Base-Output Correspondence in Korean Nominal Inflection*

Heejeong Ko

ABSTRACT

This paper discusses various puzzles concerning the phonology of Korean nominal inflection. In particular, I investigate a range of vowel hiatus resolution phenomena that differ between nouns and verbs, the overapplication of consonant cluster simplification and laryngeal feature neutralization in nominal stems, and certain asymmetries between derived nouns and nonderived nouns. After presenting some problems with previous approaches, I offer an analysis of the phonology of Korean nominal inflection in terms of *Base-Output Correspondence* (BOC) Theory, along the lines of Kager (1999). I argue that a variety of unexpected properties of noun phonology in Korean can receive a unified account under the BOC approach. I also show that noun-specific alignment and noun-specific faithfulness constraints are inadequate to capture noun phonology in Korean. My arguments support the view that the fact that nouns have a Base (isolation form) is the key factor in explaining the unique properties of noun phonology (Kenstowicz's (1996) *Base Identity*, in particular). It is shown, however, that the BOC approach overcomes shortcomings with the Base Identity approach by making a necessary distinction between minor and fatal divergence from the Base.

1. INTRODUCTION

In this paper, I revisit various puzzles concerning noun-verb asymmetries in Korean phonology, and provide a new analysis for the peculiar phonology of nouns in Korean by adopting Base-Output Correspondence Theory (Kager 1999).

The phonological behavior of nouns in Korean is interesting in several respects. First, nominal inflection shows underapplication of various phonological processes. Verbal stem-final vowels may undergo phonological processes such as glide formation, /ɨ/ deletion, and coalescence to avoid hiatus in Korean. Nominal stem-final vowels, on the other hand, consistently resist these processes. Second, nominal inflection in Korean can show overapplication of phonological processes. Verbal stem-final consonants do not undergo laryngeal feature neutralization or consonant cluster simplification when followed by a vowel-initial suffix. Nominal-stem final consonants, in contrast, may undergo these processes when followed by a vowel-initial suffix. Third, nouns in derived contexts show different behavior from nouns in nonderived contexts. Nonderived nouns behave much like verbal stems in that they do not show underapplication or overapplication of phonology, which is robustly observed at the stem-affix juncture in derived nouns.

The goal of this paper is twofold. One is to provide a detailed critical review of previous approaches to the privileged status of nouns in Korean phonology. The other is to provide a proper analysis of the phonological complexity of nouns and noun-verb asymmetries in Korean within the Optimality Theory framework (OT: Prince and Smolensky 1993, McCarthy and Prince 1993a,b).

The phonology of nouns has attracted much attention in the literature on Korean phonology. In particular, some researchers argue that nouns show special phonological patterns

because of the requirement that nouns project a prosodic word. We can term this the *Prosodic Approach* which is represented by such works as Yongsung Lee (1999, 2001: Y. Lee, hereafter) and E. Kang (2000, 2001). Other researchers argue that nouns show peculiar behavior due to domain-specific faithfulness. We term this the *Noun Faithfulness Approach* which is represented by Smith (1997) and subsequent works. Still others argue that the complex behavior of nouns is traced to a morphologically related isolation form, the Base: the *Base Identity Approach* of Kenstowicz (1996). All these approaches seem to provide a plausible analysis for certain aspects of nouns in Korean. Crucially, however, the previous analyses do not adequately handle the full range of phenomena previously mentioned concerning the phonology of Korean nominal inflection. Furthermore, the data that each analysis covers do not overlap very much, and thus there has been no serious attempt to compare these competing analyses on the same ground. In this paper, I provide detailed arguments to show that on closer inspection, all the previous analyses have some problems in dealing with the puzzles concerning the noun-verb asymmetries in Korean.

I propose a novel account for the phonology of Korean nouns by adopting Kager's (1999) Base-Output Correspondence (BOC) Theory. Specifically, I argue that the phonological complexity of nouns is tied to the morphological fact that nouns, not verbs, have a free-standing Base (cf. Kenstowicz 1996). Since nouns in Korean have a Base, they are significantly affected by the ranking of Base-output faithfulness constraints. Verbs in Korean, in contrast, have no Base, and thus they are not affected by Base-output faithfulness constraints. Consequently, the rankings of Base-output faithfulness constraints with respect to markedness constraints or input-output faithfulness constraints contribute to underapplication and overapplication of phonology

in nouns, but not in verbs. Nonderived nouns behave like verbal stems because being unaffixed they too cannot be affected by Base-output (affixed form) faithfulness constraints.

My proposal certainly inherits the insight of Kenstowicz's (1996) Base Identity approach concerning the special role of an isolation form in Korean phonology. However, it overcomes some remaining problems with the Base Identity approach. The original formulation of Base Identity requires complete identity between the output and the Base. Thus, it does not distinguish between minor and fatal deviation from the Base systematically (but see section 3.3.2 for discussions). The BOC analysis, on the other hand, evaluates the similarity between the output and the Base with respect to various relations defined in Correspondence Theory (McCarthy and Prince 1995, Kager 1999). Thus, under the BOC approach, the winning candidate may be quite different from the Base, yet be more faithful to the Base than the other losing candidates. In this paper, I show that BOC analysis resolves the puzzles that the previous Base Identity approach could not handle adequately – specifically, the cases in which some alternation from the Base is mandatory due to high ranked markedness constraints in Korean (e.g. intersonorant voicing). I also demonstrate that my proposal provides a unified account for a variety of noun-verb asymmetries in Korean, which have not been feasible under the previous analyses.

The paper is organized as follows. Section 2 illustrates underapplication of hiatus resolution and overapplication of laryngeal feature neutralization and consonant cluster simplification in Korean nominal inflection. Section 3 reviews three representative approaches to the privileged status of nouns in phonology. Section 4 proposes an account of the phonology of nouns and noun-verb asymmetries in Korean by employing Base-Output Correspondence Theory. Section 5 concludes the paper.

2. THE INITIAL PUZZLES: NOUN-VERB ASYMMETRIES IN KOREAN

In this section, I illustrate two long-standing puzzles concerning noun-verb asymmetries in Korean phonology: (i) nouns do not undergo phonological changes that verbs generally undergo to avoid hiatus (*underapplication*). (ii) nouns may undergo phonological processes that are not expected from Korean phonotactics, in contrast to verbs (*overapplication*). Throughout the paper, I will present the data employing the transcriptions given in (1) and (2).[1]

(1) *Inventory of Korean Consonants* (cf. Y. Kang 2003: 222)

p	p^h	p’	t	t^h	t’	k	k^h	k’	
			c	c^h	c’				
			s	s’					h
m			n			ŋ			
			r/l						

(2) *Inventory of Korean Vowels and Glides* (cf. Y. Lee 1993: 3)

y		w	[-syllabic]
i	ɨ	u	[+syllabic]
e (œ)	ə	o	
æ	a		

(NB. circled ones are [+ round]; Vowels in the box are [+back])

2.1 Underapplication of Phonology in Nominal Inflection

In Korean, vowel hiatus frequently arises when a vowel-final stem is followed by a vowel-initial suffix. The hiatus can be resolved by various processes such as glide formation, /ɨ/ deletion, and vowel coalescence (Y. Lee 1993). A noun-verb asymmetry is consistently observed in the hiatus resolution processes – particularly, in a stem-final position (cf. section 3.2.2 for hiatus resolution processes in nonderived contexts).

Starting with glide formation, consider the verbal stems in (3) and the nominal stems in (4). When a stem ending with a high front vowel /i/ or a round vowel /u, o/ is followed by a vowel-initial suffix, the stem-final vowel is optionally turned into a glide: (3a).[2] Glide formation is obligatory if the output without glide formation yields two consecutive onsetless syllables: (3b). Crucially, however, glide formation is not applicable to a nominal stem-final vowel: (4) (E.-J. Han 1990, Y. Lee 1993, 1997, 1999, 2001, O. Kang 1999a,b, E. Kang 2000, M. Lee 2001, among others).

(3) *Glide formation in verbal stems (Vstems)*

a. *Optional glide formation in Vstems*

/kali + ə/	ka.ri.ə	~	ka.ryə	'to cover + and'
/sumki + ə/	sum.gi.ə	~	sum.gyə	'to hide + and'
/nanu + ə/	na.nu.ə	~	na.nwə	'to share + and'
/talu + ə/	ta.ru.ə	~	ta.rwə	'to deal + and'

b. *Obligatory glide formation in Vstems*

/o + a/	*o.a	wa	'to come + and'
/seu + ə/	*se.u.ə	se.wə	'to erect + and'
/meu + ə/	*me.u.ə	me.wə	'to fill + and'

(4) *Absence of glide formation in nominal stems (Nstems)*

/tali + esə/	ta.ri.e.sə	*ta.rye.sə	'bridge + on'
/məli + e/	mə.ri.e	*mə.rye	'head + on'
/nuku + eke/	nu.gu.e.ge	*nu.gwe.ge	'who + to'

A noun-verb asymmetry is also observed in the /ɨ/ deletion processes in Korean. As described in (5), Vstem-final /ɨ/ is obligatorily deleted when followed by a vowel-initial suffix.[3] Nstem-final /ɨ/, on the other hand, is not deleted before a vowel-initial suffix, as shown in (6) (Kim-Renaud 1982, Y. Lee 1993, 2001, B.-G. Lee 1996, E. Kang 2000, 2001, M. Lee 2001, among others).

(5) *Obligatory stem-final /ɨ/ deletion in Vstems*

/kənnɨ + ə/	*kən.nɨ.ə	kən.nə	'to cross + and'
/pap'ɨ + ə/	*pa.p'ɨ.ə	pa.p'ə	'to be busy + and'
/kip'ɨ + ə/	*ki.p'ɨ.ə	ki.p'ə	'to be happy + and'
/kʰɨ + ə/	*kʰɨ.ə	kʰə	'to be tall + and'

(6) *Absence of stem-final /ɨ/ deletion in Nstems*

/kɨ + eke/	kɨ.e.ge	*ke.ge	'him + to'
/pəsɨ + esə/	pə.sɨ.e.sə	*pə.se.sə	'bus + in'
/milkɨ + e/	mil.kɨ.e	*mil.ke	'milk + in'

The vowel coalescence process in Korean again shows a noun-verb asymmetry: a Vstem-final vowel may optionally undergo coalescence with a suffix-vowel, whereas an Nstem-final vowel cannot. Specifically, when a nonhigh (nonfront) vowel /ə, o, a/ in Vstem-final position is followed by a suffix starting with the high front vowel /i/, coalescence occurs: (7).[4] By contrast, an N-stem final vowel never undergoes coalescence with /i/ in suffix-initial position: (8) (see Kim-Renaud 1974, 1982, S.-C. Ahn 1985, H.-S. Sohn 1987, D.-J. Lee 1989, Y. Lee 1993, B.-G. Lee 1996, E. Kang 2000, among many others; see also table (45) in section 4.2, which presents the overall picture including hiatus resolution processes in nonderived nouns).[5]

(7) *Vowel coalescence in Vstems*

/po + i + ta/	po.i.da	~	pœ.da	'to see + Cau + Dec'
/c^{h}a + i + ta/	c^{h}a.i.da	~	c^{h}æ.da	'to kick + Pass + Dec'
cf. /sə + i + u + ta/	*sə.i.u.da		se.u.da	'to stand + Cau$_1$+Cau$_2$+ Dec'

(8) *Absence of vowel coalescence in Nstems*

/co + ita/	co.i.da	*cœ.da	'millet + to be'
/c^{h}a + ita/	c^{h}a.i.da	*c^{h}æ.da	'car + to be'

The data in (3)-(8) show that in nominal forms, a stem-final vowel resists hiatus resolution processes, contrary to what is found with verbal forms having the same vowel hiatus sequences. In the following section, I present data showing that a nominal stem-final consonant can undergo processes such as *Laryngeal Feature Neutralization* (LFN) and *Consonant Cluster Simplification* (CCS), contrary to verbal stem-final consonants.

2.2 Overapplication of Phonology in Nominal Inflection

Korean has a three-way laryngeal contrast among plain, aspirated, and tense stops. Laryngeal contrasts among obstruents are neutralized in coda position. Thus, when an aspirated or tensed stop is not followed by a vowel (i.e. when syllabified in coda position), the obstruent surfaces as a plain stop. Some examples from verbal forms are given in (9). (The data in (9) additionally show that Korean intervocalic plain stops are voiced, and that a plain consonant preceded by an obstruent consonant is tensified (Kim-Renaud 1974, Cho and Inkelas 1994)).

(9) *Laryngeal Feature Neutralization in Vstems*

a. *When a tense/aspirated stop is syllabified in onset position:*

/kip^{h}+ ə/	ki.p^{h}ə	*ki.bə	'to be deep + and'
/pæt^{h} + ɨl/	pæ.t^{h}ɨl	*pæ.tɨl	'to spit + RCM'
/k'ak'+ ə/	k'a.k'ə	*k'a.gə	'to cut + and'
/nak'+ a/	na.k'a	*na.ga	'to raise (a fishing line) + and'

b. *When a tense/aspirated stop is syllabified in code position:*

/kip^{h}+ ta/	*kip^{h}.t'a	kip.t'a	'to be deep + Dec'
/pæt^{h} + ci/	*pæt^{h}.ci	pæt.c'i	'to spit + Q'

/k'ak'+ ta/	*kak'.ta	kak.t'a	'to cut + Dec'
/nak'+ ta/	*nak'.ta	nak.t'a	'to raise (a fishing line) + Dec'

Notice crucially that in (9a), the laryngeal feature of a Vstem-final obstruent is not neutralized when it is immediately followed by a vowel-initial suffix. That is, when syllabified in onset position, obstruents *must* preserve their laryngeal feature contrast. Interestingly, however, this generalization does not hold in nominal inflection.

An Nstem-final consonant may optionally undergo LFN when followed by a vowel-initial suffix, in contrast to verbal forms (E. Kang 2000). Some examples are given in (10).

(10) *Overapplication of laryngeal feature neutralization in Nstems* [6]

/sup^h + i/	su.p^{h}i	~	su.bi	'forest + Nom'
/cip^h + ɨl/	ci.p^{h}ɨl	~	ci.bɨl	'straw + Nom'
/mulɨp^h + e/	mu.lɨ.p^{h}e	~	mu.lɨ.be	'knee + in'
/puək^h+ ɨn/	pu.ə.k^{h}ɨn	~	pu.ə.gɨn	'kitchen + Top'

The CCS pattern in Korean demonstrates a similar noun-verb asymmetry as the LFN processes seen in (9)-(10). In Korean, consonantal sequences are simplified in coda position, where either the first or the second member of the cluster deletes (Kim-Renaud 1974, B.-G. Lee 1979, Whitman 1985, Y.-M.Y.Cho 1990, Iverson and Lee 1995, J. Jun 1998, among many others). The list of clusters that undergo simplification in coda position is given in (11).

(11) *List of Consonant Clusters in Korean* (Y. Lee 1993)

a.	ps	ls	ks	nc	lth	lh	nh
b.	lk	lp	lph	(lm)			

As described by Y. Lee (1993), when the clusters listed in (11a) are simplified, the second consonant of the cluster deletes. The result of CCS for the clusters in (11b) varies from dialect to dialect, however: roughly, in the standard Seoul dialect, the first consonant of the cluster deletes, but the second one deletes in the Kyungsang dialect except for the /lm/ cluster. As for the /lm/ cluster in coda position, /l/ deletes both in the Seoul and Kyungsang dialects (see B.-G. Lee 1979, Whitman 1985, Y.-M. Y.Cho 1990, T. Cho 1999 for dialectal variation of CCS).

Some verbal forms showing CCS are given in (12). When a consonant cluster is followed by a vowel-initial suffix (/C_1C_2 + V/), the second consonant (C_2) is syllabified in onset position (C_1.C_2V). Thus, in (12a), both consonants of the stem final cluster surface. By contrast, when a cluster is followed by a consonant-initial suffix, one of the consonants in the stem must delete to meet the phonotactic condition that complex coda is not allowed in Korean ((/(C_1)VC_2C_3 + C_4V/ => [(C_1)VC_2.C_4V] or [(C_1)VC_3.C_4V]). Thus, in (12b), only one consonant of the cluster in the stem-final position surfaces.

(12) *Consonant cluster simplification in Vstems*

a. *When a consonant cluster is followed by a vowel-initial suffix:*

/əps + i/	əp.s'i	*ə.bi	'to be absent + AVL'
/kɨlk + ə/	kɨl.g ə	*kɨ.gə	'to scratch + and'
/sa:lm + a/	sa:l.ma	*sa:.ma	'to boil + and'

b. *When a consonant cluster is followed by a consonant-initial suffix:*

/əps + ta/	*əps.t'a	əp.t'a	'not to exist + Dec'
/kɨlk + ni/	*kɨlg. ni	kɨk.ni	'to scratch + Q'
/sa:lm + ci/	*sa:lm.c'i	sa:m.c'i	'to boil + Q'

Notice that in (12a), CCS does not occur when the verbal stem-final cluster is followed by a vowel-initial suffix. This sharply contrasts with nominal forms. A stem-final consonant cluster in a noun may optionally undergo simplification even when followed by a vowel-initial suffix: particularly, in casual speech or in the speech of the younger generation (Kenstowicz 1996, Y. Lee 1999, 2001, E. Kang 2000, among others). Some examples for this are given in (13). (For clarification, the optional intervocalic CCS seen in (13) is never observed in verbal conjugation even in casual or the younger generation's speech.)

(13) *Overapplication of consonant cluster simplification in Nstems*

/kaps + i/	kap.s'i	~	ka.bi	'price + Nom'
/hɨlk + ɨn/	hɨl.gɨn	~	hɨ.gɨn	'soil + Top'
/sa:lm + e/	sa:l.me	~	sa:.me	'life + Nom'

In this section, we have seen two intriguing aspects of phonology with Korean nominal inflection. First, the final vowel of an Nstem remains unaffected by hiatus resolution even though the context should force it to occur. Second, consonant simplification processes such as LFN and CCS optionally occurs in an Nstem though the context does not require it to occur. The underapplication and overapplication effects witnessed by nominal stems indicate that such stems have a privileged status in phonology. In the next section, I review three representative approaches to these phenomena and discuss some conceptual and empirical problems with them.

3. PREVIOUS APPROACHES: PROBLEMS REMAINED

The mere existence of the noun-verb asymmetries presented above posed a problem to the rule-based framework (E. Kang 2000, Y. Lee 2001 for discussions). Under the rule-based system,

nouns and verbs are in principle treated uniformly in phonology. Thus, most discussion simply marks nominal forms as an exception to the general phonological alternation, or stipulated special conventions for nominal forms (Kim-Renaud 1982, Y. Lee 1993, among others).[7]

In this section, I critically review three recent proposals for noun-verb asymmetries developed under the Optimality Theory framework (OT: Prince and Smolensky 1993, McCarthy and Prince 1993a,b): namely, *the Prosodic Approach* (section 3.1), *the Noun Faithfulness Approach* (section 3.2), and *the Base Identity Approach* (section 3.3). I argue that these OT-approaches may overcome some of the problems with the rule-based approaches; yet, they fail to capture a host of data regarding the privileged status of noun in Korean phonology.

3.1 The Prosodic Approach

3.1.1 Insight: Alignment matters

Capitalizing on the suggestion that an Nstem in Korean projects a Prosodic Word (Prwd) (O. Kang 1992, E.-J. Han 1993, M. Oh 1995, among others), Y. Lee (1999, 2001) and E. Kang (2000, 2001) (independently) argue that an alignment constraint targeting an Nstem is responsible for the noun-verb asymmetry in Korean phonology. I call this line of approach *the Prosodic approach*. The presentation of the Prosodic approach is drawn here from Y. Lee (1999, 2001) (see notes 8, 13, and 15 for E. Kang's (2000, 2001) analysis).

Y. Lee argues that an Nstem projects a Prwd (N=PRWD in (14a)) and that alignment between a prosodic word and a syllable boundary is forced by ALIGN-PRWD in (14b). Y. Lee further argues that if we assume that ALIGN-PRWD is ranked over some markedness constraints (militating against hiatus), underapplication of phonology in Korean nouns is explained. The crucial rankings for Y. Lee are given in (15).[8]

(14) *Key constraints in the Prosodic Approach* (Y. Lee 2001; abbreviations are mine)

a. N=PRWD (Prince and Smolensky 1993)

A morphological category 'noun' is a lexical prosodic word.

(A noun contains at least one foot)

b. ALIGN (PRWD, R, σ, R): ALIGN-PRWD (cf. McCarthy and Prince 1993a)

The right edge of a prosodic word coincides with the right edge of a syllable.

c. ONSET (Itô 1989, Prince and Smolensky 1993, among many others)

Syllables must have an onset.

d. MAX-μ (Kager 1999, among others)

Input moras must have their correspondence in the output. (No deletion of moras)

e. NOCPLX(ONS) (*COMPLEXONS) (Kager 1999, among many others)

Complex onsets are not allowed.

(15) *Crucial Rankings* (Y. Lee 2001: 383; notations are mine)[9]

N=PRWD, ALIGN-PRWD >> ONSET ~ *COMPLEXONS >> MAX-μ

Let us now reconsider glide formation. The rankings in (15) capture the noun-verb asymmetry in glide formation as follows: glide formation is driven by the desire to avoid onsetless syllables (ONSET >> MAX-μ). Glide formation of an Nstem-final vowel, however, always results in violation of ALIGN-PRWD. If the Nstem-final vowel becomes a glide, the right edge of Nstem does not coincide with a syllable boundary (e.g. $/(C_1)V_1C_2\ i]_{Nstem}+V_3/$ => $[(C_1)V_1C_2.G]V_3]$). Thus, if we assume that N=PRWD and ALIGN-PRWD outrank ONSET, glide formation is blocked in Nstem-final position.

As noted by Y. Lee (2001: fn.6), this approach crucially assumes that V=PRWD is ranked lower than NOSTRUC (PRWD) in Korean that penalizes structuring of prosodic wordhood in

verbal stems. Otherwise, V=PRWD may block glide formation in Vstems as well, contrary to the facts.[10] Relevant tableaux are given in (16) for optional glide formation in verbs and in (17) for obligatory glide formation in verbs and in (18) for absence of glide formation in nouns.

(16) *Optional glide formation in verbs* (Y. Lee 2001: 383)[11]

A. /kali + ə/	N=PRWD	ALIGN-PRWD	*COMPLEXONS	ONSET	MAX-μ
☞a. ka.ri. ə				*	
b. ka.ryə			*!		*
B. /kali + ə/	**N=PRWD**	**ALIGN-PRWD**	**ONSET**	***COMPLEXONS**	**MAX-μ**
a. ka.ri. ə			*!		
☞b. ka.ryə				*	*

(17) *Obligatory glide formation in verbs* (Y. Lee 2001: 384)

A. /seu + ə/	N=PRWD	ALIGN-PRWD	*COMPLEXONS	ONSET	MAX-μ
a. se.u. ə				**!	
☞b. se.wə					*
B. /seu + ə/	**N=PRWD**	**ALIGN-PRWD**	**ONSET**	***COMPLEXONS**	**MAX-μ**
a. se.u. ə			**!		
☞b. se.wə					*

In (16), free ranking variation between ONSET and *COMPLEXONS results in the variation of two outputs: [ka.ri.ə] in (16Aa) and [ka.ryə] in (16Bb). In (17), ranking variation between ONSET and *COMPLEXONS yields the same optimal output: [se.wə]. In (16) and (17), neither N=PRWD

nor ALING=PRWD plays a role in selecting the output because verbs do not (have to) project a Prwd boundary. This contrasts with nominal forms presented in (18).

(18) *Absence of glide formation in nouns* (Y. Lee 2001: 384)

A. /məli + e/	N=PRWD	ALIGN-PRWD	*COMPLEXONS	ONSET	MAX-μ
☞a. mə.ri.]e				*	
b. mə.ry]e		*!	*		*
c. mə.rye]	*!		*		*
B. / məli + ə/	**N=PRWD**	**ALIGN-PRWD**	**ONSET**	***COMPLEXONS**	**MAX-μ**
☞a. mə.ri.]e			*		
b. mə.ry]e		*!		*	*
c. mə.rye]	*!			*	*

In (18), N=PRWD penalizes the candidates that do not project a Prwd, so [mə.rye] is eliminated. ALIGN-PRWD eliminates the candidate with glide formation, [mə.ry]e], where the right edge of the Prwd (Nstem) boundary does not coincide with a syllable boundary. Assuming that ALIGN-PRWD outranks ONSET, the candidate without glide formation, [mə.ri.]e], wins.

The Prosodic analysis for glide formation extends to the noun-verb asymmetry in stem-final /ɨ/ deletion presented in (5)-(6). Schematically, if the Nstem-final /ɨ/ is deleted, ALIGN-PRWD is violated because an Nstem(-final) consonant is syllabified in onset position of a syllable with a suffix-vowel (e.g. $/(C_1)V_1C_2ɨ]_{Nstem} + V_3/ \Rightarrow [(C_1)V_1.C_2]V_3])$. Thus, if we assume that ALIGN-PRWD outranks ONSET, candidates with Nstem-final /ɨ/ deletion always lose; this in turn

implies that a candidate without /ɨ/ deletion must win in nominal forms. Verbal stems, on the other hand, do not (have to) project a Prwd because V=PRWD is assumed to be ranked low (N=PRWD>>NOSTRUC(PRWD)>>V=PRWD). Thus, verbal stems obligatorily undergo stem-final /ɨ/ deletion to avoid hiatus (ONSET >>MAX-μ) (see Y. Lee 2001 for details).

3.1.2 Problems with the Prosodic approach

The Prosodic approach argues that alignment between an Nstem (Prwd) and a syllable derives the privileged status of nouns in phonology. In what follows, however, I show that there are in fact other aspects of noun phonology that cannot be reduced to the alignment between an Nstem and a syllable boundary. The Prosodic approach is insufficient to explain such cases. Consider first the vowel coalescence processes discussed in (7)-(8) (repeated here as (19) and (20)).

(19) *Vowel coalescence in verbal stems*

/po + i + ta/	po.i.da	~	pœ.da	'to see + Cau + Dec'
/c^{h}a + i + ta/	c^{h}a.i.da	~	c^{h}æ.da	'to kick + Pass + Dec'

(20) *Absence of vowel coalescence in nominal stems*

/co + ita/	co.i.da	*cœ.da	'millet + to be'
/c^{h}a + ita/	c^{h}a.i.da	*c^{h}æ.da	'car + to be'

ALIGN-PRWD penalizes misalignment between an Nstem and a syllable, so it may be responsible for the absence of vowel deletion in Nstem-final position (e.g. glide formation, /ɨ/ deletion). ALIGN-PRWD, however, does not penalize changes in quality or quantity of a vowel in Nstems. Specifically, since ALIGN-PRWD is a constraint about prosodic structure, it has no

bearings on changes of features in an Nstem-final vowel. Thus, if the noun-verb asymmetry in Korean must be traced to ALIGN-PRWD, we predict that there would be no noun-verb asymmetry in the context where alignment between an Nstem and a syllable boundary is not at stake. The vowel coalescence processes described in (19)-(20), however, show that this prediction is not upheld. The feature content of the Nstem-final vowels in (20) is protected at the expense of hiatus (cf. (19)), yet the underapplication of coalescence process has nothing to do with (mis)alignment between an Nstem and a syllable. That is, ALIGN-PRWD does not militate against coalescence since change in vowel quality due to coalescence does not result in misalignment.

The tableaux in (23) and (24) illustrate the point more concretely. The tableau (23) is given for vowel coalescence in a verbal form, and (24) is for a nominal form. Following B.-G. Lee (1996), I assume that UNIFORMITY in (21) is responsible for blocking vowel coalescence in Korean (cf. E. Kang 2000).[12]

(21) UNIFORMITY = No Coalescence (McCarthy and Prince 1995)

No element of the S_2 (in the output) has multiple correspondents in S_1 (in the input).

(22) *Crucial Ranking*

N=PRWD, ALIGN-PRWD >> ONSET ~ UNIFORMITY

(23) /po + i + ta/ → [po.i.da] ~ [pœ.da] V. 'to see + Cau + Dec'

A. /po + i + ta/	N=PRWD	ALIGN-PRWD	ONSET	UNIFORMITY
a. po.i.da			*!	
☞ b. pœ.da				*
B. /po + i + ta/	**N=PRWD**	**ALIGN-PRWD**	**UNIFORMITY**	**ONSET**
☞ a. po.i.da				*
b. pœ.da			*!	

(24) /co+ ita/ → [co.i.da] N. ‘millet rice’ + ‘to be’

A. /co$_N$ + ita/	N=PRWD	ALIGN-PRWD	ONSET	UNIFORMITY
a. co.]i.da			*!	
💣b. **cœ.]da**				*
B. /co$_N$ + ita/	**N=PRWD**	**ALIGN-PRWD**	**UNIFORMITY**	**ONSET**
☞ a. co.]i.da				*
b. cœ.]da			*!	

(‘💣‘ indicates a wrong winner)

As shown in (23), verbs do not project a Prwd, thus are immune to ALIGN-PRWD. Due to free-ranking between ONSET and UNIFORMITY, we obtain optional coalescence in (23): [pœ.da] ~ [po.i.da]. Turning to the nominal form in (24), note that the candidate with coalescence **[cœ.]da]** in (24A) does not violate ALIGN-PRWD because change of vowel quality does not yield misalignment. Thus, we wrongly expect that the nominal form /co + ita/ in (24) would undergo optional coalescence **[cœ.]da]** ~ [co.i.da], just like the verbal form /po + i + ta / in (23).[13] Thus, the absence of vowel coalescence in nouns remains a mystery under the Prosodic approach.[14]

The Prosodic approach also faces challenges in dealing with overapplication of laryngeal feature neutralization (9)-(10) and consonant cluster simplification (12)-(13). Consider (25) for example.

(25) a. /sup^h + i/ su.p^h]i su.b]i (LFN) N. ‘forest + Nom’

b. /kaps + i / kap.s’]i ka.b]i (CCS) N. ‘price + Nom’

Alignment between an Nstem and a syllable has nothing to do with CCS and LFN in (25). In (25a), both [su.p^{h}]i] and [su.b]i] violate ALIGN-PRWD. In (25b), both [kap.s']i] and [ka.b]i] violate ALIGN-PRWD. Hence, overapplication of LFN and CCS in Nstems cannot be derived from ALIGN-PRWD, which significantly weakens the claim that the peculiar phonology of nouns in Korean follows from alignment constraints (cf. E. Kang 2000).[15]

Y. Lee (2001) adopts Sympathy Theory (cf. McCarthy 1999, 2003) to accommodate overapplication of CCS in nouns.[16] Sympathy Theory may describe the data, but as far as I can see, there is no explanatory power to predict the overapplication of CCS from an independent principle. Furthermore, under the Sympathy/Prosodic approach, underapplication of vowel reduction and overapplication of CCS and LFN receive completely different accounts: one based on prosodic structure (alignment) and another based on certain leveling (Sympathy) (and vowel coalescence would require yet another different account). An alternative approach that can provide a unified account for the various aspects of nouns in Korean phonology then would be preferred to the Sympathy/Prosodic account. (I argue that there is in fact such an alternative theory, as will be discussed in section 4).

In summary, the Prosodic approach may account for some data concerning noun-verb asymmetries in Korean with reference to alignment between an Nstem and a syllable. However, it faces nontrivial problems in explaining a host of other aspects of nouns in Korean phonology, which has little to do with prosodic structuring of Nstems – particularly, underapplication of vowel coalescence and overappplication of LFN and CCS. To the extent that the Prosodic approach incorporates additional machinery to explain the phonology of nominal forms mentioned above, it weakens the validity of the claim that alignment derives the peculiarity of nouns in Korean phonology.

3.2 The Noun Faithfulness Approach

3.2.1 Smith (1997, 1999): Noun faithfulness constraints

It has been well documented that nouns tend to preserve more phonological contrasts than other grammatical categories in many languages (Harris 1969 for Spanish; McCarthy and Prince 1990 for Arabic; Feinstein 1979, Letterman 1997, Keer 1996 for Sinhala, among others). Capitalizing on this observation, Smith (1997, 1999) proposes that nouns have special phonological privileges because the universal constraint set contains *Noun-Faithfulness Constraints.*

Specifically, noun-faithfulness constraints are domain-specific positional faithfulness constraints for which the relevant domain is the category 'noun' (see Beckman 1997, 1998 for general discussions of positional faithfulness constraints). Smith argues that in a language where noun-faithfulness constraints are ranked high in the hierarchy, nouns can license phonological contrasts that other grammatical categories cannot. The general ranking schema capturing this insight is given in (26).

(26) NF (Noun Faithfulness) >> M (Markedness) >> F (Faithfulness)

From M >> F, we predict that some phonological changes may generally occur to satisfy markedness constraints. From NF >> F, we predict that general phonological alternations would not occur in nouns because noun-faithfulness constraints punish alternations in nouns. I call this line of approach the *Noun-Faithful Approach* (NF approach).

As Smith (1999) shows, the NF approach captures special accentual patterns of nouns in Fukuoka Japanese (see also Smith (1997) for evidence for NF from other languages). In Fukuoka Japanese, the location of accent in nouns is lexically contrastive and unpredictable. In verbs and adjectives, however, the accent must appear on the head of the syllable containing the

penultimate mora. Examples in Fukuoka Japanese are given in (27)-(28). (I follow Smith's use of a primary stress mark over a vowel rather than * to indicate accent location.)

(27) *Nouns: accents are lexically contrastive* (Smith 1999)

a. *Unaccented nouns*: *nouns do not have to be accented.*

atama	'head'
tentaibooenkyo	'telescope'

b. *Accented nouns*: *location of accents is not predictable.*

inóti	'life'
ookamí	'wolf'

(28) *Verbs and adjectives*: *obligatory penultimate accent* (Smith 1999)

a.

káku	'write'
káita	'wrote'
kakán	'does not write'

b.

akáka ~ akái	'(is) red'
akakátta	'was red'
akakaróo	'(is) probably red'

Given the ranking NF >> M, nouns must preserve the location of accent given in the input. Thus, we correctly expect that the location of accent in nouns is lexically contrastive and unpredictable, as in (27). Verbs and adjectives, on the other hand, are not affected by NF. Thus, the ranking M >> F may force the penultimate accent pattern on verbs and adjectives, as in (28).

3.2.2 Noun Faithfulness approach to Korean?

We have seen that the NF approach may explain special status of nouns in some phonological domain. This raises a question as to whether the noun-verb asymmetry in Korean can also be explained by the NF approach. In what follows, I demonstrate that the NF approach does not extend to Korean, and in fact makes a wrong prediction in certain cases.

Consider again the ranking schema in (26) in light of Korean noun phonology:

(29) NF (Noun Faithfulness) >> ONSET >> F (Faithfulness)

In order to satisfy the high ranked NF in (29), a vowel in a noun can neither delete, nor change its quantity or quality. Thus, (29) predicts that hiatus resolution would not occur in Korean nouns (unlike verbs). In this respect, the NF approach seems to overcome some problems with the Prosodic approach: not only vowel deletion (e.g. glide formation, stem-final /ɨ/ deletion), but also vowel alternation (e.g. coalescence, shortening) is disallowed in nouns.

The NF approach, however, faces a serious challenge when we consider "nonderived" nouns in Korean. In particular, NF is too powerful to the extent that it wrongly blocks necessary phonological alternations in nouns. NF constraints punish phonological changes in nouns regardless of the context of the relevant change. Hence, the NF approach predicts that hiatus resolution would be blocked *across-the-board* in nouns whether the relevant vowel is located in the edge of Nstem or in the middle of Nstem. However, this is not the case.

Hiatus resolution is indeed observed in nouns in nonderived contexts. Specifically, /ɨ/ deletion, glide formation, and coalescence may optionally apply to nouns when the trigger and target vowel are both properly included in an Nstem (Y. Lee 1993, 1999, 2001, B.-G. Lee 1996, E. Kang 2000, 2001, M. Lee 2001, among others). Some examples are given in (30)-(32). (The

vowel reduction processes in (30)-(32) are accompanied by compensatory lengthening (cf. Hayes 1989). Compensatory lengthening is observed only in the first syllable in Korean (Y. Lee 1993) because Korean allows a long vowel only in the first syllable (Kenstowicz and Sohn 2001).)

(30) *Nonderived Nouns: optional /ɨ/ deletion*

/maɨm/	ma.ɨm	~	ma:m	'heart'
/kaɨl/	ka.ɨl	~	ka:l	'autumn'
/yotaɨm/	yo.da.ɨm	~	yo.dam	'next'

(31) *Nonderived Nouns: optional glide formation*

/muət/	mu.ət	~	mwə:t	'what'
/nue/	nu.e	~	nwe:	'a silkworm'
/tuəm/	tu.əm	~	twə:m	'manure'

(32) *Nonderived Nouns: optional coalescence*[17]

/sai/	sa.i	~	sæ:	'gap'
/sanai/	sa.nai	~	sa.næ	'guy'
/səi/	sə.i	~	se:	'three'

If we resort to the ranking NF >> M >> F to explain underapplication of hiatus resolution in Nstem-final position, we would expect no hiatus resolution in nonderived nouns as well, contrary to the facts in (30)-(32). The tableaux in (33)-(34) illustrate this point more concretely. Tableau (33) shows a derived environment while (34) shows a nonderived one.

(33) /milkɨ + e/ → [mil.kɨ.e] 'milk + in'

/milkɨ + e/	NF	ONSET	F
☞ a. mil.kɨ.e		*	
b. mil.ke	*!		*

(34) /maɨm/ → [ma.ɨm] ~ [ma:m] 'heart'

('☹' indicates a losing candidate that could be a winner in the actual speech)

/maɨm/	NF	ONSET	F
☞ a. ma.ɨm		*	
☹ b. ma:m	*!		*

In (33), NF must outrank ONSET to prevent /ɨ/ deletion in /milkɨ + e/. This ranking argument (NF>> ONSET), however, makes a wrong prediction in (34). Since NF eliminates the candidate with /ɨ/ deletion, [ma:m] in (34b), we cannot obtain the variation between [ma.ɨm] and [ma:m] in (34), contrary to the fact.

In addition to the problems with nonderived nouns, the NF approach fails to explain the overapplication of LFN and CCS discussed in section 2.2. In particular, NF does not explain why nouns may undergo *more* modification than verbs in certain cases. To explain overapplication of CCS and LFN under the NF approach, we need to assume the ranking 'Faithfulness >> Markedness >> Noun Faithfulness', which directly contradicts the basic tenet of Smith (1997, 1999) that noun-faithfulness constraints must outrank general faithfulness constraints.[18]

3.3 The Base Identity Approach

3.3.1 Kenstowicz (1996): Isolation form and Base Identity in nouns

In Korean, nominal stems have a free-standing isolation form that can be pronounced without being supported by a suffix. Isolation forms are observed when nouns are used in their citation forms or when nouns are pronounced without a Case-marker. Verbal stems, in contrast, do not have an isolation form and must be supported by some suffix (e.g. *ta* 'declarative', *ni* 'question particle', *-ə/-a* 'and'). Some examples are given in (35) and (36).

(35) *Nouns: isolation forms exist*

a.	/kaps/	kap			N.	'price'
	/sup^{h}/	sup			N.	'forest'
	/məli/	mə.ri			N.	'head'
b.	/kaps + i/	kap.s'i	~	ka.bi	N.	'price + Nom'
	/sup^{h} + i/	su.p^{h}i	~	su.bi	N.	'forest + Nom'
	/məli + ka/	mə.ri.ga			N.	'head + Nom'

(36) *Verbs: isolation forms do not exist*

a.	/əps/	*əp	V.	'not to exist'
	/kip^{h}/	*kip	V.	'to be deep'
	/mək/	*mək	V.	'to eat'
b.	/əps + i/	əp.s'i	V.	'not exist + AVL'
	/kip^{h}+ ta/	kip.t'a	V.	'to be deep + Dec'

/mək + ni/ məŋ.ni V. 'to eat + Q'

Capitalizing on the noun-verb asymmetry in (35) and (36), Kenstowicz (1996) proposes that the complexity of Korean noun phonology can be derived from the fact that nouns have an isolation form. Specifically, Kenstowicz employs *Base Identity* (37) to implement this insight. I will call this line of approach *the Base Identity Approach*. (See Benua 1995, Flemming 1995, McCarthy 1995, Burzio 1996, Steriade 2000, among others, for similar proposals.)

(37) *Base Identity* (Kenstowicz 1996)

Given an input structure [X Y], output candidates are evaluated for how well they match [X] and [Y] if the latter occur as independent words (i.e. *Bases*).

Base Identity in (37) evaluates candidates in terms of their similarity to the morphologically related isolation form, *Base*. Korean Nstems have an isolation form, thus are crucially affected by (37). Korean Vstems lack an isolation form, thus are not affected by (37).

In particular, Kenstowicz (1996) argues that Base Identity captures overapplication of CCS in Korean nouns. (Kenstowicz (1996) does not discuss underapplication of hiatus resolution processes in nouns, and assumes that overapplication of LFN in Korean nouns does not occur (cf. (10)). Take /kaps + i/ in (35) and /əps + i/ in (36) for example. The tableaux in (39)-(40) are provided to illustrate the relevant data under the Base Identity approach.

(38) MAX-IO-C (McCarthy and Prince 1995)

A consonant in the input has a correspondent in the output.

(39) /kaps + i/ → [kap.s'i] ~ [ka.bi] N. 'price + Nom'

BASE IDENTITY ~ MAX-IO-C

A. /kaps + i/ **Base: [kap]**	BASE IDENTITY	MAX-IO-C
a. kap.si	*(s)!	
☞b. ka.pi		*(s)
B. /kaps + i/ **Base: [kap]**	MAX-IO-C	BASE IDENTITY
☞a. kap.si		*(s)
b. ka.pi	*(s)!	

(40) /əps + i/ → [əp.si] V. 'not to exist' + AVL

A. /əps + i/ **No Base**	BASE IDENTITY	MAX-IO-C
☞ a. əp.si		
b. ə.bi		*(s)!
B. /əps + i/ **No Base**	MAX-IO-C	BASE IDENTITY
☞ a. əp.si		
b. ə.bi	*(s)!	

In (39), the noun /kaps/ has a Base [kap]. Thus, if BASE IDENTITY is ranked higher than MAX-IO-C, the candidate faithful to the Base surfaces: [ka.pi] in (39A).[19] If BASE IDENTITY is ranked lower than MAX-IO-C, the candidate faithful to the input /kaps/ surfaces: [kap.si] in (39B). Hence, the optional CCS is obtained in nouns. In (40), on the other hand, the verbal stem /əps/

does not have a Base. Thus, BASE IDENTITY is vacuously satisfied and the candidate faithful to the input, [əp.si] always wins over [ə.bi].

3.3.2 Problems with the Base Identity approach

In what follows, I show that BASE IDENTITY is in fact inadequate to explain noun-verb asymmetries in Korean. This is because the current formulation of BASE IDENTITY requires *complete identity* between the output and the Base. The actual output forms in Korean, however, cannot meet this complete identity condition due to undominated markedness constraints such as *VpV (= no intervocalic voiceless plain stop).

Let us consider (39) again, repeated here as (43) with a crucial candidate [ka.bi], which Kenstowicz did not discuss. In Korean, plain voiceless stops are voiced in the intervocalic position (*VpV >> IDENT-IO (voice)). Thus, the correct winner in (43) must be [kap.s'i] ~ [ka.bi], not [kap.s'i] ~ [ka.pi]. The tableau in (43), however, cannot select [ka.bi] as a winner.

(41) a. *VpV (featural markedness, Kager 1999)

A voiceless plain stop is not allowed to surface in intervocalic position.

b. IDENT-IO (voice) The specification for the feature [voice] of an input segment must be preserved in its output correspondent. (Kager 1999: 14)

c. *POBS-POBS (cf. featureal markedness, Kager 1999)

Two consecutive plain obstruents are not allowed.

(42) *Crucial Ranking*

*VpV, *POBS-POBS >> BASE IDENTITY ~ MAX-IO-C >> IDENT-IO (voice)

(43) /kaps + i/ → [kap.s'i] ~ [ka.bi] N. 'price + Nom'

A. /kaps + i/ **Base: [kap]**	*VpV	*POBS-POBS	BASE IDENTITY	MAX-IO-C	IDENT-IO (voice)
☞ a. kap.s'i			* (s')		
b. ka.pi	*!			*	
c. ka.bi			* (b)	*!	*
d. kap.si		*!	* (s)		

B. /kaps + i/ **Base: [kap]**	*VpV	*POBS-POBS	MAX-IO-C	BASE IDENTITY	IDENT-IO (voice)
☞ a. kap.s'i				* (s')	
b. ka.pi	*!		*		
c. ka.bi			*!	* (b)	*
d. kap.si		*!		* (s)	

In (43), BASE IDENTITY is not satisfied either by [kap.s'i] or [ka.bi]. Specifically, [kap.**s'**i] violates BASE IDENTITY due to the additional [s']. [ka.bi] violates BASE IDENTITY due to the [voice] feature change in [ka.**b**i] from the Base [ka**p**]. Since both [kap.**s'**i] and [ka.**b**i] have undergone some alternations from the Base [ka**p**], both candidates are punished by BASE IDENTITY in (43). Consequently, both in (43A) and in (43B), the candidate more faithful to the input, [kap.s'i], becomes the winner. Therefore, the optional CCS in nouns cannot be explained under this approach.

The major concern with BASE IDENTITY in (37) is that it requires complete identity between the output and the Base. If a candidate is not identical with the Base, it is penalized. Thus, BASE IDENTITY itself does not distinguish between a *minor* and a *fatal deviation* from the Base. As seen in (43), a voicing change from the Base ([ka.bi]: Base [kap]) is penalized as much

as segmental change ([kap.s'i]: Base [kap]). BASE IDENTITY is particularly problematic when alternations from the Base are mandatory due to undominated markedness constraints, as in (43).

In fact, Kenstowicz (1996) anticipated this problem when he discussed Base Identity effects in other languages. In particular, Kenstowicz observes that the contents of the syllable bearing the main stress in the Base must be matched in the derivative, but that comparable syllables outside the main stress are not subject to such matching effects (see in particular the discussion of Base Identity effects in English, Palestinian Arabic, and Dutch presented in Kenstowicz (1996)). Kenstowicz suggested that to accommodate such cases, Base Identity may be decomposed into separately rankable subconstraints. Kenstowicz, however, left it to future research to determine the precise nature of the decomposition of Base Identity. What we observe here in (43) is that Korean data also require modification of BASE IDENTITY in (37) to make necessary distinctions between a *minor* and a *fatal deviation* from the Base.

It needs to be noted, however, that the Base Identity approach has some important conceptual advantages. Other approaches discussed in the previous sections postulate the special status of nouns in phonology without much independent evidence. The Prosodic approach crucially assumes that N=PRWD is ranked higher than NOSTRUC (PRWD), but that V=PRWD is ranked lower than NOSTRUC (PRWD). It is mysterious then why the ranking cannot be the other way around so that only verbs must project Prwd in Korean. The NF approach crucially assumes that a category 'noun' is a target of positional faithfulness constraints. It is then mysterious why 'verb' cannot be a target of the positional faithfulness constraints (cf. Smith 1999 for some suggestions). The Base Identity approach, on the other hand, derives the privileged status of nouns in Korean phonology from an independent morphological fact in Korean: namely that, Nstems in Korean have an isolation form, unlike Vstems. Hence, learnability issues concerning

acquisition of noun-verb asymmetries would not arise under the Base Identity approach. In contrast, learnability of N=PRWD or Noun Faithfulness constraints would be a potentially serious issue for the Prosodic approach and the NF approach.[20]

In the next section, I develop a theory about noun-verb asymmetries in Korean, which inherits the conceptual advantage of the Base Identity approach but overcomes its problems.

4. PROPOSAL: BASE-OUTPUT CORRESPONDENCE APPROACH

We have seen that previous approaches to noun-verb asymmetries in Korean phonology all have some problems. The Prosodic approach does not explain the noun-verb asymmetries which are not related to prosodic structuring of nouns. The NF approach explains neither that the noun-verb asymmetry occurs only in a stem-final position, nor that nouns sometimes undergo more changes than verbs. The Base Identity approach does not capture overapplication of CCS in nouns when we bring the intervocalic voicing process into the overall picture. In this section, I propose a novel solution to the noun-verb asymmetries in Korean and show that my proposal provides a unified account for the various aspects of the peculiarity of nouns in Korean phonology.

4.1 Proposal

As noted earlier, the Base Identity approach has an important conceptual advantage over the other approaches. It derives the special status of nouns in phonology from the independent morphological fact that nouns, not verbs, have an isolation form in Korean. I argue that this conceptual advantage must be supported. Specifically, I argue with Kenstowicz (1996) that the noun-verb asymmetry in Korean must be traced to the fact that nouns have a Base. I argue,

however, that the phonology of nouns in Korean can receive a coherent account in light of Base-Output Correspondence (BOC) defined in (44), along the lines of Kager (1999).

(44) *Base-Output Correspondence* (BOC) (adopted from Kager 1999: 248, 263)[21]

Given two strings S_1 and S_2, related to one another as Base-output, Base-output correspondence is a relation $\Re$ from the elements of S_1 to those of S_2. Elements $\alpha \in S_1$ and $\beta \in S_2$ are referred to as *correspondents* of one another when $\alpha \Re \beta$.

BOC shares the basic insight of Kenstowicz (1996) that a Base is taken as a reference form in evaluation of output candidates. However, the consequences of BOC are quite different from BASE IDENTITY (37). BASE IDENTITY evaluates whether a candidate is totally identical to the Base. A slight deviation from the Base yields violation of BASE IDENTITY. Hence, the current BASE IDENTITY does not distinguish between minor and fatal deviation from the Base.

BOC, on the other hand, evaluates a similarity of a candidate to a Base in terms of various relations defined in Correspondence Theory (McCarthy and Prince 1995, Kager 1999). That is, BOC allows us to evaluate a candidate with reference to a set of Base-Output faithfulness constraints such as MAX-BO, DEP-BO, and IDENT-BO constraints. Thus, depending on the ranking hierarchy among Base-output faithfulness constraints, some deviation from a Base may be considered fatal, and some trivial. The optimal output can be significantly different from a Base, yet still be more faithful to the Base than the other losing candidates. In the following, I demonstrate that the interplay between Base-output correspondence, input-output correspondence and markedness constraints provides a unified account for the underapplication and overapplication of phonology in nouns and the noun-verb asymmetries in Korean.

4.2 Underapplication in Nominal Inflection

In this section, I explain the noun-verb asymmetries in vowel reduction processes under the BOC approach. It is shown that underapplication of vowel reduction in nouns is derived from the general ranking schema, MAX-BO >> Markedness >> MAX-IO. Table (45) displays the vowel reduction phenomena presented earlier.[22]

(45) Vowel reduction phenomena in Korean

Sequences	Vstem-final	Nstem-final	Nonderived Nouns
/ɨ + V/	/ɨ/ deletion (5)	no /ɨ/ deletion (6)	/ɨ/ deletion (30)
/{i, o, u} + V/	glide formation (3)	no glide formation (4)	glide formation (31)
/{ə, o, a} + i/	coalescence (7)	no coalescence (8)	coalescence (32)

4.2.1 /ɨ/ deletion

We have seen that /ɨ/ deletion occurs in verbs and in nonderived nouns. However, it does not occur in Nstem-final position. Some representative examples are repeated here in (46) (see section 2.1 and section 3.2.2 for general description and other examples).

(46) a. /kʰɨ + ə/ *kʰɨ.ə kʰə 'to be tall + and'

b. /milkɨ + e/ mil.kɨ.e *mil.ke 'milk + in'

c. /maɨm/ ma.ɨm ~ ma:m 'heart'

Under the BOC approach, the /ɨ/ deletion data (and hiatus resolution data in general) follows from the general ranking MAX-BO (α) >> ONSET >> MAX-IO (α). The ranking MAX-BO

>> ONSET punishes /ɨ/ deletion from a Base, and thus nouns do not undergo /ɨ/ deletion if its Base contains /ɨ/. The ranking ONSET >> MAX-IO explains the fact that other categories may generally undergo /ɨ/ deletion to avoid hiatus. This ranking hierarchy also predicts that if nouns lack a Base for some reason, nouns would undergo /ɨ/ deletion, just like verbs. I argue that this is indeed the case for nonderived nouns. Specifics are given in (47)-(52).

(47) *Constraints* [23]

a. *V: (adapted from Prince and Smolensky 1993, McCarthy and Prince 1993a,b)

Long vowels may not appear in the output.

b. ONSET (Itô 1989, Prince and Smolensky 1993, among many others)

A syllable has an onset.

c. MAX-IO-V (McCarthy and Prince 1995)

A vowel in the input has a correspondent in the output.

d. MAX-BO-V (Kager 1999)

A vowel in the Base has a correspondent in the output.

e. MAX-N-μ A mora in the input noun has a correspondent in the output.

(but see note 25 for potential problems with this constraint)

(48) *Crucial ranking for the /ɨ/ deletion paradigm*

MAX-BO-V, MAX-N-μ >> *V: ~ ONSET >> MAX-IO-V

Consider first the verbal form given in (49).

(49) /kʰɨ + ə/ → [kʰə] V. 'to be tall + and'

A. /kʰɨ + ə/	MAX-BO-V	MAX-N-μ	*V:	ONSET	MAX-IO-V
a. kʰɨ.ə				*!	
☞ b. kʰə					*
c. kʰə:			*!		*
B. /kʰɨ + ə/	**MAX-BO-V**	**MAX-N-μ**	**ONSET**	*** V:**	**MAX-IO-V**
a. kʰɨ.ə			*!		
☞ b. kʰə					*
c. kʰə:				*!	*

In (49), the Vstem /kʰɨ/ does not have a Base. Thus, MAX-BO constraints do not play a role in selecting the optimal output. The ranking ONSET >> MAX-IO-V eliminates the candidate without stem-final /ɨ/ deletion, [kʰɨ.ə]. Markedness constraint *V: eliminates [kʰə:] in favor of the winning candidate without lengthening, [kʰə]. (The ranking between ONSET and *V: is not crucial here, but becomes important for nominal stems for which free ranking between ONSET and *V: yields variation in the output (see (51)). MAX-N-μ plays no role here.)

In contrast to (49), MAX-BO constraints become crucial in the determination of the optimal output in nominal forms, as shown in (50).

(50) /milkɨ + e/ → [mil.kɨ.e] N. 'milk' + 'in'

A. /milkɨ+ e/ **Base: [milkɨ]**	MAX-BO-V	MAX-N-μ	*V:	ONSET	MAX-IO-V
☞ a. mil.kɨ.e				*	
b. mil.ke	*!	*!			*
c. mi:l.ke	*!		*		*
B. /milkɨ+ e/ **Base: [milkɨ]**	**MAX-BO-V**	**MAX-N-μ**	**ONSET**	***V:**	**MAX-IO-V**
☞ a. mil.kɨ.e			*		
b. mil.ke	*!	*!			*
c. mi:l.ke	*!			*	*

In (50), the Nstem /milkɨ/ does have a Base [milkɨ], and thus MAX-BO constraints actively participate in the selection of the optimal output. Given the ranking MAX-BO-V >> ONSET, the candidates with /ɨ/ deletion, [mil.ke] and [mi:l.ke], are all eliminated. Thus, we obtain the optimal candidate [mil.kɨ.e] in (50), which does not undergo /ɨ/ deletion. (Here again, the ranking between *V: and ONSET is not crucial, but I present it for concreteness.)[24]

Now let us turn to the optional /ɨ/ deletion in nonderived nouns:

(51) /maɨm/ → [ma.ɨm] ~ [ma:m] N. 'heart'

A. /maɨm/ **Base: not determined**	MAX-BO-V	MAX-N-μ[25]	*V:	ONSET	MAX-IO-V
☞ a. ma.ɨm				*	
b. ma:m			*!		*
c. mam		*!			*
B. /maɨm/ **Base: not determined**	**MAX-BO-V**	**MAX-N-μ**	**ONSET**	***V:**	**MAX-IO-V**
a. ma.ɨm			*!		
☞ b. ma:m				*	*
c. mam		*!			*

The crucial point in (51) is that a nonderived noun *lacks* a Base to refer to. That is, (51) is the very process to select a *Base* from the underlying input /maɨm/. Thus, MAX-BO is not active in choosing the winner in (51). Consequently, free-ranking between *V: and ONSET yields the variation in the output: [ma.ɨm] in (51A) and [ma:m] in (51B).

Note that this analysis correctly distinguishes between a derived and a nonderived noun in phonology (cf. the NF approach). In derived contexts like (50), Nstems have a Base. In nonderived contexts like (51), by contrast, Nstems have no Base. Hence, it is expected that /ɨ/ deletion is blocked by MAX-BO constraints only when /ɨ/ is located in the stem-final position followed by a suffix (i.e. a derived context).

My account in (51) makes an immediate prediction about the inflected form of /maɨm/. According to (51), /maɨm/ has two Bases: [maɨm] ~ [ma:m]. Thus, if both of the Bases may act as reference forms in evaluation, we predict that the inflection form for /maɨm/ would have two variants faithful to each Base. This prediction is borne out. As shown in (52), if an input noun has multiple Bases, the inflected form also has multiple outputs.

(52) /maɨm + esə/ → [ma.ɨ.me.sə] ~ [ma:.me.sə] N. 'heart' + 'from'

A. /maɨm + esə/ **Base: [maɨm], [ma:m]**	MAX-BO-V	MAX-N-μ	*V:	ONSET	MAX-IO-V
☞a. ma.ɨ.me.sə				*	
b. ma:.me.sə			*!		*
c. ma.me.sə	*!	*!			*
B. /maɨm + esə/ **Base: [maɨm],[ma:m]**	**MAX-BO-V**	**MAX-N-μ**	**ONSET**	***V:**	**MAX-IO-V**
a. ma.ɨ.me.sə			*!		
☞b. ma:.me.sə				*	*
c. ma.me.sə	*!	*!			*

In (52), [ma.ɨ.me.sə] satisfies MAX-BO with respect to [maɨm], and [ma:.me.sə] satisfies MAX-BO with respect to [ma:m]. Thus, neither of them is penalized by MAX-BO constraints. In contrast, [ma.me.sə] violates MAX-BO and thus is eliminated.[26] Given the free-ranking between *V: and ONSET, variation between [ma.ɨ.me.sə] (52A) and [ma:.me.sə] (52B) is obtained.

4.2.2 Glide formation

As seen in sections 2.1 and 3.2.2, verbs and nonderived nouns may generally undergo optional glide formation, whereas Nstem-final vowels do not undergo glide formation. Some examples are repeated here:

(53)	a.	/kali + ə/	ka.ri.ə	~	ka.ryə	'to cover + and'
	b.	/tali + esə/	ta.ri.e.sə		*ta.rye.sə	'bridge + in'
	c.	/muət/	mu.ət	~	mwə:t	'what'

The BOC analysis for /ɨ/ deletion data in (49)-(52) directly extends to the glide formation data. Relevant constraints and rankings are given in (54)-(55).

(54) a. IDENT-BO (syll)

Let α be a segment in the Base, and β be a correspondent of α in the output.

If α is [γ syllabic], then β is [γ syllabic] (adopted from Kager 1999: 264).

b. IDENT-IO (syll)

Let α be a segment in the input, and β be a correspondent of α in the output. If α is [γ syllabic], then β is [γ syllabic] (adopted from Kager 1999: 250).

(55) *Crucial ranking for glide formation*

IDENT-BO (syll), MAX-BO-V, MAX-N-μ >> ONSET ~ {*COMPLEXONS, *V:}>> MAX-IO-V >> IDENT-IO (syll) [27]

Following Y. Lee (2001), I assume that free-ranking between ONSET and *COMPLEXONS is responsible for the optional glide formation in Korean. As described in (55), however, the ranking 'IDENT-BO (syll), MAX-BO-V >> ONSET' prevents glide formation in a noun if it

changes the [syllabic] feature of the Base of the noun. IDENT-IO (syll) is ranked lower than ONSET and MAX-IO-V, which generally allows glide formation to avoid hiatus. Detailed descriptions are given in (56)-(58).

Consider first (optional) glide formation in verbal inflection shown in (56).

(56) /kali + ə/ → [ka.ri.ə] ~ [ka.ryə] V. 'to cover + and'

A. /kali + ə/	IDENT-BO (syll)	MAX-BO-V	MAX-N-μ	ONSET	*COMPLEXONS	*V:	MAX-IO -V	IDENT-IO (syll)
a. ka.ri.ə				*!				
☞ b. ka.ryə					*			*
c. ka.ryə:					*	*!		*
B. /kali + ə/	**IDENT-BO (syll)**	**MAX-BO-V**	**MAX-N-μ**	***COMPLEXONS**	***V:**	**ONSET**	**MAX-IO -V**	**IDENT-IO (syll)**
☞ a. ka.ri.ə						*		
b. ka.ryə				*!				*
c. ka.ryə:				*!	*!			*

In (56), verbs do not have a Base. Thus, MAX-BO constraints are vacuously satisfied. Given the ranking variation between ONSET and *COMPLEXONS, we obtain optional glide formation: [ka.ryə] in (56A) ~ [ka.ri.ə] in (56B).[28]

The tableau (57) illustrates the absence of glide formation in Nstem-final position. In (57), the noun /tali/ has a Base [tari]. Thus, Base-output faithfulness constraints play a crucial role in selecting the optimal candidate. IDENT-BO (syll) eliminates the candidate with glide

formation [ta.rye.sə] in (57), which changed the value for the [syllabic] feature of the Base [tari]. Therefore, regardless of ranking variation between ONSET and *COMPLEXONS (and *V:), the candidate without glide formation, [ta.ri.e.sə], wins in (57).

(57) /tali + esə/ → [ta.ri.e.sə] N. 'bridge' + 'in'

A. /tali + esə/ **Base: [tari]**	IDENT-BO (syll)	MAX-BO-V[29]	MAX-N-μ	ONSET	*COMPLEXONS	*V:	MAX-IO-V	IDENT-IO (syll)
☞a. ta.ri.e.sə				*				
b. ta.rye.sə	*!		*!		*			*
c. ta:.rye.sə	*!				*	*		*

B. /tali + esə/ **Base: [tari]**	IDENT-BO (syll)	MAX-BO-V	MAX-N-μ	*COMPLEXONS	*V:	ONSET	MAX-IO-V	IDENT-IO (syll)
☞a. ta.ri.e.sə						*		
b. ta.rye.sə	*!		*!	*				*
c. ta:.rye.sə	*!			*	*			*

The optional glide formation process in nonderived nouns is explained by the same ranking provided in (57), as described in (58). The crucial point is that (58) is the input-output mapping process of determining a Base from the underlying form /muət/. Thus, MAX-BO (and IDENT-BO) constraints are inactive in selecting the output in (58). Due to free-ranking between ONSET and *COMPLEXONS, we obtain the two variants: [mwə:t] in (58A) ~ [muət] in (58B). (For completeness, /muət/ can be further inflected and have two inflected forms, similar to (52).

For instance, /muət + i/ 'what + Nom' can be realized in two forms: [mu.ə.si] and [mwə:.si]. In the suffixation process of /muət + i/, stem-final /t/ additionally changes into [s] for paradigm uniformity in Korean. See Y. Kang 2003 for an overview of /t-s/ alternation in Korean.)

(58) /muət/ → [mu.ət] ~ [mwə:t] N. 'what'

A. /muət/ **Base: not determined**	IDENT-BO (syll)	MAX-BO-V	MAX-N-μ[30]	ONSET	*COMPLEXONS	*V:	MAX-IO-V	IDENT-IO (syll)
a. mu.ət				*!				
b. mwət			*!		*			*
☞c. mwə:t					*	*		*
B. /muət/ Base: not determined	**IDENT-BO (syll)**	**MAX-BO-V**	**MAX-N-μ**	***COMPLEXONS**	***V:**	**ONSET**	**MAX-IO-V**	**IDENT-IO (syll)**
☞a. mu.ət						*		
b. mwət			*!	*				*
c. mwə:t				*!	*!			*

4.2.3 Vowel coalescence

Similar to /ɨ/ deletion and glide formation, vowel coalescence may generally occur in Vstems and in nonderived nouns. However, it does not occur between an Nstem-final vowel and a vowel-initial suffix. Rather, the suffix vowel /i/ may delete in nominal inflection. Some examples are repeated here in (59) (see section 2.1 and section 3.2.2 for other examples and references).

(59) Vowel coalescence

a.	/po + i + ta/	po.i.da	~	pœ.da	'to see + Cau + Dec'
b.	/co+ ita/	co.i.da	*cœ.da	co.da	'millet rice + to be'
c.	/sai/	sa.i	~	sæ:	'gap'

The BOC approach may explain the vowel coalescence process with high ranked MAX-BO constraints again. Crucial constraints and rankings for my analysis are given in (60)-(61).

(60) a. UNIFORMITY = No Coalescence (McCarthy and Prince 1995)

No element of S_2 (in the output) has multiple correspondents in S_1 (in the input).

b. MAX-BO (+back): [+back] in the Base has a correspondent in the output.

c. MAX-IO-STEM (-back) (Beckman 1998 for positional faithfulness)

[-back] in the stem of the input has a correspondent in the output.

d. MAX-IO-SUFFIX (-back) (Beckman 1998 for positional faithfulness)

[-back] in the suffix of the input has a correspondent in the output.

d. Morphological Exponence (ME) (adopted from Casali 1996, 1998)

An underlying morpheme α must be recoverable from the output.

(61) *Crucial rankings for vowel coalescence processes*

{ME, MAX-BO (+back), MAX-IO-STEM (-back)}

>> ONSET ~ {UNIFORMITY, MAX-IO-SUFFIX (-back),*V:}

As described in (61), optional vowel coalescence is captured by free-ranking between ONSET and UNIFORMITY (cf. B.-G. Lee 1996, E. Kang 2000, see also (21)-(23)). If ONSET outranks UNIFORMITY, coalescence occurs. If UNIFORMITY outranks ONSET, coalescence does

not occur. As described by the ranking MAX-BO (+back) >> ONSET, optional coalescence is blocked in nouns if coalescence changes the feature composition of the Base (concerning [+back]). The suffix vowel /i/ may optionally be deleted to avoid hiatus in nominal inflection (e.g. /co+ita/ => [co.da] in (59b)). This is captured by the free-ranking ONSET ~ MAX-IO-SUFFIX (-back). Morphological Exponence (ME) captures the fact that a suffix /i/ cannot be deleted when the suffix is composed of only one phoneme (e.g. /po + i + ta/ => *[po.da] in (59a)). The specifics are illustrated in the tableaux, (62)-(64).

Consider first the tableau in (62) for optional vowel coalescence in verbal inflection.

(62) /po + i + ta/ → [po.i.da] ~ [pœ.da] V. 'to see + Cau + Dec'

A. /po_1 + i_2 + ta/	MAX-BO (+back)	MAX-IO-STEM (-back)	ME	ONSET	UNIFORMITY	MAX-IO-Suffix (-back)	*V:
a. $po_1.i_2$.da				*!			
☞b. $pœ_{1,2}$.da					*		
c. po_1.da			*!			*	
B. /po_1 + i_2 + ta/	**MAX-BO (+back)**	**MAX-IO-STEM (-back)**	**ME**	**UNIFORMITY**	**MAX-IO-SUFFIX (-back)**	***V:**	**ONSET**
☞a. $po_1.i_2$.da							*
b. $pœ_{1,2}$.da				*!			
c. po_1.da			*!		*		

Verbs do not have a Base. Thus, MAX-BO constraints do not play a role in selecting the output in (62). Given the free-ranking variation between ONSET and UNIFORMITY, the variation

between [pœ.da] in (62A) and [po.i.da] in (62B) is obtained. Note that the candidate with suffix /i/ deletion, [po.da], is eliminated by ME. (I thank a reviewer for stressing the importance of ME in (62).) Thus, hiatus in (62) is resolved by coalescence, not by deletion of the suffix vowel /i/. This contrasts with the nominal form presented in (63), where hiatus is resolved by deletion of the suffix vowel /i/, not by coalescence.

(63) /co+ ita/ → [co.i.da] ~ [co.da] N. 'millet rice' + 'to be'

A. /co_1 + $i_2$ta/ **Base: [co]**	MAX-BO (+back)	MAX-IO-STEM (-back)	ME	ONSET	UNIFORMITY	MAX-IO-Suffix (-back)	*V:
a. $co_1.i_2$.da				*!			
b. $cœ_{1,2}$.da	*!				*		
☞c. co_1.da						*	

B. /co_1 + i_2 ta/ **Base: [co]**	MAX-BO (+back)	MAX-IO-STEM (-back)	ME	UNIFORMITY	MAX-IO-Suffix (-back)	*V:	ONSET
☞ a. $co_1.i_2$.da							*
b. $cœ_{1,2}$.da	*!			*			
c. co_1.da					*!		

In (63), MAX-BO (+back) eliminates the candidate with coalescence, [cœ.da]. Hence, there is no coalescence between an Nstem-final vowel and a suffix-vowel. Free-ranking between ONSET and MAX-IO-SUFFIX (-back) yields two variants in the output: [co.da] in (63A) ~ [co.i.da] in (63B).

Note that [co.da] in (63) is not punished by ME because /i/ is part of the polyphonemic morpheme /ita/. Thus, hiatus in (63) can be resolved by deletion of the suffix vowel /i/ (cf. (62)). Note also that MAX-IO-STEM (-back) in (63) does not punish [co.da] since /i/ belongs to the

suffix /ita/. This becomes important in (64) when we consider nonderived nouns, where avoidance of violation of the ONSET constraint triggers vowel coalescence, not /i/ deletion.

The tableau in (64) illustrates the vowel coalescence process in nonderived nouns.

(64) /sai/ → [sa.i] ~ [sæ:] N. 'gap'

A. /sa_1i_2/ **Base: not determined**	MAX-BO (+back)	MAX-IO-STEM (-back)	ME	ONSET	UNIFORMITY	MAX-IO-SUFFIX (-back)	*V:
a. $sa_1.i_2$				*!			
☞ b. $sæ_{1,2}$:					*		*
c. sa_1:		*!					*
B. /sa_1i_2/ Base: not determined	**MAX-BO (+back)**	**MAX-IO-STEM (-back)**	**ME**	**UNIFORMITY**	**MAX-IO-SUFFIX (-back)**	***V:**	**ONSET**
☞ a. $sa_1.i_2$							*
b. $sæ_{1,2}$:				*!		*!	
c. sa_1:		*!				*	

In (64), there is no Base. The tableau (64) is the very process to select the Base from the input /sai/. Thus, MAX-BO constraints do not punish the candidate with coalescence, [sæ:] in (64) (cf. (63)). Given the free-ranking between ONSET and UNIFORMITY, we correctly obtain the variation between [sæ:] in (64A) and [sai] in (64B). Notice that in contrast to (63), hiatus is resolved by vowel coalescence, not /i/ deletion. This is because MAX-IO-STEM (-back) eliminates [sa:] in (64), which lacks [-back] from the input /sai/. (Similar to (52), /sai/ can be further inflected and

have two inflected forms faithful to each Base (e.g. /sai + ka/ 'gap + Nom' => [sa.i.ga] ~ [sæ:.ga]).[31]

4.2.4 A summary: underapplication of phonology in nouns

In this section, I argued that the BOC approach explains a variety of noun-verb asymmetries concerning vowel reduction phenomena in Korean. In particular, I showed that underapplication of phonology in Korean nouns is tied to the morphological fact that a noun in derived contexts has a Base, unlike verbs or nonderived nouns. Important rankings are summarized in (65).

(65) *Important rankings for vowel reduction processes in Korean* [32]

{IDENT-BO (syll), MAX-BO-V, MAX-BO (+back), MAX-N-μ, MAX-IO-STEM (-back), ME} >> ONSET ~ {UNIFORMITY, *V:, *COMPLEXONS, MAX-IO-SUFFIX (-back)} >> MAX-IO-V >> IDENT-IO (syll)

The BOC approach has both empirical and conceptual advantages over the previous approaches. Unlike the prosodic approach, the BOC approach explains underapplication of phonology in nouns that is not expected from (mis)alignment between an Nstem and a syllable. Unlike the Noun Faithfulness approach, the BOC approach captures the contrast between derived and nonderived nouns as well as the one between verbs and nouns.

Furthermore, the BOC analysis provides a unified account for the noun-verb asymmetries in glide formation, /ɨ/ deletion, and coalescence, which could not be feasible under the Prosodic approach or NF approach. This implies that to the extent that the present analysis is successful, we no longer have to assume noun-specific alignment or noun-specific faithfulness constraints to explain the underapplication of phonology in Korean nouns. In addition, the BOC analysis derives the special status of Nstem in phonology from an independent morphological fact

concerning the presence of a Base in Korean. Thus, BOC analysis inherits the conceptual advantage of the Base Identity approach. In the next section, I show that the BOC approach extends to overapplication of LFN and CCS, overcoming problems with the previous accounts.

4.3 Overapplication in Nominal Inflection

4.3.1 Overapplication of LFN and CCS

In section 2.2, we have seen that Vstems do not undergo LFN when followed by a vowel-initial suffix. Nstems, in contrast, may undergo LFN when followed by a vowel-initial suffix. Some examples are repeated here in (66) (section 2.2 for other examples and references).

(66)	a.	/kip^{h} + i/	ki.p^{h}i		*ki.bi	V. 'to be deep' + NML
	b.	/sup^{h} + i/	su.p^{h}i	~	su.bi	N. 'forest + Nom'

Under the BOC approach, the contrast between nouns and verbs in LFN again follows from the fact that nouns have a Base in Korean. Specifically, the interplay between various Base-output faithfulness and input-output faithfulness constraints explains the overapplication of the LFN process in Korean nouns. Crucial constraints and rankings are given in (67)-(68). (The feature [s.g.] stands for the feature [spread glottis])

(67) a. DEP-BO (+s.g.)

The feature [+s.g.] in the output has a correspondent feature in the Base.

b. MAX-IO (+s.g.)

The feature [+s.g.] in the input has a correspondent feature in the output

c. IDENT-BO (s.g.)[33]

Let α be a segment in the Base, and β be a correspondent of α in the output.

If α is [γ s.g.], then β is [γ s.g.] (adapted from Kager 1999: 264).

d. IDENT-IO (s.g.)

Let α be a segment in the input, and β be a correspondent of α in the output.

If α is [γ s.g.], then β is [γ s.g.] (adapted from Kager 1999: 264).

e. IDENT-BO (voice)

Let α be a segment in the Base, and β be a correspondent of α in the output.

If α is [γ voice], then β is [γ voice] (adopted from Kager 1999: 416).

f. IDENT-IO (voice)

Let α be a segment in the input, and β be a correspondent of α in the output.

If α is [γ voice], then β is [γ voice] (Kager 1999: 14).

g. *VpV Intervocalic voiceless plain stops are not allowed to surface.

(68) *Crucial rankings*

*VpV >> {DEP-BO (+s.g.), IDENT-BO (s.g.)} ~ {MAX-IO (+s.g.), IDENT-IO (s.g.)}

>> {IDENT-BO (voice), IDENT-IO (voice)}

As described in (68), the undominated *VpV constraint forces the intersonorant voicing processes in Korean (*VpV >> IDENT-IO (voice)). The fact that nouns are allowed to undergo optional LFN is explained by the ranking, {DEP-BO (+s.g.), IDENT-BO (s.g.)} ~ {MAX-IO (+s.g.), IDENT-IO (s.g.)}. If DEP-BO (+s.g.) and IDENT-BO (s.g.) outrank MAX-IO (+s.g.) and IDENT-IO (s.g.), a candidate faithful to the Base wins: overapplication of LFN in nouns. If MAX-IO (+s.g.) and IDENT-IO (s.g.) outrank DEP-BO (+s.g.) and IDENT-BO (s.g.), a candidate faithful to the input wins: absence of LFN in nouns. Since verbs lack a Base, DEP-BO and IDENT-BO play no role in selecting the optimal output in verbal inflection. Hence, a candidate faithful to the input wins in verbal forms. The details are illustrated in the tableaux (69)-(71).

Consider first verbal inflection in (69).

(69) /kip^h + i/ → [ki.p^{h}i] V. 'to be deep' + NML

A. /kip^h+ i/	*VpV	MAX-IO (+s.g.)	IDENT-IO (s.g.)	IDENT-BO (s.g.)	DEP-BO (+s.g.)	IDENT-BO (voice)	IDENT-IO (voice)
☞ a. ki.p^{h}i							
b. ki.bi		*!	*!				*
B. /kip^h+ i/	*VpV	DEP-BO (+s.g.)	IDENT-BO (s.g.)	MAX-IO (+s.g.)	IDENT-IO (s.g.)	IDENT-BO (voice)	IDENT-IO (voice)
☞ a. ki.p^{h}i							
b. ki.bi				*!	*!		*

Vstems do not have a Base. Thus, DEP-BO does not show any effect in (69). Since no constraint triggers the LFN process in (69), the candidate faithful to the input, [ki.p^{h}i], wins both in (69A) and (69B). Compare (69) with (70) for optional LFN in an Nstem.

(70) /sup^h + i/ → [su.p^{h}i] ~ [su.bi] N. 'forest + Nom'

A. /sup^h + i/ **Base: [sup]**	*VpV	MAX-IO (+s.g.)	IDENT-IO (s.g.)	DEP-BO (+s.g.)	IDENT-BO (s.g.)	IDENT-BO (voice)	IDENT-IO (voice)
☞ a. su.p^{h}i				*	*		
b. su.bi		*!	*!			*	*
c. su.pi	*!	*	*				
B. /sup^h + i/ **Base: [sup]**	*VpV	DEP-BO (+s.g.)	IDENT-BO (s.g.)	MAX-IO (+s.g.)	IDENT-IO (s.g.)	IDENT-BO (voice)	IDENT-IO (voice)
a. su.p^{h}i		*!	*!				
☞b. su.bi				*	*	*	*
c. su.pi	*!			*	*		

In (70), *VpV punishes [su.pi] since [p] is not allowed to surface in intersonorant position. [sup^{h}i] violates DEP-BO (+s.g.) and IDENT-BO (s.g.) since it contains the feature [+s.g.], which the Base [sup] lacks. Thus, If MAX-IO (+s.g.) and IDENT-IO (s.g.) are ranked higher than DEP-BO (+s.g.) and IDENT-BO (s.g.), as in (70A), [su.p^{h}i] wins. If DEP-BO (+s.g.) and IDENT-BO (s.g.) outrank MAX-IO (+s.g.) and IDENT-IO (s.g.), as in (70B), [su.bi] wins. Notice that the intervocalic voicing process is not problematic under the present analysis (cf. (43) in the Base Identity approach). IDENT-BO (voice) is ranked fairly low in (70), reflecting the fact that voicing is not contrastive in Korean. Thus, the change in the [voice] feature from the Base [sup] is not considered fatal violation.[34]

The BOC account for (69)-(70) extends to optional overapplication of CCS. As described in section 2, verbs do not undergo CCS when followed by a vowel-initial suffix while nouns may undergo CCS when followed by a vowel-initial suffix. Some examples are repeated in (71). Relevant constraints and rankings are given in (72)-(73).

(71) a. /əps + i/ əp.s'i *ə.bi V. 'not to exist + AVL'

b. /kaps + i/ kap.s'i ~ ka.bi N. 'price + Nom'

(72) a. DEP-BO-C A consonant in the output has a correspondent in the Base.

b. MAX-IO-C A consonant in the input has a correspondent in the output.

(73) *Crucial Rankings*

{*VpV, *POBS-POBS} >> MAX-IO-C ~ DEP-BO-C >> {IDENT-IO (voice), IDENT-BO (voice)}

The fact that CCS may occur optionally is reflected in free-ranking between Dep-BO-C and MAX-IO-C. If Dep-BO-C ranks higher than MAX-IO-C, a candidate faithful to the Base

wins: *optional CCS in nouns*. If MAX-IO-C ranks higher than Dep-BO-C, a candidate faithful to the input wins: *absence of CCS in nouns*. Intersonorant voicing of plain stops is reflected in the ranking, *VpV >> {IDENT-BO (voice), IDENT-IO (voice)}. Postobstruent tensing is captured by the undominated *POBS-POBS constraint (see (41) for a description of this constraint). Details are given in (74) for verbal forms, and in (75) for nominal forms.

(74) /əps + i/ → [əp.s'i] V. 'not to exist' + AVL

A. /əps + i/	*VpV	*POBS-POBS	MAX-IO-C	DEP-BO -C	DEP-BO (+s.g.)	IDENT-BO (voice)	IDENT-IO (voice)
☞ a. əp.s'i							
b. ə.bi			*!				*
c. əp.si		*!					

B. /əps + i/	*VpV	*POBS-POBS	DEP-BO -C	DEP-BO (+s.g.)	MAX-IO-C	IDENT-BO (voice)	IDENT-IO (voice)
☞ a. əp.s'i							
b. ə.bi					*!		*
c. əp.si		*!					

In (74), the Vstem does not have a Base. Thus, DEP-BO constraints do not play a role in (74). As in the LFN case (69), a candidate faithful to the input (with postobstruent tensing), [əp.s'i], wins both in (74A) and (74B). Compare this with the nominal form given in (75).

(75) /kaps + i/ → [kap.s'i] ~ [ka.bi] N. 'price + Nom'

A. /kaps + i/ **Base: [kap]**	*VpV	*POBS-POBS	MAX-IO-C	DEP-BO-C	DEP-BO (+s.g.)	IDENT-BO (voice)	IDENT-IO (voice)
☞ a. kap.s'i				*			
b. ka.bi			*!			*	*
c. ka.pʰi			*!		*		
d. kap.si		*!		*			
f. ka.pi	*!		*				
B. /kaps + i/ Base: [kap]	***VpV**	***POBS-POBS**	**DEP-BO-C**	**DEP-BO (s.g.)**	**MAX-IO-C**	**IDENT-BO (voice)**	**IDENT-IO (voice)**
a. kap.s'i			*!				
☞ b. ka.bi					*	*	*
c. kapʰi				*!	*		
d. kap.si		*!	*				
f. ka.pi	*!				*		

In (75), the Nstem has a Base [kap].[35] Thus, DEP-BO constraints are crucial in selecting the output in (75). *POBS-POBS eliminates [kap.si]. Free-ranking between and MAX-IO-C and Dep-BO-C yields the two variants in the output: [kap.s'i] in (75A) ~ [ka.bi] in (75B). Note that *VpV eliminates [ka.pi] in (75). The BOC approach thus captures the fact that voicing alternation from a Base is considered trivial (e.g. [ka.bi]: Base [kap] in (75B)) while segmental change may be crucially penalized (e.g. [kap.s'i]: Base [kap] in (75B)).

4.3.2 A summary: overapplication of LFN and CCS

In this section, I showed that the BOC approach explains noun-verb asymmetries in Korean in consonant simplification processes. In particular, overapplication of LFN and CCS in nouns is tied to the same morphological fact that contributes to underapplication of phonology in nouns: nouns have a Base, unlike verbs. Important rankings are summarized in (76).

(76) *Rankings for LFN and CCS*

{*VpV, *POBS-POBS} >> {MAX-IO (+tense), IDENT-IO (tense)} >> {DEP-BO (+tense), IDENT-BO (tense)} >> {MAX-IO (+s.g.), IDENT-IO (s.g.)} ~ {DEP-BO (+s.g.), IDENT-BO (s.g.)} (>>) Dep-BO-C ~ MAX-IO-C >> {IDENT-IO (voice), IDENT-BO (voice)}

My arguments resolve the problems with previous approaches to noun-verb asymmetries in CCS and LFN. Under the BOC approach, the intersonorant voicing process is not problematic because voicing change from the Base is not considered fatal in comparison to segmental changes from the Base. My analysis further shows that we no longer need to entertain Sympathy Theory or ad-hoc assumptions to accommodate overapplication of CCS and LFN in Korean nouns (cf. the Prosodic approach, the NF approach). The fact that nouns show overapplication of LFN and CCS follows from the fact that nouns have a Base. Moreover, under the BOC approach, underapplication of vowel reduction and overapplication of CCS and LFN receive a unified account: namely that, BO-faithfulness constraints play a crucial role in selecting an optimal output in nominal inflection, but not in verbal inflection.

5. CONCLUSION

In this paper, I have argued that the complex phonology in Korean nouns can be traced to a morphological fact that Korean nouns have an isolation form. By adopting Base-Output

Correspondence Theory, I provided a unified account for a variety of puzzles concerning noun-verb asymmetries in Korean phonology. Specifically, underapplication of glide formation, /ɨ/ deletion, and coalescence in nouns is explained by the argument that MAX-BO constraints outrank markedness constraints militating against hiatus. Overapplication of laryngeal feature neutralization and consonant cluster simplification is reduced to the interplay between Base-output faithfulness and Input-output faithfulness constraints.

I also demonstrated that the BOC analysis overcomes problems with competing previous approaches. Unlike the Prosodic analysis, BOC explains noun-verb asymmetries in phonological alternations that are not critically affected by the alignment between a nominal stem edge and a syllable boundary. In contrast to the Noun Faithfulness approach, BOC makes the correct distinction between a derived and nonderived noun as well as the one between verbs and nouns. The BOC approach also distinguishes the minor and fatal deviation from a Base, overcoming shortcomings with the original Base Identity approach.

If correct, my arguments imply that noun-specific alignment and noun-specific faithfulness constraints are inadequate to explain the privileged status of nouns in Korean phonology. My evidence provides further support for the line of research that certain inputs may show underapplication or overapplication of phonological processes due to evaluation between candidates and a free-standing output morphologically related to the input (Benua 1995, 1997, Flemming 1995, McCarthy 1995, Burzio 1996, Kenstowicz 1996, Steriade 2000, Kager 1999, Sturgeon 2003, among others).

In this paper, we have seen that Base-Output Correspondence provides a coherent picture for the complexity of nouns in Korean phonology. This leaves us an important research question as to whether noun-verb asymmetries in other languages can be generally explained by the BOC

approach (refer to Harris 1969, Feinstein 1979, Hume 1995, McCarthy and Prince 1990, Smith 1997, 1999, Letterman 1997, Keer 1996, Davis and Torretta 1998, Y. Lee 2001, and Sturgeon 2003 for examples of peculiar phonology of nouns in other languages). It would be worth investigating whether the BOC approach can account for the data in other languages, which have remained problematic under noun-specific alignment or noun-specific faithfulness approaches. It also remains to be seen whether a grammatical category other than noun may show complex phonological behavior if it has a Base in other languages. Answering these research questions will tightly integrate this paper into the overall picture and provide a solid ground for evaluating the role of Base-Output Correspondence in explaining the phonology of nouns in the grammar.

REFERENCES

Ahn, Sang-Cheol (1985) *Interplay of Phonology and Morphology in Korean*, PhD dissertation, University of Illinois, Urbana-Champaign.

Ahn, Sang-Cheol and Gregory K. Iverson (2004) "On the Diachronic Inversion of Korean Diphthongs," Ms., Kyung Hee University, Seoul, and University of Wisconsin-Milwaukee.

Beckman, Jill N. (1997) "Positional Faithfulness, Positional Neutralization and Shona Vowel Harmony," *Phonology* 14: 1-46.

Beckman, Jill N. (1998) *Positional Faithfulness*, PhD dissertation, University of Massachusetts, Amherst.

Benua, Laura (1995) "Identity Effects in Morphological Truncation," in Jill N. Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk (eds.), *Papers in Optimality Theory*, University

of Massachusetts Occasional Papers in Linguistics 18, GLSA, University of Massachusetts, Amherst, pp.77-136.

Benua, Laura (1997) *Transderivational Identity: Phonological Relations Between Words*, PhD dissertation, University of Massachusetts, Amherst.

Broihier, Kevin (1995) "Optimality Theoretic Rankings with Tied Constraints: Slavic Relatives, Resumptive Pronouns and Learnability," Ms, Department of Brain and Cognitive Science, MIT. [ROA-46, http://ruccs.rutgers.edu/roa.html]

Burzio, Luigi (1996) "Surface Constraints Versus Underlying Representation", in Jacques Durand and Bernard Laks (eds.), *Current Trends in Phonology: Models and Methods*, CNRS, Paris X and University of Salford, University of Salford Publications, pp. 97-122.

Casali, Roderic F. (1996) *Resolving Hiatus*, PhD dissertation, University of California, Los Angeles.

Casali, Roderic F. (1998) *Resolving Hiatus*, Garland Publishing Inc., New York and London.

Cho, Taehong (1999) "Intra-dialectal Variation in Consonant Cluster Simplification," *CLS 35*, Papers from the 35th Regional Meeting of the Chicago Linguistic Society, Chicago Linguistic Society, 1999, pp. 43-57.

Cho, Young-Mee Yu (1990) *Parameters of Consonantal Assimilation*, PhD dissertation, Stanford University.

Cho, Young-Mee Yu (1997) "Liquid Specification in Korean as Geminate Alterability," in Susumo Kuno et al. (eds.), *Harvard Studies in Korean Linguistics* 7, Harvard University, pp. 78-92.

Cho, Young-Mee Yu and Sharon Inkelas (1994) "Post-Obstruent Tensification in Korean and Geminate Inalterability," in Young-Key Kim-Renaud (ed.) *Theoretical Issues in Korean Linguistics*, CSLI, Stanford University, pp. 45-60.

Davis, Stuart and Gina Torreta (1998) "An Optimality Theoretic Analysis of Compensatory Lengthening and Geminate Throwback in Turkese," in Pius N. Tamanji and Kiyomi Kusumoto (eds.), *NELS 28,* Proceedings of the 28th Conference of the Northeast Linguistic Society, University of Toronto, 1997, pp. 111-125.

Feinstein, Mark (1979) "Prenasalization and Syllable Structure," *Linguistic Inquiry* 2: 245-278.

Flemming, Edward (1995) *Auditory Representations in Phonology,* PhD dissertation, University of California, Los Angeles.

Goldsmith, John (1993) "Harmonic Phonology," in John Goldsmith (ed.), *The Last Phonological Rule: Reflections on Constraints and Derivations*, University of Chicago Press, Chicago.

Han, Eun-Joo (1990) "Glide Formation in Korean," in Hajime Hoji (ed.), *Japanese/Korean Linguistics* 1, CSLI, Stanford University, pp. 173-186.

Han, Eun-Joo (1993) "The Phonological Word in Korean," in Patricia M. Clancy (ed.), *Japanese/Korean Linguistics* 2, CSLI, Stanford University, pp. 117-129.

Han, Jeong-Im (1993) "On the Korean Tensed Consonants and Tensification," in C. Canakis, G. Chan and J. Denton, *CLS 28*, Papers from the Twenty-Eighth Regional Meeting, Chicago Linguistic Society, 1992, pp. 206-233.

Harris, James (1969) *Spanish Phonology*, MIT Press, Cambridge, MA.

Hayes, Bruce (1989) "Compensatory Lengthening in Moraic Phonology," *Linguistic Inquiry* 20: 253-306.

Hume, Elizabeth (1995) "Beyond Linear Order: Prosodic Constraints and C/V Metathesis," in Leslie Gabriele, Debra Hardison and Robert Westmoreland (eds.), *FLSM 6*, Proceedings of the Sixth Annual Meeting of the Formal Linguistic Society of Mid-America, Volume 1, Indiana University, Bloomington, pp. 15-26.

Inkelas, Sharon and C. Orhan Orgun (1995) "Level Ordering and Economy in the Lexical Phonology of Turkish," *Language* 71: 763-793.

Itô, Junko (1989) "A Prosodic Theory of Epenthesis," *Natural language and Linguistic Theory* 7: 217-260.

Itô, Junko and Armin Mester (1994) "Reflections on CodaCon and Alignment," in Rachel Walker, Jaye Padgett, and Jason Merchant (eds.), *Phonology at Santa Cruz* 3, University of California at Santa Cruz, pp. 27-46.

Itô, Junko and Armin Mester (1995) "The Core-Periphery Structure of the Lexicon and Constraints on Reranking," in Jill N. Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk (eds.), *Papers in Optimality Theory*, University of Massachusetts Occasional Papers in Linguistics 18, GLSA, University of Massachusetts, Amherst, MA.

Iverson, Gregory and Shin-Suk Lee (1995) "Variation as Optimality in Korean Cluster Reduction," *ESCOL 94,* Proceedings of Eastern States Conference on Linguistics 1994*,* CLC Publications, Cornell University, pp. 174-185.

Jun, Jongho (1994) "Metrical Weight Consistency in Korean Partial Reduplication," *Phonology* 11: 69-88.

Jun, Jongho (1995) *Perceptual and Articulatory Factors in Place Assimilation: An Optimality Theoretic Approach*, PhD dissertation, University of California, Los Angeles.

Jun, Jongho (1998) "Restrictions on Consonant Clusters," in B.-S. Park and James. H.-S. Yoon (eds.), *ICKL 11*, Proceedings of 11th International Conference on Korean Linguistics, Hankuk Publishing Company, Seoul, Korea, pp. 382-390.

Kager, René (1999) *Optimality Theory*, Cambridge University Press, Cambridge, U.K.

Kang, Eungyeong (2000) "The Noun-Verb Asymmetry in Korean Inflectional Morphology: A Prosodic Analysis," Ms., Cornell University.

Kang, Eungyeong (2001) "The Noun-Verb Asymmetry in Korean Inflectional Morphology: a Prosodic Analysis," Paper presented at the 75th Annual Meeting of Linguistic Society of America, Washington, D.C, 2001.

Kang, Ongmi (1992) *Korean Prosodic Phonology*, PhD dissertation, University of Washington.

Kang, Ongmi (1999a) "A Correspondence Approach to Glide Formation in Korean," *Korean Journal of Linguistics* 24: 477-496.

Kang, Ongmi (1999b) "A Correspondence Approach on Hiatus Resolution in Korean," Ms., Chosun University, Korea. [ROA – 375, http://ruccs.rutgers.edu/roa.html]

Kang, Seok-Keun and Chin-Woo Kim (1991) "A Moraic Account of Consonant Cluster Simplification in Korean," *FLSM 2*, Proceedings of the Second Annual Meeting of the Formal Linguistic Society of Mid-America, Indiana University, Bloomington.

Kang, Yoonjung (2003) "Perceptual Similarity in Loanword Adaptation: English Postvolcalic Word-final Stops in Korean," *Phonology* 20: 219-273.

Keer, Edward (1996) "Floating Moras and Epenthesis in Sinhala," Ms., Rutgets University.

Kenstowicz, Michael (1996) "Base-Identity and Uniform Exponence: Alternative to Cyclicity," in Jacques Durand and Bernard Laks (eds.), *Current Trends in Phonology: Models and*

Methods, European Studies Research Institute, University of Salford Publication, Manchester, pp. 363-394.

Kenstowicz, Michael and Hyang-Sook Sohn (2001) "Accentual Adaptation in North Kyungsang Korean," in Michael Kenstowicz (ed.), *Ken Hale: A Life in Language*, MIT Press, Cambridge, MA, pp. 239-270.

Ko, Heejeong (2004) "Base-Output Correspondence in Korean Nominal inflection", Ms. MIT, Cambridge, MA.

Kim, Jong-Kyu (1998) "Anti-Trapping Effects in an Iambic System: Vowel Shortening in Korean," in David James Silva (ed.), *Japanese/Korean Linguistics 8,* CSLI, Stanford University, pp. 289-302.

Kim, Young-Seok (2000) "Reconsidering Optionality without Optimality Theory," *Korean Journal of Linguistics* 25: 235-329.

Kim-Renaud, Young-Key (1974) *Korean Consonantal Phonology,* PhD dissertation, University of Hawaii, Honolulu.

Kim-Renaud, Young-Key (1982) "ɨ Deletion in Korean," in I. S. Yang (ed.), *Linguistics in the Morning Calm*, Hanshin Publishing Company, Seoul, Korea, pp. 473-488.

Kiparsky, Paul (1982) "From Cyclic Phonology to Lexical Phonology," in H. van der Hulst and N. Smith (eds.), *The Structure of Phonological Representations, Part 2*, Foris, Dordrecht, pp. 131-176.

Lee, Byung-Gun (1979) *Eumun Hyeonsang-e Isseoseouy Cheyak* [*Constraints in Phonological Phenomena*], Tower Press, Seoul.

Lee, Byung-Gun (1996) "The Emergence of the Faithfulness," MS., University of Massachusetts, Amherst. [ROA-259, http://ruccs.rutgers.edu/roa.html]

Lee, Dong-Jae (1989) "Suffixal ㅣ-deletion in Korean," in Susumo Kuno et al. (eds.) *Harvard Studies in Korean Linguistics 3,* Harvard University, pp. 145-158.

Lee, Minkyung (2001) *Optionality and Variation in Optimality Theory: Focus on Korean Phonology*, PhD dissertation, Indiana University, Bloomington.

Lee, Yongsung (1993) *Topics in the Vowel Phonology of Korean*, PhD dissertation, Indiana University, Bloomington.

Lee, Yongsung (1997) "Glide Formation and Compensatory Lengthening in Korean Verbal Conjugation," *Studies in Phonetics, Phonology, and Morphology* 3*,* 223-246.

Lee, Yongsung (1999) "Noun-Verb Asymmetry in Korean Phonology," Paper presented at the Korean conference at the summer meeting of the Linguistic Society of America 1999, Urbana, Illinois.

Lee, Yongsung (2001) "The Noun-Verb Asymmetry in Korean Phonology," *Studies in Phonetics, Phonology, and Morphology* 7: 375-397.

Lee, Youngjoo (2001) "A Moraic Account of Liquid Alternation in Korean," in Patricia M. Clancy (ed.) *Japanese/Korean Linguistics* 11, CSLI, Stanford University, pp. 303-314.

Letterman, Becky (1997) *The Effects of Word-Internal Prosody in Sinhala: A Constraint-Based Analysis*, PhD dissertation, Cornell University.

McCarthy, John (1995) "Extensions of Faithfulness: Rotuman revisited," Ms., University of Massachusetts, Amherst. [ROA-110, http://ruccs.rutgers.edu/roa.html]

McCarthy, John (1999) "Sympathy and Phonological Opacity," *Phonology* 16: 331-399.

McCarthy, John (2003) "Sympathy, Cumulativity, and Duke-of-York Gambit," in Caroline Féry and Ruben van de Vijver (eds.) *The Syllable in Optimality Theory*. Cambridge University Press, Cambridge, pp. 23-76.

McCarthy, John and Alan Prince (1990) "Prosodic Morphology and Templatic Morphology," in Mushira Eid and John McCarthy (eds.), *Perspectives in Arabic Linguistics 2*, Benjamins, Amsterdam/Philadelphia, pp. 1-55.

McCarthy, John and Alan Prince (1993a) "Generalized Alignment," in Geert Booij and Jaap van Marle (eds.), *Yearbook of Morphology 1993*: 79-153.

McCarthy, John and Alan Prince (1993b) "Prosodic Morphology I: Constraints Interaction and Satisfaction" Ms., University of Massachusetts, Amherst and Rutgers University. [Technical Report RuCCS-TR-3, Rutgers University Center for Cognitive Science]

McCarthy, John and Alan Prince (1995) "Faithfulness and Reduplicative Identity," in J. Jill N. Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk (eds.), *Papers in Optimality Theory*, University of Massachusetts Occasional Papers 18, GLSA, University of Massachusetts, Amherst, pp. 249-384.

Oh, Mira (1995) "A Prosodic Analysis of Non derived-Environment Blocking," *Journal of East Asian Linguistics* 4, 261-279.

Prince, Alan and Paul Smolensky (1993) "Optimality Theory: Constraint Interaction in Generative Grammar," MS., Rutgers University, New Brunswick and University of Colorado, Boulder. [Technical Report #2, Rutgers Center for Cognitive Science]

Seo, Misun (2002) "The Realization of the Korean Liquid in Onset Position," *ICSS 1,* Proceedings of the 1st International Conference on Speech Sciences*,* pp. 224-235.

Smith, Jennifer L. (1997) "Noun Faithfulness: on the Privileged Behavior of Nouns in Phonology," Ms. Umass, Amherst [ROA 242, http://ruccs.rutgers.edu/roa.html]

Smith, Jennifer L. (1999) "Noun Faithfulness and Accent in Fukuoka Japanese," in Sonya Bird, Andrew Carnie, Jason D. Haugen, and Peter Norquest (eds.), *WCCFL 18,* Proceedings of

the 18th West Coast Conference on Formal Linguistics, the University of Arizona, Tucson, 1999, Cascadilla Press, Somerville, MA, pp. 519-531.

Sohn, Hyang-Sook (1987) *Underspecification in Korean Phonology*, PhD dissertation, University of Illinois, Urbana-Champaign.

Steriade, Donca (2000) "Paradigm Uniformity and the Phonetics-Phonology Boundary," in Michael B. Broe and Janet B. Pierrehumbert (eds.), *Papers in Laboratory Phonology V: Acquisition and Lexicon*, Cambridge University Press, Cambridge, pp. 313-334.

Sturgeon, Anne (2003) "Paradigm Uniformity: Evidence for Inflectional Basis," in Gina Garding and Mimu Tsujimura (eds.), *WCCFL 22,* Proceedings of The 22nd West Coast Conference on Formal Linguistics, University of San Diego, 2002, Cascadilla Press, Somerville, MA, pp. 464-476.

Tak, Jinyoung (1997) *Issues in Korean Consonantal Phonology*, PhD disseratation, Indiana University, Bloomington.

Whitman, John (1985) "Korean Clusters," in Susumo Kuno et al. (eds.), *Harvard Studies in Korean Linguistics,* Harvard University, pp. 280-290.

Zoll, Cheryl (1996) *Parsing Below the Segment in a Constraint Base Framework*, PhD dissertation, University of California, Berkeley.

---

* Special thanks go to Michael Kenstowicz and Donca Steriade, whose guidance has been crucial in the development of the paper. I am also grateful to Danny Fox, Andrew Nevins, David Pesetsky, Cheryl Zoll, Kie Zuraw, and the participants of *Workshop on Phonology* (MIT, 2002) for their helpful comments. I thank the editors of *JEAL* and two anonymous reviewers for their

thoughtful comments, which greatly improved the content and presentation of the paper. Any remaining errors and inadequacies in the paper are mine.

[1] Korean does not have a voicing contrast in stops. A liquid phoneme is realized as [r] in onset position and [l] in coda position or when geminated (Y-M. Y. Cho 1997, Youngjoo Lee 2001, M. Seo 2002; see note 15). Some transcriptions have not been used consistently in the literature (/c/~/ts/; /æ/~/ɛ/; /ʌ/~/ə/; /y/~/j/). I use the transcriptions given in (1)-(2) here. For the phonemic status of the mid-front-round vowel /œ/ in Korean, see note 5. All the Korean data in the paper are drawn from Seoul Korean. Abbreviations for glosses are: Acc 'Accusative', AVL 'Adverbializer', Cau 'Causative', Dec 'Declarative', Nom 'Nominative', NML 'Nominalizer', Fut 'Future', Cau 'Causative', Top 'Topic', Pass 'Passive', Q 'Question particle', RCM 'Relative Clause Marker'.

[2] Glide formation would not occur if the resulting on-glide diphthong is one that is not allowed in the Korean inventory. Possible on-glide diphthongs in modern Korean are {yu, ye, yə, yo, (yæ), ya, wi, we, (wæ), wa, wə, ɯi}. Impossible diphthongs are {*yi, *yɨ, *wɨ, *wu, *wo} (see Ahn and Iversion 2004 for on-glide diphthongs in Korean).

[3] There is one exception to this. If the suffix-initial vowel is a high front vowel /i/ and the verb is monosyllabic, stem-final /ɨ/ deletion in verbs is optional (e.g. /tʰɨ + ita/ => [tʰɨita]~ [tʰi:ta] 'to be opened') (Kim-Renaud 1982:475).

[4] If a nonhigh front vowel /e, æ, œ/ is followed by /i/, /i/ is optionally deleted:

(i) /kæ + i + ta/ kæ.i.da ~ kæ:.da 'to be clear + Pass + Dec (weather)'

(ii) /pʰe + i + ta/ pʰe.i.da ~ pʰe:.da 'to cut + Pass + Dec'

(iii) /tœnœ + i + ta/ tœ.nœ.i.da ~ tœ.nœ.da 'to repeat silently + Dec'

[5] I take the mid front round vowel /œ/ as a phoneme in Korean (Ahn and Iversion 2004; cf. Y. Lee 1993) for the following reasons: (i) /œ/, /e/, /o/ are contrastive nuclei (e.g. /cœ/ 'sin', /ce/ 'I (polite form)', /co/ 'millet rice'). (ii) if /œ/ were not an underlying phoneme, we expect that /œ/ would always show optional variation with /oi/. However, this is not the case (e.g. /cœ/ 'sin' => [cœ], *[coi]). I thank Donca Steriade for clarifying this.

[6] It needs to be noted that unlike the aspirated stops in (10), tense stops do not undergo LFN in Nstem-final position (e.g. /pak'+ e/ 'outside + at'=> [pa.k'e], *[page]). As a reviewer pointed out, the fact that there are virtually no nouns in Korean that end in a lexical tense consonant might suggest that they have all been historically leveled. See also note 34 for discussion.

[7] Kim-Renaud (1982), for instance, proposes two different boundary symbols to deal with the discrepancy between nouns and verbs: '&' is used for a Vstem boundary and '+' for an Nstem boundary. Phonological rules are assumed to be sensitive to these rather arbitrary symbols.

[8] E. Kang proposes NSTEMR (i) and argues that the prosodic structure requires that the edge of Prwd should coincide with a syllable boundary. Thus, NSTEMR has the same effect as N=PRWD and ALIGN-PRWD in (14).

(i) NSTEMR = Align (Nstem, Right, Prwd, Right)

Align the right edge of a nominal stem to the right edge of a Prwd.

[9] For concreteness, remarks about my notations regarding the ranking schema are in order. 'A>>B' means that A outranks B. 'A ~ B' means that A and B can be re-ranked (as defined in Kager 1999: 406, *free-ranking*):

(i) Interpretation of **free ranking** of constraints C_1, C_2 (Kager 1999: 406, (60))

Evaluation of the candidate set is split into two subhierarchies, each of which selects an optimal output. One subhierarchy has $C_1 >> C_2$, and the other $C_2 >> C_1$.

From 'A ~ B', we may obtain *two optional outputs* from two different tableaux (cf. Y. Lee uses 'A : B' for my 'A ~ B'). 'A , B' means that A and B are equally ranked (cf. Broihier 1995, *tie-ranking*). That is, A and B are *not* crucially ranked with respect to each other, so the lower ranked constraints may decide an optimal output (M. Lee 2001 for discussions of *free-ranking* and *tie-ranking*). I would like to thank two reviewers for helping me to clarify this point.

[10] As a reviewer pointed out, a general question arises as to why N=PRWD outranks NOSTRUC (PRWD) and also as to why V=PRWD must be ranked lower than NOSTRUC (PWD) in Korean. As will be discussed in section 3.3, this assumption may pose some problems for the Prosodic approaches - particularly, learnability issues concerning noun-verb asymmetries.

[11] Throughout the paper, I reserve dotted lines in a tableau for denoting equally ranked (tie-ranking) constraints ('A, B'). Following Kager (1999: 406), I present two tableaux together when two constraints are re-ranked (free-ranking) by subhierarchies, as in (16) (A ~ B). (cf. Y. Lee who uses dotted lines both for tied-ranking and free-ranking). Also, '☞' indicates the winning candidate, and ']' indicates a Prwd, and '.' indicates a syllable boundary.

[12] B.-G. Lee (1996) and E. Kang (2000) derive optional coalescence in verbs by free-ranking between *[V, back] i (=Nonhigh back vowels /o, a/ cannot be immediately followed by [i]) and

UNIFORMITY. I employed ONSET instead of *[V, back]i for the sake of simplicity, but '*[V, back]i ~ UNIFORMITY' faces exactly the same criticism as the one I raise for (23)-(24).

[13] Y. Lee (1999, 2001) does not discuss vowel coalescence. E. Kang (2000, 2001) mentions the data in (20), but does not discuss the crucial candidate [cœ.]da] in (24). Proponents of the Prosodic approach might argue that feature sharing in [cœ.]da] in (24) disrupts alignment between an Nstem and a syllable. This, however, raises the question of why feature sharing in other phonological processes such as vowel harmony does not generally disrupt alignment restrictions between a stem and a syllable (Michael Kenstowicz, p.c.). For clarification, [cœda] in (24) can be a legitimate output if it means /cœ + ita/ 'sin + to be' in Korean. In order to save [cœ] derived from the underlying form /cœ/ 'sin', I assume that a featural faithfulness constraint, MAX (round/front), must outrank a markedness constraint, *round/front, which militates against the derivation of /cœ/ from /co + i/ in nominal forms. I thank a reviewer for pointing out this to me.

[14] The Prosodic approach also has problems with capturing noun-verb asymmetries in vowel shortening processes. As shown in (i), a long vowel in closed monosyllabic verbal stems (i.e. (C)VVC) can be shortened when the Vstem is followed by a vowel-initial suffix, but the same process is not found in nominal stems (ii) (J.-K. Kim 1998, Y. Lee 2001, among others). Vowel shortening does not trigger or repair misalignment between an Nstem and a syllable. Thus, as in the coalescence paradigm, ALIGN-PRWD is not a predictor for the absence of vowel shortening in nouns. For the sake of space, I do not discuss vowel shortening processes any further, but see Ko (2004) for detailed critiques of the Prosodic approach to this issue (cf. Y. Lee 2001).

(i) /ta:m + a/	*ta:.ma	ta.ma	V. 'to put + and'
(ii) /ka:m + i/	ka:.mi	*ka.mi	N. 'persimmon + Nom'

[15] E. Kang (2000) accommodates CCS and LFN by modifying the definition of alignment. E. Kang proposes that an intervocalic plain stop is ambisyllabic and that an ambisyllabic segment satisfies NstemR (note 8) in a *non-crisp* way ('non-crisp' as defined in Itô and Mester 1994). For example, [b] in [kabi] satisfies NstemR in a non-crisp way by being both coda of the Nstem and onset of the suffix-vowel /i/. This, however, makes a wrong prediction about allophonic variation in Korean. Korean lateral /l/ shows allophonic alternations: [r] in the onset, and [l] in a coda or as an (ambisyllabic) geminate (see references cited in note 1). If Kang (2001) is correct, we predict that the Nstem-final /l/ would surface as [l] when followed by a vowel-initial suffix. However, this is not the case (e.g. /nəl + i/ ==> [nəri], *[nəlli] 'seesaw + Nom').

[16] Y. Lee does not discuss overapplication of LFN in nouns. However, it would not be difficult to extend the Sympathy approach to LFN process. One thing to note, however, is that Y. Lee assumes that the selector constraint for the flower candidate in CCS data is an alignment constraint. This is peculiar because under the standard Sympathy theory, the selector constraint is always one of the Input-Output Correspondence constraints (Kager 1999: 391).

[17] It is generally assumed that vowel coalescence may occur between /a, o/ and /i/ in Nstems (E. Kang 2000, M. Lee 2001). But there are many exceptions (e.g. /nai/ 'age' *[næ:], /c^{h}ai/ 'gap' *[c^{h}æ:]). I leave to further research why certain lexical items do not undergo coalescence.

[18]A reviewer suggested that if we assume the ranking 'NM (Noun Markedness)>>F>>M', some phonological processes may be uniquely found in nouns. It would then be important to show why

we could not find overapplication of vowel reduction in nouns by employing the ranking 'NM >>F>>M'. It would also remain to be seen whether "noun-specific markedness" can be independently supported. As a reviewer notes, this surely complicates the overall picture and it is not obvious how this can be implemented under the current development of the NF approach.

[19] As will be discussed shortly (section 3.3.2), [ka.pi] is in fact not a correct output because of the intervocalic voicing of plain stops in Korean ([ka.bi] is the actual output in (39A)). Kenstowicz (1996) also abstracts away from postobstruent tensing ([kap.s'i] is the actual output in (39B)).

[20] A reviewer wondered whether the lexical phonology approach (Kiparsky 1982) may explain the noun-verb asymmetries in Korean (see Goldsmith 1993, McCarthy and Prince 1993b, and Inkelas and Orgun 1995, among others, for constraint-based multi-stratal models in OT). To answer the question, the following needs to be established under the lexical phonology framework: (i) vowel reduction processes in Korean must occur after affixation to verbs, but before affixation to nouns. (ii) nonderived nouns must be introduced before the vowel reduction rules apply. (iii) CCS and LFN sometimes occur before affixation to nouns and sometimes after affixation to nouns. (iv) CCS and LFN must occur after affixation to verbs. This might state the generalization correctly, but does not explain why certain phonological processes must be applied in a certain level only when the root is a noun or a verb. In other words, the lexical approach faces the same conceptual problems as the ones for the Sympathy account discussed in section 3.1.2. Learnability of all these rules and orderings among the rules would be a nontrivial issue to resolve, too. Thus, I do not pursue the lexical phonology approach here.

[21] The formal implementation of BOC in the paper follows Kager's (1999, Chapter 6) Base-Output (Output-Output) Correspondence Theory developed from McCarthy and Prince's (1995)

Correspondence Theory. As a reviewer notes, Base-Affixed form Correspondence would be a more precise term for certain cases presented in the paper. For general discussions, however, I employ Base-Output Correspondence stated in (44). Adopting Zoll (1996) and Casali (1996, 1998), among others, I extend the domain of MAX and DEP constraints into the feature level (e.g. MAX (+back), DEP (+spread glottis)). This slightly departs from Kager (1999), which confines the domain of MAX and DEP to the segmental level.

[22] It must be mentioned that this table by no means covers all the instances of vowel reduction paradigms in Korean. (45) lists only the facts relevant to the noun-verb asymmetries reported here. For complications and exceptions, see the literature cited in the sections 2.1 and 3.2.2. See also note 31 for relationships among different hiatus resolution processes. Important facts for current purposes are that an Nstem-final vowel *systematically* resists vowel reduction processes, in contrast to Vstems and nonderived nouns. I do not discuss the reason why there are some exceptions for each vowel reduction process, which is beyond the scope of the paper.

[23] Input-output faithfulness constraints are all drawn from McCarthy and Prince's (1995) Correspondence Theory (e.g. MAX-IO, DEP-IO, IDENT-IO). Context-free (featural) markedness constraints (e.g. *V:, *[voice]) are adopted from Prince and Smolensky (1993), McCarthy and Prince (1993a,b), and Kager (1999). Base-output faithfulness constraints are adopted from Kager's (1999) Base-Ouput Correspondence Theory (e.g. MAX-BO, DEP-BO, IDENT-BO). I do not repeat the relevant citations hereafter. For clarification, I assume that featural faithfulness constraints, MAX (-back), MAX (-high), and MAX (+round), are ranked higher than ONSET to prevent deletion of vowels other than /ɨ/ in hiatus contexts. Featural faithfulness constraints are not presented unless they play a crucial role in the selection of the optimal candidate.

[24] A reviewer suggests that the Nstem final /ɨ/ in (50) may be preserved to indicate that the Nstem is a loanword in Korean. It is unclear to me, however, how a faithfulness constraint (militating against /ɨ/ deletion) specifically targets loanwords. Furthermore, it is not clear how this approach would explain the fact that Korean pronouns that end with /ɨ/ does not undergo /ɨ/ deletion even if they are not loanwords (e.g. /kɨ + eke/ => [kɨ.e.ge], *[ke.ge] 'he + to').

[25] Following J.-K. Kim (1998), I assume that coda consonants in Korean are moraic (see also Kang and Kim 1991, J.-I. Han 1993 and J. Jun 1994; cf. Y. Lee 1993, 2001). I stipulate that Max-N-μ dominates *V: and Onset to explain the vowel length difference between [ma:m] in (51) and [kʰə] in (49). I acknowledge, however, that it has been highly controversial whether coda consonants in Korean are moraic (Tak 1997 for an overview). I hope that future research will show that the ad-hoc constraint Max-N-μ is not necessary to explain the compensatory lengthening process in nouns. For instance, as Y. Lee (1993) argued, if a verb-final /ɨ/ lacks an underlying mora, the length difference between [ma:m] and [kʰə] may follow from general constraints such as Max-IO-μ and Dep-IO-μ. See also note 30 for related discussion.

[26] Max-N-μ also penalizes [ma.me.sə] in (52). Given this, one may argue that the role of MAX-BO is not crucial in (52). This argument, however, does not extend to (50), where the illicit candidate [mi:l.ke] cannot be eliminated without positing MAX-BO-V.

[27] *COMPLEXONS and *V: are not crucially ranked with respect to each other (tie-ranking). This simply reflects the fact that empirical data do not verify their relative ranking at this moment. When ONSET is re-ranked with respect to *V:, it is also re-ranked with respect to *COMPLEXONS.

[28] The obligatory glide formation process in verbs (examples in (3b)) is straightforwardly explained by the same ranking given in (56). In particular, glide formation becomes obligatory only when glide formation does not yield a complex onset in the output (see (17)). The tableaux for obligatory glide formation processes are omitted for the sake of space.

[29] As a reviewer notes, [ta.rye.sə] and [ta:.rye.sə] do not violate Max-BO-V due to the possible correspondence between [y] in the candidates and [i] in the Base.

[30] As in (51), I postulate MAX-N-μ to explain the vowel length difference in [ka.ryə] in (56) and [mwə:t] in (58). This lengthening difference, however, may be captured without invoking MAX-N-μ (a suggestion due to Michael Kenstowicz, p.c.). Specifically, lengthening in [ka.ryə] in (56) can be blocked by the following conditions: (i) long vowels are allowed only in the first syllable in Korean (*[karyə:]). (ii) disyllabic verbs cannot contain a long vowel in the first syllable due to the metrical structure in Korean (ALL-FT-LT >> PARSE-σ). I leave this issue open.

[31] A reviewer wonders about relationships among hiatus resolution processes in Korean. Roughly speaking, whenever /ɨ/ deletion is possible, /ɨ/ deletion processes apply. If both coalescence and glide formation are possible, coalescence applies unless the results violate Korean phonotactics (e.g. /s'o + i + ta/ 'shoot + Cau + Dec' => [s'oida] ~ [sœda], *[swida]). This, however, is a radically simplified description and there are many exceptions to this (section 2.1 for references). Nonphonological conditions also contribute to the exceptions: some suffixes do not trigger any hiatus resolution processes (e.g. /s'ɨ + o/ 'write + please' => [s'ɨ.o], *[s'o]). I leave to further

research how the details of intricate interactions among hiatus resolution processes in Korean and their exceptions can be implemented in OT.

[32] A reviewer expresses concerns about the use of several variable rankings under the current analysis. Implementation of optional variation under the deterministic OT framework is certainly an important issue to be resolved (Kager 1999, Y.-S. Kim 2000, M. Lee 2001 for discussions), but it is orthogonal to the main points of the paper. I adopt Kager's free-ranking for the sake of concreteness, but the optional variation reported here can in principle be implemented in other frameworks (see, in particular, Inkelas and Orgun 1995 and Itô and Mester 1995 for alternative approaches to free-ranking and Kager 1999 for criticisms about the alternatives).

[33] IDENT (F) significantly differs from MAX (F). MAX (F) requires that a feature F must have a correspondence in the output and penalizes deletion of F in the output. MAX (F), however, does not block moving F from one segment to another segment in the output. IDENT (F), on the other hand, requires values of features of corresponding segments to be identical. Thus, IDENT (F) punishes moving F from one segment to another. The tableau presented below shows this point with the feature [s.g.]. If MAX (+s.g.) outranks IDENT (s.g.), [t^hap] wins. If IDENT (s.g.) outranks MAX (+s.g.), [tap] wins. See Casali (1996, 1998) for relevant discussions. I thank Donca Steriade for clarifying this point.

/$t_1a_2p_3{}^h$/	MAX (+s.g.)	IDENT (s.g.)
a. $t_1a_2p_3$	*	*
b. $t_1{}^ha_2p_3$		**

[34] The fact that a potential candidate [sup'i] cannot win in (70) indicates that DEP-BO (+tense) and IDENT-BO (tense) are ranked high. Along this line, recall that unlike aspirated stops, tensed

stops do not undergo optional LFN process in nouns (note 6). This indicates that MAX-IO (+tense) is always ranked higher than DEP-BO (+tense) and IDENT-BO (tense). Thus, the crucial ranking for LFN of tensed stops would be {MAX-IO (+tense), IDENT-IO (tense)} >> {DEP-BO (+tense), IDENT-BO (tense)}. I thank a reviewer for bringing this issue to my attention.

[35] I abstract away from the issue of how the Base [kap] is determined under the OT framework, which has been quite controversial and provoked many different lines of approaches. For general description of CCS in Korean, see references cited in section 2.2. See J. Jun (1995) and M. Lee (2001) for an overview of OT approaches to CCS in Korean. The specifics of derivation of CCS, however, do not affect the main points of the paper.