The noun-verb asymmetry in Korean phonology[*]

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Yongsung Lee. 2001. The noun verb asymmetry in Korean phonology. *Studies in Phonetics, Phonology and Morphology* 7.2. 375-397. This paper deals with difference between nouns and verbs in phonological alternations in Korean. The noun-verb asymmetry in glide formation, stem-final i-deletion, stem vowel shortening and intervocalic cluster simplification can be explained in a systematic way without resorting to different boundaries or arbitrary delimitation of rule application. The locus of explanation lies in the observation that nouns have a special status as prosodic words. The constraint, N=PWD, captures the generalization. The alignment constraint, ALIGN-PWD, to which nouns are subject but verbs are not, is responsible for the difference between nouns and verbs. The high-ranking nature of ALIGN-PWD is responsible for blocking nouns from undergoing the phonological alternations found in verbs. Further, it is shown that ALIGN-PWD works as a selector in the sympathy analysis of consonant cluster simplification. As such, the optimality analysis captures the generalization behind the noun-verb asymmetry and provides an insight to understanding Korean vowel phonology.**(Pusan University of Foreign Studies)**

key words: Optimality, Alignment, Sympathy, vowel phonology

1. Introduction

Nouns and verbs behave differently with respect to the phonological alternations in Korean. To be more specific, a verb-affix sequence is subject to such phonological processes as glide formation, i-deletion, and stem vowel shortening, while a noun-particle sequence systematically fails to undergo these rules. On the other hand, in the case of intervocalic consonant cluster simplification witnessed in the speech of the younger generation, we find that the intervocalic consonant cluster is reduced to a single consonant in noun-particle sequences. The same process, however, is not applied to verb-affix sequences. This paper seeks to find an explanation of such asymmetries found in nouns and verbs. On the surface one noticeable difference is that nouns can stand alone but verbs need certain suffixes thus cannot be used alone.

   This paper examines four different phonological alternations that reflect the noun-verb asymmetry in Korean. It will present the optimality theoretic

analysis of the phonological alternations in the verbal conjugation and show constraints involved in these alternations. The failure of the application of the same phonological alternations in nouns is viewed as the result of some blocking effect specific to nouns. This blocking effect indicates that nouns in Korean have a certain privileged status as in many other languages. The different behavior of nouns and verbs found in other languages is briefly summarized in (1):

(1) Noun-verb asymmetries in other languages
   a) In some Japanese dialects (Tokyo and Hakata), nouns preserve underlying accents while words of other categories show the regular accent distribution. (Smith (1997))
   b) In Tuyuca, the stress on nouns is preserved in the output, while stress in verbs or suffixes is sometimes not under the influence of the general stress pattern of the language. (Smith (1997))
   c) In Kisi (a Niger-Congo language), a final consonant of monosyllabic nouns is geminated before a vowel-initial suffix. In verbs, however, there is no augmentation by geminations. (ex: bol(N) + e → bol.le, bol(V) + i → bo.li)
   d) In Mutsun, final VC is metathesized to CV in verb stems, but the metathesis is not applicable in noun stems. (Hume (1994) based on Okrand (1977))
      (ex: posol (N, posole (stew)), poslo (V, to make posol))
   e) In Trukese, word minimality is imposed only on nouns and not on verbs or adjectives. (Goodenough & Sugita (1980), Davis & Torretta (1998))
      (ex: /tipe/(N) → [tiip] (emotion), /koka/(V) → kok (sink). Word final short vowels are always deleted. There is compensatory lengthening in nouns that would otherwise be monomoraic, whereas no lengthening of any type is witnessed in verbs.

   As shown by the examples in (1), nouns behave differently from other categories. Smith (1997) argues that the difference is mainly due to constraints specific to nouns. In this context, this paper argues that the privileged status of nouns is due to their prosodic characteristics. It will be argued that the special status of nouns is captured by a constraint N=PWD, a subclass of LEX=PWD(MCAT) as in Prince & Smolensky (1993). Being a prosodic word, a noun is subject to the requirement that the end of a prosodic word must coincide with the end of a syllable (=ALIGN R (PWD, SYLL)). These constraints interact with other structural constraints such as ONSET and NOCODA resulting in the blocking effect. This conforms to Song's (1991) observation that nouns have a tendency to have regular and simplified forms and they are resistant to alternation. In the case of the

consonant cluster simplification, we find again that the constraint, ALIGN R (PWD, SYLL) (=ALIGN-PWD), actively participates as a selector of a sympathy candidate (cf. M. Lee 1998). Since a verb stem is not a prosodic word, the verb-suffix sequence does not show the cluster simplification.

As such, this paper argues that the noun-verb asymmetry in Korean in different phonological alternations can be captured by a couple of constraints, N=PWD and ALIGN-PWD. Given the observation that the generalization of the difference is not easily accountable in the rule-based generative approach, this paper makes a strong claim that the optimality analysis gives a better insight into the noun-verb asymmetry than the rule-based approach. In section 2, the relevant data are presented along with the rule-based analyses. In section 3, the optimality analysis of the noun-verb asymmetry will be presented along with the relevant discussion of apparent problems. Section 4 sums up the discussion and concludes the paper.

2. Data and Previous Analyses

In this section, we will consider four phonological alternations, which reflect the noun-verb asymmetry: glide formation, stem-final i-deletion, stem vowel shortening and intervocalic consonant cluster reduction. Further, we will examine the locus of the asymmetry and how the asymmetry was dealt with in the rule-based approach.

(2) Glide formation (Han (1990), Y. Lee (1993) and others)[1]
　　a) Optional glide formation in Verb + affix :

kali + ə	[kariə]	[karyə]	(to cover ST)
sumki + ə	[sumgiə]	[sumgyə]	(to hide ST)
nanu + ə	[nanuə]	[nanwə]	(to share ST)
talu + ə	[taruə]	[tarwə]	(to deal)

　　b) Obligatory glide formation in Verb + affix

o + a	[wa]	*[oa]	(to come)
seu + ə	[sewə]	*[seuə]	(to erect ST)
meu +ə	[mewə]	*[meuə]	(to fill in)

　　c) No glide formation across Noun and particle boundary

tali + esə	[tariesə]	*[taryesə]	(on the bridge)
məli + e	[mərie]	*[mərye]	(on the head)
Minsu + eke	[minsuege]	*[minswege]	(to Minsu)
nuku + eke	[nugueke]	*[nugwege]	(to whom)

　　d) Noun internal glide formation (cf. Song (1991))

tuəm	[tuəm]	[twə:m]	(manure)
nue	[nue]	[nwe:]	(a silkworm)
muəs	[muət]	[mwə:t]	(what)

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[1]Low-level consonant variations are ignored here and in all the following data presentation. Plain obstruents (but not /s/) are voiced between two voiced sounds, and a lateral sound is realized as [r] in intervocalic positions, and a plain obstruent is tensed after another obstruent.

The data in (2a) show the optional glide formation across the verb and suffix boundary. If the stem ends in a front high vowel, /i/ or a round vowel, /o/ or /u/ and the suffix starts with a vowel, then the stem-final vowel is optionally turned into a glide. This process is motivated to avoid onsetless syllables. Notice that the glide formation is obligatory if the output form without glide formation results in two consecutive onsetless syllables. But the glide formation is not applicable across the noun stem boundary as shown in (2c). It should also be noted that glide formation is allowed stem internally in nouns as well, as shown in (2d).

The rule-based approach has noted the optional and obligatory glide formation phenomena and has presented different analyses to deal with them. Han (1991) proposes early vs. late syllabification. The late syllabification results in obligatory glide formation. Y. Lee (1993) suggests moraic vs. nonmoraic vowels, arguing that the underlying nonmoraic vowels trigger the obligatory glide formation. The difference between nouns and verbs is completely ignored in the literature to the best of my knowledge. We can, however, think of setting up different boundaries for nouns and verbs following Kim-Renaud (1982), and suggest that the presence of a noun boundary, but not a verb boundary, blocks glide formation. This will be further discussed in connection with stem-final ɨ-deletion.

(3) Stem-final ɨ-deletion (Kim-Renaud 1982 and others)
    a) Applied across a verb stem boundary
       tamkɨ + ə   [tamgə]   *[tamgɨə]   (to dip)
       kʰɨ + ə   [kʰə]   *[kʰɨə]   (to be big)
       kip'ɨ + ə   [kip'ə]   *[kip'ɨə]   (to be happy)
    b) Not applied across a noun stem boundary
       kɨ + eke   [kɨege]   *[kege]   (to him)
       pəsɨ + esə   [pəsɨesə]   *[pəsesə]   (in the bus)
       sɨmisɨ + eke [sɨmisɨege]   *[sɨmisege]   (to Smith)
    c) ɨ-deletion between a determiner and a noun or noun-internally
       kɨ + æ   [kɨ æ]   [kæ:]   (the child)
       kaɨl   [kaɨl]   [ka:l]   (Fall)
       maɨm   [maɨm]   [ma:m]   (mind)

(3a) shows that the stem-final /ɨ/ is obligatorily deleted before a vowel-initial suffix.[2] This ɨ-deletion seems to be another instantiation of avoiding onsetless syllables just like the glide formation. Notice, however, that ɨ-

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[2]Kim-Renaud (1982:475) notes that if the suffix initial vowel is a front high vowel and the verb is monosyllabic, the stem-final ɨ-deletion in verbs is optional.
    s'ɨ + i(ta)   [s'ɨi(da)]   *[s'i:(da)]   (to be used)
    tʰɨ + i(ta)   [tʰɨi(da)]   *[tʰi:(da)]   (to be opened)
  But, if the suffix initial vowel is not /i/, then the stem-final vowel deletes in these cases, just like the second example in (3a).

deletion is not applied across the noun stem boundary as shown in (3b). The only pure Korean noun that ends in /ɨ/ is the first word in (3b). But there are lots of loan words that end in /ɨ/ as illustrated in the rest of the data in (3b). Kim-Renaud (1982) proposes two different boundary symbols to deal with the discrepancy between nouns and verbs. She uses [&] to represent a verb stem boundary and [+] to denote a noun stem boundary and posits the following rule:

(4) Verb stem-final ɨ-deletion
    ɨ → Ø / ___ &V
    (The final ɨ of a verb stem is deleted when the following affix begins with a vowel.)

   While the rule in (4) correctly explains the lack of stem-final ɨ-deletion in nouns, we cannot help noticing that the explanation is circular. The verb stem boundary, &, is invoked only to explain the stem-final ɨ-deletion. It does not have an independent motivation elsewhere in Korean phonology. One may argue that the glide formation in (2) gives additional motivation for positing the verb stem boundary marker. This may be true, but still we face the problem of explaining the optionality of glide formation across the verb stem boundary as in (2a) and noun internally as in (2d).
   Y. Lee (1993) proposes that the stem-final /ɨ/ in verbs is non-moraic while those in nouns are moraic. Again while this may account for the difference between nouns and verbs, it suffers from the same problem as the proposal for different boundary symbols in that there is no independent motivation.

(5) Stem vowel shortening (Song 1991, J. Kim 1998 and others)
     a) Verb + affix: A monosyllabic long vowel in a verb
        shortens before a vowel-initial suffix
        ka:l + a   [kara]   *[ka:ra]   (to grind)
        ta:m + a   [tama]   *[ta:ma]   (to put ST in)
        a:n + a   [ana]   *[a:na]   (to hug ST)
     b) Noun + particle: The stem vowel shortening, however, does not
        take place in noun-particle sequences
        ka:m + i   *[kami] [ka:mi]   (persimmon-Nom.)
        pa:l + ɨl   *[parɨl] [pa:rɨl]   (blind-Obj.)
        nu:n + i   *[nuni]   [nu:ni]   (snow + Nom.)

   It should be noted that the data given in (5) is a radical simplification about Korean vowel shortening.[3] In its simplified form, the vowel shortening takes place in monosyllabic long vowel stems ((C)VVC stems)

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[3] See B. Lee (1979) and J. Kim (1998) for lexical and morphological exceptions and complications of vowel shortening in Korean.

when followed by a vowel-initial suffix in verbs. But the same process is not found in (C)VVC nouns. This constitutes another example of the noun-verb asymmetry, which has been generally ignored in Korean phonological research. The discussion on the vowel shortening is restricted to verbs, noting simply that nouns are an exception to the analysis. It may be viewed that the stem vowel shortening is caused by the desire to put as many syllables as possible in the foot (cf. anti-trapping in Mester (1994)), but the desire is overridden by another tendency to keep nouns as they are. We will return to this in the optimality theoretic analysis.

Up to this point, nouns are exceptions to the general phonological alternation. But in (6), we find that only nouns are subject to the intervocalic cluster simplification. Consider the following data:

(6) Cluster simplification
- a) Noun + particle: In the speech of the younger generation, intervocalic CC across a noun stem boundary is reduced into a single consonant.

kaps + i	[kaps'i]	[kabi]	(price-Nom)
hɨlk + i	[hɨlgi]	[hɨgi]	(soil-Nom)
sa:lm + i	[sa:lmi]	[sa:mi]	(life + Nom)

- b) Verb + affix: The optional intervocalic reduction is not observed in verbal conjugation in the younger generation's speech.

əps + i	[əps'i]	*[əbi]	(to be without)
kɨlk + ə	[kɨlgə]	*[kɨgə]	(to scratch)
sa:lm + a	[sa:lma]	*[sa:ma]	(to boil)

This time we see that cluster simplication is applied only in nouns. It is arguably true that the forms with two consonants are more common than the forms with a single consonant for nouns. But in the speech of the younger generation, one of the stem-final consonants optionally deletes. This seems to reflect the tendency for nouns to be simpler and more regular as observed by Song (1991). But such a reduction effect is not observed in verb-affix sequences as shown in (6b). The rule-based approach invokes two different rules to explain cluster reduction in nouns (cf. Song 1991):

(7) Two rules involved in intervocalic cluster reduction
- a) Coda consonant reduction[4]
  C → Ø in a complex coda
- b) Syllabification
  V(C)CV → V(C).CV

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[4] There is no triconsonantal coda in Korean. When there are two consonants in the coda, either the first or the second one deletes. The decision hinges upon the place and sonority of the consonants. (See M. Lee (1998) and Iverson and Lee (1994) for further discussion on coda consonant reduction.)

In verbs, syllabification applies before the cluster reduction. The suffix initial vowel takes the last consonant of a verb and turns it into an onset. This process eliminates a possible complex coda cluster and the coda consonant reduction is not applicable. In nouns, however, the coda consonant reduction is applied optionally before the suffixation. If reduction is applied before suffixation, a complex coda is reduced to a simple coda. This coda consonant eventually appears as the onset before a vowel-initial suffix by resyllabification. As such, the different ordering of rules in nouns and verbs results in the difference of surface forms. In standard Korean, there is just one rule ordering, the one found in the verbs. This explains the presence of intervocalic consonant clusters even in nouns. In this approach, then, the noun-verb asymmetry lies in the ordering of rules.

We have so far considered four phonological alternations that show the difference of nouns and verbs.[5] The previous approaches fail to account for the asymmetry in a consistent way. Glide formation is dealt with only with verbal conjugations. Any specific treatment of the lack of glide formation across a noun stem boundary is absent in the literature. For the stem vowel deletion, the rule specifically targets verb stems. Special boundary markers for nouns (+) and verbs (&) were proposed to explain the lack of vowel deletion in nouns. A stem-final /ɨ/ deletes only across & but not across +. Discussions on the vowel shortening completely ignore the exceptions found in nouns. Different rule ordering is invoked to explain the optional intervocalic consonant cluster reduction across a noun stem boundary. As such, the rule-based approach employs different and ad hoc devices for each of the cases and fails to give a generalized account for the asymmetry.

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[5] There may be two more sets of data related to noun-verb asymmetry: /l/ deletion and post-nasal tensification:

  (a) /l/ deletion before /n/
       pul (fire-N) + ɨn (Top)   → purɨn
       pul(blow-V) + ɨn (Past)   → pu:n
  (b) Post-nasal tensification in suffix-initial obstruents
       sim (lead-N) + to (also)   → simdo
       sim (plant-V) + ci (Neg)   → simc'i

Song (1991) suggests that (a) can be explained by assuming that the past form is simply a nasal consonant /n/, while the topic marker is /ɨn/. The appearance of [ɨ] in other examples (mək + n → məgɨn) is due to the application of the later rule of ɨ-insertion. The explanation is that /l/ deletes only before /n/. The deletion is also witnessed in nouns (atɨl (son) + nim (honorific) → adɨnim). If we take his assumption, the examples in (a) do not reflect the noun-verb asymmetry. The example given in (b) is quite problematic, since there is no systematic way to explain the asymmetry. Again, Song (1991) assumes that there is an abstract consonant after the nasal in verbs, which triggers the post-obstruent tensing. These two examples are left open for further research and is not discussed here.

3. The Optimality Analysis of The Noun-Verb Asymmetry

In this section, an OT analysis of the noun-verb asymmetry will be presented. It will be shown that the difference between nouns and verbs is due to the fact that nouns are prosodic words while verbs are not. This assumption can explain the different behavior of nouns with respect to the phonological alternations discussed in the previous section.

3.1 Glide Formation and Stem-final ɨ-deletion

The crucial assumption here is that nouns are prosodic words. This is a specific instantiation of Prince & Smolensky' (1993) claim that lexical entries are prosodic words as captured by their constraint, LEX=PRWD (MCAT). This constraint targets a certain morphological category (MCAT) and penalizes it, if it fails to show up as a prosodic word. Being a prosodic word means two things. The prosodic word boundary must be present after a noun stem and secondly it should contain at least one foot. The latter comes from the prosodic hierarchy and the minimal word condition as argued for in Prince & Smolensky (1993). Further, a layering hypothesis will claim that a syllable should not straddle across the prosodic word boundary. In other words, a prosodic word should end at the right edge of a syllable, call it ALIGN-PWD. It will be shown that these two constraints, N=PWD and ALIGN-PWD play a crucial role in analyzing the noun-verb asymmetry in Korean. The following is the initial list of relevant constraints.

(8) Relevant constraints
 a) LEX=PWD (NOUN) (N=PWD) (Prince & Smolensky (1993))
    A morphological category, noun, is a lexical prosodic word.
    (A noun contains at least one foot.)
 b) ALIGN R (PWD, σ) (ALIGN-PWD) (cf. McCarthy & Prince 1993))
    The right edge of a prosodic word coincides with the right edge of a syllable.
 c) ONSET
    Syllables must have an onset.
 d) MAX(μ)
    Input moras must have their correspondence in the output. (no mora deletion)
 e) NOCPLX(ONS) (NOCPLX)
    Complex onsets are not allowed.

There may be other constraints involved than those listed in (8). For example, we may need a constraint that prevents insertion of a mora, DEP(μ). To the exception of loan word phonology, there is no vowel lengthening caused by an inserted mora. This proves that DEP(μ) is ranked

very high in Korean. N=PWD is applicable only to nouns.[6] It should also be noted that the constraint in (8a) crucially relies on the assumption that onglides are onsets in Korean. Thus a consonant and a glide sequence before a vowel is assumed to form a complex onset. Other relevant constraints will be introduced as we go along. Let's now think about ranking arguments for glide formation:

(9) Ranking arguments for glide formation
  a) Glide formation is a way to reduce onsetless syllables:
       ONSET >> MAX(μ)
  b) Glide formation resulting in a complex onset is optional:
       NOCPLX(ONS) : ONSET[7]
  c) Nouns resist glide formation across the stem boundary[8]
       N=PWD, ALIGN-PWD >> ONSET
  d) Partial ranking
       N=PWD, ALIGN-PWD >> ONSET: NOCMPLX(ONS) >> MAX(μ)

  Glide formation is driven by the desire to avoid onsetless syllables. But the result is the violation against a complex onset. Therefore, it is reasonable to assume that the optional nature of glide formation comes from the relative ranking of NOCPLX and ONSET. The crucial observation here is that ONSET (And NOCPLX) is outranked by both N=PWD and ALIGN-PWD, the constraints that keep the integrity of nouns. Now consider the following evaluation tableaux:

(10) Optional glide formation in verbs

μμ μ kali + ə	N=PWD	ALIGN -PWD	NO CPLX	ONSET	MAX (μ)
☞ a) ka.ri.ə				*	
☞ b) ka.ryə			*		*

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[6] Some may argue that there must be constraints such as V=PWD, A=PWD, ADV=PWD and so on. V=PWD is especially true in many Bantu languages and English where we find freestanding verbs. It is tacitly assumed that the constraints, V=PWD or the like are present but are very low in ranking in Korean, which is actually lower than NoStruc(Pwd) which penalizes structuring prosodic wordhood to verb stems. Thus the ranking N=PWD >> NOSTRUC(PWD) >> V=PWD in Korean will eventually assign the prosodic wordhood only to nouns.

[7] A:B is a notational device used to denote that the ranking between them is variable Therefore, it is the shorthand representation of either A>>B or B>>A. It should also be noted that A:B is different from A=B, which means a tied ranking. (see M. Lee (2001) for further reference.

[8] The relative ranking between N=PWD and ALIGN-PWD is not discussed at this point.   We will, however, see that N=PWD is an inviolable thus an undominated constraint, while ALIGN-PWD is violated to satisfy NOCODA (See 3.2 for further discussion.)

(11) Obligatory glide formation in verbs

μμ μ seu + ə	N=Pwd	Align- Pwd	No Cplx	Onset	Max (μ)
a) se.u.ə				**!	
☞ b) se.wə					*

(12) Non application of glide formation in nouns

μμ μ məli+ e	N=Pwd	Align -Pwd	No Cplx	Onset	Max (μ)
☞ a) mə.li.]e				*	
b) mə.ry]e.		*!	*		*
c) mə.rye]	*!		*		*

("]" represents the right edge of a prosodic word.)

The tableaux are drastically simplified here. Note that NoCplx and Onset are unordered with respect to each other. This means that either ranking is acceptable. The tableau in (10) shows the combination of NoCplx >> Onset and Onset >> NoCplx. (10a) is chosen if Onset is lower than NoCplx. With the reversed ranking, (10b) becomes optimal.[9] As shown in (11), if glide formation does not result in the violation of NoCplx, it is obligatory. The form with a glide as in (11b) will be optimal regardless of the ranking between NoCplx and Onset. (See Y. Lee (1997) for a detailed analysis of optional and obligatory glide formation.)

Now let's consider (12). In nouns, glide formation does not apply across the boundary. This is a natural result of the ranking. Nouns are subject to N=Pwd and Align-Pwd which dominate Onset, which triggers the glide formation. Crucially, (12c) is eliminated due to the violation of N=Pwd because the noun is not a prosodic word. Note that it does not have a prosodic word boundary before the particle /e/. Marking the boundary as in (12b) does not help. This time, it violates the alignment constraint, Align-Pwd. The glide formation example here clearly illustrates that the noun-verb asymmetry is the result of two constraints, N=Pwd and Align-Pwd.

Let us now turn to stem-final ɨ-deletion. Again stem-final /ɨ/ deletes before another vowel, but a noun stem-final /ɨ/ stays even before another vowel. To explain the difference, we may need an additional constraint, Max(ɨ)

(13) An additional constraint and ranking
   a) Max(ɨ)
      The underlying /ɨ/ must surface in the output.

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[9] Though not discussed in here, Max(V) is assumed to be a high-ranking constraint, at least it is higher than NoCplx(Ons). This will rule out such ill-formed output as *[kari] or *[karə].

b) Ranking
ONSET >> MAX(ɨ)

MAX(ɨ) is part of MAX(V) constraint family. Since /ɨ/ is the least marked vowel in Korean, it is assumed that MAX(ɨ) is dominated by other MAX(V) constraints. The vowel /ɨ/ is deleted when it is followed by another vowel. This indicates that the desire to have onsets forces ɨ-deletion.[10] ɨ-deletion is preferable because it does not result in a complex onset, unlike in the case of the glide formation. This explains why ɨ-deletion is obligatory in polysyllabic words. Now consider the following tableaux:

(14) Stem-final ɨ-deletion in verbs

μμ μ kip'ɨ + ə	N=PWD	ALIGN-PWD	ONSET	MAX(ɨ)	MAX(μ)
☞ a) kip'ə				*	*
b) kip'ɨə			*!		

(15) Non-application of ɨ-deletion in nouns

μμ μ μ pəsɨ + esə	N=PWD	ALIGN-PWD	ONSET	MAX(ɨ)	MAX(μ)
☞ a) pə.sɨ.]e.sə			*		
b) pə.s]e.sə		*!		*	*
c) pə.se.sə]	*!			*	*

As shown in (14), the ranking, ONSET >> MAX(ɨ), correctly picks out the optimal form. The relative ranking between MAX(ɨ) and MAX(μ) is not crucial in the evaluation. That N=PWD and ALIGN-PWD are vacuously satisfied in (14) is a trivial but an important observation. When the input is a noun as in (15), we witness their work in choosing the optimal form. ALIGN-PWD penalizes the stem-final /ɨ/ deletion in nouns. If the final /ɨ/ is deleted in nouns, it violates either N=PWD (15c) or ALIGN-PWD (15b). As shown in (3c), ɨ-deletion takes place in the noun internal positions.[11] But

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[10] Though not discussed in detail, it should be noted that other vowels are not deleted even before another vowel. Thus we assume the ranking, MAX(NON-ɨ) >> ONSET >> MAX(ɨ).
[11] Noun-internal ɨ-deletion is optionally allowed. The optionality again is due to the relative unordering of NOCPLX (NUC) and ONSET as the following tableau shows:

μμ kaɨl	N=PWD	ALIGN-PWD	NOCPLX (NUC)	ONSET	MAX(ɨ)	MAX(μ)
☞ a) ka.il]				*		
☞ b) ka:l]			*		*	
c) kal]					*	*

The tableau wrongly shows that (c) is the optimal form. For (c), we have to consider FTBIN. We will return to this in 3.3 in connection with (25) to (27). It will be shown that FTBIN dominates NOCPLX(NUC), and the ranking will correctly reject (c). We find that the choice of

the noun-final /ɨ/ is not deleted. ALIGN-PWD, as such, can capture the difference of verb and noun boundaries as well as the difference of /ɨ/'s in noun-marginal and noun-internal positions.

3.2 An Apparent Problem

The discussion so far crucially relies on ALIGN-PWD that requires the alignment of the right edge of a prosodic word with the right edge of a syllable. Thus it is expected that nouns end at the right edge of a syllable. As a matter of fact, the discussion up to this point strengthens the position that a prosodic word final consonant should appear as a coda even before a vowel-initial suffix. But that may not be necessarily true. Consider the allomorph selection of nominative markers. There are two nominative markers, /i/ and /ka/, and the choice between them depends on the nature of noun-final segments as illustrated in (16):

(16) Allomorph selection of nominative markers
    a) Vowel final nouns take /ka/
        minsu + {i, ka}   min.su.]ga   (Minsu -Nom.)
        sunča + {i, ka}   sun.ǰa.]ga   (Soonja-Nom.)
        hakkyo + {i, ka}   hak.kyo.]ga   (school-Nom.)
    b) Consonant final nouns take /i/ and subsequent syllabification
        yəŋsuk + {i, ka}   yəŋ.su.g]i   (Youngsook-Nom.)
        pam + {i, ka}   pa.m]I   (night-Nom.)
        čumal + {i, ka}   ču.ma.r]i   (weekend-Nom.)

Following Y. Lee (1996), it is assumed that both of the allomorphs are competing in the evaluation and the actual outcome is the result of the evaluation by the ranked constraints. Consider how the allomorph selection is made:

(17) Choosing allomorphs

minsu + {i, ka}	N=PWD	ALIGN-PWD	ONSET	MAX (μ)
a) minsu]i			*!	
☞ b) minsu]ka				
c) minsuka	*!			

The basic assumption here is that we do not have to posit a stage for allomorph selection prior to evaluation, contra Russel's (1995) review of the optimality theory. The problem, however, is that it apparently fails to explain the choice of /i/ after consonant final nouns. To be more specific, the data given in (16b) is problematic, because ALIGN-PWD is not observed

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(a) or (b) depends on the relative ranking of NoCompex and Onset. Given that both rankings are possible, either of them appears as the optimal form, hence the optionality.

in the nouns as illustrated in (18):

(18) Wrong evaluation of allomorphy choice

pam + {i, ka}	N=Pwd	Align-Pwd	Onset	Max (μ)
?? a) pa.m]i		*!		
✂ b) pam.]ka				
c) pam.]i			*!	
d) pa.mi	*!			

The real output (18a) is rendered suboptimal due to Align-Pwd violation. Further, (18b) is wrongly chosen as the optimal form. The tableau in (18) clearly shows the problematic aspect of the alignment proposal. However, we claim that the problem is only apparent because we are dealing with only part of the constraint system in Korean. A fuller picture includes the following constraints and their ranking:

(19) Additional constraints
    a) Max(C)
       The input consonants must appear in the output.
    b) NoCoda
       Coda consonants are not allowed.

(20) Ranking arguments
    a) Max(C) >> NoCoda
       Input consonants appear on the surface even if it violates NoCoda
    b) NoCoda >> Align-Pwd
       Align-Pwd is violated to observe NoCoda.
    c) Overall ranking
       N=Pwd, Max(C) >> NoCoda >> Align-Pwd

Two additional constraints, Max(C) and NoCoda, are introduced in (19). What is crucial in our analysis is the presence of the constraint, NoCoda, and its ranking over Align-Pwd. Since N=Pwd is an inviolable constraint, the introduction of NoCoda, which is violable, shows the ranking that N=Pwd dominates Align-Pwd. This ranking, however, is not crucial in the present discussion. An important observation is that Align-Pwd is flanked by two structural constraints in ranking: NoCoda >> Align-Pwd >> Onset. This further shows that Align-Pwd is dominated by N=Pwd, since a violable constraint NoCoda crucially dominates Align-Pwd. With the introduction of NoCoda in the evaluation, we find that the evaluation does not suffer from the problem identified in (18). Consider the following revised evaluation.

(21) Evaluation with NoCoda for a consonant final noun

pam + {i, ka}	N=PWD	MAX (C)	NO CODA	ALIGN-PWD	ONSET	MAX (μ)
☞ a) pa.m]i				*		
b) pam]ka			*!			
c) pam.]i			*!		*	
d) pa.mi	*!					
e) pa]ka		*!				
f) pa]i		*!			*	

In the optimality framework, it is not surprising that a constraint is dominated by another one. Therefore, it is expected that ALIGN-PWD may be dominated by other constraints. Observe that the optimal form in (21a) has the violation of ALIGN-PWD. More importantly, the unintended winner (21b) is eliminated by the high-ranking constraint, NoCoda. We cannot simply delete the stem-final consonant to satisfy NoCoda. If we do so, we end up violating an even higher constraint MAX(C) as shown in (21e) and (21f). The analysis presented here correctly shows that the apparent problem of the allomorph choice can be dealt with by putting NoCoda over ALIGN-PWD.[12]

3.3 Vowel Shortening and Cluster Reduction

Having done away with an apparent problem, we will turn to the remaining two sets of data, stem vowel shortening and intervocalic consonant reduction. Stem vowel shortening involves a more complicated procedure. Though the stem vowel shortening is controversial among the Korean researchers, it is generally accepted that a monosyllabic long vowel shortens before a vowel-initial suffix. One possible explanation to the stem vowel shortening is to invoke the anti-trapping effect proposed in Mester (1994), with the assumption that there is only one foot per prosodic word as in J. Kim (1998). This means that Korean feet prefer to have as many syllables as possible, while observing foot binarity. As a result, a CVVCV input is footed as (CVCV) with the shortening of the first vowel rather than

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[12] This does not interfere with allomorphy selection for nouns that end in vowels as shown below:

minsu + {i, ka}	N=PWD	MAX(C)	NoCoda	ALIGN-PWD	ONSET	MAX(μ)
☞ a) min.su.]ka			*			
b) min.su.]i			*		*!	
c) mi.su.]ka		*!				
d) min.sw]i			*	*!		*

When the noun ends in a vowel, ALIGN-PWD and ONSET work together to choose /ka/.

as (CVV)CV which has an unparsed syllable. But the same vowel shortening is not observed between nouns and vowel-initial particles. We propose the following constraints:

(22) Additional constraints
    a) PARSE-σ
       Syllables must be parsed into feet.
    b) ALIGN (FT, L, PWD, L) (ALL-FT-LT)[13]
       All feet stand at the left edge of a prosodic word.
    c) FOOTBINARITY (FTBIN)[14]
       Feet are binary at the moraic level.

Following J. Kim (1988), it is assumed here that there is only one foot per prosodic word in Korean. This means that ALL-FT-LEFT is ranked higher than PARSE-σ. Monomoraic feet are not preferred. (23) summarizes the ranking arguments:

(23) Ranking arguments
    a) There is only one foot per prosodic word and it stands at the left edge of a prosodic word.[15] (J. Kim (1998))
       ALL-FT-LT is undominated.
    b) Long vowel shortens to accommodate more syllables in a foot.
       PARSE-σ >> MAX(μ)
    c) Monomoaric nouns are not augmented.
       DEP-μ >> FTBIN
    d) Foot binarity must be maintained in spite of NOCPLX (NUC)
       FTBIN >> NOCPLX(NUC) (: ONSET)

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[13] The constraint ALL-FT-LT is surely controversial as rightly pointed out by one anonymous reader. The controversy is further aggravated by the lack of research on the foot type in Korean as said in fn. 14. The constraint, ALL-FT-LT is proposed in J. Kim (1998) on the assumption that fixed stress languages have one binary foot instead of one unbounded foot. But the analysis here simply assumes any type of foot structure. There for any constraint on the structure of the foot may replace the existing constraints, since the analysis is not crucially relied on the foot structure constraints.

[14] Again, there is controversy as to the foot type of Korean. For some, Korean feet are trochaic (Y. Lee (1993)) and for others they are iambic (J. Kim (1998)). The controversy evolves around the location of stress (or accent) and the moraic status of the coda consonants in Korean. In this analysis, however, nothing hinges crucially on the foot type in Korean. See also the discussion in Hayes (1995:207) supporting that main stress placement may be independent of foot structure as in his analysis of Hixkaryana.

[15] One may justifiably argue that the constraint, ALL-FT-LT, is a doubtful one that may not characterize a foot in Korean, as pointed out by one of the anonymous reviewer. It is conceded that the constraint may be misrepresented here. But we need a certain constraint that delimits the shape of a foot in Korean. Any such constraint that would serve the foot shaping in Korean may replace the constraint introduced here.

(23a) requires that all the prosodic words have only one foot. Pressure to parse syllables into feet works together with ALL-FT-LT to cause vowel shortening. Long vowels may shorten to give room for additional parsing. DEP(μ) is very high in Korean. Empty mora insertion is not witnessed outside of loan word phonology. NOCPLX (NUC) and ONSET are adjacent and their ranking is variable with respect to each other. (See footnote (11)). Thus, by transitivity, FTBIN outranks ONSET as in (23c). Consider the tableaux (24) and (25) to see how the given constraints and their ranking explain the asymmetry:

(24) Exemplary evaluation of the stem vowel shortening in verbs

ta:m + a	ALL-FT-LT	N=PWD	NO CODA	ALIGN-PWD	FT BIN	ON SET	PARSE (σ)	MAX (μ)
a) (ta:.)ma							*!	
b) (ta:m.)a			*!			*	*	
☞c) (ta.ma)								*
d) (ta:.ma)					*!			

(A parenthesis represents a foot.)

(25) Lack of stem vowel shortening in nouns

ka:m + i	ALL-FT-LT	N=PWD	NO CODA	ALIGN-PWD	FT BIN	ON SET	PARSE (σ)	MAX (μ)
☞a) (ka:.)m]i				*			*	
b) (ka:m.)]i			*!			*	*	
c) (ka.m]i)		*!						*
d) (ka.mi)		*!						*
e) (ka).m]i				*	*!		*	*

(24) shows that stem vowels shorten to accommodate as many syllables as possible, while maintaining foot binarity. One crucial assumption in reading the tableaux is that coda consonants are not moraic in Korean.[16] The ranking, PARSE(σ) >> MAX(μ), leads to the shortening of stem vowels to accommodate the additional syllable into the foot in (24c). But in (25), other overriding requirements, N=PWD and ALIGN-PWD, prevent the stem vowel shortening in nouns. As discussed in 3.2, (25b) crucially violates NOCODA and is rendered suboptimal. (25c) has a prosodic word which is smaller than a foot. Having less than one foot, the prosodic wordhood of a noun is not satisfied, hence the violation of N=PWD.[17] The satisfaction of

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[16] The moraic status of coda consonants is quite controversial in Korean. Y. Lee (1993) assumes that coda consonants are not moraic unless they are sonorant geminates. J. Kim (2000) and others assumes that Korean coda consonants are moraic except after long vowels. The controversy, however, are mainly based on the data from idiophonic reduplication. Further since the tableau (25) shows the vowel shortening, the coda consonant in the first syllable /ka: (m)/ are nonmoraic in either interpretation, since it follows a long vowel.

[17] One may argue that (25c) does not have a violation of N=PWD since the right edge of a

FTBIN by (25a) makes it the winner over (25e).

Given that a prosodic word must contain at least a foot and that FTBIN is active in Korean, one may argue that there should not be any monomoraic noun in Korean. But in fact there are many monosyllabic and monomoraic nouns in Korean such as *so* (a cow), *pæ* (a boat), *kom* (a bear) and so forth. But the presence of these monomoraic nouns does not pose problems to the present analysis. The assumption is that FTBIN is not an undominated constraint. Monomoraic nouns may fail to satisfy FTBIN but still it does not interfere with the correct evaluation. It is assumed that these monomoraic nouns satisfy N=PWD, though they violate FTBIN. Consider the evaluation tableau in (26):

(26) Evaluation tableau of a monomoraic noun plus a postposition

kɨ + eke	N=PWD	DEP (μ)	NO CODA	ALIGN-PWD	FTBIN	ONSET	PARSE (σ)	MAX (μ)
☞a) (kɨ)]e.ge					*	*	**	
b) (kɨ:)]e.ge		*!				*	**	
c) (k)e.ge)	*!			*				*
d) (kɨ.]e.)ge	*!					*	*	

As mentioned earlier, DEP(μ) is very highly ranked in Korean. Therefore, it decisively penalizes vowel lengthening as in (26b). Note that the optimal form in (26a) violates FTBIN, but still fares better than other candidates. (26c) and (26d) crucially violate N=PWD, since the prosodic word boundary in each of the examples is embedded within, thus smaller than, a foot. The ranking, FTBIN >> NOCPLX (NUC), makes another prediction that long vowels are witnessed only in the monosyllabic stems both in nouns and verbs.

Finally we will examine the asymmetry in intervocalic consonant cluster reduction given in (6). Consonant clusters at the end of nouns are reduced even before a vowel-initial suffix. But the same reduction is never witnessed in verbs. Thus /kaps (N) + i/ is realized either as [ka.bi] or [kap.si], while /əps (V) + i/ is realized as [əp.si] and [ə.bi] is not acceptable. Kenstowicz (1995) attributes the difference to the presence and absence of the independent form. He proposes a constraint, Base-Identity, which assesses the comparison between a word in isolation (the base) and the derived form. The base is the independent form. The difference, according to the base identity proposal, therefore, is that nouns have independent

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noun coincide with the right edge of a prosodic word as represented in the tableau. But we have to consider another aspect of N=PWD. Given the prosodic hierarchy in McCarthy & Prince (1993: 43), a prosodic word should not be embedded within a foot. In this sense (25c) (and (26d) as well) violates the prosodic hierarchy, hence the violation of N=PWD. In some sense, we may suggest that N=PWD is independent of another constraint on the size of a prosodic word (i.e. PWD ≥ FT.) If so, we may place the size constraint, PWD ≥ FT, higher than N=PWD. This additional constraint, if need be, will eliminate the potential misunderstanding.

forms but verbs do not. Consider the following tableaux:

(27) Evaluation with BASE-IDENTITY
   a) Nouns with bases

kaps + i	BASE-IDENTITY	MAX(C)
i) kap.si	*!	
☞ ii) ka.bi		*
base : kap		

   b) Verbs without bases

əps + i	BASE-IDENTITY	MAX(C)
☞ i) əp.si		
ii) ə.bi		*!

  Putting Base-Identity over Max(C) straightforwardly captures the younger generation's speech. If the ranking is reversed, both of the intervocalic CC appears in the output, as is the case in standard Korean. Crucially the verbs have no bases as shown in (27b). Therefore, BASE-IDENTITY is vacuously satisfied. This shows that both of the intervocalic consonants across stem boundary appear in the younger generation's speech for verbal conjugation.
  One question that arises from the base-identity proposal is why nouns have independent forms while verbs do not. In other words, the base is the cause of constraint interaction. But where the base comes from is not clear at all. The answer might be that it simply is surface-true observation of Korean data. Then what is responsible for the surface fact in Korean? The Base Identity proposal may find difficulty in answering this question, thus, misses an important generalization. The analysis presented in this paper explains that the bases come from the special status of nouns in Korean. They are subject to the constraint, ALIGN-PWD. In other words, the output forms try to be faithful to the candidate that satisfies the constraints N=PWD and ALIGN-PWD. Therefore, we may strongly argue that it is not the base itself but the constraint N=PWD that allows the surface base to exist at all. In other words, base is not the input of constraint interaction, but the output.
  Here we may take either of the following two alternatives. First we can think of serial evaluation, first we derive base from one set of constraint interaction, by positing N=PWD and other relevant constraints in the tableau. And then, we make another evaluation with the resulting base and putting Base-Identity constraint. Another way is to put the two processes all together in one evaluation table. The constraint responsible for producing the base is ALIGN-PWD (which is crucially dominated by N=PWD). Therefore it serves as a special constraint that identify the existing base forms. Then the base identity is allowed to come into the

same tableau. I believe this is the spirit of Sympathy proposal made by McCarthy (1999). ALIGN PWD, responsible for producing base, serves as a selector and ◆SYM works as Base-Identity constraint. What I am trying to show is that Base-Identity Proposal can be subsumed by Sympathy theory. In this context, a more direct wayto capture the presence of bases for nouns, obviating the theoretical issues regarding the source of base, is to adopt the sympathy theory.[18] (cf. M. Lee (1998))

Before presenting a sympathy analysis of the consonant cluster, we have to consider one more constraint:

(28) NOCOMPLEX (CODA) (=NOCPLX(CODA))
    Complex codas are not allowed.

In Korean when there are two consonants in a coda, one of them always deletes. (See Cho (1999) for different but variable data of the cluster simplification.) This means that the constraint NOCPLX(CODA) is an inviolable constraint. The sympathy analysis of the cluster reduction claims that the intervocalic consonant cluster reduction is the result of sympathetic faithfulness to a selected output. The selector constraint is ALIGN-PWD. This consistently argues that nouns are special, being subject to the constraint ALIGN-PWD. Consider the following tableau:

(29) CC reduction for younger generation's speech
    (◆SYM >> MAX(C))

kaps + i	NOCPLX (CODA)	◆SYM	MAX (C)	NO CODA	★ALIGN-PWD	ONSET
a) kap.s]i		※ !		*	*	
☞ b) ka.b]i			*		*	
◆ c) kap.]i			*	*!		*
d) kaps.]i	*!	※		*		*

ALIGN-PWD actively participates as a selector of the sympathetic candidate as marked by "★" in the tableau. There are two candidates, (29c) and (29d) that satisfy the selector constraint. However, (29d) violates an undominated constraint, NOCPLX(CODA), and fails to be the sympathetic candidate in the presence of (29c), which fares better than (29d) in the rest of the ranking. Comparing the sympathetic candidate (29c) with other candidates, we find that (29a) and (29d) cannot satisfy the sympathy constraint, ◆SYM, since these forms did not violate the faithfulness

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[18] It should be noted that the sympathy analysis presented here is not crucially related to the issue of noun-verb asymmetry, the main topic for discussion in this paper. The discussion hereafter simply shows that base-identity proposal can be replaced by sympathy theory in a more constrained way. And doing so will crucially invoke the constraint N=PWD and ALIGN-PWD, the constraints responsible for noun-verb asymmetry in Korean.

constraint, MAX(C), that the flower candidate violates.[19] (cf. McCarthy (1999)) The difference between the younger generation's speech and the standard speech is reflected in the relative ranking of ◆SYM and MAX(C), the two adjacent constraints. If the ranking is reversed, we get the standard speech as in (30):

(30) Evaluation tableau of General Korean (Max (C) >> ◆SYM)

kaps + I	NOCPLX (CODA)	MAX (C)	◆SYM	NO CODA	★ALIGN-PWD	ONSET
☞ a) kap.s]i			※	*	*	
b) ka.b]i		*!			*	
◆ c) kap.]i		*!		*		*
d) kaps.]i	*!		※	*		*

The tableau in (30) shows that there is no sympathy effect in standard Korean. The selector constraint, ★ALIGN-PWD is at odd with MAX(C). Therefore, when ◆SYM is ranked lower than MAX(C), its effect is completely hidden under MAX(C). Now consider that the sympathy analysis leads to the correct output selection in the verbal conjugation.

(31) Sympathy evaluation of a verb-affix sequence

əps + i	NOCPLX (CODA)	◆SYM	MAX (C)	NO CODA	★ALIGN-PWD	ONSET
☞◆ a) əp.si				*		*
b) ə.bi			*!			*
c) əp.i			*!	*		**
d) əps.i	*!			*		**

Since verb stems are not prosodic words, all the verb stems vacuously satisfy ALIGN-PWD.[20] Thus among the candidates the optimal form is the one that best satisfies the ranked constraints. There is no violation of ◆SYM, since the sympathetic candidate does not violate the faithfulness constraint MAX(C). Therefore in this case, regardless of the ranking between ◆SYM and MAX(C), the sympathetic candidate is the optimal output.[21]

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[19] We can think of another form such as [ka.si], which is equal to [ka.bi] against the ranked constraints given here. However, as shown in Iverson and Lee (1994) and M. Lee (1998), there are other constraints involved. Eventually, MAX(Labial) >> MAX(Coronal) will eliminate [ka.si].

[20] The present constraints do not prevent the verb stem to be a prosodic word. But it is assumed here that there is a specific instantiation of anti-structural constraint, NOSTRUC (PWD) (Do not make prosodic words), which is high enough to prevent verbs to be prosodic word, but crucially dominated by N=PWD.

[21] One may wonder what would happen if the sympathy analysis applies to other noun-related

4. Conclusion

In this paper, we have discussed the difference of nouns and verbs with respect to phonological alternations. Glide formation that applies across verb stem boundaries optionally or obligatorily does not apply across noun stem boundaries. A stem-final vowel /ɨ/ in polysyllabic verbs are always deleted, but it stays in nouns. In verbs, we find stem vowel shortening when the following suffix starts with a vowel. But even the monosyllabic long vowels do not shorten before a vowel-initial suffix in case of nouns. Finally, we find intervocalic consonant cluster reduction over a noun stem boundary, but the reduction is not observed across a verb stem boundary.

The previous analyses have not much to say about the observed differences between nouns and verbs. Researchers often resort to different boundary markers or to arbitrary restriction of the domain of the phonological rule application. This paper, however, shows that these differences between nouns and verbs, the noun-verb asymmetry, can be explained in a systematic way. The asymmetry comes from the special status of nouns that they are prosodic words. Being prosodic words, nouns are also subject to a prosodic word alignment constraint that requires that the right edge of a prosodic word should coincide with the right edge of a syllable (ALIGN-PWD). This constraint prevents a noun-final consonant from being resyllabified with the following vowel. But since there are no such restrictions for verbs, the verb-final consonants can be resyllabified. The difference of the alignment constitutes the basic cause of the noun-verb asymmetry. It is also shown that sometimes ALIGN-PWD is violated due to a stronger demand to minimize coda consonants (NOCODA). The crucial ranking NOCODA >> ALIGN-PWD >> ONSET explains the lack of glide formation and the stem vowel deletion.

The interaction of these constraints with such foot related constraints as FTBIN and PARSE(σ) explains the presence of the stem vowel shortening in

phenomenon discussed before. Having ALIGN-PWD as a selector in noun phonology, however, does not pose any problem to the present analysis. For example, let us apply the sympathy analysis to lack of stem vowel shortening discussed in (25). Consider the following evaluation tableau:

ka:m + i	ALL-FT-LT	N=PWD	◆SYM	NO CODA	★ALIGN-PWD	FT BIN	ONSET	PARSE (σ)	MAX (μ)
☞a) (ka:.)m]i					*			*	
◆b) (ka:m.)]i				*!			*	*	
c) (ka.m)i		*!			*				*
d) (ka.mi)]		*!							*
e) (ka.)m]i					*	*!		*	*

(b) is selected as the sympathetic candidate since it is the best one out of the two candidates (b) and (d) which satisfy the selector constraint. Since the sympathetic constraint does not have any faithfulness violation, all the candidates vacuously satisfy the constraint, ◆SYM. Therefore, the work of sympathy is completely hidden in this and other cases discussed so far.

verbs as well as its absence in nouns. Again in intervocalic consonant cluster simplification, which requires a sympathy analysis, we find that the same constraint, ALIGN-PWD, is the selector. This results in the base-identity effect in nouns. As such, the analysis in this paper crucially refers to the prosodic word status of nouns and the prosodic alignment constraint. The analysis given here shows that the optimality theory helps us gain an insightful analysis of the noun-verb asymmetry in Korean, which is not obtainable under any rule-based approach.

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