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Interaction of Tone and Stress in Seoul and Chonnam Korean*

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1 Introduction

The nature of the prosodic prominence system in Korean has been controversial. Some have analyzed it as a weight-driven metrical system (Lee 1989, Kim 1997, *inter alia*.) while others have treated it as a phrasal phenomenon (Jun 1993, 1995). In this paper, I will argue that neither of these approaches is satisfactory and instead propose a lexical stress system that exhibits the characteristics of a pitch accent[1].

Factors that commonly affect the weight of a syllable in other languages such as vowel length and a coda consonant will be suggested to be irrelevant in determining the location of word-level prominence, i.e. stress, in Korean[2]. Evidence will be drawn from the tonal realization of vocative chant.

* I thank Bob Ladd for inspiring me to investigate the vocative chant, and Mark Liberman from whose class the idea was fleshed out with an experiment. I am also grateful to Gene Buckley and Rolf Noyer for very helpful discussions on the analysis of the data, and to Sun-Ah Jun for sending me her papers. However, I am solely responsible for any errors remaining.

1 In this paper, the term *stress* is used when there is a metrical prominence that is phonetically expressed in terms of pitch, length and/or amplitude. The term *pitch accent language* refers to a language in which tone or pitch differences are assigned to metrical prominences as a main acoustic manifestation of the prominence. The term *accent* refers to a metrical prominence at an abstract level before its phonetic realization. Some languages may show a combination of these properties. Whether we wish to call these cases 'stress languages' or 'pitch accent languages' is really not a concern here; the focus will be on understanding the properties of the grammar rather than fitting the grammar into an ad hoc typology.

2 This is not to say that the coda consonants are necessarily nonmoraic in Korean. For a discussion of the moraic status of Korean coda consonants, see Ko (1998).

The structure of the remainder of this paper is as follows: in Section 2, I will briefly review previous analyses of the prosodic prominence system of Korean. In Section 3, I will illustrate the different tonal behavior of vocative chant in Seoul and Chonnam. I will argue that vocative chant reveals that the laryngeal effect in Korean is a phonetic phenomenon and should not be treated as a phonological H tone contra Jun (1993, 1996, 1997). In Section 4, I will propose that the determinant of the location of the accentual H* tone in the vocative chant is the position of the metrical prominence, which is completely predictable in Seoul but is lexically marked in Chonnam. In Section 5, I will argue that the phrasal tone contours that have been argued for Chonnam and Seoul in Jun (1997) can be derived from the proposed metrical structure of Korean by assigning pitch accents to the location of prosodic prominence.

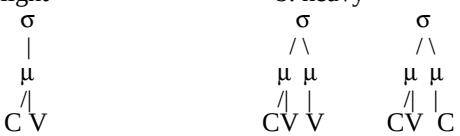
2 Previous Analyses of Korean Prominence

The nature of the prosodic prominence system in Korean has been analyzed from diverse perspectives. In this section, I will focus on the two most influential views: the weight-driven metrical system and the phrasal system. It should be noted that the Seoul dialect of Korean has been undergoing the loss of the vowel length distinction over the past few decades and younger generation Seoul speakers have lost this distinction (Magen & Blumstein 1993, Kim & Han 1998). The subject of investigation in this paper is modern Seoul dialect that does not have a vowel length distinction any more. On the other hand, Chonnam retains a vowel length distinction on the surface, although it will be argued to be a derived property.

2.1 Weight-driven Metrical System

The traditional and most influential view of the Korean prosodic prominence system anlayzes it as an iambic stress system. Lee (1976) has generalized his observation of the Seoul accent as follows: stress goes to the initial syllable if heavy; otherwise on the second. Such a view has been elaborated in later works such as Lee (1989) and Kim (1997), where both vowel length and coda contribute to the distinction between heavy and light syllables as illustrated in the following:

(1) a. light b. heavy



In other words, long or closed syllables are treated as heavy, while other syllables are light. The following examples illustrate their analysis[3]:

(2) a. tǽ:sa ‘matter of great concern’
b. kyó:doso ‘prison’
c. iyáki ‘story’
d. norǽ ‘song’
e. múncipa ‘threshold’
f. pákmulkwan ‘museum’

This analysis predicts the stress to be initial in (2a-b) since the initial syllable is heavy with a long vowel, and on the second syllable in (2c-d) since the initial syllable is light. In (2e-f), the stress is again predicted to be initial since closed syllable is considered as heavy in their analysis.

However, the prediction made for the data (2e-f) is false to most speakers of Seoul, for whom the second syllable is perceived as the most prominent (Jun 1995). One might wonder, based on these data, then whether it is only the long vowel that counts for weight and the stress is assigned to the initial syllable if long. However, later I argue that the vowel length is not phonological, but is a phonetic manifestation of stress.

2.2 Phrasal system

In an intonation-based approach to Korean prosody, Jun (1993, 1997) argues that Korean has a tonally defined Accentual Phrase (AP) similar to Tokyo Japanese (Beckman and Pierrehumbert 1986). In Japanese, each AP can have a lexically accented syllable which is assigned a pitch accent apart from phrasal tones. According to Jun, however, the Korean AP is different from Japanese in that it does not have a lexical pitch accent specific to its component word other than the phrasal tones.

Jun proposes that the AP of Seoul has a tonal pattern of **LHLH** by default, and **HHLH** if the AP begins with an aspirate or a tense consonant. In her analysis, the Tone Bearing Unit (TBU) of Seoul is suggested to be the syllable. Examples in (3) illustrate her analysis of the AP in Seoul:

(3) Accentual Phrase in Seoul (Jun)

a. L H L H
| | | |
{y s u c i} vs
‘receipt-NOM’

b. H H L H
| | | |
{p^{h} a r a s g i}[4]
‘blue color- NOM’

[3] Note that the subject of the previous metrical analyses of Seoul is a conservative version of Seoul as far as they assume that there is a vowel length distinction.

[4] { } indicates an AP boundary.

For Chonnam, Jun assumes the **LHL** tonal pattern is the default, and the **HHL** occurs in APs beginning with an aspirate or a tense consonant. The TBU of Chonnam is suggested to be the mora since, according to Jun, there is an underlying vowel length distinction in Chonnam.

(4) Accentual Phrase in Chonnam (Jun)

a. L H L L L		b. HH L L L
| | | | |		| | | | |
{y : s u c i}	vs	{p^h a : r a s g i}
'receipt-NOM'		'blue color- NOM'

Jun's treatment of the laryngeal segmental effect as a phonologized H tone is based on the data which show that the pitch after laryngeal consonants is significantly high and that the raised pitch persists for a long time (Jun 1996). In the next section, I will argue that this effect is nevertheless a phonetic effect.

Based on a production study, Jun (1995) suggests that the prominence is not a property of a word but of an AP in Korean.[5] This argument is based on an observation that the F0 and the amplitude of each vowel in a word changes depending on its location within an AP. For example, a nonsense word *{mamáma}* gets a default peninitial stress when it is the only word in the AP. However, when it is preceded by a monosyllabic word in an AP, the stress shifts to the initial syllable of *mamama* as in *{ce mámama}*.

Although Jun's observation is a legitimate one, the realization of the H* tone in vocative chant in Chonnam suggests that the phrasal analysis alone is not enough to explain the phonological and phonetic nature of the Chonnam prominence and it is necessary to posit a lexical property of metrical constituency. The phenomenon of vocative chant will be examined in the following section.

3 Vocative Chant in Seoul and Chonnam

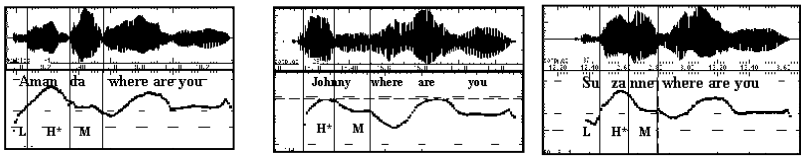
It is well known that each language has tunes for calling people (Liberman 1975, Ladd 1996). In many European languages, the tune is same as a sequence of a H tone and a M tone, but varies in the principles of association. In English and German, for example, the H tone is aligned with the most

[5] In the same spirit with Jun's analysis, in section 5 I propose that the stress assignment is done at a phrasal level.

metrically salient syllable, thus the name accentual H tone (H*)[6]. The following pictures illustrate that the H* is aligned with the stressed syllable in English. (The tonal pattern of vocative chant is repeated on the rest of the sentence, '*where are you?'*, except for (5b) where the initial L is not realized on 'Johnny' to align the H* tone with the initial stressed syllable.)

(5) Vocative chant in English

a. Amánda b. Jóhnny c. Suzánne



Since the realization of the H* tone is closely tied with the foot structure in some stress languages (Gussenhoven 1993, Inkelas and Zec 1989), I ran an experiment to investigate the metrical system of Korean through the realization of vocative chant in Korean..

Typical Korean personal names are composed of two syllables, each syllable corresponding to one sino-Korean morpheme. In vocative, they should be always followed by a suffix *-(y)a*[7]. The frame sentence used in the experiment is the following:

(6) *Name*-a nol-ca '*Name*, let's play!'
-VOCATIVE play-HORTATIVE

I have asked two subjects from each dialect to sing a certain type of vocative chant for 60 names, each one twice. The results show that the H* is always aligned with the second syllable in Seoul, but on either the first or second syllable in Chonnam. The M tone, which is also obligatorily realized, always appears on the vocative suffix. When the H* appears on the peninitial syllable, the initial syllable is realized as L. As in English, the tonal pattern of the name is repeated on the rest of the sentence, i.e. *nol-ca*. The following illustrates the tonal patterns of vocative chant in each dialect:

(7) Seoul: H* always realized on the second syllable

a. L H* M
| | |
Eon-Suk-a nol-ca

b. L H* M
| | |
Hyun-Cheol-a nol-ca

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[6] On the other hand, in Hungarian and French where the stress is realized on a fixed location, the H tone in vocative chant occurs irrespective of accentual prominence. (Ladd 1996)

[7] 'y' is inserted to avoid hiatus.

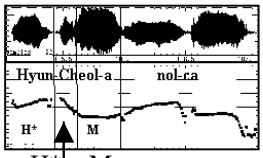
(8) Chonnam: H* either on the initial or the second syllable

a. L H* M
| | |
Eon-Suk-a nol-ca

b. H* M
| |
Hyun-Cheol-a nol-ca

In (8b), the pitch of the second syllable is realized as an interpolation between the H and the M tone, as illustrated in (9).

(9) H*M in Chonnam



H* M

interpolation of pitch between H* and M tone

Tonal patterns of different names are summarized as in the following table. I will call the tonal patterns of (7) and (8a) as LH*M and that of (8b) as H*M for convenience.

(10) Tonal pattern of names in vocatives

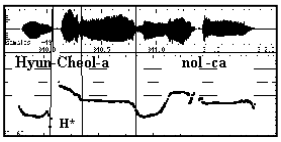
Names	Seoul	Chonnam
a. Eon-Suk, Myung-Joon, Eun-Ah	H* on the second σ (LH*M)[8]	H* on the second σ (LH*M)
b. Hyun-Cheol, Seon-Suk, Ho-Jun	H* on the second σ (LH*M)	H* on the initial σ (H*M)
c. Young-Sun, Jae-Hun, Byung-Chul	H* on the second σ (LH*M)	H* on the initial σ (H*M)
d. Sang-Won, P^{h}yung-Geun, Hi-Myung	H* on the second σ (LH*M)	H* on the second σ (LH*M)

The contrasts observed in the above data can be summarized into two categories: one is a contrast due to dialectal variation, and the other is a dialect-internal contrast in Chonnam. Dialectal variation refers to the fact that a name can be realized with different tonal patterns depending on the dialect as illustrated in the examples (10b) and (10c). The waveform and pitch track of such examples are illustrated in the following:

8 The tonal pattern in parentheses reflects the M tone realized on the vocative suffix, although for simplicity it was not spelled out in the leftmost column of the table.

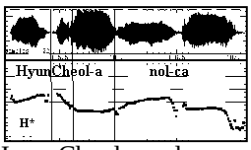
(11) Dialectal variation

a. Seoul



Hyun-Cheol-a nol-ca
'Hyun-Cheol, let's play!'

b. Chonnam

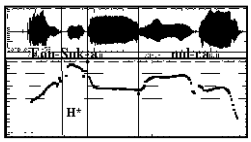


Hyun-Cheol-a nol-ca
'Hyun-Cheol, let's play!'

Dialect internal contrast refers to the fact that, in Chonnam, names do not show a uniform tonal realization of vocative chant but vary between LH*M and H*M. For example, the names *Eon-Suk*[9] and *Seon-Suk* are different only in the onset *'s'* in the latter. However, they are realized with a different tonal pattern in Chonnam as in the following:

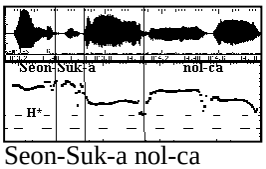
(12) Dialect internal contrast in Chonnam

a. H* on second: Eon-Suk



Eon-Suk-a nol-ca
'Eon-Suk, let's play!'

b. H* on the initial: Seon-Suk



Seon-Suk-a nol-ca
'Seon-Suk, let's play!'

One might wonder here whether the H* assigned on the initial syllable of Chonnam H*M pattern as in (11b) and (12b) is caused by the aspirated onset consonant. However, clearly this is not the case since names that do not start with a laryngeal consonant in (10c) can also begin with a H* in Chonnam and not all names that have an aspirated onset consonant begin with a H* as in the examples (10d).

Importantly, vocative chant shows the separation of phonological H tone and a segmental effect by using a greater range of pitch variation. Namely, boosted F0 as a segmental effect behaves differently from the high F0 as a manifestation of a true H tone: the former always shows a fixed amount of F0 boosting regardless of the range of F0 utilized, whereas the latter changes its F0 target as the range of the pitch changes. This idea can be schematically illustrated as in the following (Ko, *to appear*):[10]

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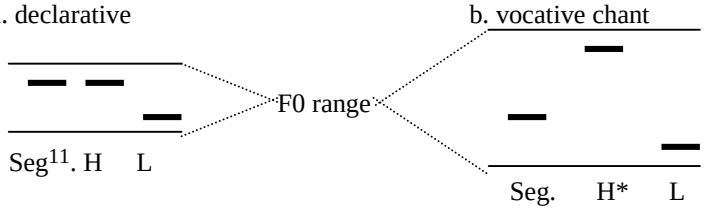
[9] Despite the spelling, 'eo' in Korean is not pronounced as a diphthong but as '/ə/' (eg. Eon-Suk, Seon-Suk, Hyung-Cheol, etc.), and 'ae' as '/æ/' (eg. Jae-Hun).

[10] Ko (to appear) also shows that the boosted F0 as a segmental effect is different from a true H tone since no correlation is found between the duration of the syllable and the seg-

(13) a. declarative b. vocative chant



An interesting consequence is that the tonal pattern of the AP's in declaratives predicted by Jun's analysis needs a significant modification in vocative chant. For example, names such as *Hyun-Cheol* and *Sang-Won*, both of which are predicted to be realized with an initial HH tone in Jun's analysis as in (14a) are realized differently in the vocative: the former shows an initial H* and the latter a peninitial H* tone pattern as in (14b).

(14) Phrasal tonal contour does not explain the H* assignment (Chonnam)

a. Declarative (Jun):	Hyun-Cheol-a	Sang-Won-a
TBU: μ	[h y n c l a]	[s a w n a]
	| | | |	| | |
	HH L L	H H L
b. Vocative chant (Ko):	Hyún-Cheol-a	Sang-Wón-a
TBU: σ	| |	| | |
	H* M	L H* M

Examples in (14) show that the tonal pattern of the vocative chant cannot be explained just by duplicating the declarative phrasal tonal pattern that has been proposed by Jun (14a). In the proposed analysis (14b), the assignment of the H* in different locations follows from different metrical structures. The question regarding the determinant of the location of the H* tone in Seoul and Chonnam will be discussed in detail in the following section.

4 Proposed Analysis

In this section, I propose that the H* is aligned with a metrically prominent syllable in Seoul and Chonnam similar to the cases of stress languages such as English and Dutch. In the previous section, I have sketched an analysis of the H* assignment in Seoul and Chonnam: H* on the second syllable in

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mental effect whereas it is a very common crosslinguistic phenomenon, including in Korean, that a H tone is often associated with a longer duration.

[11] 'Seg.' refers to the F0 boosting as a result of segmental effect.

Seoul and either on the initial or second syllable in Chonnam. According to the current proposal, this means that the metrically prominent syllable is the second syllable in Seoul but either the initial or the second syllable in Chonnam. The analysis is presented again below:

(15) a. Seoul: H* on the second syllable, M on the vocative suffix

Eon-Súk-a	Hyun-Chéol-a	Young-Sún-a	Sang-Wón-a
L H* M	L H* M	L H* M	L H* M

b. Chonnam: H* on the initial or second syllable, M on the vocative suffix

Eon-Súk-a	Hyún-Cheol-a	Yóung-Sun-a	Sang-Wón-a
L H* M	H* M	H* M	L H* M

Now, the next question is obvious: what is the determinant of the metrical structure in Korean? In Seoul, the metrically prominent position is fixed on the second syllable. In Chonnam, the question becomes more interesting since there seems to be more going on in determining the metrical prominence of a word. Clearly, it is not the weight of the syllable as the following examples show:

(16) a. Jáe-Hun, Hyún-Cheol: H* on the initial
b. Su-Yóng, Myung-Jún: H* on the second
c. Sonority of the coda irrelevant: Seok-Jú, Myung-Jún (H* on second)

In (16a), the stress falls on the initial syllable in both examples even though *Jáe-Hun* has a light initial syllable and *Hyún-Cheol* has a heavy one. Conversely, in (16b), the stress goes onto the second syllable regardless of the weight of the initial syllables. Further, examples in (16c) show that the sonority of coda is irrelevant in determining the weight of a syllable since neither *Seok-Jú*, with an obstruent coda in the initial syllable, nor *Myung-Jún*, with a sonorant coda, attracts a stress onto itself.

I suggest that the default location of stress in both Seoul and Chonnam is the second syllable. Chonnam, however, has a lexical specification for certain syllables, similar to the lexical stress system of Russian (Halle & Idsardi 1995). That is, the Syllable Boundary Projection parameter in Korean (17a) is not triggered by a phonetically manifested property of the syllable, but is an idiosyncratic property of a morpheme. Stressed syllables are realized long if they are initial. Using the scheme of Halle & Idsardi (1995), I propose the following parameters to determine the location of the prosodic prominence in Seoul and Chonnam:

(17) Parameters for Korean metrical structure

a. Project L: Project a left boundary of a lexically prominent syllable onto line 0.[12]
b. Edge LRL: Place a left parenthesis to the right of the leftmost syllable.
c. Head L: Project the leftmost syllable of the constituent onto the next line of grid.

In addition to the above parameters, there is a constraint on iterative left boundaries over a single grid, represented as in the following:

(18) Avoid (x (

The application of the above parameters are shown with the examples *Hyún-Cheol* and *Sang-Wón* in the following:

(19)

	Hyún-Cheol		Sang-Wón	
	Seoul	Chonnam	Seoul	Chonnam
Line 0: **Project L**	x x	(x x	x x	x x
Edge: LRL	x (x	(x x ***Avoid (x(***	x (x	x (x
Head: L	x (x x	(x x x	x (x x	x (x x

Now, let us compare the proposed analysis with a weight-based stress system.

(20) a. kyó:doso ‘prison’
b. tá:m-ta ‘put in-infinitive’
c. tam-á ‘put in-stative’
d. tam-ás ‘put in-connective’

According to the analysis summarized in Section 2.1, (20a) receives an initial stress since the initial syllable has a long vowel. (20b) also has an initial stress since the initial syllable is superheavy. The words (20b-d) are all derivatives of the same stem *ta:m-*. However, (20b) is pronounced long, while (20c) and (20d) are pronounced short. In an OT-based iambic analysis of the Korean stress system, Kim (1997) argues that the vowel shortening is motivated by an exhaustive parsing of the syllables into a foot. His idea is illustrated in (21):

[12] A further research is needed to investigate whether the substance of the lexical prominence is related to the tonal properties of sino-Korean morphemes in Middle Korean.

(21) Analysis of stem vowel shortening (Kim 1997)

a.	([H]$_F$ L)ω	→	([L L]$_F$)ω
	/ t a: m a /		[t a m a]
b.	([H]$_F$ L)ω	→	([H]$_F$ L)ω
	/ t a: m t a /		[t a: m t a]

In (21a), by shortening the vowel length of the stem, the suffix *-a* can be parsed into a foot, achieving exhaustivity. This is a well known shortening pattern found in trochaic languages such as Fijian (Hayes 1995). In (21b), however, even after shortening the vowel length of the stem, the suffix *-ta* will not be able to be incorporated into a foot since the stem would be bimoraic due to the closed syllable, forming a foot by itself. If the suffix could not be incorporated into a foot anyway after vowel shortening, there is no reason to apply vowel shortening, so the vowel length is maintained. His analysis is crucially based on the assumption that the vowel length and coda are moraic.

However, it is not clear how to explain the shortening of the stem vowel in cases like (20c). According to Kim's iambic analysis, the underlying representation of (20c) would be */ta:m-asə/*, which would make a well-formed foot structure in itself. Applying a vowel shortening would only make the foot form ill-formed as illustrated in (22):

(22)	([H]$_F$ [L L]$_F$)ω	→	*([L L]$_F$ L)ω
	/t a: m a s /		[t a m a s]

Also, note that under the assumption that the stem *ta:m-* has a long vowel underlyingly, the underlying syllable structures of the example *kyo:doso* (20a) and *tamasə* (20c) would be the same, i.e. both HLL. Then, in the iambic analysis, it is not clear why only (20c) undergoes vowel shortening whereas (20a) maintains the vowel length of the initial syllable.

In the proposed analysis, I assume that the vowel length is not underlyingly specified and that some suffixes in Korean are lexically marked with a left boundary[13]. For example, the suffix *–ki* which is homophonous between a nominalizing suffix and a causative suffix is marked for a stress only when it is a causative suffix. I attribute the initial stress in (20a) and (20b) to the lexical specification of the stress rather than vowel length. I further assume the following rule (23) to avoid stress clash. This is ordered before the avoidance rule ***Avoid (x(*** in (18):

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[13] Before, when I mentioned that the lexical specification is only in Chonnam, the subjects of comparison were modern Seoul and Chonnam. Since Kim's data here are from conservative Seoul, I modify the previous standpoint and assume a lexical stress for conservative Seoul as well.

(23) (→ ϕ / __ x (x

The proposed analysis of vowel shortening is illustrated below:

(24)

	a. k y o d o s o	b. t a m - t a	c. t a m - a s ə
Line 0:	(x x x	(x x	(x (x x
Project L			x (x x *(23)*

These data provide an independent motivation for assuming a lexical stress in Korean to account for morpheme controlled accentuation of verbal stems and affixes.

5 Interaction of Stress and Pitch Accent

In this section, I will provide a unified account of tonal pattern of the AP in Seoul and Chonnam, deriving the AP tonal patterns suggested by Jun[14] from an interaction of pitch accent and metrical prominence. My analysis is different from Jun's in that there is no underlyingly long vowel in Chonnam. Also, in my analysis, the TBU is syllable in both dialects.

I propose that a LH* pitch accent is assigned to the stress in Seoul and Chonnam. I also propose that only long vowels can accommodate a contour tone. As suggested in the previous section, there is no underlyingly long vowel in Korean – the only surface long vowels are the stressed initial syllables that underwent vowel lengthening due to positional licensing (Beckman 1995). Therefore, stressed initial syllable is the only location we can see the realization of the rising contour tone in Korean. If the stress is on the second syllable, vowel lengthening does not occur and the L tone is realized on the first syllable due to the universal tendency to avoid a contour tone on a short syllable. The proposed interaction of the pitch accent and stress is illustrated as follows:

(25) LH* is aligned with the stress (both in Seoul and Chonnam)[15]

a. ǰ : min n	b. inán n
/\	| |
L H*	L H*

[14] With a proposed modification of the treatment of the laryngeal effect in section 3.

[15] Although the proposed interaction of pitch accent and stress is meant to apply in both Seoul and Chonnam, the only way to get an initial stress in the current proposal is via a lexical specification. Since (modern) Seoul does not have a lexical specification, application of (25a) would be vacuous in Seoul.

After inserting a default L tone to the rest of the syllables in the AP, we get the tonal patterns proposed for Chonnam by Jun as follows[16]:

(26) Stressed syllables in AP initial position in Chonnam
{**jə: min n**} {**jə: al l**} {**mí:wəhe**}. (data from Jun 1993:44)
LH* L L LH*L L LH*L L
Youngmi-NOM Younga-ACC hate-DECL.
'Youngmi hates Younga.'

Interestingly, when the accentual phrases are expanded with prenominal modifiers, the stresses of the above noun words are suppressed in the AP medial position. This is illustrated as follows:

(27) Stressed syllable in AP medial position (data from Jun 1993: 50)
{n múna} {m dínn n **jə min n**} {miún **jə al l**} {**mí:wəhe**}.
L H* L L H* L L L L LH* L L L LH*L L
very pretty Youngmi-NOM ugly Younga-ACC hate-DECL
'Very pretty Youngmi hates ugly Younga.'

The phenomenon observed in (27) suggests that the computation of the stress should span the entire AP. In the absence of positive evidence for a secondary stress, I assume a tier conflation process in applying the head parameter in line 1. The final picture of the computation of the stress is illustrated in (28):

(28)

		m i u n	j ə ŋ a l u l
Line 0:	**Project L**	x x	(x x x
	Edge: LRL	x (x	(x x x ***Avoid (x(***
	Head: L	x (x x	(x x x x
Line1:	**Edge LLL**	x (x (x	(x x x x
	Head L	x (x ~~(x~~ ~~x~~ x	(x x x

6 Summary

In this paper, I have provided a unified analysis of the metrical prominence system of Seoul and Chonnam and also derived tonal patterns of an AP through the interaction of pitch accent and stress. The proposed analysis can be summarized as in the following table:

16 In Seoul, a boundary H tone should be inserted at the end of the AP.

(29)

1. Stress assignment (Chonnam has a UR specification) 2. Vowel lengthening in initial stress 3. LH* assignment	Phonology
4. Laryngeal effect: F0 boosting in initial position	Phonetcis

The proposed analysis provides a typologically interesting addition to the system of prosodic prominence in the world's languages in that Korean has properties of both stress and pitch accent.

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