Richness of the base, lexicon optimization, and suffix /ɨ/~{ alternation in Korean*

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Hong, Sunghoon. 2001. Richness of the base, lexicon optimization, and suffix /ɨ/~{ alternation in Korean. *Studies in Phonetics, Phonology and Morphology* 7.1. 215-242. This paper presents an OT analysis of the phonological patterns exhibited by the verbal/adjectival suffixes in Korean. I propose that it is not arbitrarily determined whether a suffix is alternating or non-alternating, but rather phonologically motivated for the most part. I will show that alternating suffixes with /ɨ/ serve us to avoid bad 'syllable contact' or to discard a coda consonant, while non-alternating suffixes without /ɨ/ enable us to be maximally faithful, better aligned, or to observe syllable-based phonotactic constraints. Based on this analysis, I touch on the issue of UR for the verbal/adjectival suffixes. Richness of the Base in OT guarantees that there are no restrictions imposed on inputs, but the consideration of learnability drives us to select a particular input for an output. Utilizing Paradigm-level Lexicon Optimization, motivated to deal with allomorphy, I propose that the suffixes in question do not have /ɨ/ in their UR's. (**Hansung University)**

Keywords: richness of base, lexicon optimization, syllable contact, phonotactic constraints

1. Introduction

The goal of this paper is bipartite. First, couched in Optimality Theory (OT), this paper presents an analysis of the phonological patterns exhibited by the verbal and adjectival suffixes in Korean. As well documented in the literature, some of these suffixes show /ɨ/~{ alternation in the suffix-initial position, as seen in the conjunctive suffix [–ɨmy@]~[-my@] (e.g. *sa-my@* 'to buy' vs. *m@k-ɨmy@* 'to eat'); but others, such as the declarative suffix /-ta/, remain unchanged (e.g. *sa-ta* vs. *m@k-ta*). Setting up specific underlying representations for the suffixes, previous analyses account for this phenomenon either by deletion (W.-J. Kim 1972, B.-G. Lee 1978, Y.-K. Kim-Renaud 1982), or by epenthesis (S.-N. Lee 1949, H.-B. Choi 1955, Kang 1982, Y.-S. Kim 1984, S.-H. Kim 1992). Imposing any restriction whatsoever on underlying representation (UR), however, is not in line with the standard OT, in which Richness of the Base (ROB) is a given concept. In this paper, I will develop an analysis not hinging on specific UR's.

It has been further noted that a 'real' UR or input must be singled out for the purpose of learnability. The second goal of the paper is to investigate

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this issue of UR related to the verbal/adjectival suffixes, centering on Lexicon Optimization (LO), the primary means that OT leans on to determine UR's. In particular, I will examine the proper method of LO, based on which I will suggest what the UR's for the suffixes in question are like.

This paper will proceed as follows. In section 2, we will examine the patterns exhibited by the verbal and adjectival suffixes in Korean, and draw some important generalizations, which the deletion or epenthesis account fails to catch. In section 3, we will formulate these generalizations as a set of surface-oriented constraints, and develop an OT analysis without depending on particular UR's. In section 4, we will search for the working version of LO and show how UR's are determined by this version of LO. Finally, section 5 will serve as a summary and conclusion of the paper.

2. /ɨ/~{ Alternation in Verbal and Adjectival Suffixes: Data and the Generalizations

In Korean, certain suffixes after a verb or an adjective stem exhibit /ɨ/~{ alternation in their initial positions. When alternating, /ɨ/ appears in the suffix-initial position after a stem that ends in a consonant other than /l/[1], as in *m@k-* 'to eat' and *sim-* 'to plant'; but /ɨ/ does not show up when the stem is vowel-final as in *sa-* 'to buy' and *po-* 'to see'.

(1) Alternating suffixes[2,3]

		C-final stems	V-final stems
-(ɨ)l@	<purpotive>	m@k-ɨl@, sim-ɨl@	sa-l@, po-l@
-(ɨ)my@	<conjunctive>	m@k-ɨmy@, sim-ɨmy@	sa-my@, po-my@
-(ɨ)si-	<honorific>	m@k-ɨsi-, sim-ɨsi-	sa-si-, po-si-

[1] The patterns exhibited by the /l/-final stems will be discussed in section 3.3.

[2] Verbal/adjectival suffixes in Korean are classified as follows, depending on the place in a word or a sentence where the suffixes appear: (i) sentence-final closing suffixes, which occur in the last position of the sentence-final words (e.g. plain indicative assertive *-ta*, plain indicative attentive *-ni*), (ii) sentence-medial closing suffixes, which appear in the last position of the sentence-medial words (e.g. purpotive *-(ɨ)l@*, conjunctive *-(ɨ)my@*), and (iii) nonclosing or prefinal suffixes, which occur in a prefinal position of a word (e.g. honorific *-(ɨ)si-*, suspective *-ci-*) (cf. Nam/Ko 1988). In this paper, nonclosing suffixes are marked by an extra hyphen attached at the end of a suffix.

[3] The suffixes are termed according to their grammatical or semantic functions, following Martin (1954). It is assmed that the cases where the name of the suffix is composed of more than one semantic function, such as <pl(ain). ind(icative). ass(ertive)> in (2) and <fam(iliar) ind(icative) att(entive)> in (3), are morphologically complex, although it is not overtly shown at the surface level. Of the terms used, 'plain,' 'familiar,' and 'authoritative' denote STYLE; 'indicative assertive,' and 'indicative attentive' are equivalent to 'declarative' and 'interrogative,' respectively.

Not all the verbal and adjectival suffixes show alternation, however. It is observed that the suffixes of which the initial consonant is /l/, /m/, or /s/ are subject to /i/~{ alternation[4] (S.-N. Lee 1949, Kang 1982, S.-H.Kim 1992). If the suffixes begin with a stop consonant, /t/, /k/, or /c/, alternation does not occur and /i/ does not appear even after a C-final stem.

(2) Non-alternating suffixes

		C-final stems	V-final stems
-ta	<pl. ind. ass.>	m@k-ta, sim-ta	sa-ta, po-ta
-ko	<gerundive>	m@k-ko, sim-ko	sa-ko, po-ko
-ci-	<suspective>	m@k-ci-, sim-ci-	sa-ci-, po-ci-

What makes the matters more complicated is the presence of /n/-initial suffixes, of which some are alternating and others non-alternating.

(3) /n/-initial suffixes

			C-final stems	V-final stems
a.	-(i)na	<adversative>	m@k-ina, sim-ina	sa-na, po-na
	-(i)ni	<sequential>	m@k-ini, sim-ini	sa-ni, po-ni
b.	-na	<fam. ind. att.>	m@k-na, sim-na	sa-na, po-na
	-ni	<pl. ind. att.>	m@k-ni, sim-ni	sa-ni, po-ni
	-ne	<fam. ind. ass.>	m@k-ne, sim-ne	sa-ne, po-ne

The traditional analyses of the divergent behavior of /n/-initial suffixes agree to the point that the non-alternating class of /n/-initial suffixes in (3b) are morphologically complex and that they all include the so-called 'indicative' prefinal suffix *-ni-* or its allomorph[5] (Martin 1954, Ko 1974, Nam/Ko 1988, S.H. Kim 1989). This indicative suffix *-ni*, as seen below, is not alternating, whether it is placed after a C-final stem or after a V-final stem.

(4)

C-final stems	V-final stems
m@k-ni-ni, sim-ni-ni	sa-ni-ni, po-ni-ni

[4] Note that the authoritative indicative assertive (=declarative) suffix *-so* does not show alternation even after a C-final stem (cf. *m@k-so*) (as opposed to the alternating imperative *-(i)so* as in *m@k-iso* and *po-so*, which is regarded as a shortened form of *-(i)si-o* (S.H. Kim 1992:118)). Another authoritative indicative assertive suffix *-(i)o*, on the other hand, is subject to the alternation although it is V-initial (e.g. *m@k-io* and *po-o*). Traditionally, these two suffixes are treated as allomorphs, both of which originate historically from *-sap-*, an honorific suffix used in Middle Korean (Martin 1954, Ko 1974, Kang 1982, S.H. Kim 1992). Further, Ko (1974:124) reports that, in actual usage, *m@k-so* is exclusively found in place of *m@k-io*, suggesting that the actual alternation is between *-so* after a C-final stem and *-o* after a V-final stem.

[5] Ko (1974: 132-133, 122-123), for example, analyzes *-na*, *-ni*, and *-ne* in (3b) as morphologically complex forms of *ni* + *i*, *ni* + *a*, and *ni* + *e*, respectively. As the allomorphs of *-ni-*, S.H. Kim (1989) proposes *-n-*, *-na-* and *-nin-*.

m@k-n-nya, sim-n-nya sa-n-nya, po-n-nya

For further reference, an extensive list of the relevant classes of suffixes are presented below.

(5) a. alternating suffixes
   i. /l/-initial: -(ɨ)l@, -(ɨ)ly@, -(ɨ)li, -(ɨ)lya, -(ɨ)laku, -(ɨ)laci
   ii. /m/-initial: -(ɨ)my@, -(ɨ)my@n, -(ɨ)mɨlo, -(ɨ)ma
   iii. /s/-initial: -(ɨ)si-, -(ɨ)se, -(ɨ)sos@

   b. non-alternating suffixes
   iv. /t/-initial: -ta, -t@la, -taka, -tolok
   v. /k/-initial: -ko, -key, -ke
   vi. /c/-initial: -ci, -ca

   c. /n/-initial suffixes
   vii. alternating : -(ɨ)na, -(ɨ)ni <sequential>, -(ɨ)nik'a
   viii. non-alternating: -nɨ-, -na, -ni <interrogative>, -ne

In the literature, this /ɨ/~{ alternation has been mostly handled by either insertion or deletion. In the insertion approach, suffixes lack /ɨ/ in UR, and the later application of insertion supplies [ɨ] before /l/, /m/, /s/, or alternating /n/ (S.-N. Lee 1949, H.-B. Choi 1955, Kang 1982, Y.-S. Kim 1984). In the deletion approach, on the other hand, underlying /ɨ/ is posited before /l/, /m/, /s/, or non-alternating /n/, and the deletion of /ɨ/ applies at the postvocalic position to yield the alternation with { (W.-J. Kim 1972, B.-G. Lee 1978, Y.-K. Kim-Renaud 1982). The obvious drawback here is that both of these approaches do not convincingly address why /ɨ/ appears only before /l/, /m/, /s/, or alternating /n/[6]. Moreover, it must be noticed that from the OT perspective, ROB in particular, both insertion and deletion approaches are laden with an inherent problem since the UR's for both analyses must be set on a particular form. In what follows, we will develop an OT analysis in which these two problems noted above are fully taken care of.

[6] S.-H. Kim (1992), in the rule-based framework, provides an interesting account of this restriction. He argues that /ɨ/ appears before these consonants to prevent them from undergoing phonological changes. If /ɨ/ does not appear as in /m@k-l@/, /m@k-my@/, /m@k-si/, and /m@k-na/, a mandatory process of assimilation or tensification incorrectly applies to produce *[m@N-n@], *[m@N-my@], *[m@k-s'i], and *[m@N-na]. If that happens, the shapes of the suffix-initial consonants, /l, m, s, n/, become different from what they originally were, and to provent this situation, the vowel /ɨ/ is epenthesized. This account, however, does not explain why /ɨ/ appears in [sim-ɨmy@], [sim-ɨsi], and [sim-ɨna], where no mandatory process would apply even without /ɨ/ and hence the original forms of the suffix-initial consonant would be preserved.

3. OT Analysis

3.1. Alternating suffixes vs. non-alternating suffixes

We begin with the discussion of the alternating suffixes (6a) and the non-alternating suffixes (6b), repeated below for ease of reference.

(6)

		C-final stems	V-final stems
a.	-(ɨ)l@	m@k-ɨl@, sim-ɨl@	sa-l@
	-(ɨ)my@	m@k-ɨmy@, sim-ɨmy@	sa-my@
	-(ɨ)si-	m@k-ɨsi-, sim-ɨsi-	sa-si-
b.	-ta	m@k-ta, sim-ta	sa-da

As seen above, the initial consonants of the alternating suffixes are confined to /l/, /m/, /s/, or /n/, before which the vowel /ɨ/ appears after a C-final stem. Of interest to us is the fact that due to the occurrence of /ɨ/ in these positions, the morphological boundaries between stem and suffix are misaligned with a syllable boundary (cf. [m@.k-ɨ.l@], [m@.k-ɨ.my@], [m@.k-ɨ.si]). These forms are violations of an alignment constraint, ALIGNSUFFIXLEFT, which aligns the left edge of a suffix with the left edge of a syllable[7].

(7) ALIGNSUFFIXLEFT (ALIGNSUF)
Align the left edge of a suffix with the left edge of a syllable (i.e. ALIGN (suffix, left, σ, left)).

The appearance of suffix-initial /ɨ/ induces an alignment violation, but by allowing suffix-initial /ɨ/, we can avoid bad 'syllable contact' (Murray/Vennemann 1983, Vennemann 1988). By bad syllable contact here, we refers to the cases where the initial sound of the second syllable, in a sequence of two syllables, is more sonorous than the final sound of the first syllable. If there is no /ɨ/ in the cases at hand, the resulting forms, *[m@k.-l@], *[m@k.-my@], and *[m@k.-si], all involve bad syllable contact. Such bad syllable contact is avoided by the following constraint, SYLLABLECONTACT (Bat-El 1996, Davis 1998, Davis/Shin 1999).

(8) SYLLABLECONTACT (SYLCONT)
Avoid rising sonority over a syllable boundary. (C1 ≥ C2)

(9) Sonority Scale
stops < fricatives < nasals < liquids < glides < vowels

[7] An obvious alternative for this constraint is ALIGNSTEMRIGHT, which aligns the right edge of the stem with the right edge of the syllable. Anticipating solid evidence that proves the validity of one or the other, I simply opt for ALIGNSUFFIXLEFT.

In OT terms, then, it appears that the alternating suffixes are motivated by the two conflicting constraints, SYLCONT and ALIGNSUF. The conflict here is resolved by satisfying SYLCONT, in violation of ALIGNSUF; thus, SYLCONT ourtranks ALIGNSUF. The representative constraint tableaux are presented below.

(10) Constraint tableaux

	SYLCONT	ALSUF
m@k.-l@	*!	
☞ m@.k-ɨ.l@		*

	SYLCONT	ALSUF
m@k.-my@	*!	
☞ m@.k-ɨ.my@		*

	SYLCONT	ALSUF
m@k.-si	*!	
☞ m@.k-ɨ.si		*

The present constraint system, however, does not account for the cases where the appearance of /ɨ/ is not motivated by SYLCONT, such as [si.m-ɨ.my@] and [si.m-ɨ.si]. In these cases, the occurrence of /ɨ/ is not driven by SYLCONT, because the candidate forms without /ɨ/ would also satisfy SYLCONT. The current constraint system would select incorrect forms *[sim.-my@] and *[sim.-si]

(11)

	SYLCONT	ALIGNSUF
💣 sim.-my@.		
si.m-ɨ.my@.		*!

	SYLCONT	ALIGNSUF
💣 sim.-si		
si.m-ɨ.si		*!

To handle these cases, we introduce NOCODA, which outranks ALIGNSUF.

(12) NOCODA
Coda consonants are not allowed.

(13)

	SYLCONT	NOCODA	ALIGNSUF
sim.-my@		*!	
☞ si.m-ɨ.my@			*

	SYLCONT	NOCODA	ALIGNSUF
sim.-si		*!	
☞ si.m-ɨ.si			*

These constraints alone, however, still do not accout for alternating suffixes (6b). Here, the optimal forms do not have the vowel /ɨ/ even

after a C-final stem, yielding violations of NOCODA. Unlike alternating suffixes, however, the non-alternating suffixes initiate with a stop consonant, /t/, /k/, or /c/, for which voicing difference is significant[8]. If /ɨ/ is allowed here, either of the following scenarios would be possible: (i) the initial stop consonant would change into a voiced one, in violation of a faithfulness constraint, IDENT-IO(voice) (e.g. -ɨ[d]a, -ɨ[g]o, -ɨ[j]i); or (ii) the initial stop consonant would nonetheless remain voiceless, violating a fairly strong constraint in Korean, INTER-V-VOICE, which prohibits a voiceless plain obstruent in intervocalic positions (e.g. *-ɨ[t]a, *-ɨ[k]o, *-ɨ[c]i). The lack of /ɨ/ in the non-alternating suffixes then is explained by NOCODA being outranked by the new constraints, INTER-V-VOICE and IDENT-IO(voice), of which the former dominates the latter.

(14) a. INTER-V-VOICE (IVV)
Intervocalic plain obstruent consonants are voiced.

b. IDENT-IO(voice)
Corresponding segments of the base and the affixed form must agree in voicing.

(15) Non-alternating suffixes: [m@k.-ta] and [sim.-ta]

	SYLCNT	IVV	ID(voi)	NOCODA	AL-SUF
☞ m@k.-ta				*	
m@.k-ɨ.ta		*!*			*
m@.k-ɨ.da		*!	*		*
m@.g-ɨ.da			*!*		*
☞ sim.-ta				*	
si.m-ɨ.ta		*!			*
si.m-ɨ.da			*!		*

Turning back to the alternating suffixes, we confirm below that the constraint system produces the correct outputs.

(16) Alternating suffixes
a. [m@.g-ɨ.l@] and [si.m-ɨ.l@]

	SYLCNT	IVV	ID(voi)	NOCODA	AL-SUF
m@k.-l@	*!			*	
m@.k-ɨ.l@		*!			*

[8] Unlike /t/, /k/ and /c/, which undergo voicing in intervocalical position, voicing is not significant for /s/, since its voicing status remain constant as voiceless regardless of the context in which it occurs.

☞	m@.g-ɨ.l@			*		*
	sim.-l@	*!			*	
☞	si.m-ɨ. l@					*

b. [m@.g-ɨ.my@] and [si.m-ɨ.my@]

		SylCnt	IVV	ID(voi)	NoCoda	Al-Suf
	m@k.-my@	*!			*	
	m@.k-ɨ.my@		*!			*
☞	m@.g-ɨ.my@			*		*
	sim.-my@				*!	
☞	si.m-ɨ.my@					*

c. [m@.g-ɨ.si] and [si.m-ɨ.si]

		SylCnt	IVV	ID(voi)	NoCoda	Al-Suf
	m@k.-si	*!			*	
	m@.k-ɨ.si		*!			*
☞	m@.g-ɨ.si			*		*
	sim.-si				*!	
☞	si.m-ɨ.si					*

In summary, alternating suffixes opt for /ɨ/ to observe SylCont or NoCoda, although its occurrence would voilate AlignSuf. Non-alternating suffixes, on the other hand, disfavor /ɨ/ because its occurrence would incur a violation of higher ranked IVV or Ident-IO(voice).

3.2. /n/-initial Suffixes

We now turn to /n/-initial suffixes (5c). We have seen above that unlike other suffixes which fall into either alternating or non-alternating class, /n/-initial suffixes are divergent in that some are alternating and others non-alternating. We also noted that non-alternating /n/-initial suffixes are morphologically complex, such that all include the indicative prefinal suffix *-nɨ-*. The two types of /n/-initial suffixes are illustrated below, repeated from (3).

(17) Alternating/non-alternating

	C-final stems	V-final stems
a. -(ɨ)na <adversative>	m@k-ɨna, sim-ɨna	sa-na, po-na

	-(ɨ)ni	<sequential>	m@k-ɨni, sim-ɨni	sa-ni, po-ni
b.	-na	<fam. ind. att.>	m@k-na, sim-na	sa-na, po-na
	-ni	<pl. ind. att.>	m@k-ni, sim-ni	sa-ni, po-ni

It is obvious that the distinction between these two classes cannot be attributed to phonological factors, as we see from above that suffixes of an identical form exhibit different behaviors with respect to /ɨ/~{ alternation. Alternating /n/-initial suffixes are treated in the same manner as we did for the other alternating suffixes. As for non-alternating /n/-initial suffixes, I propose that they come about due to a separate alignment constraint, which makes sure that the the left edge of a non-alternating /n/-initial suffixes coincides with the left edge of a syllable.

(18) ALIGNLEFT-N_{IND}
Align the left edge of /n/-initial indicative suffix, N_{IND}, with the left edge of a syllable (i.e. ALIGN (N_{IND}, left, σ, left)).

Further, the stem-final consonant as in *m@k-ni* undergoes nasal assimilation to become [m@Nni]. This assimilation is enforced to satisfy SYLCONT in violation of another faithfulness constraint, IDENT-IO(manner).

(19) IDENT-IO(manner)
Corresponding segments of the base and the affixed form must agree in manner of articulation.

As for the ranking, non-alternating [m@Nni] observes SYLCONT and ALIGNLEFT-N_{IND}, while violating IDENT-IO(manner); hence, SYLCONT and ALIGNLEFT-N_{IND} dominate IDENT-IO(manner). Alternating [m@gɨni], on the other hand, satisfies IDENT-IO(manner) but violates IDENT-IO(voice); thus, the former outranks the latter. The constraint tableaux for both non-alternating and alternating /n/-initial suffixes are presented below.

(20) a. non-alternating : -ni_{IND} <plain interrogative>

	SYLCNT	IVV	AL-N_{IND}	ID(m)	ID(v)	*CODA	AL-SUF
m@k.-ni_{IND}	*!					*	
☞ m@N.-ni_{IND}				*		*	
m@.k-ɨ.ni_{IND}		*!	*				*
m@.g-ɨ.ni_{IND}			*!		*		*

☞ sim.-ni_{IND}						*	
si.m-ɨ.ni_{IND}			*!				*

b. alternating: -(ɨ)ni <sequential>

	SYLCNT	IVV	AL-N_{IND}	ID(m)	ID(v)	*CODA	AL-SUF
m@k.-ni	*!					*	
m@N.-ni				*!		*	
m@.k-ɨ.ni		*!					*
☞ m@.g-ɨ.ni					*		*
sim.-ni						*!	
☞ si.m-ɨ.ni							*

3.3. /l/-final Stems

Now let us turn to /l/-final stems. What is peculiar about these stems is that alternation is observed not in suffixes but rather in stems. As we see below in the case of the verb stem *nol-* 'to play ', the suffixes do not allow /ɨ/ and they are all C-initial. The stems, on the other hand, exhibit alternation such that stem-final /l/ remains intact (21a) except when it is followed by a suffix whose initial consonant is /s/ or /n/ (21b)[9].

(21)

	I	II	III	
a.	*nol-ɨl@	nol-l@	*no-l@	cf. m@[g]-ɨl@
	?nol-ɨmy@	nol-my@	*no-my@	m@[g]-ɨmy@
	*nol-ɨta	nol-ta	*no-ta	m@k-ta
	*nol-ɨko	nol-ko	*no-ko	m@k-ko
	*nol-ɨci	nol-ci	*no-ci	m@k-ci
b.	?nol-ɨsi	*nol-si	no-si	m@[g]-ɨsi
	?nol-ɨni	*nol-ni	no-ni	m@[g]-ɨni
	*nol-ɨni_{IND}	*nol-ni_{IND}	no-ni_{IND}	m@[N]-ni_{IND}

To account for the first pattern in (21a), we must somehow distinguish the examples in column II from those in columns I and III so that only the former can be the wellformed outputs. For this purpose, I propose the following two constraints, MAX-IO(/l/) and *σ[[lateral][10].

(22) a. MAX-IO(/l/)
Every /l/ in the input has a correspondent in the output.

[9] In some cases in column I, the forms with initial /ɨ/ are found in some casual varieties of speech, although it seems that they are less common and perhaps less accepted. Such examples are distinguished from the others by a question mark in front.

[10] As proposed by SoonHyun Hong (1998), this constraint can be reinterpreted as an alignment constraint, AlignRight ([lateral], σ), in which alignment is extended to include the 'non-crisp' definition (Ito/Mester/Padgett 1993, Ito/Mester 1994).

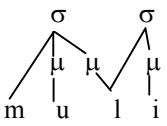
b. *σ[[lateral]
[l] is not allowed in syllable-initial positions.

It is obvious that MAX-IO(/l/), which prohibits deletion, is introduced to rule out the examples in column III. *σ[[lateral] is motivated from a general tendency in Korean to avoid syllable-initial [l] (Iverson/Kim 1987, Suh 1993, Soonhyun Hong 1998, among others). As is well-known, a lateral consonant [l] does not appear in syllable initial position, where [l] is deleted before a front high vocoid (23a) or is replaced by [n] elsewhere (23b). This generalization, however, is obtained in the face of the examples in which syllable-initial [l] does appear when preceded by another [l].

(23) a. /li-chi/ i-chi 'reason or logic' mul-li 'physics'
/ly@k-sa/ y@k-sa 'a man of strength' chul-ly@k 'output power'
b. /lo-in/ no-in 'an aged man' chol-lo 'a village senior'
/la-sin/ na-sin 'a naked body' c@l-la 'completely naked'

The examples in which syllable-initial [l] is preceded by another [l] are not in conflict with *σ[[lateral], if we adopt the notion of Linking Condition (Hayes 1986). The representation of [l] in such examples are as in (24), where [l] is multiply linked to both syllables and hence is not 'crisply' aligned with the syllable edges. Accordingly, [l] in these cases do not violate *σ[[lateral].

(24)



To ensure optimal outputs in (21a), *σ[[lateral], as well as MAX-IO(/l/), must outrank NOCODA. Note that suboptimal forms are excluded by the higher ranked constraints, *σ[[lateral] and MAX-IO(/l/).

(25) [nol-l@], [nol-my@], and [nol-ta][11]

		*σ[[l]	MAX	*CODA	AL-SUF
	no.l-ɨ.l@	*!*			*
☞	nol.-l@			*	
	no.-l@	*!	*		

[11] Other possible candidates such as [no.r-ɨ.r@], [no.r-ɨ.my@], and [no.r-ɨ.ta], in which [r] appears in place of [l], are excluded by a faithfulness constraint IDENT-IO(manner) (19), which outranks NOCODA.

	no.l-ɨ.my@	*!			*
☞	nol.-my@			*	
	no.- my@		*!		

	no.l-ɨ.ta	*!			*
☞	nol.-ta			*	
	no.-ta		*!		

Regarding the examples in (21b), I propose that the following constraint pair, POST-LATERAL PHONOTACTIC CONSTRAINTS, are primarily responsible for the lack of stem-final /l/.

(26) POST-LATERAL PHONOTACTIC CONSTRAINTS (PLPC)
a. *ln
b. *ls

The first constraint is motivated from the general avoidance of the sequence **ln* in Korean (Kim-Renaud 1982, Oh 1997, Davis/Shin 1999). Stem-internally, /ln/ is lateralized to become [ll] (e.g. /s@l-nal/ [s@l-lal] 'New Year's Day'); and across a stem-suffix boundary, stem-final /l/ disappears and /ln/ becomes [n] as we have seen in (21b). The second constraint directly accounts for the fact that /ls/ is not allowed across a stem-suffix boundary[12] (cf. Kim-Renaud 1982).

PLPC, as well as *σ[[lateral], must dominate Max-IO(/l/) to rule out suboptimal forms such as *[nol-ni], *[nol-si], *[nol-ɨni], and *[nol-ɨsi], and at the same time, to select optimal forms such as [no-ni] and [no-si]. The constraint tableaux based on this ranking are presented below.

(27) [no-si], [no-ni], and [no.-ni$_{IND}$]

		AL-N$_{IND}$	*σ[[l]	PLPC	MAX	*CODA	AL-SUF
	no.l-ɨ.si		*!				*
	nol.-si			*!		*	
☞	no.-si				*		

	no.l-ɨ.ni		*!				*

[12] An obvious question that arises in relation to the constraint **ls* is that it does not seem to take any effect within a stem, as we see from the fact that the sequence *ls* freely occurs stem-internally (e.g. [sil-su] 'a mistake'). This may be explained by fully recognizing the importance of stem-internal faithfulness. An anonymous reviewer pointed out that this is made possible in OT terms by high ranking of a faithfulness constraint LINEARITY-IO that holds stem-internally.

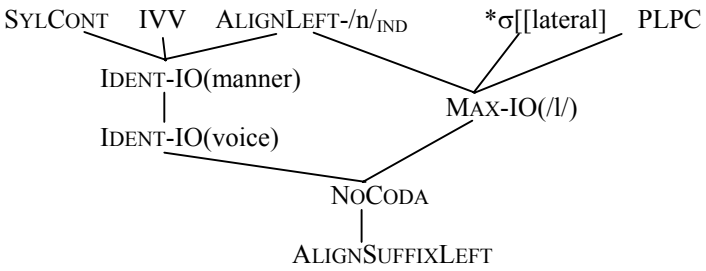
		LINEAR-IO$_{stm}$	*σ[[l]	PLPC	MAX
☞	sil-su			*	
	si-su	*!			*

	nol.-ni			*!		*	
☞	no.- ni				*		

	no.l-ɨ.ni$_{IND}$	*!	*				*
	nol.-ni$_{IND}$			*!		*	
☞	no.-ni$_{IND}$				*		

In summary, /l/-final stems exhibit alternation in stems, rather than in affixes: affixes are all C-initial, and the alternation manifests itself in stems between /l/ and {. We have explained the uniform appearance of C-initial affixes utilizing *σ[[lateral]. Disappearing stem-final /l/, on the other hand, was attributed to a couple of phonotactic constraints, PLPC, which disallow **ln* and **ls*. Both PLPC and *σ[[lateral] must outrank Max-IO(/l/) to account for all the attested patterns of /l/-final stems. The constraints established so far are summarized below.

(28) Constraint ranking compiled



4. /ɨ/~{ Alternation and Lexicon Optimization

4.1. /ɨ/~{ Alternation and the Issue of Underlying Representation

In this section, we will examin how OT addresses the issue of UR surrounding /ɨ/~{ alternation. In the rule-based framework, this /ɨ/~{ alternation has been handled by either insertion or deletion with a particularly determined UR. In the insertion approach, the UR's of the suffixes do not have /ɨ/ in them, which is supplied later by insertion that applies before /l/, /m/, /s/, or /n/ (which is not a part of the indicative marker).

(29) Insertion
/-l@ / --> [ɨl@] (e.g. /m@k-l@/ --> [m@k-ɨl@]; /sa-l@/ NA)
/-my@/ --> [ɨmy@] (e.g. /m@k-my@/ --> [m@k-ɨmy@]; /sa-my@/ NA)

/-si/ --> [ɨsi] (e.g. /m@k-si/ --> [m@k-ɨsi]; /sa-si/ NA)
/-ni/ --> [ɨni] (e.g. /m@k-ni/ --> [m@k-ɨni]; /sa-ni/ NA)
/-ni$_{IND}$/ --> NA (e.g. /m@k-ni$_{IND}$/ NA, /sa-ni$_{IND}$/ NA)
/-ta/ --> NA (e.g. /m@k-ta/ NA; /sa-ta/ NA)

In the deletion approach, on the other hand, the suffixes have underlying /ɨ/ before /l/, /m/, /s/, and /n/$_{IND}$ (a part of indicative marker), and a later application deletes this vowel in postvocalic positions.

(30) Deletion
/-ɨl@/ --> [l@] (e.g. /m@k-ɨl@/ NA; /sa-ɨl@/ --> [sa-l@])
/-ɨmy@/ --> [my@] (e.g. / m@k-ɨmy@/ NA; /sa-ɨmy@/ --> [sa-my@])
/-ɨsi/ --> [si] (e.g. /m@k-ɨsi/ NA; /sa-ɨsi/ --> [sa-si])
/-ɨni/ --> [ni] (e.g. /m@k-ɨni/ NA; /sa-ɨni/ --> [sa-ni])
/-ni$_{IND}$/ --> NA (e.g. /sa-ni$_{IND}$/ NA; /m@k-ni$_{IND}$/ NA)
/-ta/ --> NA (e.g. /sa-ta/ NA; /m@k-ta/ NA)

Such dependence on particular UR's is at odds with Richness of the Base (ROB), one of the supporting cornerstones of OT, which guarantees no restrictions on UR's or inputs.

(31) Richness of the Base (ROB) (Tesar/Smolensky 1998: 252)
The set of possible inputs to the grammar of all languages is the same. The grammatical inventories of languages are defined as the forms appearing in the structural descriptions that emerge from the grammar when it is fed by the universal set of all possible inputs.

According to ROB, the set of possible inputs to the grammar are invariant across languages, and all systematic cross-linguistic variation is attributed entirely to constraint ranking (Prince/Smolensky 1993, Smolensky 1996, Tesar/Smolensky 1996, 1998, 2000). When cast into an actual analysis, this means that a correct output is guaranteed without hinging on any particular input, and in accordance with this concept of ROB, the OT analysis proposed above does not hinge on specific UR's.

However, ROB might pose a serious computation problem on learnability. Since any input must converge on a specific output at hand, learning a grammar, whose basic function is to map an input to an output, may become a burden on the part of a learner. From the viewpoint of learnability, therefore, input or UR must be fixed for a given output. Lexicon Optimization (LO), the basic idea of which is that a proper UR automatically follows from harmonic evaluation germane to OT, comes into play to serve this purpose. In what follows, we will examine how LO deals with the issue of UR raised by the /ɨ/~{ alternation cases.

4.2. Methods of Lexicon Optimization

Let us first consider the original formulation of LO proposed by Prince/Smolensky (1993: 192).

(32) Lexicon Optimization
"Suppose that several different inputs $I_1, I_2, ..., I_n$, when parsed by a grammar G lead to corresponding outputs $O_1, O_2, ..., O_n$, all of which are realized as the same phonetic form ϕ--these inputs are all *phonetically equivalent* with respect to G. Now one of these outputs must be the most harmonic, by virtue of incurring the least significant violation marks: suppose this optimal one is labelled O_k. Then the learner should choose, as the underlying form for ϕ, the input I_k."

According to this definition of LO, the real input is the form whose mapping to the output involves the least significant constraint violations. Note that the prerequisite for LO is that the potential inputs which are subject to evaluation must all converge on the same phonetic form.

To illustrate how LO works, let us take up a hypothetical case where the inputs, /CV/, /V/, and /CVC/, all converge on a phonetic form, [CV], via the outputs, CV, □V, and CV<C>[13].

(33) a. /CV/ → CV →
b. /V/ → □V → [CV]
c. /CVC/ → CV.<C> →

This hypothetical case occurs if markedness constraints such as NOCODA, ONSET outrank faithfulness constraints, DEP-IO and MAX-IO. Given markedness dominating faithfulness, the correct output [CV] is chosen whether its input is posed as /CV/, /V/, or /CVC/.

(34) a. ONSET
Every syllable must have a onset consonant.

b. DEP-IO
Every segments in the output has a correspondent in the input.

(35) MARKEDNESS ≫ FAITHFULNESS

Input: /CV/	NOCODA	ONSET	MAX-IO	DEP-IO
☞ CV				
V		*!	*	
CVC	*!			*

[13] In conformity with Prince/Smolensky's (1993) original version of LO formulated in the Containment model, we make use of output forms such as □V and CV<C>, both of which are phonetically realized as [CV].

	Input: /V/	NoCoda	Onset	Max-IO	Dep-IO
☞	CV				*
	V		*!		
	CVC	*!			**

	Input: /CVC/	NoCoda	Onset	Max-IO	Dep-IO
☞	CV			*	
	V		*!	**	
	CVC	*!			

LO now comes in to compare the optimal mapping in each case, and after evaluation, /CV/, which is identical to the output form, is selected as the 'real' input.

(36) Lexicon Optimization

		NoCoda	Onset	Max-IO	Dep-IO
☞	/CV/ --> [CV]				
	/V/ --> [CV]				*!
	/CVC/ --> [CV]			*!	

If faithfulness constraints dominate markedness constraint, on the other hand, each input maps to an output which is identical to its input. The resulting outputs do not converge on a single phonetic form, and thus the application of LO is not significant.

(37) Faithfulness ≫ Markedness

	Input: /CV/	Max-IO	Dep-IO	NoCoda	Onset
☞	CV				
	V	*!			*
	CVC		*!	*	

	Input: /V/	Max-IO	Dep-IO	NoCoda	Onset
	CV		*!		
☞	V				*
	CVC		*!*	*	

	Input: /CVC/	Max-IO	Dep-IO	NoCoda	Onset
	CV	*!			
	V	*!*			*
☞	CVC			*	

As a whole, then, LO is significant only when multiple inputs map to a single output, and this is possible if markedness constraints outrank

faithfulness constraints. Since markedness constraints are output-based, they are only marginal in performing LO and the deciding factor is rather faithfulness constraints. For this reason, the inputs that are maximally similar to the outputs are selected as the real input forms.

As Inkelas (1995) and Tesar/Smolensky (1996, 2000) pointed out, however, this version of LO encounters a problem when dealing with allomorphy. The UR's representations chosen by LO are all identical to their output forms, and thus, there arises a situation where words in a morphologically related paradigm do not share a morpheme. This is in contradiction to the standard view of UR, which posits a single morpheme for the normal cases of allomorphy. Below, we will illustrate this problem of LO in detail based on Samoan stem-final alternation reported by Zoll (1996).

In Samoan, stem-final consonants appear before a vowel-initial suffix, but are absent in the word-final position.

(38)	underlying	without suffix	V-initial suffix	
	/tanis/	[tani]	[tanis-ia]	'wept'
	/inum/	[inu]	[inum-ia]	'drunk'

This consonant~{ alternation obtains an OT account as follows. The output forms whose word-final consonants are absent, [tani] and [inu], are produced by NOCODA dominating MAX-IO and DEP-IO. In a similar fashion, the examples [tanis-ia] and [inum-ia], where stem-final consonants are maintained before a vowel-initial suffix, are obtained by *VV, which prohibits a sequence of adjacent vowels. This constraint *VV outranks MAX-IO and DEP-IO.

(39) [tani]

	Input: /tanis/	*VV	NOCODA	MAX-IO	DEP-IO
	ta.nis.		*!		
☞	ta.ni.			*	

	Input: /tani/	*VV	NOCODA	MAX-IO	DEP-IO
	ta.nis.		*!		*
☞	ta.ni.				

(40) [tanis-ia]

	Input: /tanis-ia/	*VV	NOCODA	MAX-IO	DEP-IO
☞	ta.ni.sia.				
	ta.ni.ia	*!		*	

	Input: /tani-ia/	*VV	NOCODA	MAX-IO	DEP-IO
☞	ta.ni.sia.				*
	ta.ni.ia	*!			

In both (39) and (40), we have situations where multiple inputs converge on a single output form. LO is now introduced to determine the real input forms, and minimally violated /tani/ and /tanis-ia/ are chosen as the real input forms for [tani] and [tanis-ia], respectively.

(41) Lexicon Optimization

a. [tani]

	*VV	NoCoda	Max-IO	Dep-IO
/tanis/ --> [tani]			*!	
☞ /tani/ --> [tani]				

b. [tanis-ia]

	*VV	NoCoda	Max-IO	Dep-IO
☞ /tanis-ia/ --> [tanisia]				
/tani-ia/ --> [tanisia]				*!

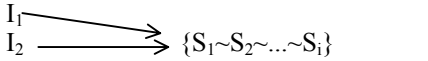
Now we are faced with a problem. The two forms in the output paradigm {[ta.ni]~[ta.ni.sia]} are morphologically related, but their input forms, /tani/ and /tanis-ia/, do not reflect such morphological relation because they do not share a common input.

To handle the problem posed by such allomorphy cases, Inkelas (1995) and Tesar/Smolensky (1996, 2000) propose that LO be performed on a entire paradigm, rather on an individual forms. This version of LO, termed here as Paradigm-level LO following Tesar/Smolensky, is defined below (adopting the alternation-sensitive restatement of LO proposed by Inkelas (1995: 289)).

(42) "Given a grammar *G* and a set of $S=S_1, S_2, ..., Si$ of surface phonetic forms for a morpheme *M*, suppose that there is a set of inputs $I=I_1, I_2, ..., Ii$, each of whose members has a set of surface realizations equivalent to *S*. There is some *Ii I* such that the mapping between *Ii* and the members of *S* is the most harmonic with respect to *G*, i.e. incurs the fewest marks for the highest ranked constraints. The learner should choose *Ii* as the underlying representation for *M*."

According to this version of LO, mapping to the entire allomorphy paradigm, rather than to a single output form, is fundamental for selecting a real input form. The following diagram schematizes the mapping relations in (42), by which it is shown that LO performs on the mapping to the entire paradigm of allomorphy, $\{S_1 \sim S_2 \sim ... \sim S_i\}$.

(43) <u>inputs</u> <u>surface phonetic forms</u>



Now let us consider how Paradigm-level LO applies to the Samoan case. I will first show below how the surface paradigm {[ta.ni]~[ta.ni.s-ia]} is produced from the two competing stem input forms, /tani/ and /tanis/.

(44)

/tani/ - { ia	*VV	NoCoda	Max-IO	Dep-IO
ta.ni ta.ni.-ia	*!			
ta.nis ta.ni.-ia	*!	*		*
☞ ta.ni ta.ni.s-ia				*
ta.nis ta.ni.s-ia		*!		* *

/tanis/ - { ia	*VV	NoCoda	Max-IO	Dep-IO
ta.ni ta.ni.-ia	*!		* *	
ta.nis ta.ni.-ia	*!	*	*	
☞ ta.ni ta.ni.s-ia			*	
ta.nis ta.ni.s-ia		*!		

Now LO applies to determine a real input. Unfortunately, LO in this case is indeterminate because the ranking between Max-IO and Dep-IO is undetermined.

(45) Paradigm-level Lexicon Optimization

		*VV	*Coda	Max	Dep
?	/tani/ - { ia --> ta.ni ta.ni.s-ia				*
?	/tanis/- { ia --> ta.ni ta.ni.s-ia			*	

For a case like this, Inkelas (1995:292), acknowledging Kiparsky (1993), proposed that the best grammar is the most transparent, i.e. deletes the least.

In OT terms, this amounts to saying that, other things being equal, MAX is ranked higher than DEP. Inkelas formulates this idea as the principle of Grammar Optimization[14].

(46) "The optimal grammar is the most transparent, i.e. the one in which alternations are maximally structure-filling (Kiparsky 1993)."

Given this principle of Grammar Optimization, /tani/ is selected as the real input form in the Samoan case.

In summary, the original version of LO proposed by Prince/Smolensky (1993) does not properly deal with the allomorphy cases, because the inputs selected by LO are in most cases identical to the surface forms. To treat the problem, Inkelas (1995) and Tesar/Smolensky (1996, 2000) propose a version of LO that is performed on the allomorphy paradigm, rather than on individual forms. This renewed version of LO is sometimes indeterminate because the grammar itself is indeterminate. For such cases, the principle of Grammar Optimization is introduced to ensure a maximally transparent grammar by ranking MAX higher than DEP.

4.3. /i̶/~{ Alternation and Lexicon Optimization

Now we examine how Paradigm-level LO applies to suffix alternation in Korean. Before we get into this, we need to consider additional constraints such as ONSET, MAX-IO(/i̶/) and DEP-IO(/i̶/) in the constraint hierarchy (28) to effectively deal with the entire paradigm including V-final stem.

(47) a. MAX-IO(/i̶/)
Every /i̶/ in the input has a correspondent in the output.

b. DEP-IO(/i̶/)
Every [i̶] in the output has a correspondent in the input.

As we see below, ONSET must dominate both faithfulness constraints, MAX-IO(/i̶/) and DEP-IO(/i̶/), to correctly exclude /i̶/ after a V-final stem. Further, the suffix patterns after a C-final stem suggest that these faithfulness constraints are dominated by NOCODA.

(48) ONSET ≫ MAX-IO(/i̶/), DEP-IO(/i̶/)

	sa - /l@/	ONSET	FAITH
☞	sa.-l@		

[14] A similar idea is expressed by Hale/Reiss (1988: 9) with the principle of Lexicon Harmony Evaluation Metric, which states that "[a]ll alternations should be handled by the OT equivalent of feature-filling (violation of FILL), not feature-changing (violation of both FILL and PARSE)."

sa.-ɨ.l@	*!	*(DEP)

	sa - /ɨl@/	ONSET	FAITH
☞	sa.-l@		*(MAX)
	sa.-ɨ.l@	*!	

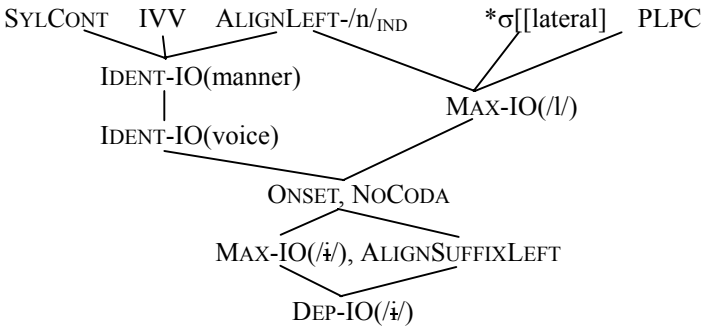
(49) NOCODA ≫ MAX-IO(/ɨ/), DEP-IO(/ɨ/)

	m@k - /l@/	NOCODA	FAITH
	m@k.-l@	*!	
☞	m@.k-ɨ.l@		*(DEP)

	m@k - /ɨl@/	NOCODA	FAITH
	m@k.-l@	*!	*(MAX)
☞	m@.k-ɨ.l@		

Combining this ranking with (28) and with Grammar Optimization (46), we get the following ranking.

(50) Constraint ranking (final)



Based on this ranking, let us consider how Paradigm-level LO applies. First, the constraint tableaux below show how harmonic evaluation is performed on the entire paradigm of non-alternating suffixes. The first tableau is for the input /ta/ and the second tableau for the input /ɨta/.

(51) Non-alternating suffixes: [m@k.-ta] and [sa.-ta]

a. Input: /-ta/

	m@ - /ta/ k sa	SYL CNT	IVV	ID(v)	ONSET	NO CODA	MAX /ɨ/	AL-SUF	DEP /ɨ/
☞	m@k.-ta sa.-da			*		*			

m@k.-ta sa.-ta		*!			*		
m@.k-ɨ.ta sa.-da		*!*	* 			*	*
m@.k-ɨ.da sa.-da		*!	* *			*	*
m@.g-ɨ.da sa.-da			**! *			*	*
m@k.-ta sa.-ɨ.da			* 	*!	*		*
m@.k-ɨ.da sa.-ɨ.da		*!	* *	*		*	* *
m@.g-ɨ.da sa.-ɨ.da			**! *	*		*	* *

b. Input: /-ɨta/

	m@ - /ɨta/ k sa	SYL CNT	IVV	ID(v)	ONSET	NO CODA	MAX /ɨ/	AL-SUF	DEP /ɨ/
☞	m@k.-ta sa.-da			* 		*	* *		
	m@k.-ta sa.-ta		*!			*			
	m@.k-ɨ.ta sa.-da		*!*	* 			* 	*	
	m@.k-ɨ.da sa.-da		*!	* *			* 	*	
	m@.g-ɨ.da sa.-da			**! *			* 	*	
	m@k.-ta sa.-ɨ.da			* 	*!	*	*		
	m@.k-ɨ.da sa.-ɨ.da		*!	* *	*			*	
	m@.g-ɨ.da sa.-ɨ.da			**! *	*			*	

Both inputs converge on a single output paradigm {[m@k-ta]~[sa-da]}, and Paradigm-level LO applies to select /ta/ as the input form.

(52) Paradigm-level LO: non-alternating suffixes

	inputs	*outputs*	SYL CNT	IVV	ID(v)	ONS	NO CODA	MAX /ɨ/	AL-SUF	DEP /ɨ/
☞	/ta/	m@k.-ta sa.-da			* 		*			
	/ɨta/	m@k.-ta sa.-da			* 		*	*! *		

The constraint tableaux for alternating suffixes are as follows. The

optimal output paradigm is identical regardless of its input being /my@/ or /ɨmy@/. Paradigm-level LO comes in to choose /my@/ as the input form.

(53) Alternating suffixes: [m@.g-ɨ.my@] and [sa.-my@]

a. Input: /-my@/

m@ - k /my@/ sa	SYL CNT	IVV	ID(m)	ID(v)	ONS	NO CODA	MAX /ɨ/	DEP /ɨ/
m@k.-my@ sa.-my@	*!					*		
m@N.-my@ sa.-my@			*!			*		
m@.k-ɨ.my@ sa.-my@		*!						*
☞ m@.g-ɨ.my@ sa.-my@				*				*
m@N.-my@ sa.-ɨ.my@			*!		*	*		*
m@.g-ɨ.my@ sa.-ɨ.my@				*	*!			* *

b. Input: /-ɨmy@/

m@ -/ɨ k my@/ sa	SYL CNT	IVV	ID(m)	ID(v)	ONS	NO CODA	MAX /ɨ/	DEP /ɨ/
m@k.-my@ sa.-my@	*!					*	* *	
m@N.-my@ sa.-my@			*!			*	* *	
m@.k-ɨ.my@ sa.-my@		*!					*	
☞ m@.g-ɨ.my@ sa.-my@				*			*	
m@N.-my@ sa.-ɨ.my@			*!		*	*	*	

m@.g- ɨ.my@ sa.-ɨ.my@				*	*!			

(54) Paradigm-level LO: alternating suffixes

	inputs *outputs*	SYL CNT	IVV	ID(m)	ID(v)	ONS	NO CODA	MAX /ɨ/	DEP /ɨ/
☞	/ m@g- my@/ ɨmy@ sa-my@				*				*
	/ɨ m@g- my@/ ɨmy@ sa-my@				*			*!	

Finally, we will examine /l/-final stems such as [no.-ni]. Since the stems show alternation in these cases, we also need to determine the UR for the stems as well as for the suffixes. Thus, there are at least four possible combinations of input forms to consider, /nol, -ni/, /nol, -ɨni/, /no, -ni/, and /no, -ɨni/. In order to explain the stem alternation, we need another faithfulness constraint, DEP-IO(/l/), which seems to be placed quite high on the constraint ranking (because no other phonological phenomena in Korean suggest an epenthesis of /l/). The four constraint tableaux below show how an optimal paradigm is selected from the four different input forms.

(55) /l/-final stems: [no.-ni]and [nol.-my@]

a. Inputs: /nol, -ni/

	/nol/ - /ni/ my@	*σ[[l]	PLPC	DEP /l/	ID(m)	MAX /l/	NO CODA	MAX /ɨ/	DEP /ɨ/
	no.l-ɨ.ni nol.-my@	*!					*		*
	nol.-ni nol.-my@		*!				* *		
	nol.-li nol.-my@				*!		* *		
☞	no.-ni nol.-my@					*	*		
	no.l-ɨ.ni nol.-my@	*!					*		*

b. Inputs: /nol, -ɨni/

	/nol/ - /ɨni/ my@	*σ[[l]	PLPC	DEP /l/	ID(m)	MAX /l/	NO CODA	MAX /ɨ/	DEP /ɨ/
	no.l-ɨ.ni nol.-my@	*!					*		

	nol.-ni nol.-my@		*!				* *	*	
	nol.-li nol.-my@				*!		* *	*	
☞	no.-ni nol.-my@					*	 *	*	
	no.l-i.ni nol.-my@	*!					 *		

c. Inputs: /no, -ni/

/no/ - /ni/ my@	*σ[[l]	PLPC	DEP /l/	ID(m)	MAX /l/	NO CODA	MAX /i/	DEP /i/
no.l-i.ni nol.-my@	*!		* *			 *		*
nol.-ni nol.-my@		*!	* *			* *		
nol.-li nol.-my@			* *!	*		* *		
☞ no.-ni nol.-my@			 *			 *		
no.l-i.ni nol.-my@	*!		* *			 *		*

d. Inputs: /no, -ini/

/nol - /ini/ my@	*σ[[l]	PLPC	DEP /l/	ID(m)	MAX /l/	NO CODA	MAX /i/	DEP /i/
no.l-i.ni nol.-my@	*!		* *			 *		
nol.-ni nol.-my@		*!	* *			* *	*	
nol.-li nol.-my@			* *!	*		* *	*	
☞ no.-ni nol.-my@			 *			 *	*	
no.l-i.ni nol.-my@	*!		* *			 *		

Different inputs all converge on a single output paradigm {[no-ni]~[nol-my@]}, and thus Paradigm-level LO is invoked to determine the real input forms. As seen below, the stem /nol/, and the suffix /ni/ are selected as the input forms.

(56) Paradigm-level LO: /l/-final stems

inputs outputs	*σ[[l]	PLPC	DEP /l/	ID(m)	MAX /l/	NO CODA	MAX /i/	DEP /i/
☞ /nol/ no.-ni /-ni/ nol.-my@					*	 *		

/nol/ no.-ni /-ɨni/ nol.-my@				*	* *	*!	
/no/ no.-ni /-ni/ nol.-my@		*!			* *		
/no/ no.-ni /-ɨni/ nol.-my@		*!			* *	*	

Note that in all the three cases of Paradigm-level LO, the ranking determined by Grammar Optimation between MAX-IO(/ɨ/) and DEP-IO(/ɨ/) plays an important role. Paradigm-level LO can select an input form only after the ranking between these constraints is settled.

For space limitation, we will not consider other suffix patterns. Since MAX-IO(/ɨ/) outranks DEP-IO(/ɨ/), it is somewhat apparent that Paradigm-level LO uniformly select the forms without /ɨ/ as the input forms for all the verbal/adjectival suffixes that we consider in this paper.

(57)	inputs		C-final stems	V-final stems
a.	/-l@/	<purpotive>	m@k-ɨl@, sim-ɨl@	sa-l@
	/-my@/	<conjunctive>	m@k-ɨmy@, sim-ɨmy@	sa-my@
	/-si-/	<honorific>	m@k-ɨsi-, sim-ɨsi-	sa-si-
b.	/-ta/	<pl. ind. ass.>	m@k-ta, sim-ta	sa-ta
c.	/-ni/	<sequential>	m@k-ɨni, sim-ɨni	sa-ni
	/-ni$_{IND}$/	<pl. ind. att.>	m@k-ni, sim-ni	sa-ni

5. Conclusion

In this paper, I have proposed an OT analysis of the patterns exhibited by the verbal and adjectival suffixes in Korean. We categorized the suffixes into three types: alternating, non-alternating, and /n/-initial suffixes. In alternating suffixes, initial /ɨ/ appears after a C-final stem, and it was noted that such alternating suffixes have /l/, /m/, or /s/ as their initial consonants. Alternation being restricted to this position was explained by SYLCONT (8) and NOCODA (12) dominating ALIGNSUFFIXLEFT (7), since the appearance of /ɨ/ incurs a violation of ALIGNSUFFIXLEFT, and the suboptimal forms without /ɨ/ would be prevented by SYLCONT and/or NOCODA.

The non-alternating suffixes are those in which /ɨ/ does not appear after a C-final stem. These suffixes begin with /t/, /k/, or /c/, for which voicing difference is significant. Noting that the suffix forms without /ɨ/ violates NOCODA, and that the incorrect forms in which initial /ɨ/ occurs would mandatorily undergo intervocalic voicing, the non-alternating suffixes obtained an OT analysis utilizing IVV (14a), IDENT-IO(voice) (14b), and NOCODA, ranked in this order (from higher to lower).

The class of /n/-initial suffixes was recognized separately because their behavior is split: some /n/-initial suffixes are alternating, and others non-alternating. We noticed following the traditional literature that the non-alternating /n/-initial suffixes exclusively include the indicative suffix *-nɨ-*

or its allomorph. hat these suffixes do not show alternation is attributed to ALIGNLEFT-N_{IND} (18) outranking NOCODA.

In addition to these three classes of suffix, we have also examined the patterns involving /l/-final stems. In this case, the suffixes are non-alternating and always C-initial, while stem-final /l/ shows alternation with {. Noticing that the occurrence of /ɨ/ would result in a syllable-initial lateral consonant, which is not allowed in Korean, non-alternating suffixes after a /l/-final stem are explained by *σ[[lateral] (22b) dominating NOCODA. Disappearing stem-final /l/ before /n/ or /s/ is directely ascribed to Post-lateral Phonotactic Constraints (26), which outrank MAX-IO(/l/) (22a).

Based on the constraint system thus established, we have investigated the issue of UR for the verbal/adjectival suffixes, which has been quite controversial since generative analysis was introduced to Korean. In standard OT that assumes ROB, UR is determined by LO. The version of LO appropriate for the case at hand is Paradigm-level LO, which is motivated to treat allomorphy. We noted, however, that Paradigm-LO is indeterminate in some cases, where the grammar (i.e. the constraint ranking) itselt is undetermined. We adopted Grammar Optimization, a kind of meta-principle proposed by Inkelas (1995) to fix an indeterminate grammar.

It turned out that Grammar Optimization plays an important role in determining UR's for the verbal/adjectival suffixes. Paradigm-level LO can single out an input form, only after the ranking between MAX-IO(/ɨ/) and DEP-IO(/ɨ/) is decided by Grammar Optimization such that the former dominates the latter. As a result of Paradigm-level LO, the forms without /ɨ/ are selected as inputs throughout the entire set of the verbal/adjectival suffixes.

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