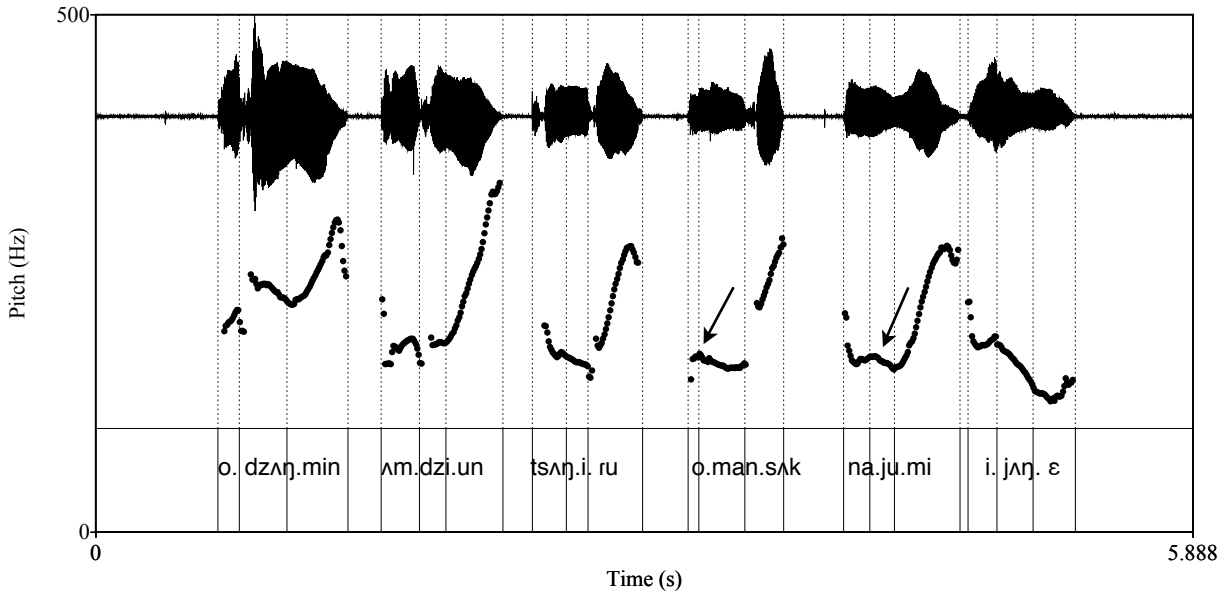


Figure 6.1. A list of names produced by a female speaker. Each name is three syllables long and the utterance contains six names without a conjunction. They are all produced as IPs as indicated by the lengthening of the final syllable and a high boundary tone (with the exception of the final IP). Note that some F0 tracks, notably, the first one, have a distinct initial peak, whereas others, e.g. the third name, contain barely identifiable peaks. Note also that the fourth and fifth names contain F0 perturbation (indicated with arrows) that may well be the AP initial peak.

The rest of this chapter is organised as follows. In 6.1, we present information status and the AP length as the factors affecting the realisation of the AP peak based on the empirical evidence and the tonal undershoot in S.-A. Jun (2000, 2005). This is followed by the detailed report on the production experiment in which we investigated the effect of information status and the AP length on the realisation of the AP initial L and H tones. In 6.3, the results and theoretical implications are discussed. This leads us to an alternative analysis of the AP in terms of a LH phrase accent associated with the initial syllable.

6.1. Factors affecting the variation of the AP peak

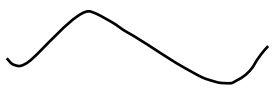
6.1.1. Information status

It was explained earlier (see 1.1.2.1 for details) that in Korean, utterances often consist only of phrases with new information, as given information (as well as predictable or highly probable information) is routinely left out. When given information is included, it is usually in the form of verbs (or verb phrases). When these verbs are very short with only one or two syllables, or preceded by a wh-word (see the wh-question in (6.1), for instance), they often form an AP together with the preceding item. Longer verbs[56], on the other hand, usually form a separate AP, which allows for the difference in the information status (new vs. given) to be reflected in the AP contours.

(6.1)

A: [[tsʌm.ɕʰim]$_{AP}$[mʌ.gʌ.s'ʌ. -jo]$_{AP}$]$_{IP}$?
lunch ate-$_{honorific\ particle}$

'Did you have lunch?'



[[mwʌ. mʌ.gʌ.s'ʌ. -jo]$_{AP}$]$_{IP}$?
what ate-$_{honorific\ particle}$

'What did you have (for lunch)?'

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[56] It is highly unlikely that a longer verb, such as /mʌ.gʌ.s'ʌ.-jo/ 'ate' in (6.1), becomes a part of another AP, as long APs (five syllables or more) are difficult to produce. However, wh-questions are exceptions. In 'What did you have (for lunch)?', for instance, the wh-word and the verb has to be produced as a single AP. Otherwise, the utterance is understood as 'Did you eat something?' (S.-A. Jun & M. Oh 1996).

Phrasing and dephrasing naturally has effects on AP contour shapes. In (6.1), 'Did you have lunch?' and 'I had Bulgogi.' contain two APs, respectively. If there were only one AP, the contour would look similar to that of 'What did you have (for lunch)?' with a gradual fall from the initial peak to the penultimate syllable. See 1.1.2.1 for more discussion on phrasing and dephrasing in Korean.

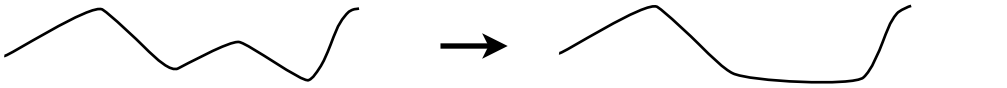
B: [[pul.go.gi.]$_{AP}$[mʌ.gʌ.s'ʌ.-jo.]$_{AP}$]$_{IP}$
Bulgogi ate-$_{honorific\ particle}$

'I had Bulgogi.'

In (6.1), utterances all contain the verb /mʌ.gʌ.s'ʌ.-jo/ 'ate'-$_{honorific\ particle}$ and it is an AP on its own in 'Did you have lunch?' and 'I had Bulgogi'. Note that the AP is produced with different pitch contours in the two utterances. It has a rise-fall followed by a high IP boundary tone (i.e., ^H%) in 'Did you have lunch?' where it is new information. On the other hand, it has a low level followed by a low IP boundary tone (i.e., L%) in 'I had Bulgogi', where the verb is given information. If /mʌ.gʌ.s'ʌ.-jo/ 'ate' is produced with a low level contour in 'Did you have lunch?' (see (6.2) for illustration), it alters the meaning of the utterance.

(6.2)

a. b.



[[tsʌm.ɕ^{h}im]$_{AP}$[mʌ.gʌ.s'ʌ. -jo]$_{AP}$]$_{IP}$ [[tsʌm.ɕ^{h}im]$_{AP}$[mʌ.gʌ.s'ʌ. -jo]$_{AP}$]$_{IP}$
lunch ate-$_{honorific\ particle}$

'Did you have lunch?' 'You had LUNCH?'

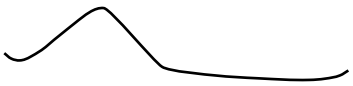
Since we kept the high boundary tone of (6.2-a), (6.2-b) remains a question. However, (6.2-a) and (6.2-b) seek different information. (6.2-a)[57] asks whether the interlocuter has 'had lunch' while (6.2-b) asks if it is 'lunch' which the interlocuter has eaten under the assumption that he has eaten something. For instance, (6.2-b) may be directed to, say, a colleague who has an empty plate on his desk with bread crumbs scattered around. The plate (and bread crumbs) leads to the assumption that he had eaten something, prompting a question if it was lunch or a snack. Thus, 'ate'/ 'have eaten' is

[57] it should be noted that there is no perfect tense in Korean. (6.2-a) may be interpreted as perfect tense as well as past tense in English, even though the verb is in past tense in Korean.

situationally given in (6.2-b). It is this assumption[58] that distinguishes (6.2-a) from (6.2-b) in meaning by altering the scope of focus. In (6.2-a), the whole utterance (i.e., 'have eaten / had lunch') is in focus, while, in (6.2-b), only 'lunch' is in focus.

(6.3)

a.



[[pul.go.gi.]$_{AP}$[mʌ.gʌ.s'ʌ.-jo.]$_{AP}$]$_{IP}$
Bulgogi ate-$_{honorific\ particle}$

'I had BULGOGI.'

b.

[[pul.go.gi.]$_{AP}$[mʌ.gʌ.s'ʌ.-jo.]$_{AP}$]$_{IP}$

'I HAD Bulgogi / I HAD BULGOGI.'

The alternation of the AP contours affects (6.3-a) and (6.3-b) in the same way, but just the other way round. (6.3-a) has focus on 'Bulgogi' and (6.3-b) either on the whole utterance or 'ate/had' (focused word in capitals in the gloss). Note that in (6.1), (6.3-a) is employed as an answer to the question 'what did you have (for lunch)?', which requires focus on 'Bulgogi'. Note also that the verb is repeated from the question and may be omitted. (6.3-a) may be reduced to /pul.go.gi.-jo/ 'Bulgogi'-$_{honorific\ particle}$ without the following AP /mʌ.gʌ.s'ʌ.-jo/ 'ate/had'. However, 'ate/had' cannot be omitted in (6.3-b), as the focus is on the whole utterance or 'ate/had' itself. It is typically used as an answer to broad focus inducing questions, such as, 'What did you do?' (see (6.4) below for an example), which suggests that the utterance should carry only new information. It may also be understood as having contrastive (or corrective) focus on 'ate'. When in contrastive (or corrective) focus, the second peak is higher than in broad focus and it is also higher (or as high as) the preceding peak. This is reflected in the illustration of the pitch contours in (6.4).

[58] (6.2-b) may also express incredulousness, or sarcasm when the assumption conflicts with the interlocuter's assertion as in (6.4). For instance, in (6.4), 'You cooked Bulgogi?!' expresses incredulousness, as the speaker's assumption that the interlocuter cannot cook is contradicted by what he believes to have been said by B, which is 'I cooked Bulgogi.'

(6.4)

A: What did you do in the kitchen?

B: 

[[pul.go.gi.]$_{AP}$[mʌ.gʌ.s'ʌ.-jo.]$_{AP}$]$_{IP}$
Bulgogi ate-$_{honorific\ particle}$

'I ATE BULGOGI.'

A: 

[[pul.go.gi.]$_{AP}$[man.dɯ.rʌ.s'ʌ.-jo.]$_{AP}$]$_{IP}$
Bulgogi made-$_{honorific\ particle}$

'You cooked Bulgogi?! (I can't believe you cooked!)'

B: 

[[pul.go.gi.]$_{AP}$[mʌ.gʌ.s'ʌ.-jo.]$_{AP}$]$_{IP}$

'(I didn't cook.) I ATE Bulgogi.'

This suggests that the AP contours are used distinctly according to the presence/ absence of the AP peak and the distinction is conditioned by different information status. The presence of the AP peak indicates 'newness' and the lack of it 'givenness' of information.

6.1.2. AP length

AP length is a major factor that creates the variation of AP contours in S.-A. Jun[59] (1996, 2000, 2005). When the number of syllables in an AP is smaller than four, i.e., the number of tones in the AP defining TH-LH pattern, it is assumed that either or both the central tones of the T**H-L**H 'undershoot' (the central tones in bold face) yielding different AP contours. In IP final APs, however, only the 'undershoot' of the H tone can be assumed because, first, the L tone is constantly present in the penultimate syllable regardless of finality (i.e., whether an IP is utterance medial or final) or utterance types (see chapter 5)

[59] See 3.2. for detailed discussion of 'tonal undershoot' and tone-syllable association in S.-S. Jun's model.

and, second, the final syllable is occupied by an IP boundary tone, T%, instead of the final H. Therefore, the alternation of a low level and rising-falling contour exemplified in (6.2) and (6.3) should be represented tonally as L(H)-L T% (undershot tone in brackets) and LH-L T%, respectively, as illustrated in Figure 6.2.

Figure 6.2. Tonal undershoot and the absence/presence of the AP peak in the IP final AP. The undershoot tone is shown in brackets. T% represents an IP boundary tone. The representation shows that the AP initial H tone undershoots in a low level AP tone, while it does not in a rising-falling AP tone.

'Tonal undershoot' is central in explaining AP contour variation in S.-A. Jun's model. Nonetheless, little is known about it other than that its occurrence seems to be affected by the number of syllables in an AP, raising varying questions (see also 3.2): if the 'tonal undershoot' is triggered by the lack of syllables only or if there are other factors affecting the occurrence of the undershoot; if the undershot tones are not realised, as assumed in S.-A. Jun, or they are merely reduced in their realisation making their presence less noticeable. In the following section, an attempt is made to provide some answers to these questions.

6.2. Realisation of the AP tones

We investigated the realisation of the AP initial LH rise. We assume that the presence of tones is indicated by the presence of tonal targets which are realised as inflection points, e.g., peaks and valleys, in the F0 contour. We located the tonal targets of the AP initial L and H tones by adopting the procedure in D'imperio (2000) and Welby (2003b) (see **Method and measurements** section below) and examined the alignment and the F0 height of the tonal targets as well as the durations of the syllables which the tonal targets are aligned with.

The target APs were placed in utterance final position. In Jun's model, the realisation of the AP final LH is predictable in the IP/utterance final position. The final H tone of the TH-LH pattern is not realised, as the final syllable is associated with the IP boundary tone (see 3.2.2). The AP penultimate L tone is constantly present as indicated by the consistent low pitch in the IP/utterance penultimate syllable (chapter 5).

The consistent presence of the IP penultimate L tone restricts the variation of the AP tones to two types, rise-fall and low level, when the AP initial syllable is associated with a low tone. This suggests that tonal variation is the result of the presence/absence of the AP peak, i.e., the realisation of the AP initial H tone (see 6.1.2. above). The restricted variation of the AP tones allows us to examine how a rise-fall and a low level differ in usage and in the realisation of the H tone.

More importantly, the utterance final position of the target AP helps to locate the H tone target in the low level tones. Earlier research on the L tone downtrends in Korean shows that final lowering hardly affects the initial L tone in the utterance final AP, whereas it lowers the penultimate L tone drastically (Kim 2006). That is, the F0 level difference between the two L tones, either side of the AP initial H tone, is distinctly greater in the utterance final AP than in the non-final APs. This suggests that the H tone target should still be distinctly higher than the following utterance penultimate L tone. That is, the H tone target should be identifiable as the beginning of an abrupt F0 fall to the penultimate L tone and a turning point in the F0 contour (see Figure 6.3-a). However, if the H tone is not realised at all, there should be no F0 turning point and the F0 contour should simply interpolate between the initial and the penultimate L tone targets (Figure 6.3-b).

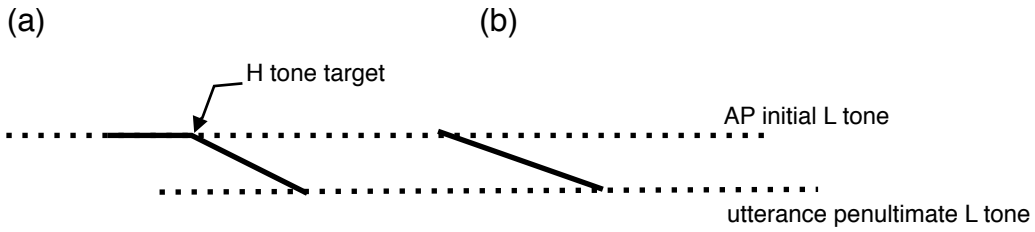


Figure 6.3. Schematic representations of the low level AP tone contours in the utterance final position. The solid lines represent the AP contours and the dotted lines the levels of the initial and the penultimate L tones. Note that the utterance penultimate L tone (lower dotted line) is represented considerably lower than the AP initial L tone reflecting the effect of final lowering. The solid lines in (a) and (b) represent the F0 contours with and without the H tone target, respectively.

It should be noted that, despite the difference in the shape, the contours in Figure 6.3 should be perceptually very similar and may be perceived equally as a low level or low fall. However, tonally, Figure 6.3-(a) and Figure 6.3-(b) are represented distinctly as LH-L and L(H)-L, respectively, because only Figure 6.3-(a) contains the F0 turning point which is the H tone target. If the low level tone in the following experiment contains an inflection point as Figure 6.3-(a), we are forced to assume that the AP initial H tone is undershot in the sense of being reduced rather than being deleted. The contour should be represented as LH-L and analysed as a variant of a rising-falling AP contour. On the other hand, if the contour does not contain an F0 inflection point as Figure 6.3-(b), we should assume that the AP initial H tone undershoots and is deleted (or delinked).

6.2.1. Experiment

6.2.1.1. Procedure

Material The target sentences contained two proper names connected with the conjunctional particle[60] /-iɾaŋ/ 'and'. The structure induces the names to be produced as two separate phrases; *name-A* /-iɾaŋ/ *name-B*. The target phrase was the second name located in sentence final position and was varied according to two conditions: the number of syllables and the information status. The number of syllables was varied between three and four by adding the honorific particle /-jo/ at the end of the target name. This is shown in (6.5) and (6.6) (target phrase in italics in the gloss).

[60] Particles in Korean are all bound morphemes and form a single word with the preceding word.

(6.5)

pɛ.joŋ.dzu.n-i.ɾaŋ o.mi.ɾa / i.sʌ.dzi.n-i.ɾaŋ o.mi.ɾa
Bae Yongjun' -'and' '*Oh Mira*' / 'Lee Seojin' -'and' '*Oh Mira*'

(6.6)

pɛ.joŋ.dzu.n-i.ɾaŋ o.mi.ɾa-jo / i.sʌ.dzi.n-i.ɾaŋ o.mi.ɾa-jo
'Bae Yongjun' -'and' '*Oh Mira*'-hon. particle / 'Lee Seojin' -'and' '*Oh Mira*'-hon. particle

The target sentences were planted in short dialogues consisting of a question and an answer. Two different questions were used, so that the target name phrase in the answer carries new information in one dialogue, but given information in the other. The examples are provided in (6.7) and (6.8). In (6.7), the question is 'Who starred in the film ___?' and the answer (i.e., the target sentence) introduces two names into the conversation. The target name phrase [o.mi.ɾa] conveys 'new' information. On the other hand, in (6.8), the question seeks confirmation suggesting two names [pɛ.joŋ.dzun] and [o.mi.ɾa]. The answer corrects the first name by introducing a new name into the conversation, but the target name [o.mi.ɾa] is simply repeated. The target phrase [o.mi.ɾa] conveys 'given' information.

(6.7)

A: Who starred in the film 'Secret sunshine' ?
B: pɛ.joŋ.dzu.n-i.ɾaŋ o.mi.ɾa
'Bae Yongjun' -'and' 'Oh Mira'

(6.8)

A: mi.ɾjaŋ.-e na.o.nɯn.ge pɛ.joŋ.dzu.n-i.ɾaŋ o.mi.ɾa.-dzi
'Secret sunshine'-'in' 'starred' 'Bae Yongjun'-'and' 'Oh Mira'-interrogative ending[61]

Was it Bae Yongjun and Oh Mira who starred in the film 'Secret sunshine'?

B: i.sʌ.dzi.n-i.ɾaŋ o.mi.ɾa
'**Lee Seojin**' -'and' 'Oh Mira'

[61] The ending -dzi is described as a question ending, however, it is also as a declarative (and imperative) ending. The distinction in the different sentence types is made, mainly, in terms of intonation.

Speakers and recording 15 native speakers of Seoul Korean (five male and ten female) in their late 20s and 30s participated. They were all residents of Germany at the time of experiment and the duration of their stay ranged from six months to four years. They all reported speaking Korean daily.

The recording was made in the sound attenuated booth at IfL-Phonetics, University of Cologne. The dialogues were quasi-randomly ordered with fillers and presented on the computer screen. The author took up the role of the first speaker and asked the questions. The participants were instructed to 'answer' the questions with the provided sentences rather than to read out. Other than that no further instructions were given. The utterances were recorded directly on to a computer disk in 16 bit at the sampling rate of 44100 Hz.

Prosodic analysis A total of 360 utterances (4 conditions x 15 speakers x 6 repetitions) were obtained. One female speaker's utterances contained creakiness in the target phrase. They were found unsuitable for the investigation and discarded. This left 343 utterances, and these utterances were subjected to prosodic analysis following the intonation model proposed by S.-A. Jun (1996, 2000), which assumes two tonally defined prosodic units, Accentual Phrase (AP) and Intonation Phrase (IP). The utterances were all found to contain two prosodic phrases.

Method and measurements The tonal targets, i.e., the turning points in the F0 contours, were located by following the procedure in D'Imperio (2000) and Welby (2003b). The location of an F0 inflection point was calculated as the intersection of two straight lines fitted to the F0 segment around the target inflection point, allowing a consistent decision of the location regardless of the magnitude or the shape of the F0 movement. The computation of the lines and their intersection as well as the annotation of the F0 turning points was done automatically using a series of Praat and R scripts[62].

Reference points (*i*, *j* and *k* in Figure 6.4) were hand-labelled around the region of the inflection points to specify the section of the F0 contour where the regression lines are calculated. For instance, the reference points *i* and *j* were marked near the preceding and

[62] I used Praat and R scripts written by Pauline Welby for this work, and I would like to thank her for making her excellent scripts available on the internet.

following F0 peaks to locate the low (L) F0 turning point (*j* and *k* for the high (H) turning point). Using a Praat script, F0 and the time information was extracted from the marked stretch. An R script calculated two regression lines (represented as dash-dotted lines) fitted to the extracted F0 segment and the intersection of the two lines. The labels, L and H, were inserted at the calculated intersection points into the Praat TextGrid files. Inserted labels were visually inspected and obvious errors were manually corrected.

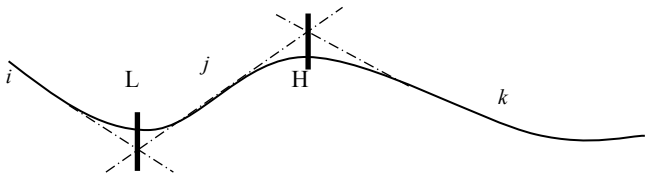


Figure 6.4. Schematisation of the inflection points labelling in the target phrase (modified from Welby 2003b: 69). The reference points (i, j and k) were hand labelled. The regression lines are represented with dash-dotted lines and the calculated intersection of the regression lines are tagged L and H, respectively.

The F0 turning points, labelled with L and H in Figure 6.4, are assumed to be the intended targets of the AP initial L and H tones. The locations of the turning points were represented as the ratio of the first and the second syllables of the target phrase. These syllables are assumed to be associated with the L or the H tones, respectively (see chapter 3), and the L and H inflections points are actually located in the respective syllables. We measured the distance from the beginning of the initial syllable to the L point and divided it by the duration of the initial syllable. By the same token, the location of the H inflection point was represented in terms of the second syllable duration.

For the scaling of the tonal targets, F0 values were extracted at the low and high turning points. Occasionally, the F0 of the target high turning point could not be extracted due to the discontinuities in the F0 tracks. In such cases, F0 was extracted at the nearest measurable point. The excursion size of the AP rise (i.e., the rise from L to H) was calculated additionally. The measured F0 values were normalised in semitones. The mean F0 of the L turning points were computed for the individual speakers and served as the reference values (see Appendix III). In addition, the durations of the target phrase and its two initial syllables (σ1 and σ2 in Figure 6.5) were measured separately.

In summary, the following measurements were made (see Figure 6.5).

The duration was measured

- of the initial syllable of the target phrase (*a*)
- of the second syllable of the target phrase (*b*)
- of the target phrase (*c*)

The distance was measured

- from the beginning of the phrase initial syllable to the L turning point (*d*)
- from the beginning of the second syllable to the H turning point (*e*)

F0 values were measured

- at the F0 inflection points L and H, respectively
- and the excursion size of the LH rise was calculated

The mean values of the measurements were calculated in each category for each individual and subjected to repeated-measures ANOVA with factors NO. OF SYLLABLES and INFORMATION STATUS.

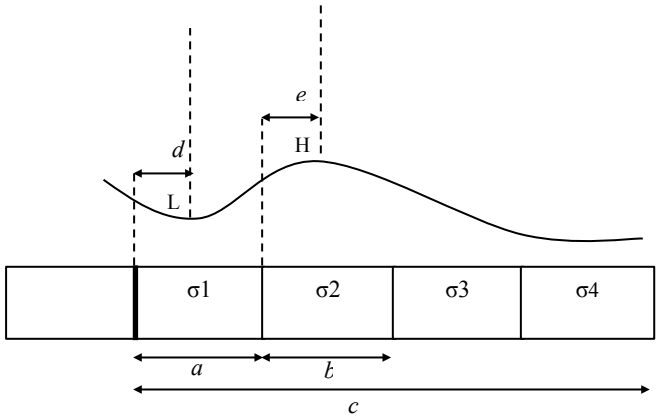


Figure 6.5. Schematised representation of the measurements. The beginning of the target phrase is marked with a thick line and the syllables are represented as square blocks σ1~σ4. The duration of the first and the second syllables (a and b) were measured as well as that of the phrase (c). F0 values were extracted at the inflection points L and H, and the size of the rise excursion was calculated. The distance was measured from the beginning of the phrase initial syllable to the L turning point (d) and from the beginning of the second syllable to the H turning point (e).

6.2.1.2. Results

Scaling of the L turning point There was a significant main effect of INFORMATION STATUS ($F(1, 13)=7.778$, $p<0.05$). The L inflection point was scaled higher in new information than given information.

Scaling of the H turning point Significant main effects were reported of NO. OF SYLLABLES ($F(1,13)=31.781$, $p<0.001$) and INFORMATION STATUS ($F(1,13)=29.580$, $p<0.001$). The turning point was scaled higher in the longer phrase and new information. The interaction effect between NO. OF SYLLABLES and INFORMATION STATUS was also reported significant ($F(1,13)=18.056$, $p<0.01$). The interaction graph in Figure 6.6. shows that the increased number of syllables has stronger effect in new information causing a greater scaling difference than in given information. The interaction effect indicates that the scaling difference caused by NO. OF SYLLABLES is statistically significant in new information.

Rise excursion Since the scaling of the L inflection point is fairly stable, the size of the rise excursion (the scaling difference between the L and the H inflection points) showed similar results to the H point scaling. There were significant main effects of NO. OF SYLLABLES ($F(1,13)=32.534$, $p<0.001$) and INFORMATION STATUS ($F(1,13)=18.109$, $p<0.01$) as well as an interaction effect of NO. OF SYLLABLES X INFORMATION STATUS ($F(1,13)=7.985$, $p<0.05$).

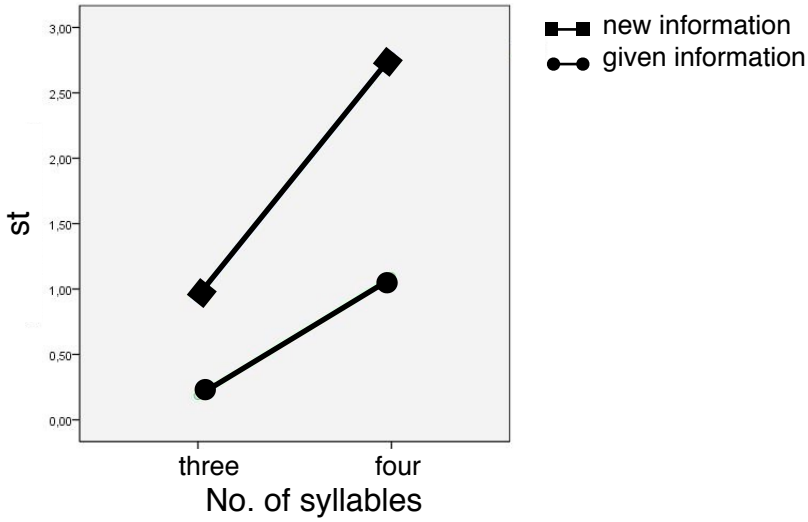


Figure 6.6. Interaction graph of NO. OF SYLLABLES x INFORMATION STATUS in the scaling of the H turning point. The increased number of syllables raises the scaling of the H turning point more drastically in new information and this is statistically significant.

No. of syllables	Information status	F0 inflection points (st)		Rise excursion (difference between L and H points)
		L point	H point	
three	new	0.25 (0.5)	1.18 (1.0)	0.93
	given	-0.24 (0.6)	-0.06 (1.1)	0.18
four	new	0.34 (0.6)	3.09 (1.1)	2.75
	given	-0.39 (0.4)	0.72 (1.6)	1.09

Table 6.1. The scaling of the F0 inflection points. The mean values are given in semitone and standard deviation is in brackets. (See Appendix III for the reference values for the semitone conversion.)

Alignment of L turning point No main effects of INFORMATION STATUS or NO. OF SYLLABLES were reported. However, there was the interaction effect of the factors ($F(1, 13) = 5.105$, $p<0.05$). This indicates that NO. OF SYLLABLES had different effects on new and given information. The interaction graph in Figure 6.7. shows that increasing the

number of syllables has contrasting effect on the alignment of the L elbow. Whereas the alignment remains relatively consistent in new information, it is distinctly later in given information. The interaction effect indicates that the later alignment is significant in given information.

Alignment of H turning point There were significant main effects of NO. OF SYLLABLES ($F(1, 13) = 25.340$, $p<0.001$) and INFORMATION STATUS ($F(1, 13) = 5.512$, $p<0.05$). The H turning point was aligned later in the longer four syllable phrase and in new information.

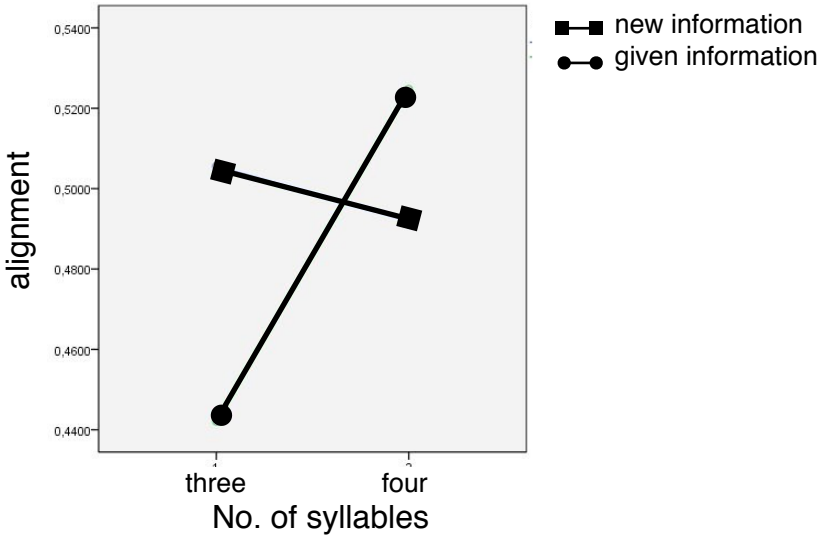


Figure 6.7. Interaction graph of NO. OF SYLLABLES x INFORMATION STATUS in the alignment of L turning point. It shows that NO. OF SYLLABLES had distinct effect according to the information status and the additional syllable caused the L elbow to be aligned significantly later in given information .

No. of syllables	Information status	L elbow alignment (% of 1st syllable)	H elbow alignment (% of 2nd syllable)	Distance between L and H turning points (ms)
three	new	50.6 (23.8)	53.0 (8.8)	131.5 (29.4)
	given	44.2 (25.4)	47.3 (11.6)	124.2 (27.2)
four	new	49.2 (21.3)	69.1 (13.9)	153.2 (22.9)
	given	52.5 (26.7)	63.4 (14.5)	135.4 (23.3)

Table 6.2. Alignment of the L and the H turning points. The location of the F0 inflection points, or elbows, is represented as the percentage of the syllable where the elbow is located. Standard deviation is provided in brackets.

Duration of the phrase initial syllable There was neither a main effect nor an interaction of factors in the duration of the phrase initial syllable.

Duration of the second syllable A significant main effect of INFORMATION STATUS ($F(1,13)=13.135$, $p<0.01$) was reported. The second syllable was longer in new information. As a matter of fact, new information increased not only the mean duration of the second syllable, but also the initial syllable (see Table 6.3).

Duration of the target phrase There was a significant main effect of NO. OF SYLLABLES ($F(1,13)=87.301$, $p<0.001$). As expected, the four syllable phrase was longer than the three syllable phrase. It is interesting to note that INFORMATION STATUS had no effect on phrase duration, despite the result that the second syllable is significantly longer in new information.

No. of syllables	Information status	1st syllable	2nd syllable	Phrase
three	new	104.7 (17.1)	148.0 (19.5)	448.0 (57.3)
	given	101.8 (13.1)	140.8 (18.6)	451.3 (51.8)
four	new	102.8 (11.8)	143.5 (15.7)	558.1(63.0)
	given	95.3 (9.6)	139.3 (16.3)	545.7 (52.7)

Table 6.3. Duration measurements of the two phrase initial syllables and the target phrase (in ms). Standard deviation is given in brackets.

6.2.1.3. Discussion

Scaling of the F0 inflection points The scaling results reveal that, on the whole, the H peak is scaled higher than the L valley (see Table 6.1). The H may be lower than the reference value, which is the mean of the L elbow measurements (see Appendix III). However, it is still scaled higher than the L inflection point (e.g., the third row from the bottom in Table 6.1). This suggests that F0 rises phrase initially from the L elbow to the H peak, albeit very gradually, and it then falls to the L tone target in the penultimate syllable. That is, the AP contours are rising-falling regardless of phrase length and information status.

The scaling results in Table 6.1 include 66 instances (about 19% of the total 343 target phrases) where the H elbow was scaled lower than the L elbow. These instances are found in all four categories. However, Table 6.4 clearly suggests that the lower H elbow is far more likely, when an AP contains three syllables than four and given information than new information. (Note that there is only one instance of lower H elbow in four syllable new information.)

No. of syllables	Information status	No. of phrases with lower H elbow
three	new	16 (24%)
	given	30 (46%)
four	new	1
	given	19 (29%)

Table 6.4. The distribution of the phrases in which the H elbow was scaled lower than the L elbow.

The contour shapes of the phrases in Table 6.4 were examined by plotting the normalised F0 values of the selected locations. F0 values were measured at the L and the H targets and the following syllable boundaries and they were normalised in semitone with reference to the F0 height of the L elbow. The time information (i.e., locations) of the F0 measuring points were also normalised in terms of the phrase duration and represented as the percentage of the duration. The plots are presented in Figure 6.8 according to the number of the syllables and information status[63]. The plots show that the contours are not simple falls interpolating the L elbow and the penultimate L tone target (indicated as σ3 in Figure 6.8-(a) and σ4 in Figure 6.8-(b)). Figure 6.8-(b), for instance, shows that the H elbow does not fall on the dashed line connecting the two L tone targets 'L' and 'σ4', but above it. The contours fall gradually from the L elbow to the H elbow and the fall becomes slightly steeper after the H elbow (cf. Figure 6.3). That is, the falling trend changes at the H elbow. This suggests that the H turning point should be the tonal target of the AP initial H tone despite the fact that it is scaled lower than the preceding L tone target. It also suggests that the H tone is consistently present regardless of the number of syllables in an AP, or information status, against the assumption that the AP initial H tone undershoots and has no phonetic realisation.

It is interesting to note that the H elbow is about the same height in the given information phrases despite the length difference (see the fourth and sixth column of the third row in Table 6.5). It seems that the H elbow has reached its lowest level in the three

[63] The four syllable phrase in new information is not included in Figure 6.7, as it is represented by a single phrase.

syllable phrases and cannot be lowered any further. In addition, the H turning point seems to be scaled a little too low even with the effect of final lowering taken into consideration. The result that the low scaling is strongly associated with given information (Table 6.4) suggests that the AP initial H tone has possibly undergone downstep.

	3 syllable phrase				4 syllable phrase	
	new		given		given	
	semitone	time (%)	semitone	time (%)	semitone	time (%)
L elbow	0	12.7	0	11.3	0	7.3
H elbow	-0.5	40.4	-1.2	35.1	-1.4	32.9
σ3	-2.0	56.5	-2.8	52.1	-2.3	42.6
σ4					-4.4	72.5

Table 6.5. Normalised heights and locations of the F0 measuring points in the phrases of Table 6.4. F0 was extracted at the L and the H elbows and also at the beginning of the third (σ3) and the fourth (σ4) syllables. The σ3 and σ4 values represent the height of the penultimate L tone in the three and the four syllable phrases, respectively. The F0 values were converted into semitone relative to the F0 of the L elbow. The location of the four measuring points are represented as the percentage of the phrase duration. The table is presented as graphs in Figure 6.8-(a) and 6.8- (b).

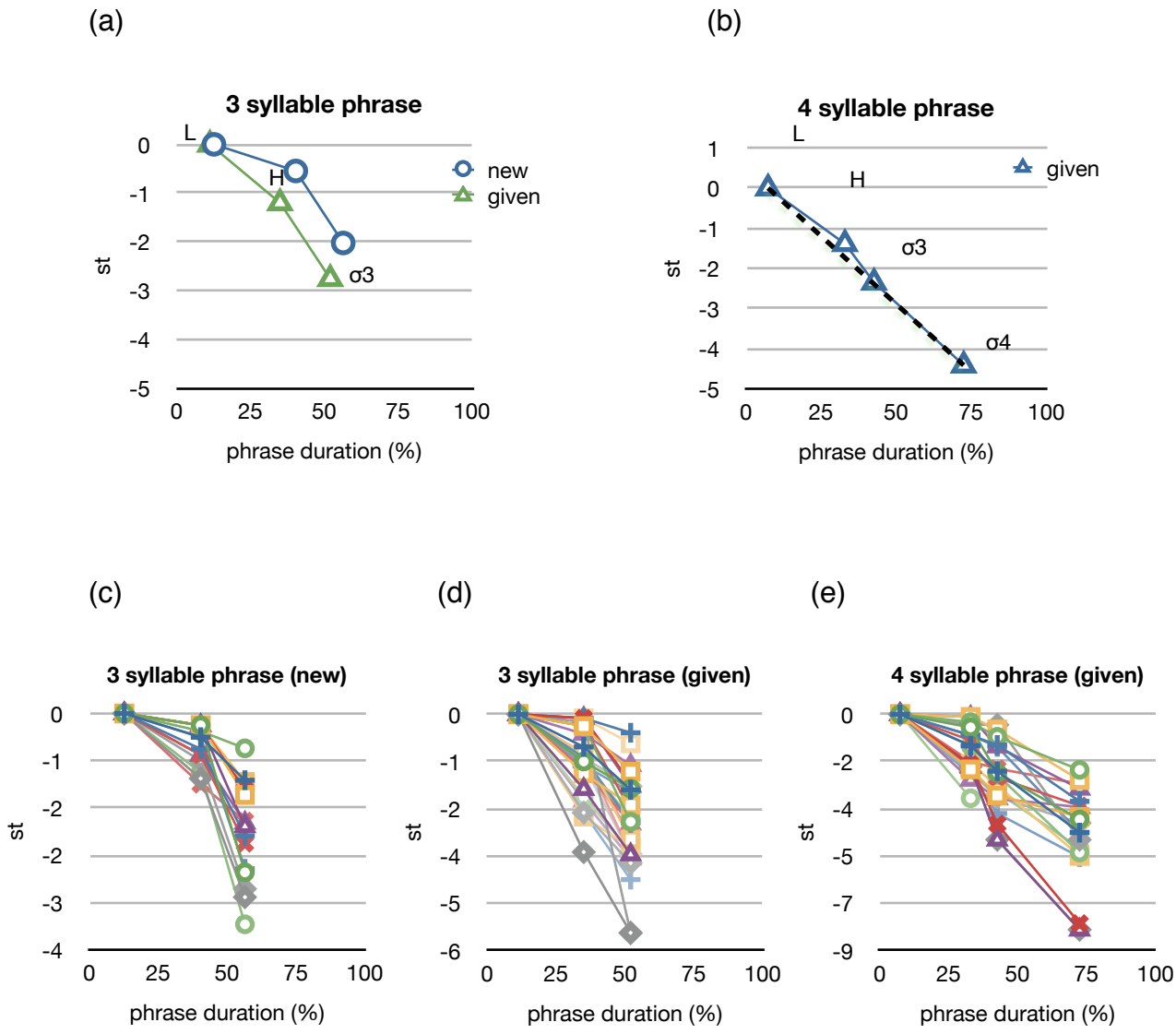


Figure 6.8. The contour shapes of the phrases of Table 6.4. The plots (a) and (b) show the average contour shapes according to the phrase length and information status. The contour for the four syllable phrase in new information is not presented as it is represented only by one phrase. (c), (d) and (e) show the contour shapes of the individual phrases.

Alignment and durations The low and high F0 turning points displayed contrasting characteristics in the alignment. While the H elbow alignment varied significantly from condition to condition, the L elbow was aligned approximately at the center of the phrase initial syllable and the alignment showed little variation (see Table 6.2). The consistent alignment of the L elbow suggests that the AP initial L tone has a characteristic of a starred tone.

This is contrary to the report which suggests that the H tone should be a starred tone with the accentual function to lend prominence (K. Kim 2011). It is also against the syllable duration results. They show that the second AP syllable was significantly longer in new information, but the initial syllable was not affected by the test factors at all. That is, new information lengthened the syllable which the H inflection point is aligned with, but not the syllable which the L point is aligned with. It should be noted that the lengthening of the second syllable should have a greater perceptual effect than indicated by the measured value. ANOVA indicates that the second syllable duration increased, while the phrase duration remained constant and unaffected by information status. This indicates that the other syllables become relatively shorter, which strengthens the perception of the syllable lengthening. This suggests that the H tone, too, has the characteristics of a starred tone supporting the report that the H tone should be a starred tone.

6.3. General discussion

The experiment results suggest that the AP initial L and H tones are constantly present regardless of the number of syllables, which is against the assumption that 'tonal undershoot' is caused by the lack of TBUs (Tone Bearing Units) and the undershoot tones have no realisation (see 3.2). Furthermore, they also suggest that the AP initial L and H tones share the different characteristics of a starred tone. Theoretically, these results have a significant impact and require reconsidering the tonal representation of the AP contours and, more importantly, the AP defining TH-LH tone pattern.

In the following sections, we examine, and compare, the characteristics of the AP initial and the final LH tones. Based on the characteristics, as well as the experiment results and various other evidence, we propose a new analysis of the AP tones.

6.3.1. AP tones and contour variation

6.3.1.1. AP initial LH

The AP initial L tone The experiment results show that the AP initial L tone target is aligned approximately at the centre of the initial syllable and the alignment is constant unlike the following H tone target. It is interesting to note that the consistent alignment of

the L is with the AP initial syllable, which is assumed to be metrically strong in H.-Y. Lee(see 3.1 for more details). He assumes that initial syllables of Phonological Words (PW) have abstract word-level 'stress' which attracts sentence level stress and allows the initial syllables (i.e., 'stressed' syllables) to initiate an AP and be 'accented'. By being 'accented', 'stressed' syllables acquire pitch prominence and rhythmic beat (H.-Y. Lee 1990, 1996). That is, H.-Y. Lee assumes that AP initial syllables have cumulative stress (prominence), providing explanations why accentual phrasing in Korean has functions comparable to those of stress and pitch accent in English (see 1.1.2.1).

Seong's study (1992) suggests that AP initial position causes vowel lengthening (see 3.1.3 for a detailed discussion of his experiment), which is suggestive of prominence (Cho and Keating 2009). Furthermore, the experiment results (see 6.2.1.2) show that the durations of the target phrase and the initial syllable remain unaffected by information status, even though the second syllable is significantly longer in new information. This suggests that the second syllable is lengthened in the expense of the other syllable(s), but not the phrase initial syllable. The vowel lengthening and the constant syllable duration supports H.-Y. Lee's assumption that the AP initial syllable is metrically strong. That is, AP initial L tone is consistently aligned with a metrically strong syllable, and this suggests that the L tone has the characteristics of a starred tone.

The AP initial H tone The alignment of the H tone target varies considerably to the degree that it is assumed that the tone has a loose association with the second syllable (Jun 1998) or secondary association with an edge of a morpheme (see chapter 4). The alignment is affected by various factors. The experiment results in chapter 4 indicate that the alignment of the H peak is affected by the morpheme boundary location and the presence (or the absence) of semantic content in the second morpheme. In addition, the results of our present experiment (see 6.2.1.2) indicate that the H peak alignment is affected by information status and the number of syllables in an AP (i.e., the tonal space). Nonetheless, it should be remembered that the peak alignment varies within the limited distance range from the initial L tone target and the H peak does not occur later than the third AP syllable. That is, the location of the H peak is bound to the L tone.

Despite the inconsistent alignment, it is important to note that the AP initial H tone does display some other characteristics of a starred tone. In chapter 4, we reported that the H tone has accentual function to lend prominence. This is supported by current

experiment results that the H tone increases the duration of the syllable which it is aligned with, when information is new. The H tone has the characteristics of a starred tone as well as the initial L tone.

6.3.1.2. AP final LH

The AP penultimate L tone The constant presence of the AP initial LH tones in the AP contours indicates that, naturally, the occurrence of the tones is predictable in all cases. The occurrence of the AP final LH tones, on the other hand, is predictable only in a certain prosodic context; the IP final position. The AP penultimate L tone is assumed to be present consistently in the IP final AP before the IP boundary tone (Lee 1990, 1997, S.-A. Jun2000). This assumption is supported by the report (K. Kim 2006) that final lowering affects the utterance penultimate L tone and different utterance types are distinguished by different degrees of final lowering. For instance, yes-no questions differ from statements in that it suffers less from final lowering. The report suggests that the AP penultimate L tone should be assumed in all IP final APs regardless of the AP length for the distinction of utterance types and the utterance final and non-final IPs.

In non-IP final APs, however, the AP penultimate L tone may or may not be realised, even if the APs satisfy the length condition and contain more than three syllables. When the L tone is realised, its realisation varies so much that it does not seem to have a fixed tonal target. The AP penultimate L tone has been assumed based on the pitch dip between the two H peaks in the rising-falling-rising contours. However, the pitch dip is observed to be shallower than the pitch valley created by the initial L tone in a sequence of two rises. That is, the second L tone in $[LHLH]_{AP}$ is not as deep as the second AP initial L tone in $[LH]_{AP}[LH]_{AP}$. Also, it seems that the depth of the penultimate L tone is affected by the number of the intervening syllables between the two H tones and it gets deeper as the number of the syllables increases. Similar observations were also made in S.-A. Jun(1998). She notes that "… the falling slope within an AP, from the first H to the following L… is shallower than that across an AP boundary… The height of the medial L is also correlated with the number of syllables within an AP; the medial L gets lower as the number of syllables within an AP increases." (1998:196). This suggests that the realisation of the assumed AP penultimate L tone does not only differ from the AP initial L tone, but also the IP penultimate L tone, which is the same AP penultimate L tone.

It should be noted that a 'pitch dip' does not necessarily indicate the presence of an L tone, particularly when it is located between two H peaks. As a matter of fact, the description of the 'pitch dip' in a rising-falling-rising AP contour is very similar to that of the 'sagging transition' (Pierrehumbert 1980, Ladd and Schepman 2003) between two H* accents in English. English intonation is specified by linearly interpolating the tones in the pitch accents and/or the edge tones (e.g., L- and H%). However, the interpolation of two H* may contain a 'pitch dip' that may or may not rise depending on varying factors, such as the degree of prominence of the pitch accent and the number of the intervening syllables between the H* accents. Due to the 'sagging transition', H* has often been confused with L+H* when it follows an H*, and this has been a major source of transcription mismatch even among the highly experienced ToBI experts. It is difficult to make a concrete decision without experimental studies if the pitch dip in the rising-falling-rising AP contours is an L tone or just the result of a sagging transition. However, the evidence clearly directs that it is a sagging transition rather than a L tone.

The AP final H tone Contrary to the L tone, the AP final H tone is assumed consistently absent in the IP final APs, as the final syllable is preempted by the IP boundary tone. However, this assumption entails the truncation of the tone which is described as the most basic and prominent in the non final APs. It should be remembered that 'tonal undershoot' is responsible for the variation of AP tones and the undershoot is assumed only for the two central tones of the AP pattern, TH-LH (see chapter 3). The AP initial T and the final H tones are assumed to be present in all the varying AP tones in the non final position.

Moreover, rising-falling-rising contours, where all four tones of the AP pattern are realised, are described as often having "higher" final peak than initial peak (H.-J. Lee and H.-S. Kim 1997, S.-A. Jun 1998) and the final peak is typically shown higher in the example F0 tracks and the illustration of the contours (Jun 2000, 2006). This suggests that the final H peak is more prominent than the initial H peak and the preemption of the IP boundary tone actually prevents the realisation of the most prominent tone in the AP tone pattern.

The higher and more prominent AP final H tone suggests that the phrase final element should receive prominence rather than the initial element. However, the morphological structures of Korean APs suggest that the phrase initial element should

receive prominence instead. A Korean AP is typically made up of a content morpheme/ word and the following functional bound morpheme(s), such as, particles including case markers and verbal endings. Semantically significant elements are placed phrase initially and functional elements phrase finally, which suggests that prominence should be placed at the beginning of an AP rather than the end. This conjecture is supported by the findings of our investigation in chapter 4. They indicate that the AP initial H peak has the accentual function to lend prominence and the peak alignment is affected by the presence/absence of semantic content as well as the morpheme boundary location. They also indicate that the AP initial peak is aligned at the end of the initial morpheme, so that the morpheme is marked with the AP initial LH rise. The peak may occur at the beginning of the second morpheme crossing the morpheme boundary when the morpheme has semantic content. However, the peak does not cross the morpheme boundary when the following second morpheme is functional without semantic content.

It should be also noted that the higher final peak conflicts with the definition of an Intermediate Phrase (Jun 2005). Proposing Intermediate Phrase (ip), S.-A. Jun notes that higher AP final peak is an indication of the end of an Intermediate Phrase, which suggests that many of the APs in the earlier analysis should be reconsidered to mark the end of an Intermediate Phrase, possibly, with a boundary tone. She explains that an ip is defined by the conformity to tonal downtrend and the beginning and the end of an ip are indicated by the change in the pitch trend, such as pitch reset and “higher Ha” (i.e., higher AP final H peak). According to this definition, the higher AP final peak in a rise-fall-rise is an indication of the end of an ip[64].

[64] It is possible that S.-A. Jun still maintains the earlier view that the final peak may be higher than the initial peak in rising-falling-rising AP contours. She specifically remarks that “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 (2005:23)”, but she provides no explanations on the initial peak in the AP contours with two H tones, such as, LH(L)H and LH-LH (see Figure 3.4). However, keeping the assumption that rising-falling-rising AP tones have higher final peak in the non ip final positions would, in fact, simply complicate and obscure the analysis of rise-fall-rises, because it would require taking the relative heights of three different peaks (i.e., the initial and the final peaks of the target contour, and the final peak of the preceding phrase) into consideration and different relative heights would indicate different locations in an ip. For instance, when the final peak of a rise-fall-rise is higher than the initial peak and the preceding AP final peak, the AP contour would be ip final. When the final peak is higher than the initial peak, but not as high as the preceding AP final peak, the contour would be ip medial. And yet, the biggest problem lies in the analysis of an ip containing only one rising-falling-rising AP contour. Since the AP is simultaneously ip initial and final, pitch is reset and the final peak is raised at the same time. It would be very difficult to determine if the phrase is ip initial, medial or final, or if it forms an ip on its own, unless pitch reset is distinctly clear in the L tones.

6.3.1.3. Diachronic and synchronic evidence against the AP final LH [65]

It was explained earlier (see chapter 2) that Middle Korean had three distinctive lexical tones, low (L), high (H) and rise (R), represented in orthography with different numbers of dots. These tones disappeared in time and became intonation of standard Seoul Korean today. In order to estimate current status of Seoul intonation, we surveyed earlier research on Middle Korean tones and reconstructed the process how the lexical tones were lost. The consensus among the Korean academics is that the loss of tonal contrast started at the end of a phrase with the generalisation of the 'phrase final H lowering'. Evidence indicates that phrases frequently contrasted in terms of the first H tone and other H tones were replaced with L tones by the lowering rule. That is, phrases began to have rising-falling patterns.

This hypothesis is supported by the phrase tone patterns of the present-day tone dialects, South and North Kyungsang. They are characterised by rising-falling phrase tone patterns and the lack of final rise (see the phrase tone patterns in (2.13) and (2.14)). It is important to note that many of the SK and NK tone patterns are shared by Seoul APs, and they are practically identical when a phrase is four syllables or shorter. In fact, NK rise-falls differ from Seoul only in the location of the H tone. In NK, the H peak can occur any syllable but the last, whereas, in Seoul, it is restricted to the second or the third syllable. That is, the trend of diachronic change suggests that a phrase should contain a single LH rise in today's Seoul, and this is supported by South and North Kyungsang varieties. The evidence suggests that a Seoul AP should contain a rise, but not at the end. It is against the phrase final rise.

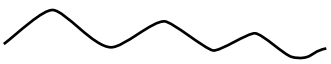
6.3.1.4. Tonal analysis of AP contours

The experiment results suggest that the AP initial LH tones should be present in all APs regardless of the presence/absence of the AP peak and/or the AP length (i.e., the number of syllables) and an AP should minimally consist of the initial LH. This is supported by the fact that rising tones are also found in one syllable APs, albeit not as often as in two or three syllable APs. A phrase as short as one syllable is usually a contracted (or reduced) form of a pronoun and a case marker, which can be and is very often left out,

[65] This section is a summary of chapter 2. The reader is referred to chapter 2 for more detailed information on the lexical tones of Korean.

and usually realised with a low level tone[66]. However, for instance, the initial AP[67] of (6.9) is produced with a rise, when it is in narrow focus and the intended meaning is something like '(Well, you may not want to go home, but) **I** want to go home' (focused word in bold face).

(6.9)



[na-n]$_{AP}$ [tɕi.b-e]$_{AP}$ [ka-l.lɛ]$_{AP}$
'I'-$_{sub.\ particle}$ 'home'-'to' 'go'-'will'
'**I** am going home'

Varying evidence (see 6.2.1.2, 6.3.1.2 and 6.3.1.3 above) suggests that an AP should contain a single LH rise and it should be the initial LH, which indicates that the final LH should not be analysed as AP level tones. As a matter of fact, the realisations of the AP final L and H tones (see 6.3.1.2) are better described as the boundary tones marking a higher level prosodic unit, that is, ip.

The assumption that an AP is defined only by the initial LH actually provides better explanations for the variation of AP contours and their lack of semantic contrasts. It allows rising and rising-falling contours (and high level and high falling contours[68], for that matter) to be analysed as the variants of the LH rise conditioned by the number of syllables. It should be remembered that rising contours occur in the non-IP final APs with three syllables or less, but not in the APs longer than three. In the longer APs, different contour shapes, notably, rise-falls, are found. Figure 6.9-(a) and Figure 6.9-(b) are schematic representations of a rising and a rising-falling contour in a non-final AP, respectively. The contours have the tonal targets for the LH rise in the identical locations (the first and the

[66] Note that the alternation between the rising and low level contour is analogous to that between the rising-falling and low level contour in 6.1.1

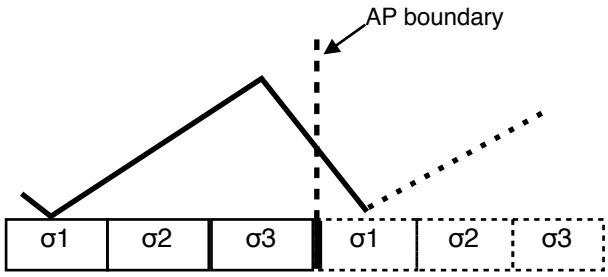
[67] The initial phrase /na-n/ is a contracted form of /na.-nɯn/ I-$_{subject\ particle}$. The phrase may be further reduced to /na/ without the subject particle or expanded back to /na.-nɯn/.

[68] It should be remembered that AP tones have the high initial tone when the onset of the initial syllable is [+stiff vocal cords].

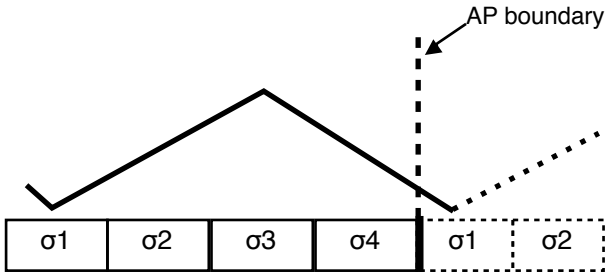
third syllable, respectively) and, after the H peak, they equally fall to the L tone target in the following AP initial syllable. However, they differ in the length of the transitional fall. In Figure 6.9-(a), the fall extends over just about half a syllable of the target AP, and the contour shape is defined by the rise. On the other hand, in Figure 6.9-(b) where the AP is one syllable longer, most of the transitional fall occurs within the initial AP and the contour contains similar portions of the rise and fall. That is, rises and rise-falls differ only in the length of the transitional fall and the duration of the fall is determined by the number of syllables. (Note that the F0 tracks of the first AP in Figure 6.10-(a) and 6.10-(b) have a rising and rising-falling contour, respectively, and they match the description.) This suggests that rises and rise-falls should be represented identically as LH. It also suggests that the alternation of rises and rise-falls is conditioned by the AP length.

At the same time, the assumption explains different shapes of rise-falls in the IP final and non-final APs as a boundary related phenomena. That is, the rise-falls are analysed to have different tonal representations. It should be noted that the two rising-falling AP contours in Figure 6.10-(b) are not identical. The fall of the first rising-falling contour ends in the initial syllable of the following AP. However, that of the second, which is in the IP/utterance final position, ends in the penultimate syllable before the IP boundary tone in the final syllable. Note the F0 valley at the end of the syllable which indicates the presence of a low tone target. This suggests that the rising-falling AP contours should be represented with an extra L tone in IP final positions, i.e., LH **L** (the additional L tone in bold face), unlike the rising-falling contours in non-final positions. The L tone should be analysed as higher level tone because its occurrence is guaranteed before IP boundary tones (see 6.3.1.2). We proposed that it should be an Intermediate Phrase (ip) boundary tone. That is, rising-falling contours are represented as LH in non-IP final APs and as LH L- in IP final APs.

a) Rising AP contour



b) Rising-falling contour in the non-final AP



c) Rising-falling contour in the IP final AP

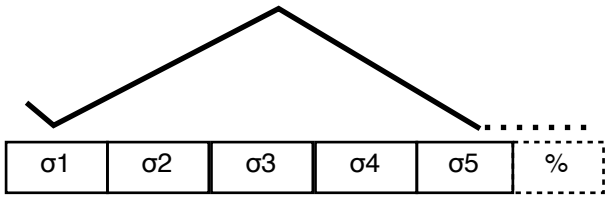


Figure 6.9. Schematic representation of the rising and rising-falling contours in the non-final and IP final AP. The target AP contour is represented with a solid line and the following AP contour with a dotted line. An AP boundary is represented with a dashed line. The IP final syllable is represented with a dashed square labelled % indicating that the syllable is associated with an IP boundary tone.

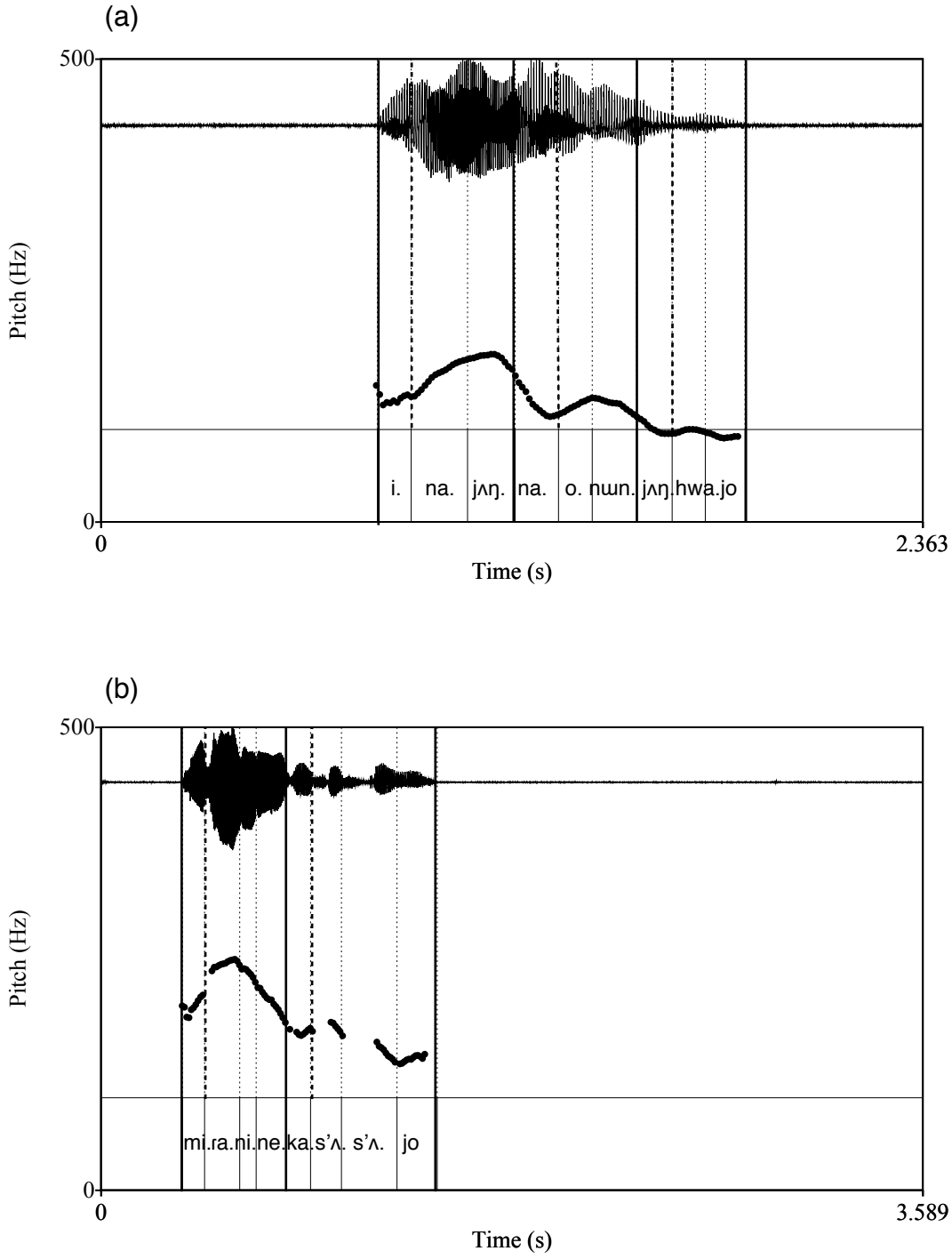


Figure 6.10. Rising and rising-falling contours. An AP boundary is marked by solid lines and the end of the phrase initial syllable by dashed lines. (a) shows the utterance [i.na.jʌŋ.]$_{AP}$ [na.o.nɯn.]$_{AP}$ [jʌŋ.hwa.jo]$_{AP}$ *'(It's) a movie starring Lee Nayoung' produced by a male speaker. The first two APs are produced with rises and the final with a rise-fall. In the two initial APs, F0 rises through the AP to the peak and falls to the L tone target in the following AP initial syllable.(b) shows the utterance* [mi.ra.ni.ne.]$_{AP}$ [ka.s'ʌ.s'ʌ.jo.]$_{AP}$ *'(I) had been to Miran's' produced by a female speaker. Both the APs are produced with rise-falls.*

6.3.2. Phrase accent in Korean

There is some evidence (see 6.3.1.) that only the initial LH of the AP tone pattern (i.e, LH-LH) should be the AP level tones and they are constantly present in the AP contours of all shapes. In terms of alignment, the LH is similar to L*+H in that the L has the consistent alignment with the metrically strong AP initial syllable (see 6.3.1.1) and the H has varying alignment within the restricted distance range from the L tone. However, contrary to the alignment, it is the H tone that has accentual function and lengthens the duration of the syllable which it is aligned with. That is, the LH behaves like a bitonal pitch accent, and yet it cannot be readily determined whether it is L*+H or L+H*, as both the tones display starred tone characteristics. It is evident, nonetheless, that the LH is a single tonal event and somehow associated with the AP initial syllable.

We propose that the LH should be analysed as a phrase accent which demarcates the beginning of an AP. We assume that the phrase accent is structured in such a way that both the component tones are simultaneously associated with the metrically strong AP initial syllable, which causes the tones to share the characteristics of a starred tone. The structure is based on Yip (1989) and Grice (1995) and will be described in the next sections.

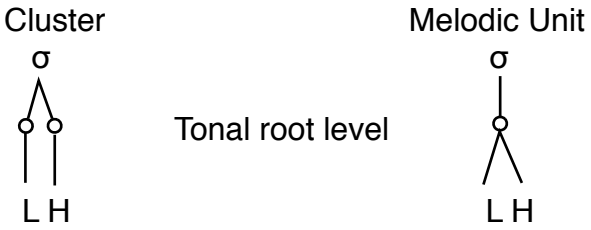
6.3.2.1. Analysis of Contour tones and pitch accents

6.3.2.1.1. Contour tones (Yip 1989)

Yip's (1989) analysis of contour tones distinguishes two types of contour tones called 'clusters' and 'melodic units'. In (6.10), the TBUs (here, syllables) carry equally two tones each. However, they differ structurally in that in clusters, two tonal root nodes are associated with one TBU and in melodic units, one branching tonal root node is associated with one TBU.

Clusters are typical of African tone languages. They are largely found domain finally, for instance, as a result of association of excess tones with the final TBU (see (6.11-a)). Therefore, clusters may distribute and a contour tone on monosyllabic word is observed to be a sequence of two level tones on a bisyllabic word (see (6.11-b)). That is, they behave like two different tones forced into a small tonal space.

(6.10)

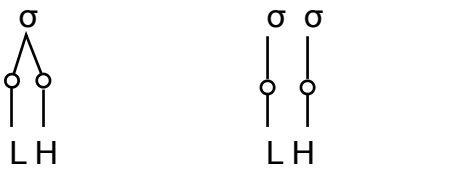


(6.11)

a.

b.

[mbă] ‘rice‘ [fàn dé] ‘cotton’

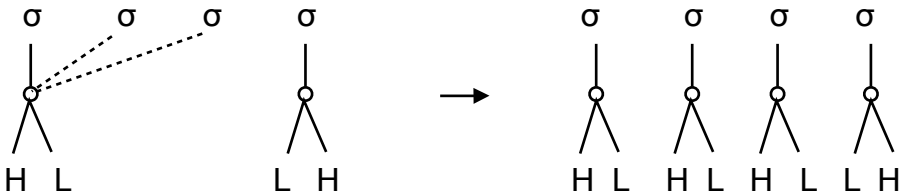


* (6.10)-a is taken from Grice (1995) and (6.11-b) is modified from Mende examples in Yip (1989).

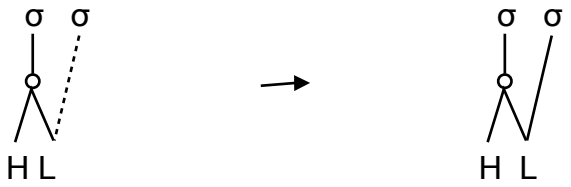
On the other hand, melodic units are typical of Chinese. They appear on any TBU freely without the restrictions on locations, and they are not derived or generally do not distribute. Melodic units spread (or are copied) as units and also as a sequence of level tones, and either one of the component tones may spread separately from the other. This is illustrated in (6.12-a) and (6.12-b) with the dashed lines indicating the direction of spreading.

(6.12) Spreading/copying of branching contour tones

a.



b.



6.3.2.1.2. Structure of pitch accents (Grice 1995)

Drawing on Yip (1989) and Grice (1992), Grice (1995) proposed to assign more elaborate structures to English pitch accents distinguishing between melodic units and clusters. Pitch accents with a leading and trailing tone are described to have different underlying structures. T*+T is analysed as a left-headed melodic unit associated with a stressed syllable (see the representations in (6.13-b)), and this accounts for two pitch accents, H*+L and L*+H. Tones in a melodic unit, which are dominated by the same tonal root node, are represented in brackets, differentiating them from tonal sequences, and the tone on the strong branch is marked with * notation to indicate its alignment (as well as association) with the starred syllable; namely, (H*+L) and (L*+H). It should be noted that the L in (H*+L) does not have a phonetic target. The L simply serves as a part of the downstep trigger (Beckman and Pierrehumbert 1986, Pierrehumbert and Beckman 1988), a branching tonal root node, and it is delinked after triggering downstep. On the surface, (H*+L) and H* are identical except that the former triggers downstep in the following accent.

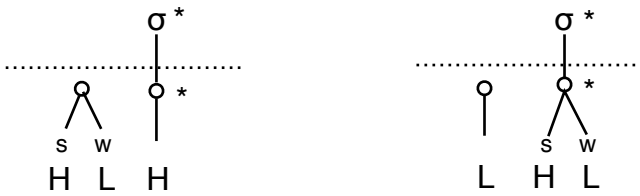
(6.13)

a. two monotonal pitch accents

b. two bitonal pitch accents with one branching tonal root node (melodic units)

c. two bitonal pitch accents with two tonal root nodes
(sequence of tones, potentially clusters)

d. two underlyingly tritonal (but superficially bitonal) pitch accents
with two tonal root nodes



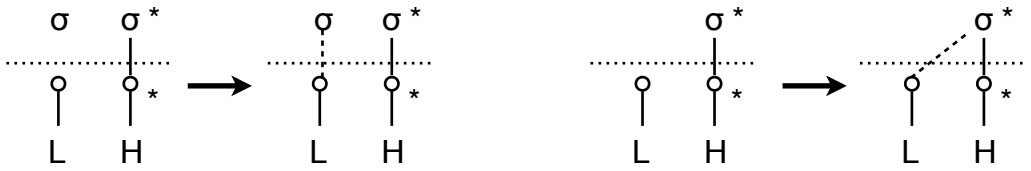
* (6.13) is taken from Grice (1995).
* The star notation indicates a priority association and the dotted line signifies that σ and tonal root node are on different tiers.

Pitch accents with leading tones are analysed as sequences of tones (represented in (6.13-c)). The tones are separately associated with two different syllables. The starred tone is associated with a stressed syllable at the initial stage of derivation and only then, the leading tone is associated with the unstressed syllable immediately preceding the stressed syllable (see (6.14-a)). When there is no free syllable available, e.g., when an utterance begins with a starred syllable, the leading tone is associated with the starred syllable forming clusters (see (6.14-b)). T+T* is also analysed as a sequence of a tone and a melodic unit (i.e., a branching tonal root node) resulting in tritonal pitch accents (shown

in (6.13-d)). However, the surface form of a pitch accent is restricted to be maximally binary only and the valid tritonal pitch accents must contain a branching node with a floating tone, i.e., (H+L). This allows for two tritonal accents, (H+L)+H* and L+ (H*+L).

(6.14)

a. b.



A branching tonal root node triggers downstep in the following node. Pitch accents with a trailing tone in (6.13-b) trigger downstep, while those with a leading tone in (6.13-c) do not. Tritonal pitch accents contain a downstep trigger, (H+L). In L+(H*+L), it triggers downstep of the subsequent pitch accent and then, the floating L tone in (H+L) is delinked. As a result, L+(H*+L) has L+H* as the surface form. L+(H*+L) and L+H* are comparable to (H*+L) and H* in that they have the identical surface form, but only one of them triggers downstep: L+(H*+L) and (H*+L) triggers downstep, while L+H* and H* do not. In (H+L)+H*, downstep occurs within the accent and (H+L) triggers downstep of the H*, the following tonal root node. (H+L)+H* is on the surface H+!H*.

It is important to note that complicated structures like the tritonal accents are needed, primarily because Grice's model assumes two different types of early peak accents H+!H* and H+L*, which are distinguished phonetically with the different pitch level, mid and low, following the peak. The downstep in H+!H* cannot be explained by the earlier assumption that downstep is triggered by the preceding bitonal pitch accent (Beckman & Pierrehumbert 1986) affecting all the tones in a pitch accent. The downstep should be triggered accent internally, and in order to include a downstep trigger, pitch accents should have structures that are more elaborate than simple leading/trailing and starred tone distinction. Other autosegmental-metrical approaches seem to agree on the need for H+! H*, as well as H+L*, in English, even though ToBI (Beckman et al 2005) restricts the use of H+!H* to a phonetic representation of the underlying H+L*. Ladd (1983) uses tonal

features [sustained pitch] and [downstep] on H tone to represent the H+!H* contours. Gussenhoven (2004) has a provision for pitch accent internal downstep in addition to morphological downstep attached to IPs.

Assuming the structures for pitch accents has some advantages over other approaches. First, it provides a consistent analysis of downstep and the alternating occurrence of downstep after, what is superficially, H* and L+H*. It is important to point out that such an analysis is possible by assuming (underlyingly) tritonal pitch accents. Second, it readily accounts for the different behaviour of leading and trailing tones. A leading tone is described to have stable alignment with the unstressed syllable preceding the accented syllable, but reduced severely in realisation when an utterance starts with an accented syllable. That is, the reduction of a leading tone is closely related with the lack of the preaccentual unstressed syllable. On the contrary, a trailing tone occurs at a normalised time distance from the starred tone, but is not aligned with a particular syllable. In addition, it does not undergo reduction in tonally crowded environments (e.g., in the utterance/IP final syllable). Such different behaviour of leading and trailing tones cannot be explained if they differ merely in the occurrence relative to the starred tone, i.e., whether a tone occurs before or after the starred tone. The accent structures (6.13-b) and (6.13-c) draw a phonological distinction between leading and trailing tones, and this provides explanations why only a leading tone is reduced and the reduction is affected by the absence of an unstressed syllable before the accented syllable, not to mention the different alignment characteristics of leading and trailing tones.

In the following section, we examine the characteristics of the LH tones of Korean APs, and propose that the tones are structured as a melodic unit and associated with the metrically strong AP initial syllable.

6.3.2.2. Structure of the Korean phrase accent

The AP initial LH is unusual in that both L and H display the starred tone characteristics (see 6.3.1.1.). However, it is important to note that neither of the tones can actually be regarded as a starred tone on its own, as they do not have the complete qualities of a starred tone. The L tone has the stable alignment with the metrically strong AP initial syllable and the H tone the accentual function, but neither the L nor the H has

both the alignment characteristics and functions of a starred tone. The starred tone characteristics are literally divided up and distributed between the L and H. The tones behave like a mono-tonal pitch accent when it is not taken into consideration that the the accent has tonal movement involving two different tonal targets. As a matter of fact, this suggests strongly that the L and H tones are structured as a melodic unit and associated with the metrically strong AP initial syllable, marking the beginning of an AP. That is, the LH should be a phrase accent.

It should be reminded that in Yip (1989) and Grice (1995), the association of the TBUs is with a tonal root node (or nodes) rather than directly with a tone (or tones), and in melodic units tones are associated to a TBU with one tonal root node (see the schema in (6.10) above), as if they are a single tone. Therefore, the unit should display the same characteristics as a single tone which is associated with a TBU. That is, a melodic unit should behave like a tone, even though it contains two tones. At the same time, differently from a single tone association, the characteristics acquired by the association with a TBU may be distributed among the tones in the melodic unit. That is, for instance, if a melodic unit was associated with a stressed syllable and acquired the starred tone qualities, it would be expected that these qualities are distributed or shared between the tones in the unit.

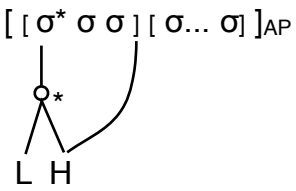
However, it is unlikely that the AP initial LH tones are clusters. Clusters are basically two (or more) separate tones forced to associate with one syllable. The tones behave like two separate tones and they do not share the characteristics as a unit. Rather, they may display the identical characteristics to each other. Also, it should be remembered that Grice (1995 and see also 6.3.2.1.2) assumes that T+T* and T*+T have different structures based on the different behaviours of leading and trailing tones. T+T* is analysed as (possible) clusters, because the leading tone is reduced, e.g., utterance initially, when the accented syllable has no preceding unstressed syllable. By contrast, trailing tones are not reduced even when the accented syllable has no following unstressed syllable. The L tone in the Korean LH sequence is by no means reduced, as is indicated by the clear tonal target.

In addition, it should be noted that the H peak alignment is affected by the morpheme boundary location within the restricted distance range from the L tone (chapter 6). We assume that this is due to the accent structure and the H tone's secondary association (Grice, Ladd and Arvaniti 2000) with a morpheme edge. The melodic unit

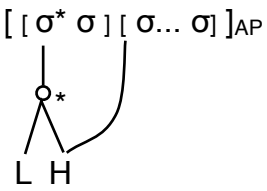
structure restricts inherently the distance between the L and H, so that the H remains in the vicinity of the L tone. The secondary association of the H tone specifies the peak alignment when the location of the primary association is not available. That is, the H tone is realised at the location of the secondary association, because the location of the primary association (i.e., the AP initial syllable) is taken up by the L tone. The H tone is assumed to be secondarily associated with the right edge of the initial morpheme (see 6.15-a). However, it gets associated with the left edge of the second morpheme, when the initial morpheme is shorter than three syllables, e.g., as in (6.15-b), and the following second morpheme has semantic content. The phrase accent structure and the association relation (the primary association indicated with the star notation) is illustrated in (6.15).

(6.15)

a.



b.



6.3.2.3. Phrase accent types in Korean

An AP normally starts with relatively low F0, however, it begins with relatively high F0, when the onset of the AP initial syllable is [+stiff vocal cords]. This provides the grounds for the assumption in Jun's Korean intonation model (Jun 1996, 2000, 2005) that the AP initial L tone alternates with a H tone according to the absence/presence of [stiff vocal cords] in the onset of the initial syllable. That is, it is assumed that an AP starts with HH, when the initial syllable starts with /pʰ, tʰ, tɕʰ, kʰ, p', t', tɕ', k', s', s, h/ and with LH otherwise.

However, it is questionable whether the high F0 caused by the [+stiff vocal cords] consonants is actually an indication of a high tone and whether the alternation of the AP initial tone should be assumed on the level of phonology. It should be noted that the high and low F0 level associated with the feature [stiff vocal cords] is not optional or voluntary in Seoul Korean, which strongly suggests that it is phonetic. It should also be noted that the

alternation of the initial tone entails that L and H do not contrast in the AP initial position. Otherwise, we are forced to assume some kind of association relation between sound classes and tonal meanings, since the tonal association is conditioned segmentally. We have to assume that, strictly in the AP initial syllable alone, [+stiff vocal cords] has the meaning of H tone, as it conditions the occurrence of H tone and, by the same token, [-stiff vocal cords] has the meaning of L tone, as it determines the occurrence of L tone. That is, if L contrasts with H in the AP initial position, we are forced to assume that, e.g., /ha.nɯl/ 'sky' and /ma.nɯl/ 'garlic' convey different intonational meanings not to mention the different lexical meanings, as they have distinct initial tones H and L, respectively; 'sky' begins with a [+stiff vocal cords] consonant and, accordingly, it has the H initial tone and 'garlic' starts with a [-stiff vocal cords] and, therefore, it has the L initial tone. However, in reality, they are just two different words uttered in the same way despite the difference in the initial F0 level, suggesting that the difference is phonetic.

Varying studies indicate that the three-way distinction of Korean obstruents is achieved with VOT (Voice Onset Time) and F0 (Cho, S.-A. Jun and Ladeforged 2002, Choi 2002, M. Kim 2004, Silva 2006, H. Lee and Jongman 2012). It is reported that the high F0 is crucial in the distinction of the aspirated and lenis consonants (i.e., /pʰ, tʰ, ʧʰ, kʰ/ and /p, t, ʧ, k/). However, F0 height does not affect the perception of fortis (or tensed) obstruents, even though they are produced with high F0. Particularly, M. Kim (2004) investigated how VOT and F0 interact to create the the three-way contrast with perception tests as well as production tests. The results of the production tests support earlier studies that the three consonant categories are distinguished by the distinct combinations of VOT and F0; the aspirated is characterised with long VOT and high F0, lenis with intermediate VOT (i.e., shorter than the aspirated, but longer than fortis) and low F0 and fortis with short VOT and intermediate F0 (i.e., not as high as the aspirated). The results of the perception tests show that the F0 height affects the perception of lenis and aspirated. Raising the F0 height of lenis resulted in the categorical shift to the aspirated and lowering the F0 level of the aspirated caused the shift to lenis. However, F0 did not have an effect on the perception of fortis and the perception was constant regardless of the F0 height. This indicates that high F0 is not an acoustic cue to fortis. As a matter of fact, M. Kim's data (reproduced below in Figure 6.11), show that F0 measurements of fortis varies considerably and may be as low as lenis or as high as aspirated, which is why the mean F0 value falls between lenis and aspirated. Note that, on the contrary, VOT is very constant.

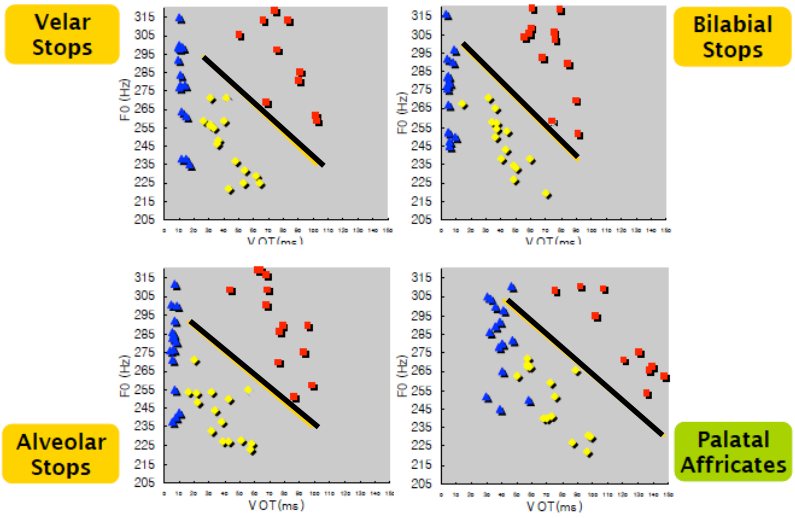


Figure 6.11. The F0 measurements of lenis (diamonds), fortis (triangles) and aspirated (squares) obstruents plotted as a function of VOT (reproduced from M. Kim 2004). The line reflects the results of the perception test and represents the categorical perception border between the aspirated and lenis obstruents. The F0 and VOT values above the line lead to the perception of the aspirated and below lenis.

This suggest that the acoustic property which prompted the adoption of [+stiff vocal cords] categorising fortis/aspirated consonants does not separate fortis and aspirated from lenis. Rather, it distinguishes aspirated from lenis. In addition, Cho et al. (2002) observe that /sʰ/ shares more phonetic characteristics with lenis than aspirated and suggest that /sʰ/ should be classified as lenis, i.e., /s/. Similarly to the lenis stops, but unlike the aspirated, it is aspirated only word-initially and loses aspiration word-medially. Particularly, it often becomes fully voiced in the intervocalic position, which is very distinct from the aspirated stops. Also, the F0 height at the vowel onset is more comparable to the lenis stops than the much higher aspirated stops. That is, only /pʰ, tʰ, ʧʰ, kʰ/ and /h/ are characterised with high F0, suggesting that high F0 is a phonetic property of strong aspiration.

The strong association of high F0 and [+stiff vocal cords] consonants is sometimes taken as a sign of the emerging lexical tones (Hombert 1978, Silva 2006). One of the theories in the tonogenesis is that high F0 in certain classes of sounds develops into lexical tones (Hombert 1978, Hombert, Ohala and Ewan 1979, Maddieson 1984), and

Korean is sometimes mentioned as an example of such a language which had lexical tones added to the system relatively recently for having regional varieties with lexical tones. Contrary to the assumption, the history of the Korean language indicates that lexical tones have become post-lexical tones (see 2.1), and the high F0 of [+stiff vocal cords] consonants should be regarded as a trace of the Middle Korean lexical tones.

On these grounds, we assume only one type of phrase accent, LH, for Seoul Korean and that the alternation of the high and low initial F0 is a phonetic variation conditioned by the presence/absence of [stiff vocal cords] in the onset of the AP initial syllable.

6.3.2.4. The question of downstep

The experiment results show that the accent H tone is sometimes scaled lower than the preceding L tone (see 6.2.1.3), which possibly suggests that the H underwent downstep. Nevertheless, it is difficult to decide if it is actually downstep for various reasons. First, the target phrase is located in the utterance final position where the tonal scaling is severely affected by final lowering, and this makes the task of identifying the occurrence of downstep very difficult. It appears that the H tone is scaled far lower than could be explained by final lowering alone, and yet there is no concrete evidence indicating that the H tone actually underwent downstep. Secondly, the lowered peak accounts for 28% (49 of 175) of the given information phrases and 10% (17 of 168) of the new information, which supports the initial assumption that the absence of the H peak is associated with given information (see 1.1.2). However, this is unlike downstep in English or Dutch which adds the sense of 'finality'. Thirdly, if we assume downstep, we are forced to assume that downstep occurs in the IP/utterance initial accent, too. The reduced H peak signals givenness of information, and 'givenness' also characterises the low level pitch sometimes observed in the pronoun phrases or pro-adverbs at the beginning of the IP/ utterance. In S.-A. Jun's model (1996, 2000, 2005), which this study is based on, the low

level is analysed as an AP contour same as in the IP/utterance final position[69]. If the low level tone represents the downstepped phrase accent in the IP/utterance final position, it should in the initial position, too. In addition, the fact that given information is usually left out in Korean utterances suggests that the H lowering is far less likely to occur consecutively.

If we assume that the H peak is reduced due to downstep, we should assume that downstep is triggered within the phrase accent, similarly to the English H+!H* (Grice 1995, Grice, M., S. Baumann, and N. Jagdfeld. 2007, 2009). It was noted above that the reduced H peak is also observed in the utterance initial AP, and this would not be possible, if downstep is triggered externally by, e.g., the preceding accent. This suggests that downstep should be triggered internally by, e.g., some floating tone which creates a HL sequence before the accent H tone. Note that this would indicate that Korean phrase accent may have more complicated structure than proposed in 6.3.2.2.

It would be too hasty to determine that this phenomenon is downstep without further and more comprehensive research. However, whether it is downstep or not, it is interesting to note that the reduced AP peak conveys a different kind of givenness from the 'exclusion (omission)' of phrases and lexical elements (see chapter 1). The 'exclusion' indicates undoubted givenness of information from the speaker's point of view. The reduced peak conveys questionable or uncertain givenness and, for that reason, the information is made available. That is, they differ in the degrees of givenness. According to Chafe (1976, 1994), the 'exclusion' indicates 'given' information and the reduced AP peak 'accessible', while the presence of the full (and unreduced) peak indicates 'new' information. This three-way distinction is in line with Baumann (2006), Roehr & Baumann (2010) and Pierrehumbert & Hirschberg (1990) that different degrees and types of givenness is marked with different accent types including deaccenting and that new information is more likely to be marked with a high accent and given information a low (or another less

[69] In H.-Y. Lee (1990), the pro-form phrases are most likely to be analysed as 'anacrusis' before the stressed (= accented) syllable of the utterance/IP initial AP and the low level is merely leading to the beginning of the AP contour, similarly to 'prehead' in O'connor & Arnold (1974). However, the identical contour in another location, e.g. the IP/utterance final position, is analysed as a low level AP contour. H.-Y. Lee's analysis is, presumably, motivated by the short duration of the phrase and the weak-strong prominence pattern, which is unusual in Korean and gives the impression that the pronoun phrase is subsidiary or subordinated to the following phrase. However, it is not clear how the low level pitch in the anacrusis and AP differ phonetically. Other than the location, they are very similar, if not identical, in the contour shapes and both convey givenness of information.

prominent) accent, if it is accented at all. This suggests that, in Korean, too, the different levels (and possibly the types) of givenness is distinguished prosodically.

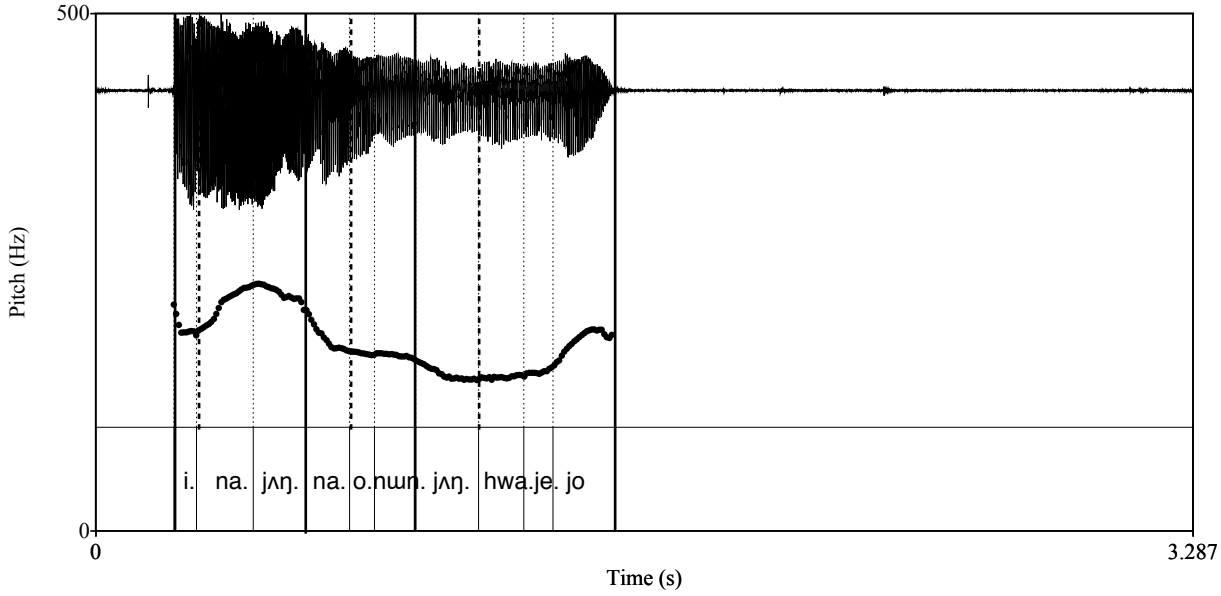


Figure 6.12 A possible case of downstep. [i.na.jʌŋ.]$_{AP}$ [na.o.nɯn.]$_{AP}$ [jʌŋ.hwa.je.jo]$_{AP}$ *'(It's) a movie starring Lee Nayoung' is produced by a female speaker with narrow focus on the initial AP. The initial rising AP contour is followed by two consecutive level contours. The right edge of an AP initial syllable is indicated with a dashed line.*

6.4. Conclusion

We investigated the realisation of the AP initial LH tones. The results indicate that the LH should be constantly present regardless of the presence/absence of the visible F0 peak in the AP contours. They also indicate that the LH should be a single tonal event sharing the characteristics of a starred tone. We proposed and argued that the AP initial LH is a phrase accent with a melodic unit structure which allows the component tones to share the characteristics of a unit, which, in this case, is a starred tone. That is, the LH tones together function as a starred tone sharing its characteristics. The phrase accent is associated with the AP initial syllable defining an AP. At the same time, it demarcates the phrase initial morpheme with the alignment of the component tones. The L tone is aligned with the initial syllable which the accent has an association with and the H tone is aligned

at the right edge of the initial morpheme (or the left edge of the second morpheme) with which it has a secondary association separately from the L tone.

On the other hand, contrary to the initial tones, the occurrence of the AP final LH is not predictable and the realisation varies considerably, if the tone(s) are realised at all. Also, different pieces of evidence suggest that the final LH should not be analysed as AP level tones. Accordingly, we proposed that the final LH should be analysed as ip boundary tones.

Part IV

An integrated model of Korean intonation

7. Korean intonation

Korean is one of the languages whose lexical tones have developed into intonation in recent history. Unlike other such languages, however, the gradual change from lexical tones to intonation is relatively well documented in various written works, and these works have been studied comprehensively to find out the factors which contributed to the loss of tonal contrast. By surveying the research, we have traced the diachronic change of Middle Korean lexical tones and investigated how the lexical tones become intonation. This has provided valuable information and insights into how lexical tones were reorganised and restructured as intonation, providing arguments for how the intonation of present day Korean should be represented. The evidence from this body of research on Middle Korean indicates that intonation should be analysed and represented differently from the current intonation models, and this is supported by the findings of the production experiments. Based on the evidence from both sources, we propose a new intonation model which includes a tonal event with an internal structure.

7.1. Summary and findings of the experiments

We first surveyed earlier research on Middle Korean lexical tones. This research indicates that the tones of functional morphemes were predictable in Middle Korean phrases, while those of lexical morphemes were not. The first H (or R) tone of a phrase, which was located in the lexical morpheme, had a higher functional load and phrases often contrasted in terms of the location of the first H tone. At the same time, the 'Phrase final H tone lowering' came to be applied more widely and generally, resulting in, often, a sequence of L tones at the end of a phrase. The complex tonal sequences of Middle Korean phrases were simplified to and changed into rising-falling patterns, making only the first H tone conspicuous.

Today, rise-falls are characteristic of the regional varieties of South and North Kyungsang which still have lexical tones (or pitch accents) and H tone location is distinctive. This is different from the Accentual Phrase of Seoul intonation which is defined

with TH-LH (T=L or H) pattern (S.-A. Jun 1996, 2000, 2005). This suggests that the AP final LH probably appeared in the later stage of the transformation from lexical tones to intonation.

In the following chapters, the focus was on the realisation of the AP tones. In chapter 4, we investigated the factors affecting the alignment of the AP peak, i.e., the realisation of the AP initial H tone. The experimental results show that alignment is affected by the location of a (lexical) morpheme boundary and the presence of semantic content in the following morpheme, and, additionally, by the presence of a preceding AP. The peak is, as a rule, aligned at the end of the lexical morpheme (the first lexical morpheme, if an AP contains more than one lexical morpheme as in noun compounds) and the AP initial LH rise demarcates the morpheme. This suggests that the H tone is associated with the edge of a morpheme. At the same time, the fact that the variation in peak alignment is restricted to the second and third AP syllable suggests that there should be another constraint in peak alignment which restricts the occurrence of the peak to near the beginning of an AP.

The results also show that narrow focus has distinct effects on the peak alignment in one-word and two-word APs. Narrow focus generally caused higher scaling of the tones and later alignment of the AP peak. However, in two-word APs, when the AP is IP/ utterance initial, it caused earlier peak alignment lowering the scaling of the following PW initial syllable. That is, when two-word APs are in narrow focus, only the first word is made prominent, and this suggests that the first Phonological Word functions as a focus exponent projecting focus on to the entire AP. The AP initial H tone can be seen as having a function similar to accents in other languages.

Chapter 5 was concerned with whether low F0 in the penultimate syllable of IPs is attributable to the presence of a low tone. The experimental results show that this IP penultimate syllable has a consistent low F0 target that follows the general L tone downtrend and undergoes different degrees of final lowering, reflecting different utterance types. This strongly suggests that a low tone target is constantly present in the IP penultimate syllable. Theoretically, the tonal target is best analysed as the AP penultimate L tone, and the experimental results suggest that the occurrence of the L tone is predictable in the IP final AP, while it is not in the other locations.

In chapter 6, we investigated rising-falling and low level contours and whether low level contours actually lack the F0 target of the AP initial H tone or simply have a reduced realisation. In addition, we investigated how the AP initial L and H are aligned with the syllables they are associated with. The experimental results show that low level AP contours still contain the F0 target of the AP initial H tone, albeit drastically reduced in scale. The results also show that new information increases the duration of the syllable which the AP initial H tone is aligned with, supporting the results of the experiment in chapter 4 that the AP initial H tone has an "accentual" function. The AP initial L and H displayed distinct alignment characteristics; while the L is aligned consistently at the center of the AP initial syllable, the H tone varied considerably in alignment. In short, the results suggest that, unlike the AP final LH, the initial LH are present constantly, regardless of AP length or the reduction in the scaling of the F0 peak. They also suggest that the L tone has the *alignment characteristics* of a starred tone, while the H tone has the *function* of a starred tone, which actually is in line with the diachrony and synchrony of Korean tones.

7.2. Phonetics and phonology of Korean intonation

The findings of our investigation indicate that Korean intonation should be analysed differently from the current autosegmental model (S.-A. Jun 1996, 2000, 2005). In chapter 6, based on varying evidence from different sources, it was argued that the initial and the final LH of the AP defining TH-LH (T= L or H) should be analysed separately as belonging to different units in the prosodic hierarchy. It was also argued that only the initial LH is analysed as AP level tones, and the tones are structured as a melodic unit (Yip 1989) and associated with a metrically strong PW initial syllable. That is, it is like a phrase accent, and marks the beginning of an AP. The final L and H are analysed as Intermediate Phrase (ip) boundary tones. We propose that Korean intonation should be analysed and represented in terms of "phrase accent" and boundary tones.

Our proposal is largely based on the autosegmental intonation model in S.-A. Jun (1996, 2000, 2005). We adopt its hierarchical intonation structure and define the prosodic units, AP, ip and IP, in terms of tonal events, specifying the tone-segment association and alignment relations. The proposal also includes the metrical structure in H.-Y. Lee (1990,

1996), allowing for the prediction of accentual phrasing and the explanations for stress/ accent-like functions of AP boundary placement (see chapter 1). It is an attempt to integrate the two intonation models by S.-A. Jun and H.-Y. Lee to embrace the advantages of both.

7.2.1. Structure and representation of intonation

The “phrase accent” analysis and the new definitions of prosodic units (see 7.2.2) does not affect the fundamental prosodic structure and hierarchy in S.-A. Jun (1996, 2000, 2005). As in S.-A. Jun, we assume that prosody is hierarchically structured following Strict Layer Hypothesis (Selkirk 1980) with the following prosodic units: IP, ip, AP, PW and syllable. IP is placed at the top of the hierarchy and ip is on the next level followed by AP, PW and syllable. A prosodic unit of a given level consists of one or more units of the immediately subordinated level; an IP consists of one or more ips, an ip one or more APs and an AP one or more PWs and so on.

However, the analysis inevitably affects the structure and representation of intonation, and intonation is specified with different types of tonal events. In S.-A. Jun, intonation is represented in terms of two tonal events, the variants of the AP tone pattern TH-LH and IP boundary tones (T%), and an ip is indicated by the change of downtrend. The proposed analysis, however, includes three tonal events, the LH “phrase accent” (PA), ip boundary tones, (T-) and IP boundary tones (T%).

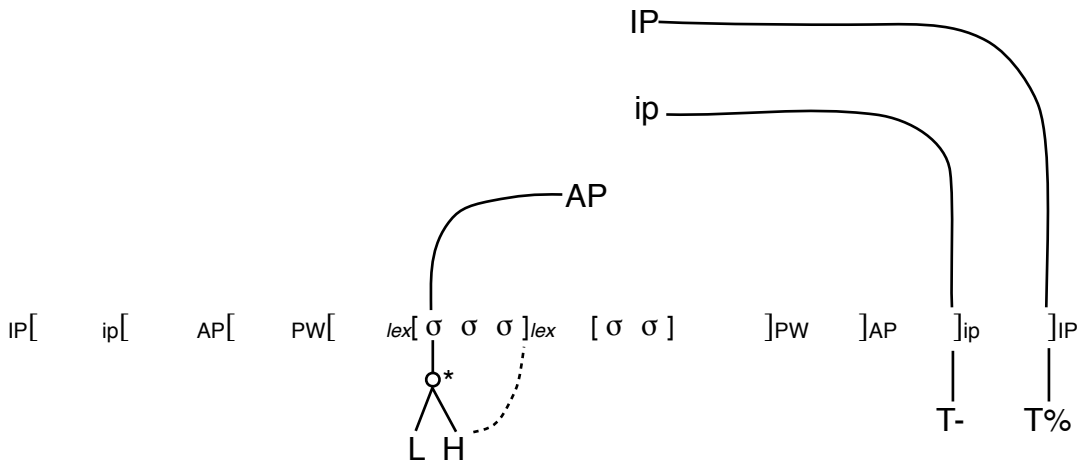


Figure 7.1. Korean intonation structure. The representation shows the hierarchical structure of intonation. Each level is indicated with a tonal event. It also shows the structure of the LH "phrase accent" and the association of tones to a syllable (or boundary). Dotted line indicates secondary association of the H tone. The edges of a lexical morpheme are represented with $_{lex}[\ ]_{lex}$ *and those of a functional morpheme with plain square brackets [ ]. 'T' stands for a 'tone' and may indicate more than one tone in T%, e.g., HLH%.*

Figure 7.1. represents the intonation of a short utterance. The utterance contains a five-syllable PW which is simultaneously an AP, ip and IP. The figure shows that the intonation is hierarchically structured and the unit of each level of hierarchy is characterised with a tonal event which indicates either the beginning or end of the unit; an AP is characterised with the LH "phrase accent" (PA) which marks the beginning and ip and IP with a boundary tone T- and T%, respectively, which demarcates the end. Intonation is represented as a sequence of these tonal events, and the intonation of the utterance in Figure 7.1 is represented as PA T- T%. This is also the minimal representation of an intonation contour.

Figure 7.1 also shows the association relations of the tonal events. The LH of the "phrase accent" is associated with the initial syllable of a PW/AP as a melodic unit and the H tone separately has a secondary association with the right edge of the lexical morpheme (indicated with a dashed line in Figure 7.1). Ip and IP boundary tones, T- and T%, are associated with the respective boundaries.

7.2.2. Prosodic units

Prosodic units higher than syllable are defined here. We define a Phonological Word (PW) adopting H.-Y. Lee (1990) and assume that PWs reflect the prominence and strength relations among syllables. We also modify the definitions of an AP and ip (S.-A. Jun 1996, 2000, 2006) following the proposal in chapter 6, and an AP and ip are defined in terms of the "phrase accent" and a boundary tone, respectively.

7.2.2.1. Phonological Word

A Phonological Word (PW) is defined following H.-Y. Lee (1990). Morphemes are divided into two groups, which approximately correspond to lexical morphemes and functional morphemes ('clitics' in H.-Y. Lee's terms), such as prefixes[70], suffixes, endings, postpositions (i.e., particles), bound nouns (probably better known as 'dependent nouns' or 'incomplete nouns'), and bound predicates (e.g., copula, existential verb). The initial syllable of a lexical morpheme is assumed to be metrically strong[71] ('stressed' in H.-Y. Lee's terms). It is the anchoring location of a prominence related tonal event of intonation (see chapter 3, 4 and 6). That is, the syllable is often accompanied by the "phrase accent" which demarcates the beginning of an AP. Functional morphemes do not have such syllables and they are distinguished from the lexical morphemes not only in that they lack semantic content (except auxiliary particles), but also a metrically strong syllable. Morphologically, a PW consists of a lexical morpheme and the following (or preceding, in the case of prefix) functional morphemes. This indicates that it starts from a metrically strong syllable and ends immediately before another. That is, a PW is defined morphologically and prosodically.

On the segmental level, the strengthening of the initial segment (S.-A. Jun 1996, Cho and Keating 2001, 2009) is reported in PW initial syllables, which suggests possibly

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[70] In my humble opinion, prefixes should not be classified as 'clitics' together with the others. However, I will follow H.-Y. Lee's analysis until it is proven otherwise.

[71] In the description of his intonation model, H.-Y. Lee (1990, 1996) distinguishes three facets of 'stress' (Ladd 1996:56); abstract prominence relations ('metrical strength'); concrete acoustic prominence or salience ('stress'); and the location of prominence-related intonational event ('pitch accent'). However, he does not differentiate them in terms of terminology and simply refers to them as 'stress' (sometimes 'accent'), which is often confusing. Here we describe H.-Y. Lee's 'stress' adopting Ladd's distinctions and terms.

that the initial syllables are acoustically more prominent than others, even if it may not be as distinct as in some other languages (e.g., English).

This definition of a PW indicates that complex verb phrases made up of a verbal modifier, a bound noun and a bound predicate, such as, the Korean expression for ‘can’ or ‘will’, constitute a PW together with the modifier, and so do the phrases containing a noun and particle(s). For instance, (7.1) is analysed into three PWs. The second PW contains three morphemes, a noun ‘Mars’ and a sequence of two particles: a locative particle /-e/ ‘to’, and an auxiliary particle /-do/ ‘too, also’. The functional morphemes (i.e., the particles, or postpositions) form a PW together with the preceding noun ‘Mars’, as they lack metrically strong syllables. The third PW is a verb phrase containing a verbal modifier, a bound noun /-su/ ‘possibility’ and an existential verb /-it.t’a/ ‘is’. They all form a PW, same as the second PW and the verbal modifier /ka-l/ ‘go’-$_{\text{modifier ending}}$ marks the beginning of the PW. In (7.2), on the other hand, each component of the compound noun constitutes a PW on its own as a noun.

(7.1)

[i.dʑe.]$_{PW}$	[hwa.s^{h}ʌŋ.-e.-do.]$_{PW}$	[ka-l.	s’u.	it.t’a]$_{PW}$
now	Mars-to-too	go-$_{\text{modifier ending}}$	possibility	there is

‘Now man can go to Mars, too.’

(7.2)

[han.guk]$_{PW}$	[paŋ.soŋ]$_{PW}$	[koŋ.s^{h}a]$_{PW}$
Korea	broadcast	corporation

7.2.2.2. Accentual Phrase

An AP is indicated by the “phrase accent” which demarcates the initial lexical morpheme as well as the beginning of an AP. The “phrase accent” falls on the initial syllable of a PW at the end of the strong node of the structure assigned by the prosodic phrase structure rules (H.-Y. Lee 1990). For instance, (7.2) is most likely to be produced with two APs, [han.guk]$_{AP}$ and [paŋ.soŋ. koŋ.s^{h}a]$_{AP}$, with a metrical structure shown below.

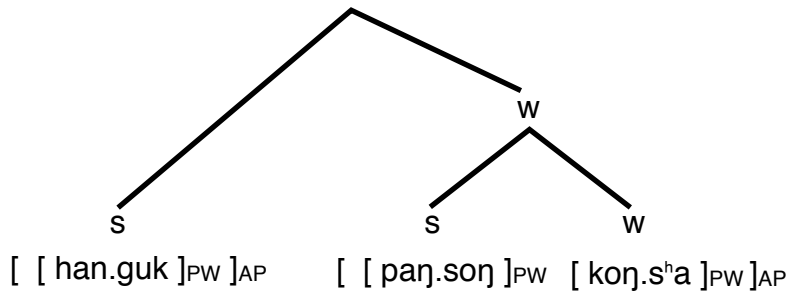

Figure 7.2. The metrical structure of /han.guk. paŋ.soŋ. koŋ.sʰa/ (officially known as) 'Korean Broadcast System (KBS)'.

The (LH) "phrase accent" is associated with the initial syllable as a melodic unit (see Figure 7.1). However, only the L tone is aligned at the syllable, and the H tone is realised primarily at the end of the first lexical morpheme due to its secondary association with the right edge of the morpheme. On the surface, the accent rise demarcates the beginning and the end of the lexical morpheme, which is located at the beginning of an AP. The accent is realised as a high level rather than a rise, when the onset of the AP initial syllable is /p', t', ts', k', pʰ, tʰ, kʰ, tsʰ, sʰ, s', h/. The [+stiff vocal cords] of the consonants raises the initial F0 level resulting in the high level. That is, AP contours start either with a rise or high level and the alternation is conditioned by the onset consonant of the initial syllable. In short APs up to three syllables, the accent rise, or high level, dominates and characterises the contour shape (see Figure 7.3-(a)). In longer APs, the rise or high level is followed by the transition to the following "phrase accent" or boundary tone (see 7.2.2.3 and Figure 7.4 for the examples of such contours). The AP contours are represented in Figure 7.3-(b), assuming that the "phrase accent" is followed by a low boundary tone or an AP starting with a [-stiff vocal cords] segment, such as, nasals, vowels and voiceless lenis obstruents.

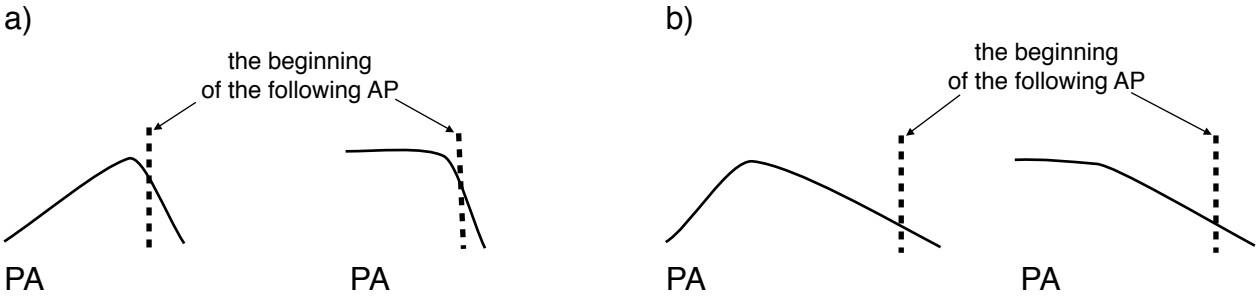

Figure 7.3. The representation of the AP contours in short (three syllables or less) and long (four syllables or more) phrases. (a) represents the contours in short APs and (b) in long APs. The contours in (a) and (b) differ in the duration of the transition from a "phrase accent" (PA) to the following PA or boundary tone. The initial pitch level is determined by the feature [stiff vocal cords] in the initial syllable and its presence raises the initial F0 as reflected in the contours on the right of (a) and (b).

7.2.2.3. Intermediate Phrase

We assume that an ip is indicated by a boundary tone, L- or H-[72], which is associated with the right edge of an ip. Assuming ip boundary tones entails that some AP contours in the current intonation model have to be reanalysed as containing ip boundary tones, i.e., the "phrase accent" (PA) followed by an ip boundary tone. For instance, a rise-(high) level is represented as PA followed by H- rather than a simple AP contour (see the representation on the left of Figure 7.4-(a)). The H tones, i.e., the H of the "phrase accent" and the H- ip boundary tone, are interpolated linearly and also non-linearly with the 'sagging transition' (Pierrehumbert 1980, Ladd and Schepman 2003). That is, the realisation of PA H- alternates rising-(high) level and rising-falling-rising contours (see Figure 7.4-(a)) and the contours are considered mere phonetic variants of the identical tonal representation PA H-. In rising-falling-rising contours, the pitch dip before the final peak varies in depth and is shallower than, e.g., the valley (or low pitch) at the beginning of an AP which has a low tone target. In short phrases with three syllables or less, H- may occur in the same syllable as the "phrase accent" H tone raising the height of the accent peak rather than having a separate realisation. That is, H- may cause the upstep of the accent H tone breaking the pitch trend. This is compatible with S.-A. Jun (2005) in which an ip is also indicated and accompanied by the change in the pitch trend.

[72] Possibly LH- demarcates the end of an ip, too. In that case, the L (of LH-) should display a distinctly low F0 target unlike the shallow dip in PA H- (the contour is shown on the right of Figure 7.4-(a).

The low ip boundary tone, L-, following a PA creates rising-falling contours which alternates with falling contours (see Figure 7.4-(b)), and the alternation is conditioned by the absence/presence of [stiff vocal cords] in the onset of the AP initial syllable (see 7.2.2.2). The PA L- contours are similar to the AP contours in Figure 7.3-(b), however, they are distinguished from the AP contours with a low pitch target at the end of the phrase. The similarly shaped AP contours have the L tone target in the following AP initial syllable (cf. Figure 7.3-(b) and Figure 7.4-(b)).

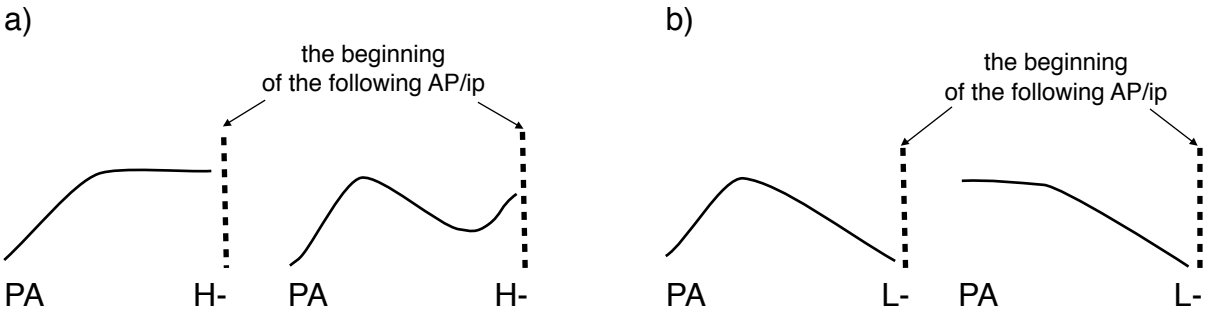

Figure 7.4. Representation of the AP contours in the ip final position. The contours on the left (a) represent PA followed by the ip boundary tone H-. The pitch dip before the final peak may or may not rise and varies in depth. The contours (b) represent PA L- when the onset of the initial syllable is [-stiff vocal cords] and [+stiff vocal cords], respectively.

7.2.2.4. Intonation Phrase

An IP is demarcated by a boundary tone. Following S.-A. Jun (1996, 2000), we assume nine boundary tones, L%, H%, LH%, HL%, LHL%, HLH%, LHLH%, HLHL%, and LHLHL%. In line with the ip boundary tones, an IP boundary tone is assumed to be associated with the IP boundary and realised in the IP final syllable. The IP final syllable is typically lengthened (i.e., final lengthening) and reported to be an average about 1.8 times of the phrase initial syllable (H.-B. Lee and Seong 1996).

7.2.3. Advantages and limitations of the model

The proposed intonation model is different from other models (see chapter 3) in that intonation is represented as a series of “phrase accents” and boundary tones, and this provides solutions to some of the problems in the contour analysis by allowing for a different perspective. At present, variations in AP contours is explained with ‘tonal undershoot’ (S.-A. Jun 2006) which, in effect, deletes either or both of the middle tones of TH-LH without a known mechanism (see 3.2). However, the proposed model attributes some variations of AP contours to ip boundary tones. That is, some alternations are assumed to be between AP and ip contours (compare the illustrations in Figure 7.3 and Figure 7.4), and the alternation is explained by the insertion of ip boundary tones as opposed to the deletion of AP tones. This analysis allows for systematic explanations for the variation of the contours, as it is clear what conditions and causes the variation. It also has advantages in predicting contour shapes (see 7.2.2.2 and 7.2.2.3) of different prosodic units and detecting boundaries, as the units are clearly defined in terms of the “phrase accent” or boundary tones. In addition, it is in line with the historical change that prosodic phrases were initially marked with a LH rise and the boundary tones are later additions to the prosodic system (see chapter 2).

Most of all, the “phrase accent” analysis of the proposed model allows for coherent analysis of tonal dialect and non-tonal Seoul variety of Korean. Some regional varieties are assumed to have lexical tones or lexically specified pitch accents. North Kyungsang, for instance, is often assumed to have either LH or HL accent (see chapter 2). Utsugi and colleagues (2007) assume LH accent based on the experimental results indicating the consistent presence of a low F0 turning point before the F0 peak. The alignment characteristics of the F0 valley and peak are actually very similar to those of the (LH) “phrase accent” of Seoul, in that the alignment of the F0 valley is consistent, while that of the peak varies, often, occurring later than the accented syllable (i.e., the syllable with a H peak). At the same time, however, the F0 valley of North Kyungsang is aligned at the beginning of the accented syllable, while that of Seoul is at the centre of the AP initial syllable. That is, other than the distinction lexical vs. post-lexical accent, North Kyungsang and Seoul are described as having identical LH accents with different alignment relative to the accented syllable; North Kyungsang has earlier alignment than Seoul.

It should be noted, however, that the model is at an early stage of development and still has theoretical and practical issues to be dealt with: most notably, downstep or H lowering. The experimental results of chapter 6 indicates that the accent peak of an AP is lowered, when following a focused phrase, and that APs create step-like contours very similar to downstep contours (see the F0 contours in Figure 6.10 and Figure 6.12 of chapter 6 for the examples). The lowering of the AP peak is similar to downstep in effect, however, it is not yet clear if it is downstep. Unlike downstep, the lowering of the AP peak seems to occur also in the utterance/IP initial position[73], resulting in low level stretch at the beginning of an utterance. On top of that, the occurrence of the peak lowering is closely related with information status and focus, or, rather, whether a speaker considers and treats a piece of information as given or less significant than the preceding or following information. Whether it is downstep, H lowering or a different "phrase accent", it needs to be investigated how it works and how it should be represented.

In addition, the analysis of rising-falling-rising contours brings up the question of the ip boundary tone types and non-linear interpolation of tones. In S.-A. Jun (1996, 2000, 2006) and H.-Y. Lee (1997)[74], the contours are considered as AP contours. However, in the proposed model, they are analysed as a "phrase accent" (LH) and a high ip boundary tone, i.e., LH H- (see Figure 7.4-(a)). The F0 dip between the two peaks has no tonal target and is considered merely as a 'sagging transition' (Pierrehumbert 1980, Ladd and Schepman 2003) between two H tones, which may or may not rise. That is, the rising-falling-rising contours in Figure 7.5-(a) and (b) are phonologically distinct and represented with different tonal strings; Figure 7.5-(a) is represented as LH H and Figure 7.5-(b) LH LH. This analysis is largely based on the observation that a rising-falling-rising contour with such a shallow F0 valley as shown in Figure 7.5-(a) is not found where the presence of a low tone is identified, e.g., in the IP final position where the penultimate syllable has a low tone (see chapter 5) and in the sequence of two consecutive AP rises. If, however, Figure 7.5-(b) is also regularly observed in the non-IP final positions, the inventory of the ip boundary tones, at the very least, needs to be reconsidered.

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[73] Grice (1995) and Grice and colleagues (2007, 2009) assume accent internally triggered downstep, which allows the accent containing a downstepped H (i.e., H+!H*) to occur utterance/IP initially. See 6.3.2.1.

[74] H.-Y. Lee (1990, 1996) analyses a rising-falling-rising contour as a sequence of a rising-falling AP contour and a high IP boundary tone, while H.-Y. Lee (1997) assumes as a single contour. An ip or ip level unit is not assumed in all of his works.

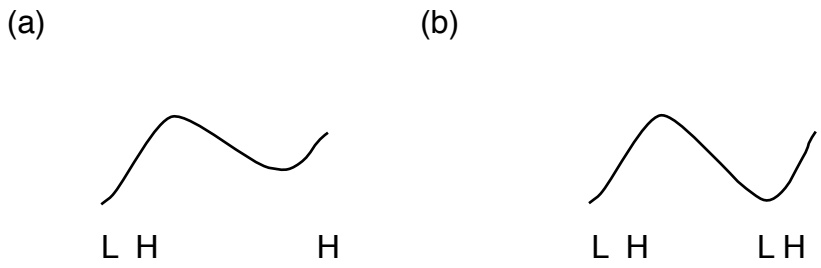

Figure 7.5. Rising-falling-rising contours in Korean. The two contours are similar, but phonologically distinct.

7.3. Future research

The work in this dissertation has incorporated aspects of different intonation models with diachronic and synchronic analysis of the Korean language. It focuses on the intonation production, offering the possibility for application in speech synthesis.

Our research indicates that in current day Seoul Korean, there still is an effect of the tonal characteristics of Middle Korean morphemes on tonal alignment. In Middle Korean, lexical morphemes had distinctive tones, whereas functional morphemes did not. In addition, a set of functional morphemes derived from nouns retained their lexical tones. These functional morphemes, now called auxiliary particles, are distinguished by having high semantic content, similarly to lexical morphemes. It is interesting to note that both these morphemes, which had distinctive tones in Middle Korean, attract the AP initial peak, which is analysed in this work as a secondarily associated tone of the “phrase accent”, making the link between the Middle Korean and Seoul Korean tones more evident. This suggests the importance of the Middle Korean lexical tones in the investigation of Seoul intonation. More comprehensive studies on Middle Korean are needed.

It is also important to take the different tonal systems of the regional varieties into account. So far, intonation and lexical tones (or pitch accents) have been considered separately. However, evidence indicates that the tonal events of the tonal and non-tonal dialects are more closely related than initially assumed. In fact, Seoul intonation is very similar in form to the pitch patterns of tone dialects.

Appendix I

MATERIAL - EXPERIMENT 1

- ONE WORD - SHORT BROAD FOCUS

Situation: You had an accident and was in a hospital. Since a few days you are at home recovering. A friend of yours came by to see you on a Saturday afternoon.

Q: What did you do all day today?
A: [mi.ɾa.n -i.ne]$_{AP}$ [ka.s'ʌ.s'ʌ.jo]$_{AP}$
Miran- home went

→ 'I've been to Miran's.'

- ONE WORD - SHORT NARROW FOCUS

Situation: You had an accident and was in a hospital. Since a few days you are at home recovering. You came just back home from a neighbour's, when a friend of yours came by to see you on a Saturday afternoon.

Q: We were worried! Where the hell have you been?
A: [mi.ɾa.n -i.ne]$_{AP}$ [ka.s'ʌ.s'ʌ.jo]$_{AP}$

→ 'I've been to Miran's.'

- TWO WORD - SHORT BROAD FOCUS

Situation: On Monday, during a coffee break at work, you are having a chat with a colleague/friend.

Q: What did you do at the weekend?
A: [o.ɾo.ɾa.goŋ.dʑu]$_{AP}$ [pwa.s'ʌ.jo]$_{AP}$
Aurora princess saw

→ 'I saw 'Princess Aurora'.

- TWO WORD - SHORT NARROW FOCUS

Situation: On Monday, during a coffee break at work, you are having a chat with a colleague/friend.

Q: What movie did you see?
A: [o.ɾo.ɾa.goŋ.dʑu]$_{AP}$ [pwa.s'ʌ.jo]$_{AP}$

→ I saw 'Princess Aurora'.

• ONE WORD - LONG BROAD FOCUS

Situation: You had an accident and was in a hospital. Since a few days you are at home recovering. A friend of yours came by to see you on a Saturday afternoon.

Q: What did you do all day today?
A: [sim.si.mɛ.sʌ]$_{AP}$ [mi.ɾa.n -i.ne]$_{AP}$ [ka.s'ʌ.s'ʌ.jo]$_{AP}$
bored **Miran- home** went

→ 'I was bored, so I've been to Miran's.'

• ONE WORD - LONG NARROW FOCUS

Situation: You had an accident and was in a hospital. Since a few days you are at home recovering. You came just back home from a neighbour's, when a friend of yours came by to see you on a Saturday afternoon.

Q: We were all worried! Where the hell have you been?
A: [sim.si.mɛ.sʌ]$_{AP}$ [mi.ɾa.n -i.ne]$_{AP}$ [ka.s'ʌ.s'ʌ.jo]$_{AP}$
bored **Miran- home** went

→ 'I was bored, so I've been to Miran's.'

• TWO WORD - LONG BROAD FOCUS

Situation: On Monday, during a coffee break at work, you are having a chat with a colleague/friend.

Q: What did you do at the weekend?
A: [jʌ.dza.tɕin.gu.-ɾaŋ]$_{AP}$ [o.ɾo.ɾa.goŋ.dʑu]$_{AP}$ [pwa.s'ʌ.jo]$_{AP}$
girlfriend - with **Aurora princess** saw

→ 'With my girlfriend I saw 'Princess Aurora'.

• TWO WORD - LONG NARROW FOCUS

Situation: On Monday, during a coffee break at work, you are having a chat with a colleague/friend.

Q: What movie did you see yesterday?
A: [ʌ.dze.-nɯn]$_{AP}$ [o.ɾo.ɾa.goŋ.dʑu]$_{AP}$ [pwa.s'ʌ.jo]$_{AP}$
yesterday - particle **Aurora princess** saw

→ 'Yesterday I saw 'Princess Aurora'.

MATERIAL - EXPERIMENT 2

Q: It's such a beautiful necklace! Who are you going to present it to?
A: [mi.na -e.ge]$_{AP}$ [tɕul.k'ʌ.je.jo]$_{AP}$
Mina- dative case marker will give/present

→ '(I) will present (it) to Mina.'

Q: You used to meet up with your boyfriend/girlfriend for lunch. Do you still see him/her *everyday?

A: [tɕu.mal. -ma.da]$_{AP}$ [man.na.jo]$_{AP}$
weekend- every meet

→ ‘(I) see (him/her) every weekend.‘ * [mɛ.il] is used for ‘everyday’.

Appendix II

Reference F0 values for tone and syllable scaling in Experiment 1

- Reference F0 values for tonal scaling

speaker	Ref. value (Hz)
M1	115.4
M2	90.4
M3	95.8
M4	146.0
F1	181.4
F2	204.6

- Reference F0 values and scaling of / ne / in one-word AP

Speaker	long broad focus			long narrow focus			short broad focus			short narrow focus		
	ref. value (Hz)	scaling in st	stdev	ref. value (Hz)	scaling in st	stdev	ref. value (Hz)	scaling in st	stdev	ref. value (Hz)	scaling in st	stdev
M1	114.8	1.08	0.06	116.3	1.12	0.04	127.4	1.10	0.04	135.5	1.22	0.09
M2	91.3	1.07	0.05	94.5	1.12	0.06	97.7	0.92	0.05	100.4	1.04	0.06
M3	97.7	1.08	0.06	99.3	1.16	0.09	106.5	1.22	0.13	109.2	1.24	0.11
M4	146.1	1.12	0.13	162.3	1.38	0.08	150.0	1.25	0.06	165.8	1.54	0.13
F1	194.5	1.09	0.09	201.3	1.14	0.05	202.8	1.04	0.06	211.4	1.15	0.16
F2	217.3	1.20	0.06	217.5	1.28	0.04	224.3	1.30	0.02	225.2	1.25	0.05

- Reference F0 values and scaling of / goŋ / in two-word AP

Speaker	long broad focus			long narrow focus			short broad focus			short narrow focus		
	ref. value (Hz)	scaling in st	stdev	ref. value (Hz)	scaling in st	stdev	ref. value (Hz)	scaling in st	stdev	ref. value (Hz)	scaling in st	stdev
M1	115.9	1.44	0.22	125.0	2.31	0.39	130.5	1.08	0.73	138.4	0.39	1.16
M2	89.5	2.04	0.50	94.5	2.23	0.59	97.6	-0.65	0.21	99.7	-1.43	1.14
M3	93.8	1.68	0.77	96.6	2.42	0.83	109.8	0.65	1.34	112.3	-0.61	0.89
M4	145.9	2.59	0.87	149.0	4.23	0.89	156.3	2.83	0.95	167.3	1.37	1.27
F1	168.2	6.76	0.62	173.5	5.42	1.59	207.0	5.56	0.94	216.3	2.51	1.27
F2	191.9	5.04	0.66	201.6	6.29	0.99	213.8	7.59	1.02	217.2	5.25	0.99

Appendix III

- Reference values for semitone conversion

Speaker	reference value (Hz)
F1	181.4
F2	175.4
F3	192.3
F4	169.8
F5	159.3
F6	202.4
F7	170.5
F8	192.2
F9	212.8
M1	116.2
M2	97.2
M3	101.7
M4	119.5
M5	84.1

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