

## A tone-domain interactive approach to binary spread and shift of high tone\*

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**Kim, Sun-Hoi. 2005. A tone-domain interactive approach to binary spread and shift of high tone.** *Studies in Phonetics, Phonology and Morphology* 11.2. 51-70. This paper focuses on the binary (bounded) spread and shift of high tone in the case where high tone is specified on a tone-bearing unit in the input. The main idea of this paper is that high tone is realized only within the domain for high tone. In this view, the spread and shift of high tone are both domain-internal processes. Therefore, this view requires that the domains for high tone should be optimally constructed. In this paper, it is shown that this view adequately explains various ways to realize the input high tone in the output. The parametric interactions of constraints in this view have applied to four Korean tonal dialects, that is, Hoylyeng, Samchek, Taykwu, and Pwukcheng Korean. In this case study, it is shown that the approach proposed in this paper accounts for the rich variation of tonal phenomena relevant to binary spread and shift of high tone in the Korean tonal dialects. (Chung-Ang University)

Keywords: high tone, domain, constraint, Korean tonal dialects, sponsor, spread of high tone, shift of high tone

### 1. Introduction

When the *sponsor* of high tone is defined as a tone-bearing unit that is specified with high tone in the input, an input high tone may be placed on its sponsor, spread from its sponsor onto other tone-bearing units, or shift to another tone-bearing unit in the output. Spread of high tone falls into two basic categories. One type is that high tone spreads from its sponsor onto the immediately adjacent tone-bearing unit and the other is that it spreads unboundedly onto other tone-bearing units. Both types of spreads of high tone are observed in natural languages. In the shift of high tone, however, its bounded type is absolutely favored in natural languages. In other words, high tone shifts from its sponsor to the immediately preceding/following tone-bearing unit and it is rare to find the long-distance shift of high tone in natural languages. In this paper, I focus on the bounded spread and shift of high tone, naming them as *the binary spread and shift of high tone*.

In explaining the binary spread and shift of high tone, the main idea of this paper is that high tone is realized only within the domain for high tone. In this idea, therefore, it is important to appropriately choose the optimal domain for high tone as well as the optimal way to realize the input high

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tone within the domain in the output. The tonal analysis based on this idea is called a *tone-domain interactive approach* in this paper.

In fact, the tone-domain interactive approach is deeply related to the question of the tonal independence from its featural domain. Separate from the debate on rules versus constraints and separate from the debate on the presence of intermediate representations, some phonologists, such as Cassimjee and Kisseberth (1997) and McCarthy (2004), have argued that tonal feature interacts with its featural domain.

According to this approach, when high tone is specified on its sponsor in the input of a given form, the spread of high tone is regarded as the domain-internal sharing of the high tone, as shown in (1), where an acute mark indicates high tone and the syllable containing a sponsor is underlined.

$$(1) \sigma \sigma (\sigma \underline{\acute{\sigma}}) \sigma \rightarrow \sigma \sigma (\acute{\sigma} \underline{\acute{\sigma}}) \sigma$$

The spread of high tone does not occur across the domain-boundary, as shown in (2).

$$(2) \begin{array}{l} \text{a. } \sigma \sigma (\sigma \underline{\acute{\sigma}}) \sigma \rightarrow * \sigma \acute{\sigma} (\acute{\sigma} \underline{\acute{\sigma}}) \sigma \\ \text{b. } \sigma \sigma \sigma (\underline{\acute{\sigma}}) \sigma \rightarrow * \sigma \acute{\sigma} \sigma (\underline{\acute{\sigma}}) \sigma \end{array}$$

The shift of high tone is also a domain-internal process. No shift of high tone occurs in the situation where the head of a domain is a sponsor, as shown in (3), where the head position is marked with a bold face.

$$(3) \begin{array}{l} \text{a. } \sigma \sigma (\sigma \underline{\acute{\sigma}}) \sigma \rightarrow \sigma \sigma (\sigma \underline{\acute{\sigma}}) \sigma \\ \text{b. } \sigma \sigma \sigma (\underline{\acute{\sigma}}) \sigma \rightarrow \sigma \sigma \sigma (\underline{\acute{\sigma}}) \sigma \end{array}$$

When the head of a domain does not correspond to a sponsor, high tone shifts to the head position, as shown in (4a). Like the spread of high tone, no shift of high tone occurs across the domain-boundary, as shown in (4b).

$$(4) \begin{array}{l} \text{a. } \sigma \sigma (\sigma \underline{\acute{\sigma}}) \sigma \rightarrow \sigma \sigma (\acute{\sigma} \underline{\sigma}) \sigma \\ \text{b. } \sigma \sigma (\sigma \underline{\acute{\sigma}}) \sigma \rightarrow * \sigma \sigma (\sigma \underline{\acute{\sigma}}) \sigma \end{array}$$

In this paper, it is argued that an input high tone is placed on its sponsor by the inviolable constraint **DomH** if the domain for high tone is not expanded but unary. However, when the domain for high tone is expanded in the binary way, an input high tone basically spreads or shifts to the adjacent tone-bearing unit within the domain. One of these two ways (binary spread and shift of high tone) is chosen as an optimal way by the ranking relation between the constraints **Sharing** and **\*(Nonhead, H)**.

In this paper, the ranking relation among domain-relevant constraints is crucial to determining the optimal domain for high tone. That is, the

optimal domain for high tone is chosen by the ranking of the constraint **DomBin** relative to the constraints **Align-R** and **Align-L**. The six core constraints mentioned above are as follows.

(5) Six Core Constraints of This Paper

- a. DomH  
Every domain for high tone contains at least one high tone
- b. Sharing  
The members of the domain for high tone share high tone
- c. \*(Nonhead, H) (Cassimjee and Kisseberth 1997: 25)  
High tone is not realized on a nonhead
- d. Align-L (Cassimjee and Kisseberth 1997: 11)  
Align the left edge of a domain for high tone with the left edge of the sponsor of high tone to which it “corresponds”
- e. Align-R (Cassimjee and Kisseberth 1997: 11)  
Align the right edge of a domain for high tone with the right edge of the sponsor of high tone to which it “corresponds”
- f. Domain Binarity (DomBin)  
Every domain for high tone is binary.

The dialectal difference may be a result of a variety of ways to realize the same input in the output and it is expressed by the difference in ranking relations among constraints in Optimality Theory (OT, Prince and Smolensky 1993 and McCarthy and Prince 1993a, b). This paper shows that parametric interactions of the core constraints in (5) account for the rich variation of tonal phenomena relevant to binary spread and shift of high tone.

The organization of this paper is as follows. In Section 2, I discuss the tone-domain interactive approach within the OT framework in detail. In Section 3, dealing with the rich variation of tonal phenomena in four Korean tonal dialects (KTD's) as a case study, I show that each Korean tonal dialect chooses one between unary and binary domains as an optimal domain for high tone and one between spread and shift of high tone as an optimal way to realize an input high tone within the binary domain in the output. The conclusion of this paper is summarized in Section 4.

## 2. A tone-domain interactive approach in OT

A domain for high tone may extend beyond a sponsor of high tone itself. In other words, the optimal domain for high tone may consist of more than one tone-bearing unit including a sponsor or consist of only a sponsor. If we focus on unary and binary domains, one of these two types of domains is chosen as an optimal domain for high tone by the interaction of DomBin, Align-R, and Align-L.

A unary domain is chosen as an optimal domain for high tone when DomBin is ranked below Align-R and Align-L, as illustrated in (6).

(6) Unary Domain for High Tone: Align-R, Align-L»DomBin

	Align-R	Align-L	DomBin
$\sigma \sigma \sigma (\underline{\sigma})$	*!		
$\sigma \sigma (\sigma \underline{\sigma}) \sigma$		*!	
$\sigma \sigma \sigma (\underline{\sigma}) \sigma$			*

In the unary domain, high tone is placed on its sponsor by the inviolable constraint DomH, regardless of the ranking relation between Sharing and \*(Nonhead, H).

A binary domain is chosen as an optimal domain for high tone when DomBin is ranked above at least one of the two alignment constraints Align-R and Align-L. If DomBin is ranked above Align-L, a domain for high tone is expanded leftward in the binary way, as illustrated in (7).

(7) Leftward Expanded Binary Domain: DomBin, Align-R»Align-L

	DomBin	Align-R	Align-L
$\sigma \sigma \sigma (\underline{\sigma}) \sigma$	*!		
$\sigma \sigma \sigma (\underline{\sigma} \sigma)$		*!	
$\sigma \sigma \sigma (\sigma \underline{\sigma}) \sigma$			*

On the other hand, if DomBin is ranked above Align-R, a domain for high tone is expanded rightward in the binary way, as illustrated in (8).

(8) Rightward Expanded Binary Domain: DomBin, Align-L»Align-R

	DomBin	Align-L	Align-R
$\sigma \sigma \sigma (\underline{\sigma}) \sigma$	*!		
$\sigma \sigma (\sigma \underline{\sigma}) \sigma$		*!	
$\sigma \sigma \sigma (\sigma \underline{\sigma})$			*

In (7) and (8), we have not considered the ranking relations between DomBin and Align-R and between DomBin and Align-L, respectively. Their ranking relations are important in determining the optimal domain for high tone when a sponsoring syllable is initial or final, even though it is not necessary to determine their ranking relations in other cases.

First, let us consider the case where DomBin and Align-R are ranked above Align-L (DomBin, Align-R»Align-L in (7)). In this case, the ranking DomBin»Align-R and the ranking Align-R»DomBin cause different results when the first syllable contains a sponsor of high tone, as illustrated in (9).

## (9) a. DomBin»Align-R»Align-L

	DomBin	Align-R	Align-L
$\sigma \sigma \sigma (\underline{\sigma}) \sigma$	*!		
$\sigma \sigma \sigma (\underline{\sigma} \sigma)$		*!	
$\sigma \sigma (\sigma \underline{\sigma}) \sigma$			*
$(\underline{\sigma}) \sigma \sigma \sigma \sigma$	*!		
$(\underline{\sigma} \sigma) \sigma \sigma \sigma$		*	

## b. Align-R»DomBin»Align-L

	Align-R	DomBin	Align-L
$\sigma \sigma \sigma (\underline{\sigma}) \sigma$		*!	
$\sigma \sigma \sigma (\underline{\sigma} \sigma)$	*!		
$\sigma \sigma (\sigma \underline{\sigma}) \sigma$			*
$(\underline{\sigma}) \sigma \sigma \sigma \sigma$		*	
$(\underline{\sigma} \sigma) \sigma \sigma \sigma$	*!		

When DomBin is ranked above Align-R, as shown in (9a), the rightward expansion occurs in the case where the first syllable contains a sponsor. As shown in the tableau of (9b), however, the ranking Align-R»DomBin in the same case results in the unary domain. These are both exceptional because a domain for high tone is expanded leftward in the binary way in other cases.

As shown in Section 3 below, Samcheok and Taykwu Korean exhibit the case of (9a) whereas Pwukcheng Korean demonstrates the case of (9b). Therefore, the parametric difference in the ranking relation between DomBin and Align-R causes the basic difference in tonal melodies between Samcheok/Taykwu and Pwukcheng.

Next, let us consider the case where DomBin and Align-L are ranked above Align-R (DomBin, Align-L»Align-R in (8)). If DomBin is ranked above Align-L in this case (DomBin»Align-L»Align-R), a domain for high tone is expanded leftward in the binary way when the final syllable contains a sponsor. On the other hand, the permuted ranking Align-L»DomBin (Align-L»DomBin»Align-R) chooses the unary domain as an optimal output for high tone in the same situation. These are also both exceptional because a domain for high tone is expanded rightward in the binary way in other cases. The following tableaux in (10) demonstrate this irregularity.

## (10) a. DomBin»Align-L»Align-R

	DomBin	Align-L	Align-R
$\sigma \sigma \sigma (\underline{\sigma}) \sigma$	*!		
$\sigma \sigma (\sigma \underline{\sigma}) \sigma$		*!	
$\sigma \sigma \sigma (\underline{\sigma} \sigma)$			*
$\sigma \sigma \sigma \sigma (\underline{\sigma})$	*!		
$\sigma \sigma \sigma (\sigma \underline{\sigma})$		*	

## b. Align-L»DomBin»Align-R

	Align-L	DomBin	Align-R
$\sigma \sigma \sigma (\underline{\sigma}) \sigma$		*!	
$\sigma \sigma (\sigma \underline{\sigma}) \sigma$	*!		
$\sigma \sigma \sigma (\underline{\sigma} \sigma)$			*
$\sigma \sigma \sigma \sigma (\underline{\sigma})$		*	
$\sigma \sigma \sigma (\sigma \underline{\sigma})$	*!		

Unlike the case of (9), this case will not be observed in KTD's in Section 3. However, these interactions of domain-relevant constraints provide an important key for answering the question of why irregular tonal patterns are frequently observed in the case where the first or final syllable contains a sponsor of high tone.

Let us now discuss the ways to realize an input high tone within the binary domain in the output. The constraint Sharing requires that high tone should surface on two syllables constituting the binary domain. Therefore, this constraint is a pro-binary spread markedness constraint. It is conceptually similar to Cassimjee and Kisseberth's (1997) constraint Express (F), which requires that every element in the F-domain capable of expressing the feature F should realize F. On the other hand, the constraint \*(Nonhead, H) bars the realization of high tone on a nonhead of a binary domain. It thus disfavors spreading processes. Therefore, if Sharing is ranked above \*(Nonhead, H), the binary spread of high tone occurs in the binary domain for high tone. However, the spread of high tone is blocked by the permuted ranking \*(Nonhead, H) »Sharing, whereby only the head of a binary domain surfaces with high tone.

Instead of determining the headedness of a domain for high tone by the constraint-interaction, this paper adopts Cassimjee and Kisseberth's (1997) assumption that the headedness is correlated with the direction of the expansion of the domain for high tone. In other words, the following generalization is assumed in this paper.

## (11) Generalization of Headedness (Cassimjee and Kisseberth 1997: 25)

If the domain for high tone is expanded rightward, the domain is right-headed and if it is expanded leftward, it is left-headed.

The generalization of headedness in (11) says that a sponsor of high tone cannot be a head of a binary domain for high tone, and that the ranking \*(Nonhead, H)»Sharing always results in a pro-binary shift process, whereby high tone is not placed on its sponsor but shifts to the non-sponsoring syllable in the binary domain for high tone.

This assumption is compatible with the argument that the binary spread and shift of high tone occur only within the binary domain for high tone. When the ranking between Sharing and \*(Nonhead, H) is Sharing»\*(Nonhead, H), it is not important to determine the head of a binary domain

because high tone falls on two syllables constituting the binary domain. If the head of a binary domain would correspond to a sponsor of high tone, the ranking  $*(\text{Nonhead}, H) \gg \text{Sharing}$  would not result in the binary shift of high tone, but cause the same result as the realization of high tone in the unary domain, as shown in (12).

(12) a.  $*(\text{Nonhead}, H) \gg \text{Sharing}$  in the Binary Domain

When the head member of binary domain corresponds to a sponsor of high tone;  $\sigma \sigma (\sigma \underline{\sigma}) \sigma / \sigma \sigma \sigma (\underline{\sigma} \sigma)$

b. Realization of High Tone in the Unary Domain

$\sigma \sigma \sigma (\underline{\sigma}) \sigma / \sigma \sigma \sigma (\underline{\sigma}) \sigma$

Therefore, the shift of high tone is not explained by the distinction between the unary and binary domains for high tone if the head of a binary domain would correspond to a sponsor of high tone.

The following tableaux demonstrate how the binary spread and shift of high tone occur in the binary domain for high tone by the interaction between Sharing and  $*(\text{Nonhead}, H)$ .

(13) Binary Spread and Shift of High Tone

a. Leftward Spread

	Sharing	$*(\text{Nonhead}, H)$
$\sigma \sigma (\sigma \underline{\sigma}) \sigma$	*!	*
$\sigma \sigma (\underline{\sigma} \underline{\sigma}) \sigma$	*!	
$\sigma \sigma (\underline{\sigma} \underline{\sigma}) \sigma$		*

b. Rightward Spreading

	Sharing	$*(\text{Nonhead}, H)$
$\sigma \sigma \sigma (\underline{\sigma} \underline{\sigma})$	*!	*
$\sigma \sigma \sigma (\underline{\sigma} \underline{\sigma})$	*!	
$\sigma \sigma \sigma (\underline{\sigma} \underline{\sigma})$		*

c. Leftward Shifting

	$*(\text{Nonhead}, H)$	Sharing
$\sigma \sigma (\sigma \underline{\sigma}) \sigma$	*!	
$\sigma \sigma (\underline{\sigma} \underline{\sigma}) \sigma$	*!	*
$\sigma \sigma (\underline{\sigma} \underline{\sigma}) \sigma$		*

d. Rightward Shifting

	$*(\text{Nonhead}, H)$	Sharing
$\sigma \sigma \sigma (\underline{\sigma} \underline{\sigma})$	*!	
$\sigma \sigma \sigma (\underline{\sigma} \underline{\sigma})$	*!	*
$\sigma \sigma \sigma (\underline{\sigma} \underline{\sigma})$		*

In summary, the overall picture that emerges from the proposed tone-domain interactive approach is one in which a variety of surface tonal melodies relevant to binary spread and shift of high tone depends on the

ranking of DomBin relative to Align-R and Align-L and the ranking of Sharing relative to \*(Nonhead, H). In the following sections, let us discuss the application of this approach to surface tonal melodies of KTD's.

### 3. A case study: Korean tonal dialects

The following trisyllabic-word examples illustrate a variety of tonal melodies in four KTD's called Hoylyeng, Samchek, Taykwu, and Pwukcheng, respectively.

(14) Four KTD's (Y.-S. Hwangbo 2003b: 34)

Meanings Dialects	'rainbow'	'daughter-in-law'	'raven'
Hoylyeng	mwúcikay	meynwúli	kamaki
Samchek	mwucikay	meynwuli	kkamakwu
Taykwu	mwucikay	myenwuli	kkamakwu
Pwukcheng	mwucikey	meynwuli	kkamakwi

Without any inflectional suffixes and enclitics, each of nominal stems in KTD's can form a simple noun. Simple nouns of KTD's fall into two basic categories in terms of tonal melodies. The tone-domain interactive approach of this paper gets at this fundamental division by postulating two distinct types of simple nouns in terms of the sponsor of high tone: a simple noun containing a sponsor of high tone, or a simple noun containing no sponsor of high tone.

Let us focus on the former-type simple nouns of KTD's in this paper and leave the other simple nouns of KTD's for further research, because this paper basically deals with the ways to realize the input high tone within the optimal domain for high tone in the output. According to Y.-S. Hwangbo (2001, 2003a, b, 2004, 2005), the trisyllabic words in (14) contain a sponsor of high tone and each syllable in the trisyllabic words can be a sponsor of high tone.

Now let us discuss the rich variation of tonal melodies in KTD's in (14) in detail in the tone-domain interactive approach. In Hoylyeng Korean, high tone falls on a single syllable and its location is lexically determined. In other words, high tone falls on the first syllable in the words like *mwucikay* 'rainbow,' on the penult in the words like *meynwuli* 'daughter-in-law,' and on the final syllable in the words like *kamaki* 'raven.' Since the location of high tone depends on the lexical determination, the most principled way to explain it is to place high tone on its sponsor in the output, as shown in (15).<sup>1</sup>

<sup>1</sup> There are two types of final high-toned words in Hoylyeng Korean. The final high tone in (15c) does not shift rightward even when enclitics are attached to these types of words. On the other hand, high tone in the words like *khokwuméng* 'nostril' shifts rightward in that situation. As pointed out by Y.-S. Hwangbo (2005), high tone in these words is not specified in the input.

## (15) Hoylyeng Korean

- a. mwɨcikay 'rainbow'  
 b. meynwuli 'daughter-in-law'  
 c. kamaki 'raven'

The supporting evidence for this sponsoring emerges from the insightful works of C.-G. Gim (1988, 1999, 2002) and Y.-S. Hwangbo (2001, 2003a, b, 2004, 2005) on the contemporary inheritance of the Middle Korean (MK) tonal information.

MK is very special in that tonal information was symbolized as a diacritic mark called *pang-ceom* in its spelling system called *Hangeul*. Contemporary Korean dialects still use Hangeul as their spelling system, but pang-ceom has already disappeared in the contemporary Hangeul. Therefore, we cannot get any tonal information from the contemporary Hangeul.

According to the works of C.-G. Gim (1988, 1999, 2002) and Y.-S. Hwangbo (2001, 2003a, b, 2004, 2005), the high-toned syllable in Hoylyeng Korean corresponds to one that is marked with a pang-ceom in MK. For instance, the word for *raven* in MK was *kamakwoy* and its final syllable had a pang-ceom: *kamakw<sup>o</sup>oy*. In Hoylyeng Korean, high tone falls on the final syllable in the corresponding word *kamaki*. This correspondence is also found in other types of words, as shown in (16).


## (16) Correspondence between MK Pang-ceom and Hoylyeng High Tone

- a. mwɨcikay 'rainbow' (< m<sup>o</sup>ucikey (in MK))  
 b. meynwuli 'daughter-in-law' (< myen<sup>o</sup>uli (in MK))

This observation implies that the tonal information with a pang-ceom in MK is inherited to the contemporary Hoylyeng Korean in the way high tone is specified in the input of the syllable marked with a pang-ceom in MK. In other words, the syllable marked with a pang-ceom in MK becomes a sponsoring syllable, which surfaces with high tone in Hoylyeng Korean.

It is simple to explain the case where high tone is placed on its sponsor in the output. When a unary domain is chosen as an optimal domain for high tone, high tone stays on its sponsor. The unary domain is chosen as an optimal domain for high tone when DomBin is ranked below Align-R and Align-L, as illustrated in the case of *meynwuli* 'daughter-in-law' in (17).

## (17) meynwuli→mey(nwu)li 'daughter-in-law' in Hyolyeng Korean

	Align-R	Align-L	DomBin
a. (meynw <u>u</u> )li		*!	
b. mey(nw <u>u</u> li)	*!		
c.  mey(nw <u>u</u> )li			*

In a unary domain, high tone is realized on the single member of the domain by the inviolable constraint DomH, regardless of the ranking relation between Sharing and \*(Nonhead, H): *mey(nwu)li*.

Let us now compare the tonal melodies of Samchek Korean with those of Hoylyeng Korean. In Samchek Korean, high tone shifts one syllable to the left in the corresponding words, except for the case where the first syllable contains a sponsor, as shown in (18).

(18) Samchek Korean



- a. mwucíkay ‘rainbow’
- b. méynwuli ‘daughter-in-law’
- c. kkamákw ‘raven’

In Hoylyeng Korean, in the words like *mwucikay* ‘rainbow,’ high tone falls on the first syllable that is a sponsor of high tone. In Samchek Korean, however, high tone falls on the penult in the corresponding words, as in (18a). In other words, the example of (18a) shows that high tone shifts one syllable to the right in Samchek Korean in the words like *mwucikay* ‘rainbow.’ On the other hand, in the words where high tone falls on the non-initial syllable in Hoylyeng Korean, high tone shifts one syllable to the left in Samchek Korean. This contrast in the tonal behavior between these two types of words in Samchek Korean is puzzling. It seems to be difficult to explain this contrast unless we assume that the sponsor of high tone in a word may be different between Hoylyeng and Samchek Korean.

However, assuming that a sponsor of high tone in a word is the same among KTD’s, this paper will show that two different shifts of high tone in Samchek Korean is a natural result of constraint-interaction. It will also show that the contrast in tonal melodies between Hoylyeng and Samchek Korean is caused by the difference in the scope of the domain for high tone between them.

In Samchek Korean, unlike in Hoylyeng Korean, the domain for high tone is expanded leftward in the binary way, except for the case where the first syllable contains a sponsor. When the first syllable contains a sponsor, the domain for high tone is expanded rightward in the binary way. This is exactly the case of (9a) in Section 2, which is repeated here as (19), where DomBin is ranked above Align-R and Align-R is ranked above Align-L.

(19 = (9a)) DomBin»Align-R»Align-L

	DomBin	Align-R	Align-L
σ σ σ ( <u>σ</u> ) σ	*!		
σ σ σ ( <u>σ</u> σ)		*!	
 σ σ (σ <u>σ</u> ) σ			*
( <u>σ</u> ) σ σ σ σ	*!		
 ( <u>σ</u> σ) σ σ σ		*	

When a sponsor is non-initial, the domain is expanded leftward in the binary way by this ranking, as shown in (20).

(20) meynwuli→(meynwu)li ‘daughter-in-law’ in Samchek Korean

	DomBin	Align-R	Align-L
mey(nwu)li	*!		
mey(nwu)li		*!	
☞(meynwu)li			*

The binary (leftward) shift of high tone is a result of the ranking \*(Nonhead, H) »Sharing:

(21) \*(Nonhead, H)»Sharing in Samchek Korean: meynwuli→(méynwu)li

	*(Nonhead, H)	Sharing
a. (meynwu)li	*!	
b. (meynwu)li	*!	*
c. ☞(meynwu)li		*

According to the generalization of headedness in (11), since the domain chosen as an optimal domain in (20) is one that is expanded leftward, it is left-headed. The candidates in (21a) and (21b) violate \*(Nonhead, H) because the non-head syllable surfaces with high tone. Since the leftward shift of high tone in (21c) satisfies \*(Nonhead, H), it is chosen as an optimal output.

When the first syllable contains a sponsor, the apparently exceptional rightward shift of high tone occurs in Samchek Korean, as in the words like *mwucikay* ‘rainbow.’ However, it is no longer exceptional and it is correctly predicted by the ranking DomBin»Align-R»Align-L and the ranking \*(Nonhead, H)»Sharing, as illustrated in (22).

(22) mwucikay→(mwuci)kay ‘rainbow’ in Samchek Korean

a. DomBin»Align-R»Align-L

	DomBin	Align-R	Align-L
(mwu)cikay	*!		
☞(mwuci)kay		*	

b. \*(Nonhead, H)»Sharing

	*(Nonhead, H)	Sharing
(mwuci)kay	*!	
(mwuci)kay	*!	*
☞(mwuci)kay		*

Since DomBin is ranked above Align-R in Samchek Korean, the domain for high tone is expanded rightward in the binary way to satisfy DomBin. Contrary to other cases, the binary domain in this case is right-headed

because it is expanded rightward. Therefore, the rightward shift of high tone does not violate  $*(\text{Nonhead}, H)$ , though violating *Sharing*, and thus it is correctly chosen as an optimal output.

In other approaches, the tonal melodies in Samcheok Korean are difficult to explain since the rightward shift of high tone is mixed up with the leftward shift of high tone there. As demonstrated above, however, in the tone-domain interactive approach proposed in this paper they are adequately explained by the requirement of DomBin prior to other constraints and the correlation of headedness to the direction of expansion of the domain for high tone. Further, the contrast in tonal melodies between Hoylyeng and Samcheok Korean is also adequately explained by the difference in the scope of the domain for high tone between them.

The explanation proposed in this paper predicts that there is no case where high tone falls on the final syllable in the trisyllabic words of Samcheok Korean containing a sponsor of high tone. In other words, when the final syllable contains a sponsor of high tone, the penult is assigned high tone by the leftward binary shift of high tone caused by the constraint-ranking proposed for Samcheok Korean in this paper. This prediction is quite right. According to C.-G. Gim (1999) and Y.-S. Hwangbo (2003a: 233), no trisyllabic word containing a sponsor in Samcheok Korean surfaces with high tone on the final syllable. Further, the proposed constraint-ranking also adequately explains the tonal melodies of bisyllabic words containing a sponsor in Samcheok Korean.

Now let us examine Taykwu Korean, which has been called North Kyungsang Korean in previous studies on KTD's. A more complicated case is observed in this dialect. As shown in (23), binary spread of high tone happens when the first syllable contains a sponsor, whereas high tone shifts one syllable to left from the sponsor in other cases.

(23) Taykwu Korean

- |                      |                   |
|----------------------|-------------------|
| a. mw <u>u</u> cikay | 'rainbow'         |
| b. myenw <u>u</u> li | 'daughter-in-law' |
| c. kkamakw <u>u</u>  | 'raven'           |

The contrast in tonal melodies between Samcheok and Taykwu Korean is observed only in the case where the first syllable contains a sponsor. Taykwu Korean exhibits the co-occurrence of binary spread and shift.

In this paper, it is proposed that a binary domain is chosen as an optimal domain for high tone in both Samcheok and Taykwu Korean. Therefore, the ranking DomBin»Align-R»Align-L applies to Taykwu Korean as well as Samcheok Korean. Further, like in Samcheok Korean, in Taykwu Korean too, the constraint  $*(\text{Nonhead}, H)$  is ranked above the constraint *Sharing*. The only difference between Samcheok and Taykwu Korean is the ranking of the following constraint relative to  $*(\text{Nonhead}, H)$ .

## (24) Align-L(Dom, H)

Align the left edge of a domain for high tone with the left edge of high tone

The constraint Align-L(Dom, H) requires that the left edge of every domain for high tone should be aligned with the left edge of high tone. The effect of Align-L(Dom, H) on the choice of optimal output is null when it is ranked below \*(Nonhead, H). SamcheK Korean is an example for that.

When high tone is placed on the leftmost syllable in the leftward expanded domain, it satisfies Align-L(Dom, H) as well as \*(Nonhead, H). The rightmost high-toned syllable in this domain is ill-formed because it violates \*(Nonhead, H) as well as Align-L(Dom, H). The binary spread of high tone in this domain is also ill-formed because it violates \*(Nonhead, H), though satisfying Align-L(Dom, H). These are illustrated in (25a). However, when high tone is placed on the rightmost syllable in the rightward expanded domain of (25b), it satisfies \*(Nonhead, H), though violating Align-L(Dom, H). The leftmost high-toned syllable and the binary spread of high tone in this domain are both ill-formed since they violate \*(Nonhead, H), though satisfying Align-L(Dom, H), as shown in (25b).

## (25) \*(Nonhead, H)»Align-L(Dom, H)»Sharing in SamcheK Korean

## a. Leftward Expanded Domain

	*(Nonhead, H)	Align-L(Dom, H)	Sharing
(meynwu)li	*!		
(meynwu)li	*!	*	*
☞(meynwu)li			*

## b. Rightward Expanded Domain

	*(Nonhead, H)	Align-L(Dom, H)	Sharing
(mwuci)kay	*!		
(mwuci)kay	*!		*
☞(mwuci)kay		*	*

However, if Align-L(Dom, H) is ranked above \*(Nonhead, H), which is ranked above Sharing, it results in the binary spread of high tone when the domain is right-headed, whereas it still results in the binary shift of high tone when the domain is left-headed. This is the case in Taykwu Korean.

First, in the leftward expanded domain, the ranking Align-L(Dom, H)»\*(Nonhead, H)»Sharing has the same result as the ranking \*(Nonhead, H)»Align-L(Dom, H)»Sharing. Compare the following tableau with the tableau of (25a).

## (26) Leftward Expanded Domain in Taykwu Korean

Align-L(Dom, H)»\*(Nonhead, H)»Sharing

	Align-L(Dom, H)	*(Nonhead, H)	Sharing
(mɛynwɯ)li		*!	
(mɛynwɯ)li	*!	*	*
☞(mɛynwɯ)li			*

Second, in the rightward expanded domain, where the first syllable contains a sponsor of high tone, the binary spread of high tone is chosen as an optimal output, as shown in (27).

## (27) Rightward Expanded Domain in Taykwu Korean

Align-L(Dom, H)»\*(Nonhead, H)»Sharing

	Align-L(Dom, H)	*(Nonhead, H)	Sharing
a. (mwɯci)kay	*!		*
b. (mwɯci)kay		*	*!
c. ☞(mwɯci)kay		*	

Since the binary shift in the candidate of (27a) fatally violates Align-L(Dom, H) though satisfying \*(Nonhead, H), it cannot be chosen as an optimal output. In comparing the non-mutation of high tone in the candidate of (27b) with the binary spread of high tone in the candidate of (27c), both forms satisfy Align-L(Dom, H) but violate \*(Nonhead, H). Therefore, we cannot choose one of the two, depending on Align-L(Dom, H) and \*(Nonhead, H). The optimal output is determined by the lowest ranked constraint Sharing. The binary spread of high tone in the candidate of (27c) satisfies Sharing whereas the non-mutation of high tone in the candidate of (27b) violates it. Therefore, the candidate of (27c) is chosen as an optimal output.

The tableau in (27) shows that the initial binary spread of high tone in Taykwu Korean is a result of the ranking Align-L(Dom, H)»\*(Nonhead, H)»Sharing. It contrasts with the rightward binary shift of high tone occurring in the same case in Samchek Korean, which is a result of the permuted ranking \*(Nonhead, H) »Align-L(Dom, H)»Sharing. The constraint rankings of the Samchek and Taykwu Korean are summarized as follows.

## (28) a. Samchek Dialect

DomBin	*(Nonhead, H)
Align-R	Align-L(Dom, H)
Align-L	Sharing

## b. Taykwu Dialect

DomBin	Align-L(Dom, H)
Align-R	*(Nonhead, H)
Align-L	Sharing

A prediction from the constraint ranking proposed here for Taykwu Korean is that like in Samcheok Korean, in Taykwu Korean too, there is no case where high tone falls solely on the final syllable in the trisyllabic words containing a sponsor of high tone. This is the case in Taykwu Korean.

Another important prediction is that there is no case where high tone falls on the final syllable in the bisyllabic words containing a sponsor of high tone in Taykwu. If the first syllable contains a sponsor of high tone in a bisyllabic word of Taykwu Korean, this ranking predicts that high tone should spread rightward onto the adjacent syllable. It also predicts that high tone falls on the first syllable as a result of the leftward shift when the second syllable contains a sponsor of high tone in a bisyllabic word of Taykwu Korean. According to the constraint-ranking proposed for Taykwu Korean in (28), therefore, high tone should not fall solely on the final syllable when a bisyllabic word contains a sponsor in Taykwu Korean. This prediction is supported by N.-J. Kim (1997), C.-G. Gim (1999), and Y.-S. Hwangbo (2000, 2001, and 2003b), where no data of Taykwu have not exhibited the singly high-toned final syllable in the bisyllabic words containing a sponsor of high tone.<sup>2</sup>

Let us finally examine Pwukcheng Korean, where the most complicated tonal melodies are found. Two different types of tone patterns are observed in this dialect, i.e., non-mutation and binary spread of high tone, as shown in (29).

(29) Pwukcheng Korean

- a. Non-mutation of high tone
 

mwúcikey	‘rainbow’
meynwúli	‘daughter-in-law’
- b. Binary spread of high tone
 

kkamakwí	‘raven’
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We have shown that a binary domain is chosen as an optimal domain for high tone by the ranking DomBin»Align-R»Align-L in Samcheok and Taykwu Korean. In these dialects, when the first syllable contains a sponsor of high tone, the domain for high tone is expanded rightward in the binary way by the ranking DomBin»Align-R.

In (9b) of Section 2, we have also discussed the effect of the permuted ranking Align-R»DomBin on the domain for high tone when the first syllable contains a sponsor of high tone. Since Align-R is ranked above DomBin, the domain for high tone cannot be expanded rightward and thus

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<sup>2</sup> In Taykwu Korean, there are trisyllabic and bisyllabic words where high tone falls on the final syllable. However, these words do not contain a sponsor of high tone. As mentioned above, the tonal behavior of these words is different from that of the words containing a sponsor of high tone in the encliticized form.

the unary domain is chosen as an optimal output in this case. The tableau of (9b) is repeated here as (30).

(30 = (9b)) Align-R»DomBin »Align-L

	Align-R	DomBin	Align-L
$\sigma \sigma \sigma (\underline{\sigma}) \sigma$		*!	
$\sigma \sigma \sigma (\underline{\sigma} \sigma)$	*!		
$\text{[} \sigma \sigma (\sigma \underline{\sigma}) \sigma$			*
$\text{[} (\underline{\sigma}) \sigma \sigma \sigma \sigma$		*	
$(\underline{\sigma} \sigma) \sigma \sigma \sigma$	*!		

In this paper, Pwukcheng Korean is argued to have this ranking. In the words like *mwucikey* ‘rainbow,’ therefore, the unary domain consisting of the first syllable is chosen as an optimal output, as shown in (31).

(31) *mwucikey* → (mwu)cikey ‘rainbow’ in Pwukcheng Korean

	Align-R	DomBin	Align-L
a. $\text{[} (mwu)cikey$		*	
b. $(mwuci)key$	*!		

In the words like *meynwuli* ‘daughter-in-law’ and *kkamakwi* ‘raven,’ where the non-initial syllable contains a sponsor of high tone, as shown in (32), the leftward expanded binary domain is chosen as an optimal domain for high tone.

(32) Align-R»DomBin »Align-L in Pwukcheng Korean

*meynwuli* → (meynwu)li ‘daughter-in-law’

*kkamakwi* → kka(makwi) ‘raven’

	Align-R	DomBin	Align-L
<i>mey(nwu)li</i>		*!	
<i>mey(nwuli)</i>	*!		
$\text{[} (meynwu)li$			*
<i>kkama(kwi)</i>		*!	
$\text{[} kka(makwi)$			*



The binary spread of high tone in the words like *kkamakwi* ‘raven’ tells us that Sharing is ranked above \*(Nonhead, H) in Pwukcheng Korean, as illustrated in (33).

(33) *kkamakwi* → kka(mákwi) ‘raven’ in Pwukcheng Korean

	Sharing	*(Nonhead, H)
<i>kka(makwi)</i>	*!	
<i>kka(makwi)</i>	*!	*
$\text{[} kka(mákwi)$		*

However, the penultimate high tone in the words like *meynwu<sup>u</sup>li* ‘daughter-in-law’ shows that this ranking is not enough to explain the overall pattern of high tone in this dialect, as illustrated in (34).

(34) *meynwu<sup>u</sup>li*→(*meynwu<sup>u</sup>*)*li* ‘daughter-in-law’ in Pwukcheng Korean

	Sharing	*(Nonhead, H)
a. ( <i>meynwu<sup>u</sup></i> ) <i>li</i>	*!	
b.  ( <i>meynwu<sup>u</sup></i> ) <i>li</i>		*
c.  ( <i>meynwu<sup>u</sup></i> ) <i>li</i>	*!	*

The ranking *Sharing*»*\*(Nonhead, H)* incorrectly predicts that the binary spread of high tone in (34b) should be an optimal output in this case.

To choose the actual output in (34c) as an optimal output, an additional constraint is required. In this paper, the following constraint is proposed:


(35) \*Initial H

High tone is prohibited in the initial position

The constraint \*Initial H is ranked above the constraint *Sharing* in Pwukcheng Korean, as illustrated in (36).

(36) *meynwu<sup>u</sup>li*→(*meynwu<sup>u</sup>*)*li* ‘daughter-in-law’ in Pwukcheng Korean


\*Initial H»*Sharing*»*\*(Nonhead, H)*

	*Initial H	Sharing	*(Nonhead, H)
a. ( <i>meynwu<sup>u</sup></i> ) <i>li</i>	*!	*	
b. ( <i>meynwu<sup>u</sup></i> ) <i>li</i>	*!		*
c.  ( <i>meynwu<sup>u</sup></i> ) <i>li</i>		*	*

The initial high tone in the words like *mwu<sup>u</sup>cikey* ‘rainbow’ is produced by the inviolable constraint *DomH*, which is ranked above \*Initial H. In other words, the ranking *DomH*»*\*Initial H*»*Sharing*»*\*(Nonhead, H)* chooses the initial high tone in the unary domain in the words like *mwu<sup>u</sup>cikey* ‘rainbow’ as an optimal output, as illustrated in (37).

(37) *mwu<sup>u</sup>cikey*→(*mwu<sup>u</sup>*)*cikey* ‘rainbow’ in Pwukcheng Korean

*DomH*»*\*Initial H*»*Sharing*»*\*(Nonhead, H)*

	<i>DomH</i>	*Initial H	Sharing	*(Nonhead, H)
a. ( <i>mwu<sup>u</sup></i> ) <i>cikey</i>	*!		*	
b.  ( <i>mwu<sup>u</sup></i> ) <i>cikey</i>		*		

The effect of the constraint \*Initial H is realized by ranking it above the constraints *Sharing* and *\*(Nonhead, H)* in this dialect, whereas it plays no role in other dialects, where it is ranked below the constraints *Sharing* and *\*(Nonhead, H)*.

To summarize this section, it has been shown that each Korean tonal dialect chooses one between unary and binary domains as an optimal domain for high tone and one between spread and shift of high tone as a basic way to realize the input high tone within the binary domain in the output. It has also been shown that the appearance of the mixture of various patterns in a dialect emerges from a single constraint ranking system existing in that dialect.

#### 4. Conclusion

In this paper, it has been shown that the tone-domain interactive approach within the OT framework adequately explains the binary spread and shift of high tone in the case where high tone is specified in a tone-bearing unit in the input. It has also been shown that the dialectal difference in tonal melodies in Korean is a result of a variety of ways to realize the same input high tone in the output.

In this paper, it has been argued that high tone is realized only within the domain for high tone and thus the surface tonal melodies are correctly predicted by the appropriate choice of the optimal domain for high tone as well as the optimal way to realize the input high tone within the domain in the output.

The parametric interactions of constraints in this view have applied to four KTD's, that is, Hoylyeng, Samchek, Taykwu, and Pwukcheng Korean and this case study has shown that the approach proposed in this paper accounts for the rich variation of tonal phenomena relevant to binary spread and shift of high tone in the KTD's.

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