

Korean palatalization in Optimality Theory: against the strict parallelism*

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Kim, Gyung-Ran. 2002. Korean palatalization in Optimality Theory: against the strict parallelism. *Studies in Phonetics, Phonology and Morphology* 8.1. 1-15. With the data from Korean palatalization, this study presents one more piece of evidence against the strict parallelistic view of OT. Following Kiparsky (2000) in the model of OT-based Lexical Phonology and Morphology, it is pointed out that two levels of constraint hierarchy are needed to present an adequate description of two kinds of Korean palatalization: *t*-palatalization at one level and *s*-, *n*-, and *l*-palatalization at another level. The conjunction of constraints, a device for dispensing with intermediate structures in Lubowicz (1997), is shown to be insufficient, which in turn suggests the stratification of constraint hierarchy. Only when coupled with two levels of constraint hierarchy, where the ranking of the relevant constraints PAL and IDENT(ant) is reversed, can Korean palatalization be fully described. This is to support the level-ordered OT. (Yeungnam University)

Keywords: palatalization, stratification, parallelism, derived environment, level-ordered OT

1. Introduction

The phenomenon of palatalization in Korean has been dealt with in various frameworks of phonological theory such as standard generative phonology (C.-W. Kim 1980, Kim-Renaud 1974), Lexical Phonology (Ahn 1985, 1988), and Underspecification Theory (Iverson 1985, Kiparsky 1993) to name only a few.

Different in theoretical backgrounds, previous analyses have one thing in common in that the output form is derived from the input by the serial application of phonological rules, with intermediate forms ensuing in the course of derivation. Thus it is possible for phonological rules to refer to the intermediate forms even when the environment included in the latter disappears in the later stages of derivation. This is how the opacity in the surface phonetic form has been explained.

As for the recent development of phonological theory, Optimality Theory (McCarthy and Prince 1993) takes a strict parallelist position and does not allow intermediate forms. Only the input and output forms are considered against the universal constraints, whose ranking is dependent on individual languages. It follows that in OT, the opacity in the output

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form should be explained with some other devices rather than intermediate forms and that different rankings mean different grammars. To take an example of an OT analysis of palatalization, Lubowicz (1997) uses a device of local conjunction of constraints in an attempt to avoid using intermediate forms in morphologically derived environments of the Polish data. In passing, Polish palatalization does not occur in non-derived environments.

However, language can have different rankings of constraints if it is proved that there exists more than one level in that particular language. Booij (1997), for example, suggests a level-ordered OT analysis in Dutch implicates stress as well as coda devoicing. In the model of Lexical Phonology and Morphology, Kiparsky (2000) argues for the level difference even in OT such as the stem level and word level in an analysis of [i] deletion in the Levantine data. He refutes the strict parallelism of OT, which has to include new constraint types like Base-Output constraints and Sympathy. Rubach (2000) is in line with Kiparsky's idea in an analysis of Russian palatalization.

This paper supports Kiparsky's constraint-based version of Lexical Phonology and Morphology with the data from Korean palatalization. It will be argued that there should be two different constraint rankings in Korean in order to reflect morphologically derived environment effect in *t*-palatalization, compared with *s*-, *n*-, and *l*-palatalization with no such effect.

Section 2 summarizes Lubowicz (1997) with a purpose of showing that Polish needs just one level of constraint ranking since Polish palatalization applies in morphologically derived environments only. Adhering to the strict parallelism of OT, the local conjunction of the two constraints PAL and R-ANCHOR(stem, σ) is shown to play a key role in explaining morphologically derived effects in Polish palatalization. Section 3 points out that as far as Korean palatalization is concerned, the strict parallelism of OT should be revised; it cannot have descriptive adequacy, not to mention explanatory adequacy. It will be presented that the constraint ranking for phonemic change in *t*-palatalization should be different from that for allophonic change in *s*-, *n*-, and *l*-palatalization in Korean: the ranking between PAL and IDENT(ant) is reversed in two levels. The final section considers the implications of the suggestion and concludes the paper.

2. Strict Parallelistic Analysis of OT: A Case of Polish Palatalization

This section shows how the non-derived environment blocking is treated by the use of local conjunction of markedness constraint PAL and faithfulness constraint R-ANCHOR(stem, σ), with only one constraint hierarchy implied by the strict parallelism of OT.¹

¹ It is one of the four fundamental concepts of OT along with violability, ranking, and inclusiveness: "Best-satisfaction of the constraint hierarchy is computed over the whole

In Polish velar consonants change into postalveolar affricates before /i, e, j/ and the front yer *y*.² This process is called First Velar Palatalization. The following data and some of discussion are adopted from Lubowicz (1997).

(1) Velar Palatalization

krok	'step'	kroč+y+ć	'to step'	kroč+ek (dim.)
mozg	'brain'			mozŷ+ek(dim.)
słux	'hearing'	słyś+ek+ć	'to hear'	

However, when the environment is morphologically non-derived, that is when the target and the following environment are in the same morpheme, there is no palatalization. This is a case of opacity according to the definition of Kiparsky (1973, 79).³

(2) No Velar Palatalization

kefir	'kefir'	kelner	'waiter'	k'isiel	'jelly'
gencjana	'gentian'	gest	'gesture'	g'ips	'plaster'
x'igiennstka	'hygienist'	x'istoria	'history'	xeter	'shrew'

In addition to velars, anterior coronals change into prepalatals in the same environment.

(3) Coronal Palatalization

zes	'squint'	zeż+e	(loc. sg.)
serwis	'servis'	serwiś+e	(loc. sg.)

In the left hand column the sequence of *ze-* and *se-* in the first syllable meets the environment of Coronal Palatalization. However, the process does not apply because the environment is not derived.

In rule-based approaches, whatever their frameworks are, the serial derivation provides the distinction between derived and non-derived environments by referring to intermediate forms. However, in OT where no intermediate derivational stages are allowed, this distinction is almost impossible to come by.⁴ The only difference here is that palatalization

hierarchy and the whole candidate sets. There is no serial derivation." (McCarthy and Prince 2001, 2)

² In a rule-based analysis, this process can be described as follows: [k, g, x] → [č, ȷ, š] / [-cons, -back].

³ Polish is the case of (a) in the following definition of opacity:

A phonological rule *P* of the form *A* → *B* / *C* __ *D* is opaque if there are surface structures with any of the following characteristics:

a. instances of *A* in the environment of *C* __ *D*.
b. instances of *B* derived by *P* that occur in the environment other than *C* __ *D*.

⁴ Although Base-Output constraints and Sympathy Theory can be employed to describe derived environment processes, they are not supported here. As mentioned in McMahon (2000, 50), "There is a possibility that Sympathy necessarily weakens the parallelism of OT since the output will depend on the sympathy candidate, which might therefore require earlier

applies when the stem final consonants are resyllabified as the onset of the following syllable, which is provided by morpheme concatenation, while palatalization does not take place when there is no resyllabification of the stem final segments.

In the light of resyllabification in morphologically derived environments, Lubowicz conjoins palatalization constraint PAL (4) with anchoring constraint (5) and sets up the hierarchy of the relevant constraints in (6):

- (4) PAL: Velars and anterior coronals agree in backness with the following [-cons, -back] segments.⁵
- (5) R-ANCHOR(stem; σ): Any rightmost segment of a stem in the input has a correspondent at the right edge of a syllable in the output.
- (6) [PAL & R-ANCHOR(stem; σ)]_{AdjacentSegments} » IDENT(ant) » PAL

The violation of the locally conjoined constraint takes place only when both conjuncts are violated. In other words, the violation of one of the two conjuncts does not lead to that of the conjoined constraint.⁶ Here the conjoined constraint [PAL & R-ANCHOR(stem; σ)]_{AdjacentSegments} is violated only when a sequence of the target and the environment of palatalization violates both PAL and R-ANCHOR(stem; σ) at the same time. This means that the conjoined constraint has an effect only when the palatalizing consonant is the input stem final and followed by the triggering environment as in (1) and (3).

To see how the ranking (6) works, let's compare the situations of *zes* 'squint' and *zež+e* 'squint (loc. sg.)' in (7) and (8).

(7) No Palatalization in Non-derived Environment: *zes* 'squint'

[zes] _{stem}	[PAL & R-ANCHOR] _{AS}	IDENT(ant)	PAL
a. <i>zes</i>			*
b. <i>žes</i>		*!	

Both candidates meet the highest constraint, since the stem final segment -s is syllable-final, with R-ANCHOR(stem; σ) applying vacuously. The violation of PAL in the first syllable of (7a) is not relevant to the conjoined constraint [PAL & R-ANCHOR(stem; σ)]_{AS} because the initial segment z- is not stem final and thus the sequence of *ze-* does not belong to the domain

selection." See Kiparsky (2000) and McMahon (2002 sec. 2.6) for claims against Sympathy Theory. On the other hand, McCarthy (2002) thinks of the term Comparative Markedness to explain these processes and divides markedness constraints into two kinds: old and new markedness constraints. However, as he specifies in his article (fn. 11), Comparative markedness is not applicable to morphologically derived environment effects.

⁵ Although Lubowicz does not specify the constraint PAL in her paper, let us assume that PAL as in (4) does the job. However, velars are not included in Korean palatalization, which is to be discussed in section 3.2.

⁶ See Hewitt and Crowhurst (1996) for more about conjunctive constraints and their violation.

specified by the conjoined constraint. The application of PAL in the first syllable of (7b) makes no difference, either, since it is irrelevant to the conjoined constraint. However, the ranking IDENT(ant) » PAL makes (7a) the optimal output.

In the case of *zež+e* ‘squint(loc. sg.)’, the conjoined constraint plays a critical role. The stem final segment *-s* is resyllabified as the onset of the following syllable and when there is no palatalization in the resyllabified – *s*, the conjoined constraint is violated. This is what happens in (8b). In (8c), Coronal Palatalization applies to the first as well as the second syllable. However, this candidate is ruled out of consideration since IDENT(ant) is violated twice, compared with the optimal one (8a), which has only one violation of IDENT(ant).

(8) Palatalization in Derived Environment: *zež+e* ‘squint(loc. sg.)’

[zes] _{stem} +e	[PAL & R-ANCHOR] _{AS}	IDENT(ant)	PAL
a. <i>ze.že</i>		*	*
b. <i>ze.ze</i>	*!		**
c. <i>že.že</i>		*!*	

So far it has been shown that the hierarchy (6) can describe morphologically derived environment effect in the data of Polish palatalization, where the conjunction of two constraints PAL and R-ANCHOR(stem, σ) is instrumental in distinguishing the applicability of palatalization.

However, what if a language has two kinds of palatalization, one applying in morphologically derived environments only, leading to neutralization and the other applying indiscriminately, both hetero- and tautomorphemically, with no neutralization? This is what happens in Korean palatalization, which is to be considered next.

3. Korean Palatalization

3.1. Rule-Based Approach

In a rule-based approach, Korean palatalization has been divided into two groups: *t*-palatalization which leads to phonemic change and *s*-, *n*-, and *l*-palatalization resulting in allophonic change.⁷ These two types take place

⁷ The Korean consonant inventory is as follows, where C stands for plain, C' for tense and C^h for aspirated consonant:

	labial	coronal	dorsal	glottal
stops	p, p', p ^h	t, t', t ^h	k, k', k ^h	
affricates		c, c', c ^h		
fricatives		s, s'		h
nasals	m	n	ŋ	
liquid		l		

in the same environment (Ahn 1988, 249).

- (9) a. phonemic palatalization
 t-palatalization: {t, t^h} → {c, c^h} / ___ {i, y}⁸
 b. allophonic palatalization
 s-palatalization: {s, s'} → {š, š'} / ___ {i, y}
 n-palatalization: n → ñ / ___ {i, y}
 l-palatalization: l → λ / ___ {i, y}

Let's look at the case of *t*-palatalization first.

- (10) *t*-palatalization in derived environment
 a. mat-i [maji] 'the eldest'
 eldest-Noun forming suf.
 kut-i [kui] 'stubbornly'
 become solid-Adverbial suf.
 b. pat^h-i [pac^hi] 'field(nom.)'
 field-Subj.
 kat^h-i [kac^hi] 'together'
 same-Adverbial suf.
 put^h-i [puc^hi] 'to make something stick to'
 stick to-Causative suf.

In (10) both plain and aspirated dental stops /t/ and /t^h/ become palatal to be neutralized to [c] and [c^h], respectively, in front of a morpheme beginning with /i/.⁹ However, when there is no morpheme boundary between the target and the environment, palatalization does not occur. There is no neutralization to [c] and [c^h], either.

- (11) No *t*-palatalization in non-derived environment
 a. mati [madi] 'knot'
 titi- [tidi] 'to step on'
 b. t^hi [t^hi] 'dust, dirty spot'
 nɛt^hinamu [nɛt^hinamu] 'zelkova tree'

Compared with that in (10), the environment in (11) is non-derived. *t*-palatalization is sensitive to morphological structure, which has been called the derived environment effect. The phenomenon has been treated under the name of various conditions such as the Alternation Condition

Coronals include palatals, too. In this study, dentals, which are [+anterior], are used to be distinguished from palatals, which are [-anterior].

⁸ The phonemic palatalization of /t'/ is unattested.

⁹ The neutralized [c] becomes [j] by voicing assimilation, whereby voiceless stops get voiced between voiced segments in Korean.

(Kiparsky 1968)¹⁰ and the Revised Alternation Condition (Kiparsky 1973).¹¹ With the advent of Lexical Phonology and Morphology (Kiparsky 1982) backed by the recognition of the cycles in the lexicon, the Strict Cycle Condition (Mascaró 1976) has been employed to account for the applicability of phonological processes depending on derived structures. The following condition is cited from Spencer (1991, 108).

(12) Strict Cycle Condition (SCC)

- a. Cyclic rules apply only to derived representations.
- b. Def.: A representation \emptyset is derived w.r.t. rule R in cycle j iff \emptyset meets the structural analysis of R by virtue of a combination of morphemes introduced in cycle j or the application of a phonological rule in cycle j .

Following Ahn (1988, 252) in the framework of Lexical Phonology and Morphology, the derivation of (10a) and (11a) is as follows:

(13)	[mat]	‘eldest’	[mati]	‘knot’
<i>t</i> -pal.	_____		_____	blocked by SCC
cycle 0	-----			
	[[mat]i]		_____	
Derivation		N-forming		
<i>t</i> -pal.	[[mac]i]		_____	blocked by SCC
cycle 1	-----			
Voicing	[maji]		[madi]	
Postlexical	-----			
Phonetic form	[maji]		[madi]	

The SCC blocks *t*-palatalization in both [mat] and [mati] at zero cycle, while it blocks the process in [mati] ‘knot’ only at the first cycle. Voicing applies to both [maci] and [mati] at the postlexical level, producing each phonetic form, [maji] and [madi].

Next is *s*-, *n*-, and *l*-palatalization, whose change is allophonic.

(14) *s*-palatalization

- a. sikan [šiɡan] ‘time’
 - kasi [kaši] ‘thorn’
 - b. kas-i [kaši] ‘traditional hat(nom.)’
- Korean traditional hat-Subj.
- n*-palatalization
- a. k’ini [k’iɲi] ‘meal’

¹⁰ Alternation Condition: Obligatory neutralization rules cannot apply to all occurrences of a morpheme (Kiparsky 1968, sec. 1).

¹¹ Revised Alternation Condition: Obligatory neutralization rules apply only in derived environments (Kiparsky 1982, 152).

- b. mun-i [muŋi] 'door(nom.)'
 door-Subj.
l-palatalization
 a. talli- [taɭɭi] 'to run'
 b. kal-li- [kaɭɭi] 'to be ground'
 grind-Passive suf.

Unlike *t*-palatalization, *s*-, *n*-, and *l*-palatalization occurs in non-derived and derived environments alike.

In Lexical Phonology and Morphology, *t*-palatalization is classified as a lexical process since it occurs only in derived environments, while *s*-, *n*-, and *l*-palatalization is classified as a postlexical one since it applies automatically insensitive to morphological structure, both tauto- and heteromorphemically. The following (15) shows how *s*-palatalization applies to [[kas]i] 'traditional hat(nom.)' and [kasi] 'thorn' alike:

(15)	[kas]	'traditional hat'	[kasi]	'thorn'
Case marking	[[kas]i]		—	
	Subj. marker			
Lexical	-----			
<i>s</i> -pal.	[kaši]		[kaši]	
Postlexical	-----			
Phonetic form	[kaši]		[kaši]	

Although morphological structures are different, the phonetic forms are the same because of the postlexicity of *s*-palatalization. This is due to the fact that the SCC has no force at the postlexical level. The same can be said of other allophonic palatalization: *n*- and *l*-palatalization, the discussion of which is omitted here.

Even though the environment of palatalization is the same in both phonemic and allophonic palatalization, the two types of palatalization should be differentiated either as phonemic and allophonic or lexical and postlexical processes. This distinction is reflected in the Korean orthography, too. The orthographical syllabification is indicative of the fact that native speakers of Korean are aware of the difference in the morphological structures: *mat.i* 'the eldest' vs. *ma.ti* 'knot' or *kas.i* 'hat(nom.)' vs. 가 ka.si 'thorn.' For example, the *t* in [[mat]i] is a coda at the beginning, before being resyllabified as the onset of the second syllable, which is created by the noun forming suffix *-i*. On the other hand, the *t* in [mati] 'knot' is an onset of the second syllable from the beginning and there is no resyllabification. As for *s*, palatalization applies indiscriminately; whether *s* is resyllabified or not makes no difference at all.

In this section we have seen that the separation of two kinds of palatalization is necessary, which is supported directly by the results of palatalization, neutralizing and phonemic on one hand and non-

neutralizaing and allophonic on the other hand, and indirectly by the orthographical syllabification of Korean.

3.2. Non-Strict Parallelistic Approach in OT

As far as *t*-palatalization is concerned, it is the same as Polish palatalization in that the process applies only when the stem final segment is resyllabified as the onset of the following syllable provided by morpheme concatenation. Thus, the conjoined constraint [PAL & R-ANCHOR(stem; σ)]_{AdjacentSegments} is effective in distinguishing derived and non-derived environments: [[mat]i] \rightarrow [ma.ji] ‘the eldest’ vs. [mati] \rightarrow [ma.di] ‘knot.’ The ranking order of constraints is the same as in (6), which is repeated here.

(6) [PAL & R-ANCHOR(stem; σ)]_{AdjacentSegments} » IDENT(ant) » PAL

The markedness constraint PAL is responsible for palatalization of *t*, *tʰ*, *s*, *sʹ*, *n*, and *l* in Korean and the ranking IDENT(ant) » PAL ensures the preservation of anteriority.

Let’s consider *t*-palatalization in derived environments first.

(16) *t*-palatalization in Derived Environment: [[mat]i] \rightarrow [ma.ji]

[[mat] _{stem} i]	[PAL & R-ANCHOR] _{AS}	IDENT(ant)	PAL
a. ma.di	*!		*
b. ma.ji		*	

In (16a), the highest and conjoined constraint [PAL & R-ANCHOR(stem; σ)]_{AdjacentSegments} is violated because the stem final *t* is not palatalized and it is not the coda of the syllable, either. On the other hand, (16b) violates R-ANCHOR(stem; σ) only and this does not lead to the violation of the conjoined constraint. Thus, (16b) is optimal even though IDENT(ant) is violated due to the application of palatalization.

In the case of non-derived environments, *t*-palatalization does not apply since resyllabification of the stem final segment *-t* is not involved. Thus the conjoined constraint has no force at all and the hierarchy IDENT(ant) » PAL decides the optimal output. Tableau (17) illustrates the situation.

(17) No *t*-palatalization in Non-derived environment: [mati] \rightarrow [ma.di]

[mati] _{stem}	[PAL & R-ANCHOR] _{AS}	IDENT(ant)	PAL
a. ma.di			*
b. ma.ji		*!	

The conjoined constraint is irrelevant since no resyllabification of the stem final segment is involved in both candidates. (17a) is chosen as optimal

against (17b), which violates the next highest constraint IDENT(ant).

So far we have seen that the hierarchy in (6) is successful in explaining the derived environment effect of *t*-palatalization. However, the same hierarchy cannot deal with allophonic palatalization. Let's look at (18) for $[[kas]i] \rightarrow [ka.ši]$ 'traditional hat(nom.)' and (19) for $[kasi] \rightarrow [ka.ši]$ 'thorn.'

(18) *s*-palatalization in Derived Environment: $[[kas]i] \rightarrow [ka.ši]$

$[[kas]_{stem}i]$	$[PAL \ \& \ R-ANCHOR]_{AS}$	IDENT(ant)	PAL
a. $ka.si$	*!		*
b. $ka.ši$		*	

(18a) violates the highest constraint since both $R-ANCHOR(stem; \sigma)$ _{AdjacentSegments} and PAL are violated. On the other hand, (18b) violates only the second part of the highest constraint, $R-ANCHOR(stem; \sigma)$ _{AdjacentSegments}, and this does not bring about the violation of the conjoined constraint. This is how (18b) is chosen as optimal.

Next is the case of the process in a non-derived environment.

(19) *s*-palatalization in Non-derived Environment: $*[kasi] \rightarrow [ka.si]$

$[kasi]_{stem}$	$[PAL \ \& \ R-ANCHOR]_{AS}$	IDENT(ant)	PAL
☛ a. $ka.si$			*
b. $ka.ši$		*!	

According to the constraint hierarchy given in (6), (19a) should be optimal, but the actual output form is (19b). (The symbol ☛ stands for the counterfactually winning candidate.)

This indicates that the constraint hierarchy in (6) is not adequate for Korean. Korean palatalization is not like the Polish counterpart, where both First Velar Palatalization and Coronal Palatalization are sensitive to the morpheme boundary. As seen in 3.1., there are two kinds of palatalization in Korean: *t*-palatalization sensitive to the morpheme boundary and *s*-, *n*-, and *l*-palatalization insensitive to it. This is in turn indicative of the fact that these two kinds belong to different levels.

The level difference in OT is reflected in the ranking difference among constraints. There have been several proponents of level-ordered OT, trying to solve ranking paradoxes. For one example, in dealing with coda devoicing in Dutch, Booij (1997) claims that the set of candidates must be evaluated in two steps, at the lexical level and at the postlexical level, comparing the difference in Coda Devoicing between a derived word and a word plus clitic combination.¹² Lin (1997) suggests more than one level of

¹² The minimal pair he uses is as follows: hebber /heb+ r/ [hebr] 'greedy person' vs. heb er [hɛpr] 'have her.' The former is a derived word, while the latter is a word plus clitic

constraint evaluations in accounting for compensatory lengthening in Piro: $\text{MAX-}\mu \gg \text{OCP}_{\text{st}}$ at the lexical level and $\text{OCP}_{\text{st}} \gg \text{MAX-}\mu$ at the postlexical level, where the constraint OCP_{st} prohibits adjacent identical stops. Bermúdez-Otero (1999) is another proponent of it. He responds to opacity, arguing against Sympathy Theory and proposes constraint hierarchies at stem, word, and phrase levels, which are ranked differently at each level.¹³ One more example comes from J. H. Kim (1999), who deals with cyclicity effects in English derivation. Level 1 affixation has the ranking order $^*(\text{H}'\text{L}) \gg \text{OO-IDENT}(\mu)$, $\text{IO-FAITH}(\mu)$, while level 2 affixation has $\text{OO-IDENT}(\mu)$, $\text{IO-Faith}(\mu) \gg ^*(\text{H}'\text{L})$.¹⁴ On the other hand, in treating front high vowel [i] deletion in Levantine, Kiparsky (2000) posits $\text{MAX-V} \gg \text{No [i]}$ at the stem level and $\text{No [i]} \gg \text{MAX-V}$ at the word level. All these ranking paradoxes suffice to prove the raison d'être of level-ordered OT.

Korean palatalization is another case of ranking paradox. Here the ranking order between PAL and IDENT(ant) is responsible for the two kinds of palatalization.

- (20) a. phonemic/lexical level (*t*-palatalization):
 $[\text{PAL} \ \& \ \text{R-ANCHOR}(\text{stem}; \sigma)]_{\text{AdjacentSegments}} \gg \text{IDENT}(\text{ant}) \gg \text{PAL}$
 b. allophonic/postlexical level (*s*-, *n*-, and *l*-palatalization):
 $[\text{PAL} \ \& \ \text{R-ANCHOR}(\text{stem}; \sigma)]_{\text{AdjacentSegments}} \gg \text{PAL} \gg \text{IDENT}(\text{ant})$

Tableaux (18) and (19) are revised into tableaux (21) and (22), respectively.

(21) *s*-palatalization in Derived Environment: $[[\text{kas}]\text{i}] \rightarrow [\text{ka.}\text{ši}]$

$[[\text{kas}]\text{i}]_{\text{stem}}$	$[\text{PAL} \ \& \ \text{R-ANCHOR}]_{\text{AS}}$	PAL	IDENT(ant)
a. $\text{ka.s}\text{i}$	*!	*	
b. $\text{ka.}\text{ši}$			*

(22) *s*-palatalization in Non-derived Environment: $[\text{kasi}] \rightarrow [\text{ka.}\text{ši}]$

$[\text{kasi}]_{\text{stem}}$	$[\text{PAL} \ \& \ \text{R-ANCHOR}]_{\text{AS}}$	PAL	IDENT(ant)
a. $\text{ka.s}\text{i}$		*!	
b. $\text{ka.}\text{ši}$			*

To prove that the constraint ranking $\text{PAL} \gg \text{IDENT}(\text{ant})$ is not fit for *t*-palatalization, (23) and (24) are illustrated.

combination. To explain the surface difference between [b] and [p] of /b/, He asserts that lexical morphemes and lexical combinations of morphemes must be evaluated before postlexical morpheme combinations are evaluated.

¹³ To quote Bermúdez-Otero (1999, 135), “In practice, the deployment of anti-opacity strategies in strongly parallel OT is entirely opportunistic and unprincipled.”

¹⁴ Here H' stands for a stressed heavy syllable, L for a light syllable, and the parentheses for a foot. The constraint $^*(\text{H}'\text{L})$ prohibits a foot consisting of a stressed heavy syllable followed by a light syllable.

(23) *t*-palatalization in Derived Environment: $[[\text{mat}]_i] \rightarrow [\text{ma.ji}]$

$[[\text{mat}]_{\text{stem}} i]$	$[\text{PAL} \ \& \ \text{R-ANCHOR}]_{\text{AS}}$	PAL	IDENT(ant)
a. ma.di	*!	*	
b. ma.ji			*

(24) No *t*-palatalization in non-derived environment: $*[\text{mati}] \rightarrow [\text{ma.ji}]$

$[\text{mati}]_{\text{stem}}$	$[\text{PAL} \ \& \ \text{R-ANCHOR}]_{\text{AS}}$	PAL	IDENT(ant)
a. ma.di		*!	
b. ma.ji			*

The ranking $\text{PAL} \gg \text{IDENT(ant)}$ in (20b) seems to be fit for the situation of *t*-palatalization in a derived environment in (23), but it is not an appropriate ranking in a non-derived environment as can be seen in (24). According to the given constraint hierarchy, (24b) should be optimal, but the actual output form is (24a) marked with *. This confirms the necessity of two different levels of constraint ranking in Korean palatalization.

Compared with the constraint ranking at the lexical level, the ranking at the postlexical level has PAL over IDENT(ant). This reflects the fact that postlexical processes such as *s*-palatalization apply automatically whenever the environment is met, at the expense of preserving the anteriority of segments.

However, the faithfulness constraint IDENT(ant) ranks over the markedness constraint PAL at the lexical level. This means that a segment maintains its anteriority unless it is located at a special environment such as a resyllabified onset position resulting from morpheme concatenation. *t*-palatalization in Korean has been shown to be the case at hand.

4. Implications and Conclusion

It has been shown in this study that even when equipped with a constraint conjunction like $[\text{PAL} \ \& \ \text{R-ANCHOR}(\text{stem}; \sigma)]_{\text{AdjacentSegments}}$, trying to dispense with intermediate forms (Lubowicz, 1997), only one level of constraint hierarchy is not sufficient enough to describe Korean palatalization. Previous studies have found *t*-palatalization to show neutralizing and phonemic change, applying only in derived environments, while *s*-, *n*-, and *l*-palatalization shows non-neutralizing and allophonic change, applying in both derived and non-derived environments.

The native speakers of Korean, in passing, know the difference in the morphological structures of these two kinds of palatalization, which is indicated indirectly by the orthographical syllabification and directly by the difference in the results of the process: phonemic vs. allophonic change. In the sense that the intuition of native speakers of a certain language is reflected in the grammar, it can be said that Polish has one level of constraint hierarchy as in (6) and Korean has two levels as in (10), as far as

palatalization is concerned. More than one level of constraint hierarchy in one language leads us to reconsider the strict parallelistic view of OT, which admits no serial derivation as noted in footnote 1.

This finding in turn suggests that the strict parallelism of OT be revised in order to have any descriptive adequacy in Korean palatalization. The solution lies in the stratification of the constraint ranking, which is achieved by different rankings of constraints. The ranking under question is that of PAL and IDENT(ant), which is reversed depending on the level: IDENT(ant) » PAL at the lexical level and PAL » IDENT(ant) at the postlexical level.

Faithfulness constraints, in principle, ensure the identity between the input and the output, while markedness constraints relate to the structural well-formedness of the output form. Thus it stands to reason that the ranking IDENT(ant) » PAL at the lexical level intends to preserve the morpheme identity, while the ranking PAL » IDENT(ant) at the postlexical level tries to induce palatalization to occur in the relevant environment as much as possible. For example, the surface opacity in [mati] → [madi] ‘knot,’ where [d] is not palatalized to [j], explains the semantic contrast with [[mat]i] → [maji] ‘the eldest’ which shows no such opacity. Accompanied by the conjoined constraint [PAL & R-ANCHOR(stem; σ)]_{AdjacentSegments}, the ranking IDENT(ant) » PAL keeps the anteriority of [t] in tact, making it possible for [madi] ‘knot’ to contrast with from [maji] ‘the eldest’ semantically as well as morphologically.

In terms of articulation and perception, the ranking IDENT(ant) » PAL at the lexical level may be said to enhance perceptual distinctiveness on the part of the listener at the expense of the speaker’s articulatory effort. On the other hand, at the postlexical level, articulatory economy of the speaker is achieved in the ranking PAL » IDENT(ant) at the expense of the listener’s perceptual effort.

As seen in 3.2, previous works on ranking paradoxes have already argued for the separation of levels in OT. To repeat those studies, Booij (1997), Lin (1999), Bermúdez-Otero (1999), J. H. Kim (1999), Rubach (2000) and Kiparsky (2000) are among them. As one more proponent of level-ordered OT, Roca (1997, 14) can be included when he contends that ‘multi-level phonology appears inevitable in OT.’ Although more languages need to be considered in arguing against the strict parallelistic view of OT, the data from Korean palatalization provide one more piece of evidence against it. All these add up to the necessity of serialism into OT, in the form of level-ordering.

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