The Metrical Tone in North Kyungsang Korean

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0. Introduction

In this paper we examine various tonal patterns in North Kyungsang Korean (NKK). Although there have been a number of attempts to account for the tonal patterns in NKK, no previous research has examined them from a metrical perspective. We argue that NKK is a pitch-accent language in which the tonal phenomena are manifestations of metrical organization. Examining tone shift and tone spread in NKK, we show that the slightly different settings for the Edge Marking and Headedness parameters of Idsardi (1992) will give the correct results for NKK when combined with a two-level (cyclic and noncyclic) phonological computation.

1. Background

The generally assumed difference between tonal languages and pitch-accent languages is that the occurrence of specific tones cannot be predicted in tonal languages whereas the tones in pitch-accent languages can be predicted from the location of the accent of a phonological word. In tonal languages, it is a general property of the language that many words are differentiated only by the tone. Therefore, in tonal languages tones must be stored in the underlying representation. In pitch-accent languages, however, tones are derivationally assigned. For example, in the metrical approach to the tonal patterns in Tokyo Japanese (a common example of a pitch-accent language), there are parameter settings for constructing the metrical structure, and tones are assigned by metrical tone rules applying to the metrical structure constructed by the metrical computation, as in (1), where “)” denotes the metrical boundary and the bold face denotes the high tone. In Tokyo Japanese the lexical representation includes metrical boundaries for accented vowels.

(1) Tokyo Japanese
a. accented stem  
  koko’ro ‘heart’ ---+ koko’ro
b. unaccented stem  
  sakana ‘fish’ ---+ sakana
c. Metrical Parameters: Cyclic: Lexical Bracket

Noncyclic: Line 0: Edge:L.R.I., Head:R
Line 1: Edge:L.L.I., Head:L

d. the metrical computations of words

<table>
<thead>
<tr>
<th>Input</th>
<th>Cyclic Lexical Bracket</th>
<th>NonCyclic</th>
<th>Line 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>koko’ro</td>
<td>x x)x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>kokoro</td>
<td>kokoro</td>
<td>kokoro</td>
</tr>
<tr>
<td>sakana</td>
<td>N/A</td>
<td>x(x)</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>sakana</td>
<td>sakana</td>
<td>sakana</td>
</tr>
</tbody>
</table>

e. Tone Mapping Rule (Noncyclic)  
0 ---+ H / x --- Line 2

f. Tone Spreading Rule (Noncyclic)

\[ x \]

Output: [koko’ro] [sakana]

Given the location of accent in Tokyo Japanese, as shown in (1), the surface tonal patterns of words are predictable. First, the metrical structure for each word is constructed by the metrical calculation based on the metrical parameter settings for Tokyo Japanese. Second, Tokyo Japanese has tone mapping and spreading rules, which apply to the constructed metrical structure. The examples illustrated in (1), therefore, show that the tonal patterns of pitch-accent languages can be derived by the metrical structure and the metrical tone rules. Tone shift phenomena can be found in many languages. Thus, before examining the NKK tone, we will review the current approaches to tone shift. There are two main approaches to tone shift: the spreading and delinking rule approach and the metrical approach. Many analyses of tone shift employ rules of spreading and delinking, but Idsardi and Purnell (1995) argue that the conjunctive application of spreading and delinking rules violates the Elsewhere Condition (Kiparsky 1973).

(2) a. Spreading  
  VC\textsubscript{0}V \rightarrow VC\textsubscript{0}V
  \rightarrow \rightarrow \rightarrow
  H H H

b. Delinking  
  (Idsardi and Purnell 1995:5)
  VC\textsubscript{0}V \rightarrow VC\textsubscript{0}V
  \rightarrow \rightarrow \rightarrow
  H H H

\( SD \quad SC \quad SD \quad SC \)
(\( SD = \) structural description, \( SC = \) structural change)
In (2), the result of applying the spreading rule is distinct from the result of applying the delinking rule. That is, the two rules make incompatible demands with respect to the association line between the first vowel and the high tone. The structural descriptions of the rules are nondistinct in that the structural description of (2a) is wholly contained in the structural description of (2b). Therefore, these rules must be subject to the Elsewhere Condition which then requires that the two rules must be applied disjunctively. Thus, conjunctive application, where (2a) feeds (2b), is ruled out by the Elsewhere Condition.

Idsardi and Purnell (1995) propose a metrical approach to tone shift as an alternative. In the metrical approach, as shown in the Japanese examples in (1), a high tone is mapped to the most prominent element of a phonological word. The most prominent element is determined by the metrical computation between constituents based on the settings for the metrical parameters for each language. Therefore, tone shift is a result of metrical computing constituents.

In the next section we will turn to the NKK tone. It will be shown that the metrical approach is an appropriate theory to account for the properties of NKK tone.

2. Pitch-Accent, Tone Shift and Tone Spreading in NKK

First we will examine NKK tone shift using a spreading and delinking approach. Consider the examples in (3)

(3) a. apuci ‘father’  
    apuci-uy ‘father’s’  
    apuci-eko ‘to a father’

    b. satali ‘ladder’  
    satali-uy ‘ladder’s’  
    satali-eko ‘to a ladder’

In (3a) the enclitics do not affect the tonal pattern of the enclitic constructions; the pattern is the same as that of the stem in isolation. The examples in (3a), therefore, demonstrate that there is no tone shift in the construction where the stem has a high tone in pre-final position. On the other hand, it is shown in (3b) that tone shift occurs in this construction, which also consists of a stem and an enclitic. If a vowel-initial enclitic or a monosyllabic consonant-initial enclitic is adjacent to a final high-toned stem, then the high tone shift does not occur. Otherwise, the high tone of final high-toned stems shifts to the pre-final position of the entire construction. Consequently, the generalization regarding NKK tone shift can be stated as follows:

(4) The high tone of final high-toned stems shifts to the pre-final position of the entire construction when a disyllabic or larger consonant-initial enclitic is adjacent to the stem.

In order to account for the generalization (4), the rules in (5) are required in the spreading and delinking approach.

(5) a. \[ V \rightarrow CV_C V_C V_C \]  
    b. \[ V \rightarrow CV_C V_C V_C \]  

\[ \text{(5b) could be simplified to } V \rightarrow CV_C \text{, without affecting the argument} \]

The spreading and delinking rules in (5) apply only if the high tone is in stem-final position and the enclitic is consonant-initial and larger than monosyllabic. The conjunctive interaction between the spreading rule and the delinking rule in (5), like those in (2), violates the Elsewhere Condition. In addition to violating the Elsewhere Condition, the spreading and delinking analysis has serious problems in explaining the NKK tonal patterns. First, why does the high tone shift occur only if the consonant-initial enclitic is adjacent to the final high-toned stem? The spreading and delinking approach does not explain the different tonal behaviors between the final high-toned stems and the other high-toned stems and between the vowel-initial enclitics and the consonant-initial enclitics. Second, why does the high tone shift only to the pre-final position, instead of the very next position (\text{satali-maingkuo}, but *\text{satali-maingkuo})? Why does the high tone not shift in the constructions consisting of a final high-toned stem and a monosyllabic consonant-initial enclitic? Third, how can we account for the tonal patterns of compounds, such as in (6), in the spreading and delinking approach?

(6) a. \text{chuca ‘walnut’ + nama ‘tree’}  
    \text{chuca-namu ‘walnut tree’}

    \text{napi ‘butterfly’ + nekthai ‘necktie’}  
    \text{napi-nekthai ‘bow tie’}

    b. \text{poli ‘barley’ + kkkay ‘ridge’}  
    \text{poli-kkkay ‘spring famine’}

    \text{nama ‘tree’ + satali ‘ladder’}  
    \text{nama-satili ‘wooden ladder’}

In each compound in (6), one of two high tones is changed to low tone. The interesting fact is that the first high tone is changed to low if the first element is a final high-toned stem, as in (6b). Otherwise, the second high tone is changed to low, as in (6a). Notice that only stem-final high tone exhibits tone shift in (3b). What is the relation between the loss of stem-final high tone in the first element of compounds demonstrated in (6b) and the shift of stem-final high tone...
in the enclitic constructions demonstrated in (3b)? The spreading and delinking approach cannot provide any answer to this question.

In our discussion, we have seen that the spreading and delinking approach cannot be an appropriate theory for the NKK tone. Now let us turn to the metrical approach. As shown in Section 1, in this approach the tonal alternation is the result of the relative metrical prominence between the constituents. Once the metrical structure is established, a high tone is mapped to the element marked as the head of the phonological word. We propose that in NKK the metrical structure is generated by the parameter settings for edge marking and headedness in (7), in combination with a two-level phonological computation with cyclic and noncyclic calculations:

(7) Cyclic: Line 0: Edge: RLR Noncyclic: Line 0: Edge: RRR, Head: R

ie x x) x # Line 1: Edge: LLL, Head: l

Now let us consider the classification of stems and enclitics. It has been generally assumed in Lexical Phonology (Kiparsky 1982) that enclitics can be divided into cyclic and noncyclic enclitics, but that stems are all cyclic. Analyzing tonal patterns in Japanese, however, Watanabe (1993) argues that the Japanese stems must be divided into cyclic and noncyclic stems. Following Watanabe (1993), we will assume that NKK stems are divided into cyclic and noncyclic stems. Only noncyclic rules apply to noncyclic stems in the metrical computation. However, both cyclic and noncyclic rules apply to cyclic stems because all words are subject to the noncyclic rules. In NKK the final high tone in stems is generated by the noncyclic metrical computation. Therefore, we propose that final high-toned stems are noncyclic and the other kinds of stems are cyclic. We have seen that the disyllabic and larger consonant-initial enclitics have a pre-final high tone in the combination with the final high-toned stems (noncyclic stems). This empirical evidence shows that the surface representations, which have the pre-final high tone in enclitics in those cases, are correctly derived only if enclitics are cyclic and have their own domain for the metrical computation.

Now let us consider how the proposed metrical approach derives the correct outputs. First we will examine stems in isolation:

(8) a. apuci ‘father’ b. satali ‘ladder’

According to our classification of NKK stems, the stem in (8a) is cyclic and the stem in (8b) is noncyclic. The metrical computations for these stems are shown in (9):

(9) the metrical computations of stems

<table>
<thead>
<tr>
<th>Input</th>
<th>Cyclic Edge: RLR</th>
<th>NonCyc Edge: RRR, Head: R</th>
<th>Line 1 Edge: LLL, Head: L</th>
</tr>
</thead>
<tbody>
<tr>
<td>apuci</td>
<td>x x) x</td>
<td>x x</td>
<td>x</td>
</tr>
<tr>
<td>satali</td>
<td>x x) x</td>
<td>x x) x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>apuci</td>
<td>apuci</td>
<td>apuci</td>
</tr>
<tr>
<td></td>
<td>satali</td>
<td>satali</td>
<td>satali</td>
</tr>
</tbody>
</table>

In (9) the cyclic rule must apply to apuci ‘father’ which is cyclic, while it cannot apply to satali ‘ladder’ which is noncyclic. Therefore, in the cyclic domain, apuci has a right parenthesis to the left of the final syllable from the edge marking RLR, while satali does not have any parenthesis. In the noncyclic domain, the application of edge marking RRR, headedness R on line 0 and edge marking LLL, headedness L on line 1 results in the accentuation of the pre-final vowel in apuci, and the accentuation of the final vowel in satali.

To give these words the correct tonal patterns, we propose that NKK has the following tone mapping rule:

(10) Tone Mapping Rule (Noncyclic): 0 --> ( ) / x --> Line 2

The high tone is mapped to the most prominent vowel of constructions by the tone mapping rule, as in (11):

(11) a. x       b. x
( )       ( )

Consequently, the application of tone mapping rule (10) results in the correct outputs, apuci and satali. In the other words, the surface tonal representations are derived by the metrical structure and the metrical tone rule.
The next issue is whether the metrical computation used to generate the correct outputs of stems can account for the NKK tone shift. Let us see the following examples where a consonant-initial enclitic is combined with a stem:

(12a) a hanul ‘sky’  hanul-cocha ‘even sky’
b palam ‘wind’  palam-cocha ‘even wind’

In (12a) an enclitic is combined with a cyclic stem, while an enclitic is combined with a noncyclic stem in (12b). Here we will examine the metrical computations of hanul-cocha ‘even sky’ and palam-cocha ‘even wind’.

(13) the metrical computations of the stem + cons.-initial enclitic combinations

<table>
<thead>
<tr>
<th>Input</th>
<th>Cyclic Edge: RL.R</th>
<th>NonCyc Edge: RRR, H: R</th>
<th>Line 1 Edge: LLL, H: L</th>
</tr>
</thead>
<tbody>
<tr>
<td>hanul</td>
<td>x) x hanul</td>
<td>x x x (x x x x x)</td>
<td>x x x (x x x x x)</td>
</tr>
<tr>
<td>-cocha</td>
<td></td>
<td>hanul-cocha</td>
<td>hanul-cocha</td>
</tr>
<tr>
<td>N/A</td>
<td>(x x)</td>
<td>(x x)</td>
<td>x</td>
</tr>
<tr>
<td>palam</td>
<td>x x palam</td>
<td>x x x (x x)</td>
<td>x x x (x x)</td>
</tr>
<tr>
<td>-cocha</td>
<td></td>
<td>palam-cocha</td>
<td>palam-cocha</td>
</tr>
</tbody>
</table>

In the metrical computations of the stem + enclitic combinations, enclitics have their own domain for the metrical computation. In the cyclic domain, like in (9), the edge marking RLR applies to the cyclic stem, hanul ‘sky’, while it cannot apply to the noncyclic stem, palam ‘wind’. The edge marking RLR also applies to the enclitic -cocha ‘even’. In the noncyclic domain, the edge marking and headedness rules apply to the whole stem + enclitic combinations. By applying the tone mapping rule (10), a high tone is mapped to the most prominent vowel. Therefore, the metrical computations in (13) demonstrate that tone shift is also the result of the application of the metrical tone rule to the constructed metrical structure.

In choosing this metrical analysis as the appropriate theory for the NKK tone, however, there are some remaining issues to be addressed. One of them is the ‘no tone shift’ phenomenon shown in the tonal patterns of stem + vowel-initial enclitic combinations. As illustrated in (14), in those combinations the high tone of all stems, noncyclic as well as cyclic, does not shift.

(14a) a apuci ‘father’  apuci-uy ‘father’s’  apuci-eke ‘to a father’
b palam ‘wind’  palam-i ‘wind (nom)’  palam-eke ‘to wind’

It has been proposed in metrical theory that there are some pre-accenting morphemes, which induce accent on the preceding morpheme. We claim that the vowel-initial enclitics must be pre-accenting morphemes in NKK. We will see later that there are also some pre-accenting stems in NKK. We assume that the pre-accenting morpheme has a left parenthesis before the morpheme indicating the metrical boundary. Under this assumption, for example, the vowel-initial enclitic -eke ‘to’ has the following representation in the lexicon: -eke. We also assume that the application of rules for constructing the metrical structure is governed by certain general conditions in NKK. One of these is the Exhaustivity Condition requiring that the rules for constructing the metrical structure are applied in an exhaustive fashion. In NKK the Exhaustivity Condition is instantiated by the following rule introducing a right parenthesis in the position adjacent to a left parenthesis, as is proposed by Halle and Vergnaud (1987, 117; their convention (17))

(15) x (x --> x) x

The application of rule (15) in constructing the metrical structure, along with the pre-accenting nature of vowel-initial enclitics, accounts for the ‘no tone shift’ phenomenon shown in the stem + vowel-initial enclitic combinations. Here we examine the metrical computation of palam-eke ‘to wind’.

(16) the metrical computation of the stem + vowel-initial enclitic combination

<table>
<thead>
<tr>
<th>Input</th>
<th>Cyclic Edge: RL.R</th>
<th>NonCyc Edge: RRR, Head: R</th>
<th>Line 1 Edge: LLL, Head: L</th>
</tr>
</thead>
<tbody>
<tr>
<td>palam</td>
<td>N/A x palam</td>
<td>x x (x x) x (x x) (Rule (15))</td>
<td>x (x x) x (x x) x</td>
</tr>
<tr>
<td>-(eke)</td>
<td></td>
<td>palam-eke</td>
<td>palam-eke</td>
</tr>
</tbody>
</table>

In (16) -eke ‘to’ has parentheses in both sides. The right parenthesis is inserted by the application of the Binary Constituent Construction (BCC) rule: -eke ‘to’ (x --> (x)). which we will propose later as an NKK parameterized version of the Iterative Constituent Construction (ICC). The edge marking RLR cannot apply to -eke, because its application would destroy the metrical constituent constructed by the application of the BCC. If the rule (15) does not apply in the noncyclic domain, the final vowel e in palam-eke ‘to wind’ would be the most prominent element and the tone mapping rule would associate a high tone to the final vowel. Without the rule (15), therefore, the metrical computation of palam-eke incorrectly predicts that the correct output should be palam-eke, where the high tone is in the final position. The rule (15) has a crucial role in...
determining the second vowel as the most prominent element in the example, \textit{palam-eke}.
The next issue is the bounded tone spreading phenomenon observed in (17)

(17) \textit{tanci} ‘jug’
\textit{mucigay} ‘rainbow’
\textit{tanci-cocha} ‘even a jug’
\textit{mucigay-cocha} ‘even a rainbow’

As illustrated in (17), some words in NKK exhibit high tone on the first and the second vowels. In analyzing the constructions containing a vowel-initial enclitic, we have classified vowel-initial enclitics as pre-acenting morphemes, morphemes which begin a metrical constituent in our analysis. If a language has pre-acenting morphemes, then there can also be pre-acenting stems in the language. Compared with the behaviors of tonal patterns in other stems, the different behavior of tonal pattern in stems in (17) implies that these stems must be classified differently from the other stems. We classify these stems as cyclic pre-acenting stems. The fact that these stems are pre-acenting is justified in that like the consonant patterns of the vowel-initial enclitic constructions the high tone is always in the first elements of compounds where these stems are the second elements. The fact that no tone shift can be found in any constructions containing these stems also shows that these stems and the noncyclic stems must be differentiated.

In the metrical computation (16), the Binary Constituent Construction ($xx \rightarrow (xx)$), whose function is to make the binary constituent, has been introduced. In many languages including Warao, Weri and Maranungku (see examples in Idsardi (1992)), constituency is assigned starting from the right-most element or from the left-most element, making binary constituents by grouping two elements at a time. Iidsardi (1992) proposes the Iterative Constituent Construction for this kind of constituent construction. However, in NKK the binary constituents are restricted in occurring only if an element has a left parenthesis. Therefore, we assume that the Binary Constituent Construction is a parameterized version of the more general Iterative Constituent Construction (ICC). Now let us consider the metrical computations of \textit{tanci} ‘jug’ and \textit{tanci-cocha} ‘even a jug’.

(18) the metrical computations of pre-acenting cyclic stems

<table>
<thead>
<tr>
<th>Input</th>
<th>Cyclic Edge: RLR</th>
<th>NonCyclic Edge: RRR, H: R</th>
<th>Line 1 Edge: LLL, H: L</th>
</tr>
</thead>
<tbody>
<tr>
<td>(tanci)</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>(x x) (BCC)</td>
<td>tanci</td>
<td>(x x)</td>
<td>(x x)</td>
</tr>
<tr>
<td>tanci</td>
<td></td>
<td>tanci-cocha</td>
<td></td>
</tr>
</tbody>
</table>

In (18) the edge marking RLR cannot apply to the binary constituents constructed by the BCC and in the first row the noncyclic edge marking RRR vacuously applies on line 0. The metrical computations select the second vowel of the stem as the most prominent element in both cases. Thus, the tone mapping rule associates a high tone to the second vowel of the stem. The following (19) is an example of the application of tone mapping rule to the metrical structure of \textit{tanci}.

(19) $x$
\((x x)
\textit{tanci}
\)
\H

In order to derive the correct output of \textit{tanci}, NKK needs a tone spreading rule. In examining the tonal patterns of Tokyo Japanese, we have seen that the tone spreading phenomenon can be accounted for by employing the tone spreading rule (11), which is repeated as (20):

(20) Tone Spreading Rule (Noncyclic) - Tokyo Japanese
\(x x \rightarrow \text{Line 0}\)
\(\text{H}\)

Now compare (19) and (11a), repeated as (21a) and (21b) respectively:

(21) a. $x$
\((x x)
\textit{tanci}
\)
\H
b. $x$
\((x x)
\textit{apuci}
\)
\H

If the tone spreading rule (20) is used for NKK, it would derive the correct output, \textit{tanci} for (21a) but it would derive the incorrect output, \textit{apuci} for (21b).
In order to derive the correct outputs of both *tanci* and *apuci*, therefore, a more restricted tone spreading rule is required in NKK. We propose the following tone spreading rule for NKK, which is more restricted than the Tokyo Japanese tone spreading rule in applying only in certain metrical configurations:

\[(22) \text{Tone Spreading Rule (Noncyclic) - NKK} \]
\[
(x \times \rightarrow \text{Line 0})
\]

\[H\]

According to the tone spreading rule (22), the high tone spreads leftward to an element which has a left parenthesis on line 0. Therefore, the high tone mapped to the most prominent vowel spreads only to the first vowel *a* of *tanci* which has a left parenthesis, while it cannot spread to the first vowel *a* of *apuci* which does not have any parenthesis. This analysis shows that the different setting of tone spreading rules between Tokyo Japanese and NKK accounts for the difference between the Tokyo Japanese 'high plateau' effect and the NKK bounded tone spreading effect. Consequently, within the metrical approach, the NKK tone spreading phenomenon can be accounted for by employing the BCC and the restricted version (22) of tone spreading rule.

So far we have examined the phenomena such as tone shift and tone spread shown in the various patterns of stems and stem + enclitic combinations in NKK. The metrical approach to these phenomena exhibits that NKK cannot be a tonal language, where the tone shift must be accounted for by the spreading and delinking rule, but a pitch-accent language, where the metrical structure and the metrical tone rules are involved to derive the correct tonal patterns. In the next section, it will be examined whether the metrical framework adopted here for NKK works for the tonal patterns of compounds.

3. The Tonal Patterns of Compounds

The NKK compounds exhibit various tonal patterns. In compounds in (23), where the first elements of compounds are all cyclic pre-accenting stems, the high-toned vowels of the pre-accenting stems are still high-toned in compounds, while the high-toned vowels of the second elements lose their high tone and become low-toned regardless of the classes of stems.

(23) \[\text{[[olepi]}[[kaksi]] \rightarrow [olepi-kaksi]} \quad \text{‘brother’s bride’} \]
\[\text{[[lyaki][chayk]] \rightarrow [lyaki-chayk]} \quad \text{‘story book’} \]

The compound, *olepi-kaksi* 'brother's bride', where a pre-accenting stem *olepi* and a cyclic unaccented stem *kaksi* 'bride' are combined, is metrically computed as follows:

(24) the metrical computation of *olepi-kaksi* 'brother’s bride'

<table>
<thead>
<tr>
<th>Input</th>
<th>Cyclic Edge: RLR</th>
<th>NonCyc Edge: RRR, H: R</th>
<th>Line 1 Edge: LLL, H: L</th>
</tr>
</thead>
<tbody>
<tr>
<td>olepi</td>
<td>(BCC)</td>
<td>x x</td>
<td>x</td>
</tr>
<tr>
<td>kakai</td>
<td>olepi</td>
<td>x x</td>
<td>(x x x)</td>
</tr>
<tr>
<td></td>
<td>kakai</td>
<td></td>
<td>(x x x x x)</td>
</tr>
<tr>
<td></td>
<td>olepi-kaksi</td>
<td></td>
<td>olepi-kaksi</td>
</tr>
</tbody>
</table>

We assume that stems are combined into compounds in the noncyclic domain. Thus, each stem of compounds has its own cyclic domain for the metrical calculation and the noncyclic edge marking and headedness rules apply to the entire compounds, as demonstrated in (24). The most prominent element is the second vowel of the pre-accenting stem which is the first element of the compound in (24). Consequently, the tone mapping and spreading rules make the first and the second vowels high-toned.

The examples in (25) exhibit the tonal patterns of compounds where the cyclic unaccented stem is the first element.

(25) \[\text{[[napi][nekthai]] \rightarrow [napi-nekthai]} \quad \text{‘bow tie’} \]
\[\text{[[chuca][namu]] \rightarrow [chuca-namu]} \quad \text{‘walnut tree’} \]

The metrical computation (26) explains why the high-toned vowel of the first element (cyclic unaccented stem) is still high-toned, with the loss of high tone in the second element.

(26) the metrical computation of *napi-nekthai* 'bow tie'

<table>
<thead>
<tr>
<th>Input</th>
<th>Cyclic Edge: RLR</th>
<th>NonCyc Edge: RRR, H: R</th>
<th>Line 1 Edge: LLL, H: L</th>
</tr>
</thead>
<tbody>
<tr>
<td>napi</td>
<td>x</td>
<td>x</td>
<td>x x</td>
</tr>
<tr>
<td>-nekthai</td>
<td>napi</td>
<td>x x</td>
<td>(x x x)</td>
</tr>
<tr>
<td></td>
<td>napi-nekthai</td>
<td></td>
<td>(x x x x x)</td>
</tr>
</tbody>
</table>

In the noncyclic domain, the edge marking and headedness rules determine the first vowel of the first stem as the most prominent element in the metrical computation of the compound in (26). The tone mapping rule associates a high tone to the first vowel of the first stem. It is also obvious that the tone spreading...
rule cannot apply to this construction because there is no ‘left-parenthesis
vowel’ adjacent to the left of the vowel associated to the high tone.

In compounds in (27) where the first element is noncyclic, the high-toned
vowel of the second element is high-toned unless the second element is pre-
accepting.

(27) a. [satali][tha-ki] --> [satali-tha-ki] 'ladder climbing'
b. [poli][kokay] --> [poli-kkokay] 'spring famine'

(28) the metrical computations of examples in (27)

<table>
<thead>
<tr>
<th>Input</th>
<th>Cyclic Edge:RLR</th>
<th>NonCyclic Edge:RRR, H: R</th>
<th>NonCyclic Edge:LLL, H: L</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>N/A</td>
<td>(rule (15))</td>
<td>x</td>
</tr>
<tr>
<td>satali</td>
<td>x x</td>
<td>x x</td>
<td>x</td>
</tr>
<tr>
<td>-thaki</td>
<td>x x</td>
<td>x x(x)</td>
<td>x</td>
</tr>
<tr>
<td>b</td>
<td>N/A</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>poli</td>
<td>x x</td>
<td>x x(x)</td>
<td>x</td>
</tr>
<tr>
<td>-kkokay</td>
<td>x x</td>
<td>x x(x)</td>
<td>x</td>
</tr>
</tbody>
</table>

As discussed above, the left-parenthesis before the pre-accepting stem, which is
the second element of compound, feeds rule (15), x(x --> x) / x. In the noncyclic
domain, the application of rule (15) in the noncyclic + cyclic pre-accepting
compound makes the final vowel of the noncyclic stem the most prominent
element of the compound, as in (28a). When the second element is not pre-
accepting, on the other hand, the rule (15) cannot be applied. Therefore, the
noncyclic stem does not have any parenthesis, as in (28b). This ultimately
results in the tonal pattern that the high-toned vowel of the second element is
still high-toned, with the loss of high tone in the first element.

In the metrical computations of compounds demonstrated in (23-28), we have
shown that the metrical approach proposed here accounts for the tonal patterns
in NKK compounds. However, we have to note that there are systematic
exceptions shown in some compounds, as in (29).

(29) [[chentung][oli]] --> [chentung-oli] 'duck called 'thunder''
[[mole][sacang]] --> [mole-sacang] 'sand beach'

These compounds cannot be generated by our account so far. However, the
exceptional tonal patterns are systematic in that the metrical computation and
the metrical tone rules will derive the correct outputs if the first elements of
these compounds are treated as noncyclic (unaccented) stems, as in (30),
regardless of their original class.

(30) the metrical computations of the compounds: the exceptional tonal patterns

<table>
<thead>
<tr>
<th>Input</th>
<th>Cyclic Edge:RLR</th>
<th>NonCyclic Edge:RRR, H: R</th>
<th>Line 1 Edge:LLL, H: L</th>
</tr>
</thead>
<tbody>
<tr>
<td>chentung</td>
<td>x x</td>
<td>(BCC)</td>
<td>x</td>
</tr>
<tr>
<td>-oli</td>
<td>x x</td>
<td>(x x)</td>
<td>x</td>
</tr>
<tr>
<td>mole</td>
<td>N/A</td>
<td>N/A</td>
<td>x</td>
</tr>
<tr>
<td>-sacang</td>
<td>x x</td>
<td>x x</td>
<td>x</td>
</tr>
</tbody>
</table>

In (30) chentung 'thunder' and mole 'sand', which are originally pre-accepting
and cyclic unaccented respectively, do not have any parenthesis in the cyclic
domain because they are regarded as the noncyclic stems in this approach. In
the noncyclic domain, the edge marking and headedness rules apply to the
compounds. The high tone is correctly assigned to the most prominent
elements, the final vowel of the first stem in the compound chentung-oli 'duck
called 'thunder' and the final vowel of the second stem in the compound mole-
sacang 'sand beach' by the tone mapping rule. Therefore, we propose that in
some NKK compounds the first element becomes noncyclic. This proposal is
supported by two kinds of evidence: One is that there are no exceptional tonal
patterns in compounds where the first element is a noncyclic stem. This
systematic gap in the exceptional tonal patterns implies that the exceptional
tonal patterns are caused by the status-change of the first element of compounds
from cyclic to noncyclic. Other evidence is found in the Tokyo Japanese
compounds. There are many compounds in Tokyo Japanese in which the first
element must be treated as noncyclic regardless of its original stem class.
Consequently, many Tokyo Japanese compounds have accent on the second half
of the compound (see examples in McCawley (1977)).

In this section, we have examined the tonal patterns of compounds in NKK
from a metrical perspective. It has been shown that the metrical approach
adopted in this paper, which consists of the metrical structure rules based on
metrical parameters and the metrical tone rules, gives an appropriate framework
to account for the tonal patterns shown in compounds as well as stems in
isolation and enclitic constructions in NKK.
4. Conclusions

The theory of metrical computation developed here shows that NKK is a pitch-accent language. This finding leads to a new view in the study on the tonal patterns of NKK, which has been treated as a tonal language in previous research. The analysis in this paper also gives a new understanding of enclitics in NKK. Enclitics have their own domain for the metrical computation, i.e., a cyclic domain. That is, they behave as if they are the second part of a compound. Therefore, the metrical computation applies to the combination of stem + enclitic and the compounds in the same way.

5. References

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Non-release and Neutralization in Korean Revisited

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1. Introduction

This paper has two goals. The first one is to present a result of our experiment casting doubt on Jongman & Kim's (1996) according to which 83% of all Korean word final stops in their study on Korean were followed by a brief release burst. Contra Jongman & Kim, we interpret that the low amplitude inaudible acoustic signal sometimes observed in the waveforms of the stop sequences is not a burst normally associated with stop release in the literature on Korean phonology. The second goal is to give a revision to Rhee (1995) and Tak (1996) on the basis of Correspondence Theory (CT, McCarthy & Prince 1995), claiming that coda neutralization is a direct outcome of a constraint that requires a coda end in a closed articulation.

2. Release or Non-release

Even though the main purpose of Jongman & Kim's (1996) research is not about release vs. non-release, they reported that 83% of all word final stops in their study on Korean were followed by a brief release burst. They derived the result from the investigation on the collected acoustic data of Korean tk sequences embedded in a carrier phrase like [asap sap malhaseyo] 'Please say ______ and a shovel!' (e.g., aso /mal/ kwa sap malhaseyo, sos /pas/ [l] kwa ... aso /mit/ [l] kwa ... : /mat/ 'elder', /pas/ 'friend', /mit/ 'underneath'). Based on their experiment, they said that their result was of particular interest given the long tradition in Korean phonology that coda neutralization yields unreleased stop (Jongman & Kim 1996: 295, 309). Moreover, Kim (1996) in her short report stated that 15% of Korean coronal final stops (102 out of 680 underlying t, p, s) were followed by an oral burst.

If their observation is understood such that Korean final stops are 'released' in a normal sense of 'release' in the literature on phonology, it is hard to maintain many previous works such as Kim (1967, 1972, 1979), Kim-Renaud (1974, 1977), Chung (1986), Soln (1987), Rhee (1995), and Tak (1996) where notion of 'non-release' plays an important role in their...