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Lexicon and syntax in Korean phonology

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University of Hawaii, 1990

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LEXICON AND SYNTAX IN KOREAN PHONOLOGY

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF
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Abstract

This study is about the interplay between phonology and other two modules of grammar—morphology and syntax. The purpose of the study is to demonstrate that failures of some fundamental assumptions in lexical phonology are inevitable in the description of morphology and phonology in Korean.

For the description of Korean word-formation processes, the Stratum Ordering Hypothesis which maintains linear organization of lexical strata, is invalid, because it requires all conceivable combinations of loops. From the phonological aspect, violations of the Opacity Principle (Mohanan 1982) are unavoidable for the description of a wide range of phonological rules in Korean. Contrary to the local reference convention of the Opacity Principle, many lexical and postlexical rules in Korean require global reference to morphosyntactic configuration. The correlation between the directionality of word-internal or phrasal tree branching and the applicability of the rules in question exists. To the exclusion of phrasal coordinate structure, the rules apply only to left-branching structures, whereas they fail to apply to right-branching structures. The same fact is well described by the dependency condition which encompasses modifier-head and argument-head relationships.

In relation to the interaction between morphosyntactic structure and ordering paradoxes, two pairs of phonological rules in Korean which display ordering paradoxes are examined. As opposed to the unmotivated separation of the rules in question as is the usual practice in linear

ordering descriptions, I claim that the ordering paradoxes observed are predictable phenomena given the proper placement of syllabification. The late syllabification at the end of the phonological derivation of a word cycle is proposed to predict the ordering paradoxes.

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List of Abbreviations and Symbols

Abbreviations

A	adjective
Ahn	Ahn (1985)
ACC	accusative case
Adv	adverb
adv1	adverbial
AdvP	adverbial phrase
AP	adjective phrase
arg	argument
ASP	Aspiration
BE	bracket erasure
caus	causative
CCS	Consonant Cluster Simplification
Co-co	Co-compounding
conj	conjunction
cop1	copula
DAT	dative case
decl	declarative
delm	delimiter
Deri	derivation
Det	determiner
dimi	diminutive
DOC	disjunctive ordering convention
frm1	formal
GEN	genitive case
HCI	Homorganic Consonant Insertion
hon	honorific
impr	imperative
ind	indicative
inf	infinitive
Infl	inflection
intr	interrogative
ISS	Initial Syllable Shortening
KR	Kim-Renaud (1974)
]-Nas]-Nasalization
LOC	locative case
LP	lexical phonology
mod	modifier
N	noun
n-Lat	n-Lateralization
NISS	Non-Initial Syllable Shortening
Nom	nominalization
NOM	nominative case
nomn	nominalizer
KK	Kenstowicz and Kisseberth (1973)
KR	Kim-Renaud (1974)
NP	noun phrase
pass	passive
past	past

pastm	past modifier
pcle	particle
perf	perfective
pl	plural
POT	Post-Obstruent Tensification
PP	postpositional phrase
pres	present tense
proc	processive modifier
prop	proposative
pros	prospective modifier
pstm	postmodifier
retr	retrospective modifier
S	sentence
SAdv	sentential adverb
SD	structural description
SFN	Syllable-Final Neutralization
Sub-co	Sub-compounding
susp	suspective
t-Ep	t-Epenthesis
TOP	topic marker
transf	transferentive
V	verb
VOI	Intersonorant Lenis Stop Voicing
VP	verb phrase

Phonemic Inventory of Korean

1. Consonants

	labial	alveolar	palatal	velar	glottal
stops:					
lenis	p	t	c	k	
tense	p'	t'	c'	k'	
aspirate	p''	t''	c''	k''	
fricatives:					
lenis		s			h
tense		s'			
nasals	m	n		ŋ	
lateral		l			
glides	w		y		

2. Features of Consonants

	p	p'	t	t'	s	s'	c	c'	k	k'	m	n	ñ	l	w	y	h
cons	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+
son	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+
cont	-	-	-	-	-	+	+	-	-	-	-	-	-	-	+	+	+
ant	+	+	+	+	+	+	+	-	-	-	-	-	+	+	-	+	-
cor	-	-	-	+	+	+	+	+	+	+	-	-	-	+	-	+	-
tns	-	+	+	-	+	+	-	+	+	-	+	-	-	-	-	-	-
asp	-	-	+	-	-	+	-	-	-	+	-	-	-	-	-	-	+
lat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
nas	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-
back	-	-	-	-	-	-	-	-	-	+	+	+	-	-	+	-	+

3. Vowels

backness	-back		+back	
roundedness	-round	+round	-round	+round
+high	i	ü	ɨ	u
-hi, -low	e	ö	ø	o
+low	æ		a	

The following phonetic symbols are used instead of the IPA symbols:

C'	tense or tensed consonant
C''	aspirate or aspirated consonant, [c ^h]
C=	unreleased consonant
Ñ	velar nasal, [ŋ]
ñ	palatalized nasal, [ɲ]
ɺ	palatalized lateral, [ɺ]
Ü	high front rounded vowel, [u]
ö	mid front rounded vowel, [ø]
ø	mid back unround vowel, [ʌ]
ɨ	high back unround vowel, [ɨ]
y	palatal glide, [j]
j	voiced palatal stop, [j̥]

Chapter 1

Introduction

This dissertation is about the interplay between phonology and other two modules of grammar--morphology and syntax. The main concern of the study is to demonstrate that violations of some fundamental principles in lexical phonology are inevitable in the description of morphology and phonology in Korean.

In the theory of generative phonology given in Chomsky and Halle (1968) "The Sound Pattern of English (SPE)," morphology-sensitive phonology has been described by various formative boundaries in the formulation of phonological rules. Opposed to the boundary account in SPE, in the theory of lexical phonology (e.g. Mohanan 1982, 1986), the interaction between morphology and phonology is described by linearly-ordered morphological strata, a subset of phonological rules being specified for the strata they apply in. Other phonological rules are in the postlexical module.

On morphological grounds, I argue against linear organization of lexical strata which is based on the Stratum Ordering Hypothesis. For the description of Korean word-formation processes, the linearly-ordered strata organization of Ahn (1985) turns out to be invalid, because it requires all combinations of loops, for which the theory has to allow the output of one stratum to move back to any of its previous strata. In fact, any ordered strata organization will end up with very many loops due to the fact that Korean word-formation rules are relatively

free in taking the results of other word-formation processes as their input (cf. Chapter 2).

From the phonological aspect, violations of the Opacity Principle (Mohanan 1982) are inevitable in the description of a wide range of phonological rules (lexical and postlexical rules) in Korean.

The Opacity Principle can be seen as a direct consequence of the bracket erasure convention by which all internal brackets are erased at the end of every morphological operation. This theoretical assumption yields very powerful claims about the nature of lexical and postlexical rules. By virtue of the erasure of internal brackets at the end of a morphological operation, a lexical rule cannot refer to the morphological information of its previous strata. Postlexical rule operations are blind to word-internal morphological structure or information, since all internal brackets are erased at the end of the last lexical stratum.

Contrary to the claims of the Opacity Principle, many lexical and postlexical rule applications in Korean prove to be sensitive to the internal morphosyntactic configuration of forms to which they apply: There is a correlation between the morphosyntactic structure (of word or phrase) and the applicability of the phonological rules in question. Violations of the Opacity principle with respect to word-internal structure/information include constraints on t-Epenthesis in derivative compound nouns, Initial Syllable Shortening, and Post-Obstruent Tensification in compound nouns. Modifier Tensing is also a counterexample to the Opacity Principle: Modifier Tensing requires morphological information despite its postlexical status. Moreover, a

careful observation of Modifier Tensing reveals that it is not only morphology-sensitive but also syntax-sensitive. The rules in question apply only to left-branching structures (of words or phrases), whereas they fail to apply to right-branching structures (cf. Chapter 3).

In Chapter 4, I present two pairs of rules in Korean which display ordering paradoxes. In a number of languages, many apparent counterexamples to the Connectedness and the Antisymmetry conditions of the linear ordering theory have been observed. But, within linear ordering theory, due to the linear ordering requirement, ordering problems have been dealt with in many ad hoc ways, such as reformulation or separation of otherwise well-formed rules, and redefinitions of features, etc. As an alternative to the unmotivated separations of the rules in question (as found in, e.g., Kim-Renaud 1974), I claim that the two ordering paradoxes observed in Korean are predictable phenomena, given the proper assignment of syllable structure. There is a correlation between the morphosyntactic structure of forms to which rules apply and the applicational precedence between two types of rules--syllable structure sensitive and syllable structure insensitive rules. Within underived forms or across suffixational boundary, syllable structure insensitive rules precede syllable structure sensitive rules, whereas the opposite order is obtained across compound, word, phrase boundary. For the description of such ordering, I propose late syllabification at the end of a word cycle. This late syllabification ensures the word-internal order, syllable-structure insensitive rules before syllable-structure sensitive rules. For the opposite order required across a word boundary, which includes compound

or phrase boundary, I propose the obligatory application of syllable-structure sensitive rules in the presence of syllable structure.

Chapter 5 concerns syntax-phonology interaction in Korean. The domain of phrasal phonology also reveals the failure of the Opacity Principle in the postlexical level. The phrasal domain of three assimilation rules in Korean has been defined as a phonological phrase (P) in Y-M. Cho (1987) and G-R. Kim (1988), adopting Selkirk's theory of hierarchical organization of prosodic categories. The rules in question are Intersonorant Lenis Stop Voicing, Stop-Nasalization, and Consonant Place Assimilation. Y-M. Cho (1987) and G-R. Kim (1988) propose different versions of P-mapping rules which make use of the syntactic notions in X-bar theory.

The reevaluation of these two P-mapping accounts reveals that there is a restructuring problem with regard to P-formation. In an effort to eliminate the restructuring problem, the c-command condition is examined. But, the c-command condition turns out to be very ad hoc, containing the coordinate structure constraint within the definition of c-command. Instead, I propose the dependency condition which make use of the notion of complement-head relationship. The dependency condition not only predicts the phrasal applicability of the rules in question correctly, but also does not raise certain other problems that the other accounts have.

Chapter 2

Against Lexical Phonology

In this chapter, I will argue against some basic assumptions of the theory of Lexical Phonology, particularly those of Mohanan (1982, 1986). The major concern of the chapter is to demonstrate the morphological inadequacy of ordered stratification in the description of Korean word-formation rules. Ahn (1985), being one of the comprehensive works on Korean morphophonology in the framework of Lexical Phonology, provides a practical object of my criticism of the theory (henceforth, I will refer to it as Ahn or the LP analysis).

The inadequacy of linearly ordered strata for the description of Korean morphology has been demonstrated in much of the current literature on Korean morphophonology: That is, any linearly ordered strata organization will end up with very many loops due to the fact that Korean word-formation rules (the morphological strata in Lexical Phonology) freely take other word-formation rules as their input (cf. Y-S. Kim 1984: 146-149, J-M. Kim 1986: 286-289, and H-S. Sohn 1987: 212-229).

Section 2.1 introduces some basic theoretical assumptions of Lexical Phonology. Section 2.2 presents a morphology-sensitive postlexical rule, Modifier Tensing, which violates the Opacity Principle (Mohanan 1982), and discusses its theoretical implications. The interesting fact is that Modifier Tensing is not only morphology-sensitive but also syntax-sensitive. The phrasal domain of Modifier Tensing appears to be sensitive to the directionality of syntactic trees

branching. In other words, one may say that the modifier-head relationship plays the key role in the application of Modifier Tensing (cf. Chapter 5 for more detailed discussion about the phrasal domain of phonological rules).

Section 2.3 deals mainly with the morphological inadequacy of stratification theory for the description of Korean word-formation rules. For the morphological inadequacy of ordered strata theory, 2.3.3 presents all conceivable combinations of loops needed for Ahn's strata organization. 2.3.4 shows that, with regard to Umlaut in Korean, the Stratum Domain Hypothesis (Mohanan 1982, 1986) is not achievable unless we reorder the strata organization of Ahn (1985), and 2.4 explores alternative ways to describe the domain of the lexical rules in question.

2.1 The Basic Assumptions in Lexical Phonology

The theory of Lexical Phonology, which incorporates the idea of level ordered morphology (Aronoff 1976, Siegel 1974, Allen 1978) into phonology, has been developed by Petsetsky (1979), Kiparsky (1982, 1985) and Mohanan (1982, 1986).

There are two major views regarding the interaction between morphology and phonology: The earlier work of Kiparsky (1982) takes the view that each word-formation component or stratum constitutes an independent module with its own set of phonological rules. The later work of Kiparsky (1985) and Mohanan (1982, 1986) takes a different view; there is a single set of phonological rules which interact with

word-formation strata in the lexical module and with postlexical modules. In other words, in the former model, the phonological rules *belong to* discrete modules or strata, whereas, in the latter model, phonological rules do not belong to a module or stratum, but each phonological rule *is specified for* its domain of application with respect to one or more strata. In this respect, Mohanan uses the term X-stratum applications or operations instead of X-stratum rules. Since I deal mainly with Mohanan's version of Lexical Phonology in this study, I follow Mohanan's terminology for presentational purposes without intending to imply any preference of my own.

In the core of Lexical Phonology in Mohanan (1982, 1986), the interaction between phonology and morphology is described by the assignment of lexical strata, and it is maintained that a phonological rule must be specified for its domain with respect to one or more strata in tandem with morphological operations. Another subset of rule operations are in the so-called postlexical module. As a major criterion to distinguish lexical rule applications from postlexical rule applications, Mohanan (1982, 1986) uses sensitivity to morphological information, maintaining the following principles:

- (1) Postlexical rules are blind to the internal structure of words. (Mohanani 1982: 2)
- (2)
 - a. A rule application requiring morphological information must take place in the lexicon.
 - b. A rule application across words (=output of the lexicon) takes place postlexically.
 - c. A rule application across words may not precede a rule application requiring morphological information in any derivation. (Mohanani 1986: 8-10)

(1), which expresses the opacity of postlexical rule application, is a sub-principle based on the fundamental principle called the Opacity Principle or Bracket Erasure:

- (3) **The Opacity Principle**
 The internal structure at one stratum is invisible to the process at another. (Mohanani 1982: 8)

Bracket Erasure
 Erase the internal brackets at the end of each cycle. (Mohanani 1986: 23)

Notice that Bracket Erasure (Mohanani 1986) is a narrow version of Opacity Principle (Mohanani 1982): Bracket Erasure erases the internal brackets at the end of each *cycle*, while the Opacity Principle makes the internal structure of one *stratum* invisible to others. A cycle is defined as a round trip to and from a morphological operation, and a stratum may consist of more than one trip to the same morphological operation if it is cyclic (cf. Mohanani 1986: 59, footnote 7). Since the difference does not matter to my discussion, I will use the term *the Opacity Principle* as a cover term for both principles.

Along with these, some other basic assumptions of Lexical Phonology in Mohanani (1982, 1986) which are relevant to the subsequent discussion are:

- (4) **Lexical Word-Formation Rules (henceforth WFRs)**
 All WFRs are in the lexicon. WFRs are organized into one or more lexical strata.
- (5) **Stratum Ordering Hypothesis (Mohanani 1982: 4, 1986: 21)**
 The lexicon consists of a set of ordered strata.

- (6) **Stratum Domain Hypothesis**
 The domain of application of a rule is specified in terms of continuous strata (Mohanani 1982: 60)
 The domain of application of a rule is specified in terms of strata. The domain of a rule may not contain nonadjacent strata. (Mohanani 1988: 21, 47)
- (7) **Looping Device** (Mohanani 1982: 26-28, 1986: 51-52)
 Recursion between adjacent strata is possible through the device of the loop.

Unfortunately, the morphophonological facts in Korean appear not to be compatible with any of the claims listed above. In this chapter, I will point out that not a single assumption in (1) through (7) is accurate or appropriate for the description of morphophonology in Korean: In the next section, I will argue against the claims of (1) through (4), and the section following will deal with those of (5) through (7).

2.2 Postlexical Violation of the Opacity Principle

(1), which expresses the opacity of postlexical rules, is a sub-principle of the Opacity Principle (3). While (1) disallows postlexical rules from having access to morphological information, (2a) states that morphological information is the exclusive property of lexical rules. (2b) defines a postlexical application as a rule application across words, and (2c) defines the order between the two types of rule applications.

(4) claims that WFRs are exclusively in the lexicon. This so-called "lexicalist" view excludes other sources of word-formation such as syntactic word-formation. This view has been widely accepted by

lexical phonologists, such as Mohanan (1982, 1986) and Kiparsky (1982, 1985). But the question of whether all WFRs are in the lexicon is an empirical question which needs to be verified by actual linguistic data.

Morphosyntactic and phonological facts regarding the postlexical rule called Modifier Tensing strike a strong blow against the claim (1), (2a), (3) and (4): First, as a counterexample for (4), the word-formation rule with regard to Modifier Tensing reveals that there must be a recursion from syntax to lexicon. Second, contrary to the claims of (1), (3) or (2a), despite its postlexical status, Modifier Tensing requires morphosyntactic information. Before showing this, I will describe Modifier Tensing.

2.2.1 Modifier Tensing

Modifier Tensing refers to the tensing of lenis obstruents as the beginning segment of nouns when preceded by the prospective modifier $-t_1$. The following is the rule formulation in Kim-Renaud (1974) (henceforth KR). KR calls it Modifier Boundary Fortition.

(8)¹ Modifier Tensing (from KR 1974: 178)

[-son] --> [+tns] / t = ___

(A lenis obstruent becomes tense after a modifier final t; here '=' stands for a modifier boundary.)

Given below are some examples of Modifier Tensing:

(9)²

- a. **ponə-1 salam** [ponəls'aram] 'person to send away'
 send-pros person
- cu-1 ton** [cult'on] 'money to give'
 give-pros money
- môk-+1 pap** [môk+1p'ap] 'rice to eat'
 eat-pros rice
- kônnô-1 tal1** [kônnô1t'ari] 'bridge to cross'
 cross-pros bridge
- p"a-1 cip** [p"a1c'ip] 'house to sell'
 sell-pros house
- cap-+1 koki** [cab+1k'og1] 'fish to catch'
 catch-pros fish
- b.
- nə11 ka-1 salam** [nə11gals'aram] 'the person who will leave tomorrow'
 tomorrow go-pros person
- sun1 cu-1 ton** [sun1jult'on] 'the money to give Suni'
 Suni give-pros money
- nə11 môk-+1 pap** [nə11môg+1p'ap] 'the rice to eat tomorrow'
 tomorrow eat-pros rice
- c.
- môk-+n pap** [môg+mbap] 'rice that one ate'
 eat-past rice
- môk-n+n pap** [môñn+mbap] 'rice that one is eating'
 eat-proc
- môk-tôn pap** [môkt'ônbp] 'rice that one used to eat'
 eat-retr
- d.
- ku1 + côc** [ku1jôt] 'oyster preserve'
 oyster preserve
- mul + paña** [mulbaña] 'water mill'
 water mill
- sal-ta** [saldə] 'live'
 live-deci
- e.
- nə-ka mat"-+1 sal1im**
 *[.....s'.....]
 [.....s.....]
 I-NOM take-pros living
 'a livelihood that I will take'

uli-ka ilukha-! kukka kyôŋce
 *[.....k'.....]
 [.....k.....]
 we-NOM accomplish-pros nation economy
 'national economy that we will accomplish'

Notice that the obstruent tensification does not happen after other modifiers which end with an alveolar nasal (such as the past modifier -ŋ, the processive modifier -nŋ, and the retrospective modifier -tôn); rather intersonorant stop voicing occurs (cf. (9c)). Also, as is illustrated in (9d), in compounding or verbal suffixation, when Modifier Tensing fails to apply, intersonorant voicing takes place. Modifier Tensing is selective to particular lexical items, as is illustrated in (9e). Apparently, the rule applies mostly to mono- or disyllabic pure Korean words, but not to disyllabic or longer Sino-Korean words. Since other modifiers which end with segments other than 1, and since compounding and other suffixation do not trigger tensification of the following obstruents, the structural description (henceforth SD) of rules like KR's (8) contains the segmental specification 1 as well as requiring the presence of a modifier boundary.

However, the rule formulation (8) is inaccurate because there is no such tensification between modifiers. Consider the following examples in which determiners, quantifiers or other modifiers mediate a prospective modifier and a head noun (cf. (10a), (10b) and (10c) respectively):

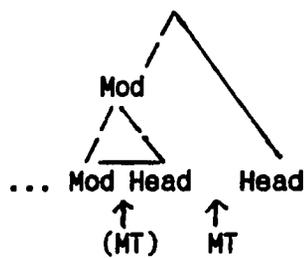
- (10)³
- a. [môk-+1 [k+ pap]]
 [môg+lg+bap], *[môg+lk'+bap]
 eat-pros that rice
 'that rice to eat'

- [p"al-1 [tu cip]]
 [p"aldujip], *[p"alt'ujip]
 sell-pros two house
 'two houses to sell'
- b. [ponə1-1 [salañha-nŋ salam]]
 [ponə1sarañhanŋsaram]⁴
 send-pros love-pres person
 'the loving one to send away'
- [hyðñcañ-e ka-1 [cuk-ŋ1 salam]]
 [hyðñjañega1jugŋ1s'aram]
 execution ground go-pros die-pros person
 'the one who will go to the execution ground and will die'
- c. [[ton pð1-1 sañkak-man-ha-1]S' salam]N
 [tombð1s'añgañmanhals'aram]
 [.....s'.....s'.....]
 money earn thought-delm-do-pros person
 'the one who will merely think of money making (business)'
- [[cuk-ŋ1 kðkcðñ-ŋ1-ha-1]S' salam]N
 [cugŋ1k'ðkc'ðñŋ1hals'aram]
 [.....k'.....s'.....]
 die-pros worry-ACC-do-pros person
 'the one who will worry about dying'

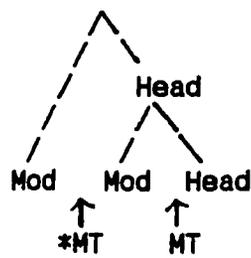
Examples in (10a/b) constitute a negative condition for Modifier Tensing in the right-branching structure. While Modifier Tensing never applies between modifiers in the right-branching structures like (10a/b), there is no such absolute restriction in the left-branching structures of (10c). According to the observation of natural speech of (10c), Modifier Tensing may or may not apply within a relative clause, while it applies obligatorily between a modifier and its head noun. Then, putting details aside, such as the optionality in the relative clause of the left-branching structure, the applicability of Modifier Tensing can be well predicted by the directionality of syntactic tree branching--the left-branching vs. right-branching. Configuration-sensitivity like this leads to a very interesting topic in the discussion of the domain of

phrasal phonology (cf. Chapter 5 for details). The diagram below summarizes the correlation between the two structures and the applicability of Modifier Tensing:

(11) a. Left-branching



b. Right-branching



(Here, \overline{MT} stands for the obligatory application of Modifier Tensing, parentheses for the optional application of the rule, and * for non-application of the rule.)

From a different perspective, we may postulate that Modifier Tensing applies only across words which hold a modifier-head relationship. That is, the rule applies continuously when there is a successive modifier-head relationship as in (11a), whereas the rule fails to apply between two modifiers which do not hold such dependency relationship as in (11b). Then, the rule must specify not only \bar{l} as a part of a modifier but also the obstruent as the initial segment of a head noun. As a first approximation, Modifier Tensing can be revised as (12):

(12) Modifier Tensing (1st approximation)

[-son] --> [+tns] / \bar{l}]_A N [_____

(A lenis obstruent of a noun becomes tense after a modifier final \bar{l} .)

But, a rule formulation like (12), which refers to sound value, is misleading due to the fact that the sonorant segment *l* does not have an inherent feature to tensify or glottalize the following obstruent. What we really gather from the SD of "*l*]_A" is morphological information which designates the prospective modifier as a left-side environment. For that matter, a rule formulation which uses the morphological feature like "*]*_{pros}," which stands for a prospective modifier ending, is more straightforward way to express the phenomenon. As a second approximation, the rule can be revised as (13):

(13) Modifier Tensing (2nd approximation)

[-son] --> [+tns] /]_{pros} N[_____

(A lenis obstruent of a noun becomes tense after a prospective modifier.)

The reason that I still call (13) an approximation is that if we adopt a general principle such as the right-branching constraint (cf. (11)), such detailed specification like "*N*[" will not be needed. Then, the final version of rule formulation will look like following:

(14) Modifier Tensing (final version)

[-son] --> [+tns] /]_{pros} _____

(A lenis obstruent becomes tense after a prospective modifier.)

That morphological information is required in Modifier Tensing is a problem for Lexical Phonology. The theory maintains that postlexical applications are blind to the internal structure of words and that

morphology-sensitive rules must take place in lexical strata (cf. (1) and (2a) respectively). By principle (2b), since the rule applies across words, the domain of Modifier Tensing must be postlexical. Yet, we have seen that Modifier Tensing requires a word-internal morphological condition, namely, reference to the prospective modification suffix. The blindness to word-internal structure or morphological information in the postlexical applications can be considered as a consequence of the Opacity Principle (3): I.e., when words enter the postlexical module, internal brackets are no longer visible by the Opacity Principle (or do not exist by virtue of Bracket Erasure—since we are dealing with a postlexical operation, the version does not make any difference in this case).

The morphology sensitivity of Modifier Tensing described above contradicts the dichotomy between lexical and postlexical application by the sensitivity to morphological information (cf. (2a)). For convenience, (2) is copied below:

- (2)
- a. A rule application requiring morphological information *must* take place in the lexicon. (the emphasis is mine—DSP.)
 - b. A rule application across words (=output of the lexicon) takes place postlexically.
 - c. A rule application across words may not precede a rule application requiring morphological information in any derivation.

While Modifier Tensing satisfies both conditions of (2a) and (2b), requiring morphosyntactic information and applying across words, each

principle tells Modifier Tensing to go in different modules--the former to the lexicon, the latter to the postlexical module. Then, where should Modifier Tensing go? If the phrasal application of (9) is the determining relevant fact, consistent with (2b) as a correct principle, we might be able to say that (2a) is an incorrect principle.

But the fact is not that simple. (9) is not the only relevant data for classifying Modifier Tensing. There are so-called sentential compounds with bound nouns which involve the same prospective modifier. Given below are some examples of such compounds:

- (15)
- | | | | |
|----|--------------------------------------|--------------|---|
| a. | /môk-†l-kôs/
eat-pros-thing | [môg†lk'ôt] | 'food, things to eat' |
| | /p"al-l-kôs/
sell-pros | [p"alk'ôt] | 'goods, things to sell' |
| | /p'a-l-kôs/
wash-pros | [p'alk'ôt] | 'laundry, things to wash' |
| | /k'al-l-kôs/
sit-pros | [k'alk'ôt] | 'mat, things to spread out' |
| | /t"a-l-kôs/
ride-pros | [t"alk'ôs] | 'means of transportation,
things to ride on' |
| b. | /anc-†l-kæ/
sit-pros-thing | [anj†lk'æ] | 'the seat of a loom' |
| | /c"am-†l-s'ôÑ/
endure-pros-nature | [c"am†ls'ôÑ] | 'endurance' |
| | /cuk-†l-sañ/
die-pros-face | [cug†ls'aÑ] | 'an agonized look' |
| | /cuk-i-l-nom/
die-caus-pros-guy | [cugillom] | 'a rascal' |
| | /cuk-†l-pyôÑ/
die-pros-disease | [cug†lp'yôÑ] | 'an incurable disease' |

The compound nouns above not only have the prospective modifier, but also exhibit the identical phonological phenomenon, Modifier Tensing. For both the WFR and Modifier Tensing, which are responsible for the forms in (15), what we need is a syntax-to-lexicon recursion or loop. Cases like this are treated as exceptional *limited recursions* in Kiparsky (1982). However, considering the fact that sentential nominalizations (by bound nouns or nominalizers such as -ki and -im) are very productive WFRs in Korean, I am reluctant to call it exceptional. According to David Stampe (personal communication), a *morphologization* or lexicalization process like this is one of the prominent typological features of left-branching (SOV) languages. At any rate, very productive processes in a language must not be set aside as exceptions.

In fact, there appears to be a gradual transition of the morphologization or lexicalization process from phrasal to lexical forms: I.e., for the compounds in (15b), the literal compositional meaning is not appropriate, but only the lexicalized meaning exists, e.g. [anjɨlk'æ] does not mean 'the thing to sit on' but 'the seat of a loom,' and [cugillom] is no longer 'one to kill' but 'a rascal,' etc.⁵ For the forms in (15a), on the other hand, both lexicalized and compositional meanings are possible, e.g., [mŏkgɨlk'ŏt] can be either 'food' or 'something to eat' according to the context of speech. This suggests that the forms in (15a) are somewhere in the intermediate stage between phrasal and lexical status.

To summarize, so far we have confirmed that morphosyntactic and phonological facts with regard to Modifier Tensing disqualify the assumptions (1), (2a), and (3): I.e., in their morphological aspect,

WFRs are not the exclusive property of the lexicon, but some are syntactic (the postlexical level in Lexical Phonology's terminology). The syntax-to-lexicon recursions of WFRs, being very productive in a certain type of language, must not be treated as exceptions. From the phonological viewpoint, the existence of postlexical morphology-sensitive rules like Modifier Tensing reveals that the principle that asserts postlexical operations to be blind to word-internal structure or morphological information is too strong. Obviously, to account for morphology-sensitive phrasal (postlexical) rule operations, what we need is a theory in which at least some rules may have access to morphosyntactic information.

In connection with accessibility of non-phonological information, in fact, the latter revised model of Lexical Phonology (Mohanan 1986) releases postlexical operations in some degree, allowing postlexical operations to refer to some syntactic information. In this model, the postlexical module is divided into two sub-modules, the syntactic and postsyntactic modules. The change is that the rules applying in the syntactic module may (or may not) be sensitive to syntactic information, but they are still blind to morphological information, whereas the rules in the postsyntactic module cannot be sensitive to either one. Although Mohanan (1986) opens the way to access syntactic information in the syntactic module, it still excludes morphological information from the syntactic module. Then, even within this revised model of Lexical Phonology, morphology-sensitive postlexical operations still pose a dilemma.

For that matter, if Modifier Tensing requires syntactic features like [noun] or [adjective], as appears to be the case in the rule formulation of (11), the revised theory will not have a difficulty in handling the rule in the syntactic module. For lexical exceptional features and for syntactic features, Mohanan suggests one dubious path to explore: I.e., to have Bracket Erasure not only erase internal brackets but also external brackets at the end of a stratum (in our case, it will be the end of lexical strata), and to rebracket the forms at the next stratum (in our case, at the syntactic module) with some morphological and lexical exceptional features (e.g. [Latinate], or [-Trisyllabic Shortening], etc.) and syntactic features (e.g. [noun], [adjective], [+past], [+ACC], and [+plural], etc.) (cf. Mohanan 1986: 24-25, 149).

However, for Modifier Tensing, in addition to the syntactic and phonological information (viz. [noun] and [-son]), what we need is a morphological feature [pros] which selects one specific type of modifier ending among many. Recall that I rejected the rule formulation (11) in favor of (12) due to the fact that the sole motivation for " $]_A$ " is to choose the prospective modifier ending. A feature which denotes a specific modificational suffix is certainly morphological, and may be syntactic. One may say that the new theory may work for Modifier Tensing if we treat the feature [pros] as syntactic, not morphological. But, at least for cases like this, the distinction between syntactic and morphological features is obscure, and the differentiation of the two appears to be unimportant.

However, insofar as the directionality of tree-branching (or the modifier-head relationship) contributes to the phrasal domain of Modifier Tensing (cf. (11)), the applicational restriction, namely the right-branching constraint, is only possible through dominance-based relations in the syntax.

For the last decade, there has been much discussion on the syntax-phonology interface issue. In a number of languages, the application vs. non-application of phrasal rules has been established in terms of syntactic properties. Both the two logically possible positions have been taken--namely, the direct and indirect syntax approaches.⁶ The direct syntax approach has been taken by Kaisse (1985) and Odden (1986): For a phonological rule to operate between two words of α and β , they propose requirements such as that α and β belong to the same maximal projection (X_{α}^{\max}), or that α must c-command β within this maximal projection, and the like.

The opposing view has been taken by Selkirk (1980), Nespor and Vogel (1986), and Hayes (1984). As a typical model of indirect syntactic approaches, we may cite Selkirk's hierarchical organization of phonological representations: A very rich hierarchy of prosodic categories--the syllable (σ), the foot (ϕ), the prosodic word (W), the phonological phrase (P), the intonational phrase (I), and the utterance (U)--is proposed. This is a two-step process. The similar morphosyntactic information can be used in defining phonological domains (such as W and P). But, the syntax (which includes word-level syntax) does not directly interact with the phonology, while these phonological domains derived from the syntax do. I will examine which approach is

desirable for the description of Korean in Chapter 5, using more relevant data. Putting off details for Chapter 5, suffice it to say that there are two major views on the issue, and that for our immediate concern, for specifying the phrasal domain of Modifier Tensing, the right-branching constraint will be sufficient.

2.3 Ordered Stratification

2.3.1 Theoretical Preliminaires

Before I turn to the next assumption (3b), the Stratum Ordering Hypothesis, a brief sketch of how Mohanan supports his stratal organization is in order.

To justify the ordering lexical strata, Mohanan (1982, 1986) cites facts on morpheme distribution and phonological behavior with respect to morphological processes in English and Malayalam. E.g., in the description of English, as a morphological motivation, he uses distributional facts about affixes: A certain set of affixes (namely, class II) are able to attach to stems containing another set of affixes (namely, class I), but not vice versa (compare (16a) with (16b)), while affixes in the same class can be attached freely more than once (see (16c) and (16d)):

(16)

a. stem + II + I

*bcuntifulity, *guardedity, *pitilessity

b. stem + I + II

religiousness, universalness, periodicness

c. stem + I + I
religiosity, universality, periodicity

d. stem + II + II
bountifulness, guardedness, pitilessness

(Class I affixes include *-in*, *-ity*, *-ic*, *-ian*, *-ory*, *-ary*, *-ous*, *-ion*, *-ate*, *-al* (adjectival), *-y* (nominal); and class II affixes include *un-*, *-ness*, *-less*, *-hood*, *-like*, *-dom*, *-ful*, *-ship*, *-ed* (adjectival), *-ing* (nominal).)

Here, what Mohanan assumes is that, if a WFR with a group of morphemes can be an input to that of another group of morphemes, the former must precede the latter in his linearly ordered morphological strata organization.

As a phonological motivation of the stratal organization, he uses the fact that certain phonological rules may apply exclusively with a particular type of morphological process. E.g., English stress rules, Trisyllabic Shortening, etc. are applicable with the class I affixation but not across the class II affixations, while another set of rules such as *g*-Deletion and *n*-Deletion applies with the class II affixations but not with the class I affixations.

However, as Mohanan (1986: 51-52) realizes, it would be too much to expect for a language to provide both morphological and phonological motivations for the strata distinction in all cases. Therefore, we often have to accept a strata distinction on a single ground: I.e., if a language exhibits data which require any loop (a device that allows the output of stratum *n* to move back to stratum *n-1*) in the word formation process, we should turn to the other side of the coin, the phonological phase. E.g., English words like [[re [[air] [condition]]] and [[[hard] [hearted]] ness] require a looping device from a

compounding process (stratum 3) to the class II derivation (stratum 2). Since this morphological loop weakens the assumption of linear order of strata 2 and 3, we look to the distribution of phonological rules to evidence such an assumption.

On the other hand, if a phonological rule applies in more than one stratum, as in the case of English Palatalization, we should depend on distributional facts of morphemes. E.g., English s-Palatalization applies in both lexical (stratum 2) and postlexical modules, as in 'racial' [reyʃəl] and 'race yard' [reyʃyard], we should look for morphological evidence (for detailed discussion see Mohanan 1986: 42-44).

2.3.1.1 Sub-compounds vs. Co-compounds

Prior to the main discussion about the lexical analysis of Korean in Lexical Phonology, Ahn (1985), a few words about criteria by which lexical WFRs can be distinguished into sub-fields are in order: Since Ahn (1985) proposes four lexical strata of Sub-compounding, Co-compounding, Derivation and Inflection for Korean, I should mention the grounds for such a four-way classification.

The distinction of sub(ordinate) vs. co(ordinate) compoundings can be made principally by semantic interpretation of compounds. I.e., as labels indicate, if there is a coordinate relationship between compounding elements, it is treated as a co-compound, whereas, if there is a subordinate relationship (the modifier-head or complement-head

relationship) between the elements, it is a sub-compound. This criterion can be represented as the semantic headedness of compounds:

(17) a. Sub-compounding



b. Co-compounding



(X and Y stand for semantic entities, and higher nodes are semantic heads of compounds.)

(18)

a. examples of sub-compounds

/næ + ka/ [næt=ka] --> [næk=k'a] 'riverside'

/næ + mul/ [næt=mul] --> [næmul] --> [næmmul] 'stream water'

b. examples of co-compounds

/ma + so/ [maso] 'horses and cows'

/pom + kaɬl/ [poŋgaɬl] 'spring and fall'

Related to our major interest, there are phonetic differences between the two types of compounds in Korean. As is exemplified in (18a), across the sub-compounding elements an epenthetic-t is proposed, whereas there is no such phenomenon across the co-compounding boundary. Because of this very fact, two strata of compounding are proposed in Ahn (1985), providing that t-Epenthesis applies in Sub-compounding stratum only.⁷

2.3.1.2 Derivations vs. Inflections

Among others, the most frequently used criteria for the distinction between derivations and inflections include (i) changes in word-class, (ii) relative order of the two types of suffixes, (iii) semantic regularity, and (iv) productivity.

Related to (1), Anderson (1982: 586) states that

... We conclude that the fact that a given process changes in word-class membership constitutes only a sufficient and not a necessary criterion for classifying it as derivational, and thus that we must look elsewhere for our definition (of derivation) ...

Contrary to Anderson's condition for derivational status, as Ahn (1985) classifies some nominalizers (-ki, and -4m) as inflectional on other grounds, such as the relative order with respect to inflectional suffixes, and semantic shift, etc., it is doubtful that changes in word-class is a sufficient condition for classification as derivational. Notice that nominalizers -ki and -4m change a verb into a noun, but they are classified as inflectional. On the one hand, the fact that the lexical causative or passive suffixes like -i, -hi, -ki, etc. do not change word-class (although they may change subclass from intransitive to transitive) does not mean that they are inflectional. Then, the existence of changes in word-class may be neither a sufficient nor necessary condition for derivational status.

As Anderson (1982) concludes, (ii) the relative order of the two (i.e., derivations never follow inflections) and (iii) semantic regularity in inflections as opposed to the greater semantic shift in derivations can be seen as a consequence of *syntactic accessibility* of inflections. That is to say, derivational processes are confined to the lexicon, independent of the syntax, whereas inflectional processes operate on the so-called *lexically interpreted S-structure*—the representation by the association of lexical items from the lexicon and

the S-structure from the syntax which includes morphosyntactic representations. This view of morphology predicts that inflectional morphology must follow derivational morphology. Moreover, according to Anderson (1982), since inflections take place on the already lexically interpreted structure, they may not have access to the rules creating Logical Form which contribute to the meaning, and cannot affect semantic interpretation. Insofar as inflection contributes to meaning, then, it can only be through the medium of the morphosyntactic features. Consequently, meaning of inflected words can be well predicted by the composition of the literal meanings of each morpheme of the composition, whereas such compository meanings are not suitable for words resulting from derivational processes.

Productivity in the word-formation processes is another frequently used criterion for the distinction. Productivity appears to be promising for the fact that many inflectional suffixations like case markings and agreement, etc. are in general quite independent of particular lexical choice, while derivational suffixations with nominalizers or adjectival suffixes, etc. are not. But, as Anderson (1982: 585) points out, this turns out to be not that clear cut either because often there are so-called *defective paradigms* in languages. The other side of the coin is that certain derivational processes are completely productive, e.g., English nominalization by the gerundial *-ing*.

Then, the most reliable criteria we may depend on seems to be Anderson's theory internal definition of inflections, *syntactic*

accessibility, which yields the relative order and the semantic contributions of the two morphological operations.

2.3.2 t-Epenthesis

Ahn (1985) proposes the following four lexical strata mainly because of distributional facts about certain word-level phonological rules:

(19) Ahn's Strata Organization (1985)

Stratum 1:	Sub-compounding	-- t-Epenthesis
Stratum 2:	Co-compounding	
Stratum 3:	Derivation	-- t-Palatalization
Stratum 4:	Inflection	-- t-Palatalization Predicate Tensification

Prior to the main discussion, t-Epenthesis needs to be introduced. The other two rules (t-Palatalization and Predicate Tensification) will be introduced when they become relevant to the discussion (cf. section 2.3.5).

t-Epenthesis refers to the insertion of an alveolar stop between compounding noun stems which may feed quite a number of rules like Post-obstruent Tensification (POT, cf. 3.3), Stop-Nasalization (NASN, cf. 5.1.2), Consonant Place Assimilation (CPA, cf. 5.1.3), and Consonant Cluster Simplification. Often the rule is formulated as if it applies only between a sonorant segment and a lenis consonant (cf. KR 1974). The following are KR's rule formulation and her examples:

(20) t-Epenthesis (optional if a stem is polysyllabic)

$$\emptyset \rightarrow t / [+\text{son}] _ \emptyset \left[\begin{array}{l} +\text{cons} \\ -\text{tns} \end{array} \right]$$

(t is inserted after a sonorant, when it is followed by a lenis consonant across a compound boundary. This change is optional if one or both of the stems are polysyllabic.)

(21)		t-Ep	SFN, POT, CCS	
a.	/pom pi/	[pomtpi]	[pomp'i]	'spring rain'
	/kom kuk/	[komtkuk]	[komk'uk=]	'beef soup'
	/ma+m sok/	[mamt sok]	[ma+m s'ok=]	'inside of the heart'
	/an pañ/	[antpañ]	[anp'añ]	'ladies' quarters'
	/son t+ñ/	[sontt+ñ]	[sont'+ñ]	'back of the hand'
	/san kil/	[santkil]	[sank'i]	'mountain path'
	/salañ pañ/	[sarañtpañ]	[sarañp'añ]	'men's quarters'
	/cañ tok/	[cañttok]	[cañt'ok=]	'seasoning jar'
	/coñ soli/	[coñtsori]	[coñs'ori]	'sound of bell'
b.	/il pok/	[iltpok]	[ilp'ok=]	'luck of chore (irony)'
	/mul koki/	[multkoki]	[mulk'ogi]	'fish (lit. water meat)'
	/kil son/	[kiltson]	[kils'on]	'wanderer'
c.	/c"o pul/	[c"otpul]	[c"ot=p'ul]	'candlelight'
	/k"o t+ñ/	[k"ott+ñ]	[k"ot=t'+ñ]	'nose ridge'
	/nə ka/	[nətkə]	[nətk'a]	'shore of a stream'
	/i sok/	[itsok]	[it=s'ok=]	'inside of the teeth'

One question that arises regarding (20) is why t-Epenthesis has to be limited to the environment between a sonorant and a lenis consonant. KR describes it as an effort to prevent the intersonorant voicing of the initial lenis stops of the second noun. But, the restrictions on both sides of the environment appear to be unnecessary complications for the rule, which is otherwise of a very general form. Notice that even when the right-side environment is specified as any consonant (with feature [+cons]), the rule will not derive any ungrammatical forms, i.e., due to the fact that tense and aspirate series stops, provided with the feature [+tns] underlyingly, are immune to tensification, and as a

result of Consonant Cluster Simplification the epenthetic consonant will not surface anyway. The following examples, especially those of (22a), illustrate this point:

(22)		I	II	
		t-Ep	CCS	
a.	/sil p"ə/	[siltp"ə]	[silp"ə]	'spool'
	/pal t"op/	[paltt"op]	[palt"op]	'footnaill'
	/cumök k"o/	[cumökktk"o]	[cumök=k"o]	'bulboud nose'
	/t+ñ p'yô/	[t+ñtp'yô]	[t+ñp'yô]	'backbone'
	/san t'alki/	[santt'algi]	[sant'algi]	'wild strawberry'
	/san k'ac"i/	[santk'ac"i]	[sank'ac"i]	'mountain magpie'
			CPA followed by Homorganic CCS	
b.	/tə p"a/	[tətp"a]	[təp"a]	'green onion'
	/hōli t"oñ/	[hōlitt"oñ]	[hōrit"oñ]	'the waist'
	/myōnto k"a/	[myōntotk"a]	[myōntok"a]	'razor'
	/ōkə c"um/	[ōkatc"um]	[ōkac"um]	'shoulder dance'
	/so p'u/	[sotp'u]	[sop'u]	'horns of ox'
	/c"amsə t'e/	[c"amsatt'e]	[c"amsət'e]	'a flock of sparrows'
			CCS	
c.	/ip pōl+s/	[iptpōl+t]	[ip=p'ōr+t=]	'a manner of speech'
	/os kōli/	[ostkōli]	[ot=k'ōri]	'hanger'
	/kuk k+l+s/	[kuktk+l+t]	[kuk=k'+r+t=]	'soup bowl'
d.	/pi os/	*[pit=ot=], [piot=]		'raincoat'
	/mul ankyōñ/	*[mult=angyōñ], [murañgyōñ]		'goggle'
vs.	/pi sok/	[pit=sok]		'in the rain'
	/mul pañul/	[mult=p'añul]	[mulp'añul]	'water drops'

One advantage of having a general SD of [+cons] is that it complies with the fact that both forms of columns I and II of (22b) are acceptable pronunciations. In fact, the pronunciations of the forms in the first column of (22b) are more natural than those of the second column. In order to produce tense or aspirate consonants, a preparatory stage to build up oral air pressure seems to be needed, and the insertion of a stop performs this function being unreleased at the syllable-coda position (cf. Syllable-Final Neutralization (SFN), cf.

4.2.2). One might say that the forms in (22bI) can be described by a separate rule, such as Homorganic Consonant Insertion⁸ (HCI, cf. 4.2.3), but the choice is not that clear in this case. The point is that when a more general rule formulation is not contradicted by the surface facts there is no need to propose a complex SD for the rule. (22d) also suggests that what we need in the SD of t-Epenthesis is only [+cons] in the right-side environment.

The left-side environment of (20), [+son], is also not necessary. For example, having t-Epenthesis between obstruents will not cause unacceptable surface forms, due to the fact that Post-Obstruent Tensification happens after an obstruent anyway and the epenthetic t will not surface by virtue of Consonant Cluster Simplification (cf. (22c)). Taking this general approach, C-W. Kim (1970) proposes a rule formulation similar to the following:

(23) t-Epenthesis (from C-W. Kim 1970: 17)

$$\emptyset \rightarrow t /]_N \text{ ______ } N [[+cons]]$$

(t is inserted between noun stems when the second noun begins with a consonant.)

(23) is a slightly modified version of C-W. Kim's rule formulation which uses the compound boundary + ___ +. One may argue against this rule formulation on the basis of /u ɔl+n/ → [ut=ɔr+n] 'one's seniors (lit. upper adults).' But with t-Epenthesis reformulated as (24) below, we still need to account for prevocalic cases where the rule fails to apply, e.g., /pi os/ → [piot=], *[pidot=] as in (22d). Detailed discussion on the reason to adopt the rule (23) rather than (24) will

follow soon. In 3.1, I propose an exceptional treatment for compounds which involve locative nouns like [udŏr+n] (cf. paragraphs below (3) and (4) in 3.1).

(24) t-Epenthesis (domain: Sub-compounding) (from Ahn 1985)

$$\emptyset \rightarrow t /]_N \text{ — } N[$$

There appears to be more going on than the segmental restriction described above. That is, as was mentioned in the discussion about the definition of two types of compounds (cf. (17)), there is a correspondence between these two types of compounds and the applicability of t-Epenthesis. This is the sole reason for Ahn's proposing two compounding strata, Sub-compounding and Co-compounding, and for maintaining t-Epenthesis only with respect to the sub-compounding process.

2.3.3 The Morphological Inadequacy

Let us now turn to the lexical analysis of Ahn (1985) (henceforth Ahn). For convenience, I copy Ahn's diagram (19) of strata organization below. Ahn proposes the four lexical strata for the description of Korean morphophonology mainly on the basis of the distribution of phonological rules with respect to morphological processes.

(19) Stratum 1: Sub-compounding -- t-Epenthesis
 Stratum 2: Co-compounding
 Stratum 3: Derivation -- t-Palatalization
 Stratum 4: Inflection -- t-Palatalization
 Predicate Tensification

Adopting the Stratum Ordering Hypothesis, Ahn tries to adhere to certain theoretical assumptions concerning unmarked strata assignment, such as the Stratum Domain Hypothesis (Mohanani 1982), the Strong Domain Hypothesis (Kiparsky 1984) and the Principle of Domain Assignment (Mohanani & Mohanani 1984). For ease of reference, I list the definitions of those principles, as well as that of Mohanani's looping device below:

(25)

a. Stratum Ordering Hypothesis

The lexicon consists of a set of ordered strata.
(Mohanani 1982: 4, 1986: 21)

b. Strong Domain Hypothesis:

The domain of a lexical rule is assigned as the last stratum in which the rule ceases to apply.
(Kiparsky 1984: 142)

c. Stratum Domain Hypothesis:

The domain of application of a rule is specified in terms of continuous strata.
(Mohanani 1982: 60)

The domains of application of a rule are specified in terms of strata. The domain of a rule may not contain nonadjacent strata.

(Mohanani 1986: 21, 47)

d. Principle of Domain Assignment:

In the absence of counterevidence, assign the smaller number of strata as the domain of a rule, and include the lowest possible stratum as the domain of a rule.

(stratum i is higher than j if $i < j$)

(Mohanani & Mohanani 1984: 578-9)

e. Looping Device

Recursion between adjacent strata is possible through the device of the loop.

A loop is a device that allows the output of stratum n to move back to stratum $n-1$. (Mohanani 1986: 51)

The Stratum Ordering Hypothesis (25a), which assumes a set of linearly ordered lexical strata, is the fundamental assumption on which Ahn's analysis stands. The others, (25b) through (25e), are used to designate the unmarked assignment of domains to rules in his organization of strata.

We begin our criticism by proposing that, contrary to (25a), the morpheme distributional facts in Korean make any ordered lexical stratum organization invalid, since Korean WFRs require very many loops—even beyond what (25e) permits. In fact, all possible loops appear to be needed for Ahn's lexical strata organization in the description of Korean WFRs. Second, as Ahn notices, the Strong Domain Hypothesis (25b) seems to be too strong to be universal because it seems not to be obeyed in cases like t-Palatalization in Korean. This is indicated in (19), where t-Palatalization cannot apply to compounding. Then, the assignment of t-Palatalization to the derivational process (Stratum 3) violates (25b), since the rule does not cease to apply at that stratum. For this reason, Ahn turns to the Stratum Domain Hypothesis (25c) which prevents for a rule from having disjoint strata as its domain.

However, assuming that (19) represents the correct order of strata in Korean, I note that *the continuous strata domain* of (25c) also is difficult to maintain for cases like Umlaut in Korean, which applies both to underived words and certain derived ones (cf. 2.3.3 for detail).

Fourth, the Principle of Domain Assignment (25d) is to suggest that we make the grammar as simple as possible, and to maintain the unmarkedness of postlexical rules. Here, the lexical rules which involve morphological information are claimed to be more marked than

morphology-free postlexical rules. I have no counterarguments to the simpler grammar, and moreover, although we have seen an example of a morphology-sensitive postlexical rule, Modifier Tensing, in the previous section, (25d) admits of no counterexamples because of its generous condition--*in the absence of counterevidence*.

In the following section (and in Chapter 3), I argue against the Stratum Ordering Hypothesis (25a) and the Stratum Domain Hypothesis (25c) on the basis of morphological and phonological sets of facts in Korean: (i) From the morphological aspect, WFRs in Korean may not be restricted by the leveled (linearly ordered) strata because of the fact that WFRs may freely take any other WFRs as their input, especially between compounding and suffixation. Consequently, any ordered strata organization will end up with many loops (cf. Y-S. Kim 1984: 146-149, J-M. Kim 1986: 286-289, and H-S. Sohn 1987: 212-229). (ii) From the phonological aspect, the stratal distinction is not sufficient to capture all the relevant facts about morphophonology in Korean. For the description of some lexical rules (viz. t-Epenthesis, Initial Syllable Shortening, and the optionality of Post-Obstruent Tensification), the violation of the Opacity Principle is inevitable, since the distinction of word-internal configuration appears to be necessary condition to predict the applicability of the rules.

This section deals mainly with the morphological inadequacy of the ordered strata hypothesis, but occasionally introduces phonological problems with regard to t-Epenthesis when they are related to the topic, and the first section in Chapter 3 presents the phonological inadequacy of stratal specification for t-Epenthesis.

The weakness of the stratum organization in Ahn is revealed by the following lists of data for which loops must be entangled all together. The first type of apparent looping is co-compounds which are followed by sub-compounds. Consider the following examples:

(26) Stratum 2 to 1

a. [[[alə]_N [wi]_N]_{Co} [cip]_N]_{Sub} --> [arəwit=c'ip=]
 lower upper house
 'neighboring houses'

[[[alə]_N [wi]_N]_{Co} [c'+ŋ]_N]_{Sub} --> [arəwit=c'+ŋ]
 lower upper level
 'downstairs and upstairs'

[[[alə]_N [wi]_N]_{Co} [salam]_N]_{Sub} --> [arəwit=s'aram]
 lower upper person
 'juniors and seniors'

[[[alə]_N [wi]_N]_{Co} [pɔl]_N]_{Sub} --> [arəwit=p'ɔl]
 lower upper piece
 'upper and lower garments'

[[[alə]_N [wi]_N]_{Co} [toŋne]_N]_{Sub} --> [arəwit=t'oŋne]
 lower upper village
 'neighboring villages'

b. [[[ap"]_N [twi]_N]_{Co} [cip]_N]_{Sub} --> [ap=t'wit=c'ip=]
 front back house
 'neighboring houses'

[[[ap"]_N [twi]_N]_{Co} [salam]_N]_{Sub} --> [ap=t'wit=s'aram]
 front back person
 'people in a row'

[[[ap"]_N [twi]_N]_{Co} [toŋne]_N]_{Sub} --> [ap=t'wit=t'oŋne]
 front back village
 'neighboring villages'

[[[ap"]_N [twi]_N]_{Co} [səŋkak]_N]_{Sub} --> [ap=t'wit=s'əŋgak=]
 front back thought ~[ap=t'wisəŋgak=]
 'deep thought'

[[[ap"]_N [twi]_N]_{Co} [kwankyə]_N]_{Sub} --> [ap=t'wigwaŋge]
 front back relationship *[ap=t'wit=k'waŋge]
 'consistency'

In order to account for the forms in (26), a loop from Stratum 2 to 1 (Co-compounding to Sub-compounding) is required for Ahn's strata organization. Since Ahn assumes that t-Epenthesis applies exclusively with respect to Sub-compounding Stratum (Stratum 1), the compounds in (26) should be treated as formed by co-compounding followed by sub-compounding. In fact, by the definition of two types of compounds (17), such a distinction can reasonably be made: We can say that *wi alə* 'upper and lower' and *ap" twi* 'front and back' are co-compounds, since they do show a coordinate relationship, and it will be safe to call the second process a sub-compounding processes because of the headedness status of right-most nouns and because of the application of t-Epenthesis. This type of looping between adjacent strata can be tolerated by the looping device (25e).

Another type of WFR in Korean which requires a loop is compounding which is fed by deverbal nominalization. With the nominalizer -i, verbs become nouns (henceforth, derivative nouns), and they further undergo a compounding process. Given below are some examples of this:

(27) Right-side Derivative Compounds

a.

1. $[[[h\text{æ}]_N [[\text{tot}]_V i]_{Nom}]_N \rightarrow [h\text{æ}d\text{oj}i]$
 sun rise nomn
 'sunrise'
2. $[[[k\text{ok}i]_N [[\text{cap}]_V i]_{Nom}]_N \rightarrow [k\text{og}i\text{j}ab\text{i}]$
 fish catch nomn
 'fishing'
3. $[[[palam]_N [[\text{pat}]_V i]_{Nom}]_N \rightarrow [parambaj\text{i}]$
 wind recieve nomn
 'a windswept place'

[[t'am]_N [[pat]_V i]_{Nom}]_N --> [t'ambaji]
 sweat receive nomn
 'a sweatshirt'

[[t+ñ]_N [[pat]_V i]_{Nom}]_N --> [t+ñbaji]
 back receive nomn
 'the back of a chair'

4. [[[kôt]_V 4m]_{Nom} [[kôt]_V i]_{Nom}]_N --> [kôr4mgôri]
 walk nomn walk nomn
 '(one's) manner of walking'

5. [[p"i]_N [[put"]_V i]_{Nom}]_N --> [p"ibuc"i]
 blood attach nomn
 'family members in a direct line'

6. [[[se]_N [pañ]_N]_N [[sal]_V i]_{Nom}]_N --> [set=p'añsari]
 rent room live nomn
 'living in a rented room'

7. [[s'i]_N [[pat]_V i]_{Nom}]_N --> [s'ibaji]
 seed receive nomn
 'a mistress for a son'

b.

1. [[ton]_N [[no]_V i]_{Nom}]_N --> [tonnori]
 money play nomn
 'money lending'

[[tal]_N [[mac]_V i]_{Nom}]_N --> [talmaji]
 moon meet nomn
 'welcoming the first full moon (of a year)'

[[sok'up]_N [[no]_V i]_{Nom}]_N --> [sok'umnori]
 doll furniture play nomn
 'playing house'

[[[kə]_N ñaci]_{Deri} [p"u]_N]_N --> [kañajip"u]
 dog dimi grass
 'the foxtail plant'

2. [[os]_N [[kô]_V i]_{Nom}]_N --> [ok=k'ôri]
 clothes hang nomn
 'a hanger'

[[cip]_N [[t+]_V i]_{Nom}]_N --> [cip=t'+ri]
 house enter nomn
 'a house knowing party'

The examples of both (27a) and (27b) contain derivative nouns as their right-side elements. The examples in (27a) exhibit a failure of t-Epenthesis, while those of (27b) provide neither positive nor negative evidence for t-Epenthesis. Note that for the forms in (27b) a hypothetical application of t-Epenthesis would not leave any traces anyway. That is, assuming t was epenthesized in the forms of (27b1), since both edges (the end of first nouns and the initial of second nouns) are consonants, the epenthetic t would create an intolerable triple consonant-clusters (CCC) and that t would be pruned by Consonant-Cluster Simplification. Moreover, the t would cause no phonetic effect before it is deleted, since the initial segments of the second nouns happen to be either nasals or aspirate obstruents, which are immune to tensification. So we would not get any trace of t-Epenthesis. Note that the last example of (27b1) involves the diminutive suffix *ṣaci*, and the forms in (27b2) are ones in which Post-Obstruent Tensification would happen with or without t-Epenthesis.

We will assume, then, that there is no t-Epenthesis phenomenon in compounds which contain right-side derivative nouns. This assumption can be supported by examining compound nouns which contain derivative nouns as their left-side elements. (28) below has some examples of this type. Note that t-Epenthesis does not fail to apply between a left-side derivative noun and a lexical noun:

- (28) Left-side Derivative Compounds
- | | | | | |
|---|----------------------|------|-----|---------------|
| [[[no]] _v i] _{Nom} | [mataṣ] _N |]N | --> | [norit=madaṣ] |
| play | nomn | yard | | 'stage' |
| [[[mōk]] _v i] _{Nom} | [pap] _N |]N | --> | [mōgit=p'ap=] |
| eat | nomn | food | | 'bait' |

[[[mo]V i]Nom [kun]N]N --> [morit=k'un]
 drive nomn person 'chasers (in hunting)'

From a morphological standpoint, the WFRs which are responsible for (27) or (28) require a loop from the Stratum 3 (Derivation) to either Stratum 1 (Sub-compounding) or Stratum 2 (Co-compounding). Then, how the lexical analysis might describe the application and non-application of t-Epenthesis between (27) and (28)? One way to get around is to call (27) co-compounds fed by derivational processes, so as not to predict the application of t-Epenthesis. But, this is not a description, but an ad hoc labelling. Note that the given definition of compounds (17) cannot provide a natural account of (27) as co-compounds, since there is no coordinate relationship between compounding elements in (26). There is no reason to call the forms in (27) co-compounds, except for the failure of t-Epenthesis to apply.

In fact, Ahn is reluctant to say that the loop involved in (27) is from Derivation (Stratum 3) to Sub-compounding (Stratum 1), since this would contradict what he has proposed about the domain of t-Epenthesis and would violate the looping device (25e) by requiring a non-adjacent loop (1985: 85-87). Instead, Ahn opts for the sort of morphological reanalysis proposed by Kiparsky (1983: 17-23). He employs a morphological reanalysis from [[hæ]N [[tot]V + i]N]N to [[[hæ]N [tot]V]S + i]N]N, maintaining that t-Epenthesis becomes inapplicable through the change of word-class from N to V. Notice, however, in doing so, he has to accept the fact that this is a syntax-to-lexicon loop among the WFRs. Moreover, this is a clear contradiction to the Opacity Principle/Bracket Erasure he adopts, and I do not see any plausible way

to make this morphological reanalysis idea work within the theory of Lexical Phonology (further detailed discussion will follow in 3.1).

But, what about the compounds in (28) which do show t-Epenthesis? Perhaps one could extend Ahn's analysis and say it is a loop from Derivation (Stratum 3) to Sub-compounding (Stratum 1), so as to describe the fact that t-Epenthesis applies.

Reserving detailed phonological discussion for 3.1, suffice it to say that the cases like (27) and (28) are real problems for the theory of Lexical Phonology. The problem lies in differentiation of left- and right-branching structures, and is mainly due to the theoretical assumption, the Opacity Principle. I.e., when morphological information/structure of one stratum/cycle is invisible/erased by virtue of the Opacity Principle/Bracket Erasure, there is no way to achieve the distinction between left-side vs. right-side derivational processes. In this respect, the cases requiring morphological reanalysis are a real contradiction to a theory which assumes the Opacity Principle/Bracket Erasure. I.e., how can the grammar select one type of structure over another to apply an exceptional treatment when it is blind to the structure in question?

There are some more compound nouns with right-branching derivative nouns which appear to be counterexamples to the claim that I just proposed.⁹ Unlike (27), despite the existence of right-side derivative nominals, the compounds in (29) show t-Epenthesis:

(29) Stratum 3 to 1

a.

1. [[alə]_N [[mak]_V i]_{Nom}]_N --> [arat=magi] --> [arənmagi] NASN
 lower block nomn --> [arənmagi] CPA
 'bottom piece (of garment)'

2. [[wi]_N [[mak]_V i]_{Nom}]_N --> [wit=magi] --> [winmigi] NASN
 upper block nomn --> [winmigi] CPA
 'upper piece (of garment)'

3. [[alə]_N [[toŋ]_N ali]_{Deri}]_N --> [arat=toŋari]
 lower part dimi --> [arat=t'ori] POT
 'the base (of tree)'

b. [[ton]_N [[pəli]_V i]_{Nom}]_N --> [tont=pəli] --> [tont=p'əli] POT
 money earn nomn --> [tonp'əli] CCS
 'earning money' --> [tomp'əli] CPA
 --> [tomp'əri] 1 -> r

c. [[pa]_N [[kəli]_V ɪm]_{Nom}]_N --> [palt=kəliɪm] --> [palt=k'əliɪm] POT
 foot walk nomn --> [palk'əliɪm] CCS
 'footstep' --> [palk'əriɪm] 1 -> r

Within Ahn's analysis, using t-Epenthesis as a diagnostic device for sub-compounds, the examples (29a/b) might have to be treated as sub-compounds fed by derivational processes, while (29c) might be treated as a sub-compound fed by an inflectional process. Then, the WFRs involved here will require non-adjacent loops from Stratum 3 to 1 and Stratum 4 to 1, and these are not recursions allowed by the looping device (25e). Notice that the epenthetic-t may feed Stop Nasalization and Consonant Place Assimilation (cf. (29a1/2)) as well as Post-obstruent Tensification (cf. (29a3) and (29b/c)).

Also, there are cases which need a loop from Co-compounding and Derivation to compounding. Again, using t-Epenthesis as a diagnostic for sub-compounds, this would have to be treated as a loop from Strata 2 and 3 to Stratum 1 (Sub-compounding). Notice that the left-side nominals are co-compounds, while the right-side elements are a

derivative noun (by the nominalizer -i)¹⁰ and a diminutive noun (by the diminutive suffix -ali) respectively:

- (30) Strata 2 and 3 to 1
- a. [[[alə]_N [wi]_N]_{Co} [[mak]_V i]_{Nom}]_N --> [arəwimmagi]
 lower upper block nomn
 'top and bottom pieces (end pieces)'
- b. [[[alə]_N [wi]_N]_{Co} [[toŋ]_N ali]_{Der1}]_N --> [arawit=t'oŋari]
 lower upper part dimi
 'roots and branches (of a tree)'

The followings are cases where inflections are followed by compoundings. Because t-Epenthesis occurs in the compounding process, forms of (31) might have to be treated as inflections followed by sub-compounding processes. Then they need a loop from Stratum 4 to Stratum 1:

- (31) Stratum 4 to 1
- a. [[[c'am]_V ɬi]_V [sōŋ]_N]_N --> [c'amɬs'ōŋ]¹¹
 endure pros nature
 'patience'
- b. [[[put"_V i]_V m]_N [sōŋ]_N]_N --> [puc"ɬms'ōŋ]
 attach caus nomn nature
 'sociability'
- c. [[[u]_V ɬm]_N [pata]_N]_N --> [urɬmp'ada]
 cry nomn sea
 'the sea of sorrow (a metaphor)'
- d. [[[us]_V ɬm]_N [kōli]_N]_N --> [usɬmk'ōri]
 laugh nomn stock
 'a laughing-stock'

The following are cases where inflections loop back to compounding. Similarly, because of the failure of t-Epenthesis, the LP

analysis might assume (32) to be co-compounds fed by inflectional processes (Stratum 4 to 2):

(32) Stratum 4 to 2

a. [[nun]_N [[kai] m]_N]_N --> [nungarim]
 eye hide nomn
 'deceiving'

[[nun]_N [[[sok] v i] v m]_N]_N --> [nunsogim]
 eye cheat caus nomn
 'deceiving'

[[t+ñ]_N [[pac"i] m]_N]_N --> [t+ñbac"im]
 back support nomn
 'a back support'

[[s'añ]_N [[pac"i] m]_N]_N --> [sañbac"im]
 double support nomn
 'double coda consonants'

b.. [[somæ]_N [[c"i] v ki]_N]_N --> [somæc"igi]
 sleeve hit nomn
 'a pickpocket'

[[ton]_N [[næ] v ki]_N]_N --> [tonnægi]
 money bet nomn
 'a money bet'

Finally, as a last type of looping, we may observe derivational processes which are fed by inflectional processes. Given below are some examples of this:

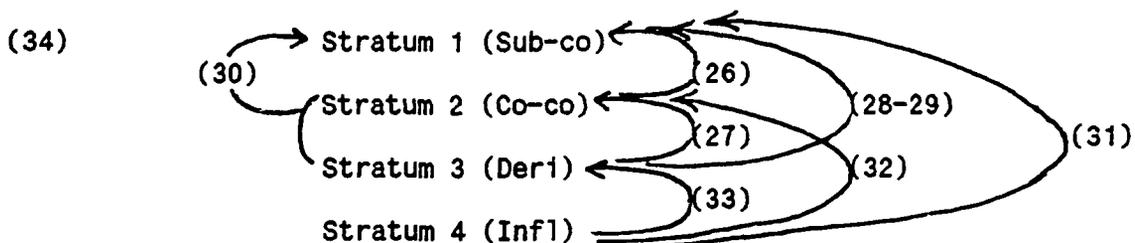
(33) Stratum 4 to 3

[[[anc] v +n] v [pæñi]_N]_N --> [anj+mbæñi]
 sit past person (bound noun)
 'a cripple'

[[[ke+i+] v +m] v [pæñi]_N]_N --> [ke+r+mbæñi]
 be lazy nomn person (bound noun)
 'a bum'

Note that *paŋi* 'person' is a bound noun which may not stand alone, but needs to be attached to another word. One thing to mention is that it is not clear whether cases like this should be treated as due to derivational processes or as compounding. If (33) is classified as a compound, we will not need a loop from Inflection to Derivation for (23). However, if one classifies the nominalizers *-ki* and *-ŋm* as derivational suffixes (cf.. Y-S. Kim 1984), we will end up with numerous cases requiring a loop from Inflection to Derivation for Ahn's strata organization (19).¹²

To sum up the data in (26) through (33), Korean WFRs appear not to be limited by an ordered strata organization, and rearrangements of strata may not help reduce the number of loops at all because of the fact that WFRs are relatively free in taking other WFRs as their inputs. The diagram and the table below summarize the observations that we have made so far:



1 \ 2	Sub-co	Co-co	Deri	Infl
Sub-co	no problem	no problem	unavailable(?)	no problem
Co-co	(26)	no problem	no problem	no problem
Deri	(28), (29)	(27)	no problem	no problem
Infl	(31)	(32)	(33)	no problem

(Here, 1 and 2 stand for the first and second morphological operations.)

2.3.4 Umlaut and the Stratum Domain Hypothesis

In this section, I will briefly demonstrate that, assuming Ahn's strata organization (19) is correct, it is impossible to achieve the Stratum Domain Hypothesis (25c) with Umlaut in Korean, which Ahn overlooks.

Umlaut refers to an optional vowel fronting phenomenon before a syllable which contains the high front vowel /i/. The following is the rule formulation and its segmental sketch:

(35) Umlaut (optional)

$$[+\text{vowel}] \longrightarrow [-\text{back}] / \text{ ______ } [-\text{cor}] \left[\begin{array}{l} +\text{vowel} \\ +\text{high} \\ -\text{back} \\ -\text{round} \end{array} \right]$$

(Vowels are fronted before a syllable which contains a high front unrounded vowel.)

	round	;	-round	;	+round		
	back	;	-back	+back	;	-back	+back
+high	i	<--	ɨ	;	ü	<--	u
-hi,-low	e	<--	ø	;	ö	<--	o
+low	a	<--	ɶ	;			

One interesting condition for Umlaut is that the rule fails to apply when intervening consonants are alveolar or palatal, while it applies when they are labial or velar. C-W. Kim (1973) elucidates this peculiar constraint by the so-called *centrifugal force* in the balancing of *the close articulation* tendency in Korean. He claims that it is a movement of the articulators toward peripheral consonants as opposed to central

ones, due to the predominant close articulation tendency in Korean (cf. C-W. Kim 1973 for details). The following examples illustrate this point:

(36)

a. intervening labial/velar			b. intervening alveolar/palatal		
aki	[əgi]	'baby'	kasi	*[kasi]	'throne'
api	[əbi]	'father'	kaci	*[kaji]	'eggplant'
cip"añi	[cip"əñi]	'stick'	oti	*[edi]	'where'
omi	[emi]	'mother'	omoni	*[omeni]	'mother'
mok-i-ta	[megida]	'feed'	solu	*[sori]	'sound'
sok-i-ta	[sogida]	'cheat'	kuti	*[kujil]	'insistently'
nop"-hi-ta	[nöp"ida]	'elevate'	söpuc"i	*[söbüc"i]	'metal'

In addition to this segmental constraint, Umlaut calls for morphological specification, since it applies only to underived words and to derivational processes, but not to inflectional processes:

(37) a. *Umlaut in derivation*

sok-i-ta	[sogida]	'cheat (be cheated-caus-decl)'
cuk-i-ta	[cugida]	'kill (die-caus-decl)'
cap-hi-ta	[cap"ida]	'be caught (catch-pass-decl)'
son cap-i	[sonjəbi]	'handle (hand + hold-nomn)'
mok-i-ta	[megida]	'feed (eat-caus-decl)'
mok-hi-ta	[mek"ida]	'be eaten (eat-pass-decl)'

b. *No Umlaut in Inflection*

sok-i	*[sogi]	'inside-NOM'
cuk-i	*[cugi]	'soup-NOM'
sap-i	*[səbi]	'shovel-NOM'
mok-i	*[megi]	'ink-NOM'

The underived words in (36a) and some minimal pairs in (37) require Umlaut to be limited to underived words and derivational processes. Now, the question is how this fact can be described in Ahn's strata organization under the Stratum Domain Hypothesis which proposes to specify the domain of a rule in continuous strata. If we are forced to

follow the Stratum Domain Hypothesis, the strata organization of Ahn would become very strange-looking, placing the underived environment (let us call it the Underived Strata) in between Co-compounding and Derivation or between Derivation and Inflection (cf. (38a) and (38b) respectively):

(38)

- a. Stratum 1: Sub-compounding -- t-Epenthesis
 Stratum 2: Co-compounding
 Stratum 3: Underived -- Umlaut
 Stratum 4: Derivation -- Umlaut, t-Palatalization
 Stratum 5: Inflection -- t-Palatalization, Pred-Ten
- b. Stratum 1: Sub-compounding -- t-Epenthesis
 Stratum 2: Co-compounding
 Stratum 3: Derivation -- Umlaut, t-Palatalization
 Stratum 4: Underived -- Umlaut
 Stratum 5: Inflection -- t-Palatalization, Pred-Ten
- c. Underived -- Umlaut
 Stratum 1: Derivation -- Umlaut, t-Palatalization
 Stratum 2: Inflection -- t-Palatalization, Pred-Ten
 Stratum 3: Sub-compounding -- t-Epenthesis
 Stratum 4: Co-compounding
- d. . .
 . .
 . .
 Stratum 4: Derivation -- Umlaut, t-Palatalization
 Underived -- Umlaut

More plausible choices would be like (38c) or (38d), but the burden of proof is on the proponent of the LP analysis. So far we have seen that the Stratum Domain Hypothesis does not work without changing the order of Ahn's strata. What does this imply? There can be two possible answers within the theory--i.e., either Ahn's strata organization or the Stratum Domain Hypothesis must be incorrect. One bad indication for Ahn's strata is in the gap in word-formation processes (see the table

(34)). Among the sixteen possible combinations of strata, I could not find any sub-compound which is fed by a derivational process. This gap may provide evidence for reordering the two strata so that Derivation comes before Sub-compounding for the LP analysis.

2.4 Alternative Approaches

This section mainly deals with the other two lexical rules in suffixational processes in Ahn—t-Palatalization and Predicate Tensification. Rejecting the lexical strata theory mainly on the basis of morphological inadequacy and the phonological inadequacy with respect to t-Epenthesis (cf. 3.1), in the following pages, I will examine alternative approaches which use rather direct references to the word-internal structure in the description of phonology. After a brief introduction to the nature of each rule, I will explore alternative ways to describe the domain of the rules.

2.4.1 t-Palatalization

t-Palatalization refers to the phonemic palatalization of lenis and aspirate alveolar stops /t/ and /t"/ to their corresponding palatals /c/ and /c"/ before a high front vowel /i/ or a palatal glide /y/. In addition to the phonological condition, t-Palatalization requires morphological information. t-Palatalization applies only to derived environments of suffixational processes, but does not apply to underived words or in compounding processes (compare (40a) with (40b)

below). The following are the segmental rule formulation and some examples:

(39) t-Palatalization

$$\begin{bmatrix} t \\ t'' \end{bmatrix} \rightarrow \begin{bmatrix} c \\ c'' \end{bmatrix} / \text{---} - \{i, y\}$$

(Lenis and aspirate alveolar stops become corresponding palatals before a high front vowel or a palatal glide; here '-' stands for any suffix boundary.)

(40)

a.

1. *derivation*

[[kut]_v i]_{Adv} → [kuj*i*] 'firmly, intentionally'
solidifies-adv*l*

[[[kut]_v hi]_v ta]_v → [kuc"ida] 'make things hard'
solidifies-caus-dec*l*

[[[pat]_v hi]_v ta]_v → [pac"ida] 'to be hit'
hit-pass-dec*l*

2. *bound noun compounding*

[[mat]_N i]_N → [maj*i*] 'the eldest child'
firstborn-person (bound noun)

3. *inflection*

[[mat]_N i]_N i] ta] → [majida] '(He) is the eldest child.'
firstborn-NOM-cop*l*-dec*l*

[[[pat"]_N i]_N i] ta] → [pac"ida] '(It) is a field.'
field-NOM-cop*l*-dec*l*

[[kyôc"]_N i]_N → [kyôc"i] 'side'
side-NOM

4. *noun plus particle*

[[pat"]_N i] lañ] → [pac"irañ] 'field and'
field-conj

b.

1. *before a non-high vowel*

[[kyôc"] e] → *[kyôc"e], [kyôc"e] 'on the side'
side-DAT

2. *underived environment*

[[titi] ta] --> *[cijita], [tidida] 'step on
step on-decl

[[matɪ] [madt]] --> *[majimaji], [madɪmadɪ] 'every joint'
joint joint

3. *compounds*

[[mat] [hyðÑ]] --> *[mac"yðÑ], [mat"yðÑ] 'the oldest brother'
firstborn brother

[[pat"] [iɫaÑ]] --> *[pac"iraÑ], [padiraÑ] 'furrows of a field'
field furrow

Because of the fact that t-Palatalization applies only to the derived environments of suffixations, the rule is formulated with a suffix boundary, as in (39) (e.g. KR (1974: 201)). Here the concept of *derived environment* proposed by Kiparsky (1968) applies in a more limited fashion: that is, t-Palatalization applies in the derived environment of suffixations, not that of compoundings. In the framework of Lexical Phonology, there will not be any problem in describing this fact, as Ahn does it, by the assignment of the domain of t-Palatalization with respect to the derivational and inflectional morphological strata. Furthermore, by describing the domain of the rule in terms of strata, the rule formulation does not need to carry the suffix boundary, as in (41):

(41) t-Palatalization (domain: Derivation and Inflection)

$$\begin{bmatrix} t \\ t'' \end{bmatrix} \rightarrow \begin{bmatrix} c \\ c'' \end{bmatrix} / \text{_____} - \{i, y\}$$

(Lenis and aspirate alveolar stops become corresponding palatals before a high front vowel or a palatal glide.)

2.4.2 Predicate Tensification

Predicate Tensification refers to obstruent tensification after a verb stem which ends with a nasal. The following are a possible rule formulation and some examples:

(42) Predicate Tensification

[-son] ---> [+tns] / [+nas]]_{VS} _____

(43) examples of Predicate Tensification

- a.
- | | | |
|---------------|----------|--------------------------|
| /sin-ta/ | [sint'a] | 'wears (shoes or socks)' |
| wear-decl | | |
|
 | | |
| /sin-ki/ | [sink'i] | 'wearing' |
| wear-nomn | | |
|
 | | |
| /an-ta/ | [ant'a] | 'embraces' |
| embrace-decl | | |
|
 | | |
| /an-ki/ | [aÑk'i] | 'embracing, hugging' |
| embrace-nomn | | |
|
 | | |
| /côlm-ta/ | [cômt'a] | 'be young' |
| be young-decl | | |
|
 | | |
| /salm-ta/ | [samt'a] | 'boils' |
| boil-decl | | |
- b.
- | | | |
|------------------------|--------------------------|---|
| /sin-n+ñ-ta/ | *[sinn+nt'a], [sinn+nda] | 'is wearing (shoes)' |
| wear-pres-decl | | |
|
 | | |
| /sin-ki-ta/ | [siÑk'ida]~ [siÑgida] | 'help (someone) wear (shoes or socks)' |
| wear-caus-decl | | |
|
 | | |
| /an-ki-ta/ | *[aÑk'ida], [aÑgida] | |
| embrace-pass/caus-decl | | 'be hugged, throw (things) to one's arms' |
|
 | | |
| /a1-n-ta/ | *[ant'a], [anda] | 'knows' |
| know-pres-decl | | |
|
 | | |
| /côlm-tm-to/ | *[côlm+mt'o], [côlm+mto] | 'even the youth' |
| be young-nomn-del'm | | |

Unlike Post-Obstruent Tensification (POT, cf. 3.3), Predicate Tensification appears to be a very peculiar phenomenon, as is the case in Modifier-Tensing (cf. 2.2.1). That is to say that nasals do not inherently tensify the following obstruents, as in /inpu/ → [imbu], *[inp'u] 'a laborer,' /imk+m/ → [iŋg+m], *[iŋk'+m] 'the king.' Moreover, the rule selects a specific morphosyntactic structure on which to operate on. Notice that Predicate Tensification does not occur after tense markers which end with nasals. Predicate Tensification requires not only a peculiar segmental feature [+nas], but also specific morphological domain, between a verb stem and an inflectional suffix. Note that only exception to this morphological condition is an optional pronunciation [siŋk'ida] 'help (someone) wear.' In an effort to specify this morphological information, KR presents rule (44) which uses '&' as a verb stem boundary. KR calls it Verb Stem Boundary Fortition:

(44) Verb Stem Boundary Fortition (from KR 1974: 175)

[-son] → [+tns] / [+nas] & _____

(A lenis obstruent becomes fortis after a verb stem final nasal.)

Unfortunately, (44) is not accurate enough to exclude derivational suffixation, unless we add two different boundaries for inflectional and derivational suffixes. This same fact is described by the stratal specification in Ahn, which assigns Predicate Tensification (42) in the Inflection Stratum only.

2.4.3 The Domain Problem

Rejecting the ordered strata theory, J-M. Kim (1985: 252) proposes the use of the feature [+/-MC], where MC stands for a major category such as N, V, etc. Along the same line, H-S. Sohn (1987) assumes the binary distinction of endocentric and exocentric structures for compounding and suffixation. Opposing the LP approach, in the following pages, I will examine these two proposals primarily to describe the domain of t-Palatalization and Predicate Tensification.

J-M. Kim (1985) presents the following two subcategorization frames with [+/-MC] for compounds and suffixations:

- | | | | | |
|------|----|--------------|----|----------------------------------|
| (45) | a. | compounds | b. | suffixations |
| | | [X Y] | | [X Y] |
| | | [+MC] | | [-MC] |
| | | t-Epenthesis | | t-Pal (and others) ¹³ |

(45a) works only under a strange assumption that the right-side element in co-compounds may not be a major category, such as N, V, etc. Under the reasonable assumption that co-compounds may contain both X and Y with [+MC], (45a) must be interpreted as an exclusive condition, such as iff (if and only if) Y is a major category in compounds. Similar to the lexical strata theory, (45) will not work for cases like bound noun compounding (40a2), unless we treat it as a suffixational process, as in (45b). Furthermore, this binary distinction will not capture the domain of Predicate Tensification which has to be limited to apply only across inflectional processes. Describing all verbal inflections by a set of syntactic phrase structure rules, J-M. Kim demonstrates that the

inapplicability of Predicate Tensification in derivational processes can be described by assignment of the domain of Predicate Tensification only to the postlexical (syntactic) module (cf J-M. Kim 1986: 236-242).

H-S. Sohn (1987) assumes the following two structures with different bracketing for compounds and suffixations, calling the former the exocentric structure, the latter the endocentric structure (cf. (46a) and (46b) respectively):

- (46) Exocentric vs. Endocentric Structures
- | | |
|--------------|-----------------|
| a. Compounds | b. Suffixations |
| [[X] [Y]] | [[X] Y] |

As opposed to Mohanan's identical internal brackets of compounds and suffixation (e.g. [[X] [Y]]), if we assign endocentric structures of [[X] Y] to not only suffixation but also bound noun compounding, we may state the domain of t-Palatalization as an endocentric structure.

As in (40), however, t-Palatalization applies not only across a suffixational process (derivational and inflectional processes), but also in a compound noun with the bound noun -i 'person' (e.g. /mat-i-ka/ --> [majiga] 'the firstborn child (nominative) (firstborn-person-NOM), cf. (40a2)).

At this moment, one question that arises is whether (40a2) is a suffixational process or a compounding process. While others treat it as compounding (cf. Martin, Lee and Chang (1967)), in Ahn (1985) it is treated as if it is a suffixation. Attachment of the bound noun -i to the noun mat is treated as a derivational process in Ahn (1985), so as to fit the domain of t-Palatalization. Then, what matters in the

application of t-Palatalization seems to be the internal structure of word-formation processes, not the name of WFR itself. To describe the domain of t-Palatalization, I propose an endocentric structure for bound noun compounding in Korean. t-Palatalization applies only across an endocentric structure, namely ']', and this automatically excludes the underived words which do not contain any internal brackets. This is a more straightforward way to express the fact that bound noun morphemes behave as if they are suffixes with regard to t-Palatalization.

However, for the description of t-Epenthesis, (46a) is not enough since Sohn assumes the same exocentric structure for both sub-compounds and co-compounds. The distinction between sub-compounds and co-compounds is a necessary condition for the description of t-Epenthesis, although it does not constitute a sufficient condition. The semantic headedness notion like (17) can be used.

However, instead of phonological analysis like our t-Epenthesis, Sohn proposes a morphological account, postulating the denominal adjectival morpheme 'x' which stands for the most underspecified (or least specified) consonant associated with a [+constricted glottis] feature which surfaces as a stop or nasal in accordance with other phonological processes such as Stop Nasalization, Consonant Place Assimilation, etc. (cf. H-S. Sohn 1987: 249-263).

As is the case in J-M. Kim's binary distinction, this two-way classification will not work for the specification of Predicate Tensification, which has to be limited to inflectional processes. Assuming the identical bracketing structure for derivations and inflections, Sohn looks for an alternative solution. Sohn extends the

underspecified feature-size morpheme 'x' in the description of *Bindungs-s* (t-Epenthesis in our terms) to Predicate Tensification and even to Modifier Tensing. Inserting an 'x' slot after a nasal-ending verb stem and a lateral-ending modifier, Sohn achieves the tensifications in all three different rules by treating them as if they are all phonetically motivated phenomena. If we are allowed to postulate a ghost segment (as a morpheme or epenthetic consonant which triggers obstruent tensification) whenever morphology-sensitive peculiar tensification appears in a language, in principle, we might be able to eliminate all morphology-sensitive tensification, but the extension of the underspecified morpheme 'x' to these two morphology-sensitive tensification rules seems to be too abstract to accept. In short, Sohn shuffles off phonological responsibility to the morpheme 'x' which carries the tensifying feature [+constricted glottis] (cf. H-S. Sohn 1987: (4.68) and (4.71)).

For the domain of Predicate Tensification, one may elaborate the endocentric structure with labelled brackets, as illustrated below:

(47) a. Derivation	b. Inflection
[[X] _R Y] _S	[[[X] _R] _S Y]
[[[an] _R ki] _S ta]	[[[an] _R] _S ki]
----- [aŋgida]	[ank'i] Pred-Ten
[aŋgida]	----- [aŋk'i] Umlaut
	CPA

(Here, S and R stand for a stem and a root boundary, respectively)

Stating the domain of Predicate Tensification across a stem boundary ']_S', we may describe the peculiar domain of Predicate Tensification.

2.5 Summary

In this chapter, arguing against Lexical Phonology, we have confirmed that many of its theoretical assumptions are incompatible with both morphological and phonological sets of data in Korean.

Violations of the Opacity Principle (Mohanan 1982) are inevitable for the description of some lexical and postlexical rules in Korean. Contrary to the Opacity Principle, which prevents phonological rules from looking back at their previous morphological structure, there are some lexical/postlexical rules in Korean for which word-internal configurations/morphological information is necessary. As an example of postlexical violation of the Opacity Principle, a morphology-sensitive postlexical rule, Modifier Tensing, is cited. One interesting finding is that Modifier Tensing is not only morphology-sensitive but syntax-sensitive. In the description of the phrasal domain of Modifier Tensing, a correlation between the directionality of syntactic tree branching and the applicability of the rule has been found--the rule applies to a left-branching structure, while it fails to apply to a right-branching structure (namely, the right-branching constraint). The same fact can be described by the modifier-head relationship between words. That is, the left-branching structure is compatible with successive modifier-head relations ([modifier head-mod] head), while

the right-branching structure is parallel with double modifiers followed by a head noun in this case ([modifier [modifier head]]).

With regard to Modifier Tensing, bound noun compounding processes with a prospective modifier in Korean reveal that word-formation rules are not exclusive in the lexicon. The syntax-to-lexicon recursion like this (and phrasal/sentential nominalizations), being a very productive morphologization process in left-branching languages like Korean, should not be treated as exceptions.

As an example of lexical violation of the Opacity Principle, I introduced the configuration-sensitivity of t-Epenthesis in the derivative compound. The same right-branching constraint holds for the applicability of t-Epenthesis. The phonological alternation of t-Epenthesis in derivative nouns requires a word-internal configuration. As is briefly mentioned in the discussion of morphological loops, the same right-branching constraint can be extended to t-Epenthesis in derivative compound nouns. (The next chapter begins with the phonological account of t-Epenthesis in derivative compounds, cf. 3.1 - 3.3.)

Against the Stratum Ordering Hypothesis, we have seen that linearly-ordered strata organization is invalid for the description of Korean word-formation processes because of the many recursions/loops required. Korean word-formation processes appear to be free in taking other word-formation processes as their input. All logically possible combinations of loops are needed for Ahn's strata organization. For this matter, rearrangement of strata will not help reduce the number of loops.

With regard to the domain of Umlaut in Korean, I pointed out that the continuous stratal specification of a phonological rule proposed by the Stratum Domain Hypothesis is difficult to achieve, unless we reorder Ahn's strata organization. Finally, in order to describe the domain of the lexical rules in question, I briefly examined an alternative way which uses the notion of exocentric and endocentric structures.

Notes

1. Notice that in the rule formulation of (8), there is no specific feature for the input lenis obstruents. This is due to the feature system we adopt for obstruents in Korean: Korean has three series of obstruents--lenis, aspirate, and tense. Since we assign the following features for each types of obstruents, the feature [-son] will suffice (8) to perform tensification. Note that aspirate and tense obstruents are, being underlyingly tense, (8) vacuously applies, and, as a result, they are immune to tensification:

lenis	aspirate	tense
$\left[\begin{array}{c} -\text{son} \\ -\text{tns} \\ -\text{asp} \end{array} \right]$	$\left[\begin{array}{c} -\text{son} \\ +\text{tns} \\ +\text{asp} \end{array} \right]$	$\left[\begin{array}{c} -\text{son} \\ +\text{tns} \\ -\text{asp} \end{array} \right]$

/p,t,k,c,s/ /p",t",k",c"/ /p',t',k',c',s'/'

2. Note that there is a Vowel Hiatus phenomenon by which /t/ is deleted when preceded by vowel-ending verb stems. The same fact has been described as t-Epenthesis in Y-S. Kim (1984: 76-82).
3. Cook (1988: 42, footnote 3) points out this fact with no solution.
4. Note that /s/ does not undergo intersonorant voicing in Korean.
5. J-M. Kim (1986: 248) cites /k'al-+l-kæ/ --> [k'algæ] 'cushion (spread-pros-thing)' as a lexicalized word which is exceptional to Modifier Tensing. But I do not accept her underlying prospective modifier -+l for the form, since the bound noun kæ (or ke as a variation) does not take the modifier endings, e.g. /tôp"-kæ/ --> [tôpk'æ], *[tôp"+lk'æ] 'cover (lit. cover-thing)' and /cip-ke/ --> [cipk'e], *[cib+lk'æ] 'tongs (lit. pick up-thing)'. Then, the idiosyncrasy resides in the form /anc-+l-kæ/ 'the seat of a loom' for taking the prospective modifier, not in /k'al-kæ/ 'cushion.'
6. The terminology is borrowed from Hyman (1986).
7. The order Sub-compounding before Co-compounding is achieved by the Strong Domain Hypothesis (Kiparsky 1984: 142), which suggests that the domain of a lexical rule to be assigned as the last stratum in which the rule ceases to apply.
8. The rule can be written as another t-Epenthesis in emphatic speech using a free-ride of Consonant Place Assimilation.
9. I will return to this issue in Chapter 3 (cf. discussions below (3) and (4) in 3.1).

10. Ahn (1985) classifies nominalizers *-ki* and *-im* as inflectional. However, if we follow Y-S. Kim (1984: 129-152) and J-M. Kim (1986: 73-76), which recognize two types of *-ki* and *-im*, derivational and suffixational, we will lose a loop from Stratum 4 to 2. In Y-S. Kim (1984), *-ki* and *-im* in derived nouns are classified as derivational suffixes, while the sentential nominalizers *-ki* and *-im* as inflectional suffixes. Notice also that, adopting these two types of *-ki* and *-im*, (31b/c/d) will not require a loop from Stratum 4 to 1, while (31a) still needs a loop from Stratum 4 to 1.

For supporting evidence for the two-way classification of *-ki*, Y-S. Kim (1984: 131) presents the following distinct characteristics of each type:

<i>-ki</i> in derived nouns	<i>-ki</i> in gerunds
a. may not attach to a stative verb	may attach to any verb stem
b. cannot be preceded by inflection	may follow inflection
c. irrelevant to syntax	relevant to syntax
d. meaning is not always compositional	semantic compositionality

11. This can be handled by another rule, Modifier Tensing. (cf. 2.2.1 for details).

12. If we assume the change in word-classes as a sufficient condition to be derivational, as Anderson (1982) does, the bound noun attachments to inflectional suffixes will be another case for a loop from Inflection to Derivation (Stratum 4 to 3).

13. J-M. Kim (1985) presents two more phonological rules for suffixational processes, Hiatus and Ablaut, which I do not include in the discussion. See J-M. Kim (1985) for details.

Chapter 3

Lexical Violations of the Opacity Principle

On top of the morphological inadequacy, the stratal specification of the domain of phonological rules appears to be insufficient to account for all the relevant facts of morphology-phonology in Korean. Especially, the Opacity Principle (Mohanan 1982), as a local reference convention for phonological rule operations, yields very powerful claims on the nature of lexical (word-level) and postlexical (phrasal) rules. By virtue of the erasure of internal brackets at the end of each morphological operation, a lexical rule application cannot refer to morphological information of its previous stage, but may refer to its local morphological information. Postlexical rule operations are blind to any morphological structure or information, since all internal brackets are erased at the end of the last lexical stratum.

Mohanan (1982: 8) notes that the opacity of postlexical rule operations in his theory originates from the Lexical Integrity principle of Chomsky's (1970) "Remarks on Nominalization," which says that syntactic rules cannot move material into or out of lexical items, or modify their structure. The concept of independence of syntax and word structure in derived nominals in Chomsky (1970) has been extended to morphology-free postlexical rule applications in Mohanan (1982) in terms of the Opacity Principle.

Contrary to the Opacity Principle (Mohanan 1982), which prevents phonological rules from looking back to their previous morphological structure, there are many lexical and postlexical rules in Korean for

which reference to internal morphological or syntactic configuration is necessary. For convenience, I will refer to the former as a lexical violation, and the latter as a postlexical violation of the Opacity Principle.

We have seen one instance of postlexical violation of the Opacity Principle, a morphology-sensitive postlexical rule, Modifier Tensing in 2.2.1. This chapter presents three lexical rules for which the violation of the Opacity Principle is inevitable: They are t-Epenthesis in derivative compound nouns, Initial Syllable Shortening in double compound nouns, and the optionality of Post-Obstruent Tensification in compound nouns. The interesting generalization made from the two types of violations is a correlation between the configuration of forms to which rules apply and the applicability of the rules in question. The right-branching constraint appears to hold for both lexical and postlexical configuration-sensitive rules in Korean (cf. Chapter 5 for details). The directionality of word-internal tree branching appears to be a necessary condition for the domain of three phonological rules in compound nouns.

3.1 deals with the phonological insufficiency of the stratal specification and the failure of the Opacity Principle for t-Epenthesis in derivative compounds. 3.2 and 3.3 introduce a rhythmic rule in the double compound nouns and the optionality of Post-Obstruent Tensification for which we need the right-branching constraint.

- b. [[[ôl]V 4m]N [k1l]N]N --> [ôr4mt=k1l] --> [ôr4mk'1l]
 freeze nomn road 'icy road'
- [[[t"wik1]V m]N [k4l4s]N]N --> [t"wigimt=k4r4t=] --> [...mk'..]
 fry nomn utensil 'frying utensil'
- [[[us]V 4m]N [kôl1]N]N --> [us4mt=kôri] --> [...mk'...]
 laugh nomn matter 'laughing stock'
- [[[u]V 4m]N [pata]N]N --> [ur4mt=pada] --> [...mp'...]
 cry nomn sea 'the sea of sorrow (a metaphor)'
- [[[no]V 4m]N [paŋ]N]N --> [nor4mt=paŋ] --> [...mp'...]
 play nomn room 'gambling room'
- c. [[[nə]V ki]N [ton]N]N --> [nəgit=ton] --> [...t=t'...]
 take out nomn money 'betting money'
- d. [[[[k4l]N [[cis]V ki]N]N [təhwe]N]N --> [k4l4ik=k'idəhwe]
 word build nomn contest 'writing contest'
- [[[môk]V ki]N [təhwe]N]N --> [môk=k'idəhwe]
 eat nomn contest 'eating contest'

As in (1a/b), t-Epenthesis applies between derived nominals and lexical head nouns. The fact that a compound noun includes a derived nominal in its left-branch does not inhibit the application of t-Epenthesis. Unfortunately, I could not find many compound nouns of left-side derivative nouns with the nominalizer -ki and lexical pure Korean nouns (cf. 35c). Notice that in the last two examples of (1d) which contain disyllabic Sino-Korean nouns as the second element of the compounding, t-Epenthesis fails to apply. Because of the exceptionality of Sino-Korean nouns, we may have to exclude them from the application of t-Epenthesis, as a special condition imposed on that rule.

On the other hand, as shown in the examples below, the right-branching derivative compound nouns do not exhibit t-Epenthesis at all. The examples in (2) are arranged into three groups by their nominalizer:

(2) right-branching derivative compounds

- a. [[hə]_N [[tot]_V i]_N]_N --> [hədoji]
 sun rise nomn 'sunrise'
- [[son]_N [[cap]_V i]_N]_N --> [sonjabɪ]
 hand hold nomn 'door knob/handle'
- [[koki]_N [[cap]_V i]_N]_N --> [kogijabɪ]
 fish catch nomn 'fishing'
- [[c"im]_N [[pat]_V i]_N]_N --> [c"imbaji]
 saliva receive nomn 'spittoon, bib'
- [[mul]_N [[ka]_V i]_N]_N --> [mulgari]
 water plow nomn 'plowing with water'
- [[kwi]_N [[kô]_V i]_N]_N --> [kwigôri]
 ear hang nomn 'earrings'
- [[mul]_N [[kip"]_V i]_N]_N --> [mulgip"i]
 water be deep nomn 'depth of water'
- [[môs+m]_N [[sal]_V i]_N]_N --> [môs+m̄sari]
 farmhand live nomn 'working as a farmhand'
- [[[se]_N [pañ]_N]_N [[sal]_V i]_N]_N --> [sep=p'añsari]
 rent room live nomn 'living in a rented room'
- [[ma]_N [[tôt+m]_V i]_N]_N --> [maldôd+m̄i]
 speech stammer nomn 'a stutter'
- [[p"i]_N [[put"]_V i]_N]_N --> [p"ibuc"i]
 blood attach nomn 'family members'
- [[[kô:t]_V +m]_N [[kô:l]_V i]_N]_N --> [kôr+m̄gôri]
 walk nomn walk nomn 'walking style'
- [[[c"i]_V ki]_N [[no]_V i]_N]_N --> [c"iginori]
 hit nomn plau nomn 'hitting game'
- b. [[k+l]_N [[cis]_V ki]_N]_N --> [k+l̄jit=k'i]
 word build nomn 'composition'
- [[son]_N [[po]_V ki]_N]_N --> [sonbogi]
 hand see nomn 'taking care of'
- [[k"oñ]_N [[pok']_V ki]_N]_N --> [k"oñbok'i]
 bean roast nomn 'roasting beans'
- [[[i]_N [son]_N]_N [[top]_V ki]_N]_N --> [i]s'ondok=k'i]
 work hand help nomn 'helping hands'

- [[hæ]N [[pala]V ki]N]N --> [həbaragi]
sun hope nomn 'sunflower'
- c. [[caŋ]N [[[col]V i]V m]N]N --> [caŋjorim]
sauce boil caus nomn 'boiled beef in soysauce'
- [[mɔm]N [[kaci]V m]N]N --> [mɔmgaɟim]
body hold nomn 'behavior, conduct'
- [[nun]N [[[sok]V i]V m]N]N --> [nunsogim]
eye cheat caus nomn 'cheating'
- [[k'o]N [[us]V ɬm]N]N --> [k'ousɬm]
nose laugh nomn 'snort, pooh-poohing'

As is mentioned in the discussion of (29) of Chapter 2, two kinds of counterexamples are found, given in (3a) and (3b) below.

(3)

- a.
1. [[alə]N [[mak]V i]N]N --> [arat=magi] --> [arənmagi] NASN
bottom block nomn --> [arənmagi] CPA
'bottom piece (of garment)'
 2. [[wi]N [[mak]V i]N]N --> [wit=magi] --> [winmigi] NASN
upside block nomn --> [winmigi] CPA
'upper piece (of garment)'
 3. [[alə]N [[toŋ]N aɬi]N]N --> [alat=toŋaɬi] --> [alat=t'oŋaɬi] POT
bottom part dimi --> [arat=t'oŋari] l->r
'the base (of tree)'
 4. [[u]N [[toŋ]N aɬi]N]N --> [ut=toŋaɬi] --> [ut=t'oŋaɬi] POT
upside part dimi --> [ut=t'oŋari] l->r
'the upper trunk, the span between the shoulders'
- b.
1. [[ton]N [[pɔɬi]V i]N]N --> [tont=pɔɬi] --> [tont=p'ɔɬi] POT
money earn nomn --> [tonp'ɔɬi] CCS
'earning money' --> [tomp'ɔɬi] CPA
--> [tomp'ɔri] l->r
- c.
1. [[pal]N [[kɔɬi]V ɬm]N]N --> [pait=kɔɬiɬm] --> [pait=k'ɔɬiɬm] POT
foot walk nomn --> [palk'ɔɬiɬm] CCS
'footstep' --> [palk'ɔriɬm] l->r

Although these compounds violate our constraint on t-Epenthesis in the right-branching derivative compounds, I treat them as understandable counterexamples on the basis of their peculiar lexical behavior with respect to t-Epenthesis. First, examples in (3a) involve locative nominals such as *wi* (or *u* as a variant) 'upper side,' or *alæ* 'bottom part.' The important thing is that locative nouns like these never fail to take t-Epenthesis, unless they are in a coordinate structure as in [*wiaræ*] 'the upper and lower.' The following examples illustrate this point:

(4)

/u kan/	[uk=k'an]	'the upper room'
/alæ pañ/	[aræp=p'añ]	'the lower room'
/twi kan/	[twik=k'an]	'toilet (lit. back room)'
/u nyök'/	[unnyök=]	'the upper part'
/u ni/	[unni]	'upper teeth'
/alæ ni/	[arænni]	'lower teeth'
/u toli/	[ut=t'ori]	'the upper part of the body'
/alæ toli/	[aræt=t'ori]	'the body part from the waist down,'
/u ton/	[ut=t'on]	'premium'
/wi mok/	[wimmok=]	'the upper part of the room, (the place away from the fireplace)'
/alæ mok/	[aræmmok]	'the lower part of the room, (the place near the fireplace)'
/u ðl+n/ ¹	[udðr+n]	'one's elderer'
/u os/	[udot=]	'the outer coat'

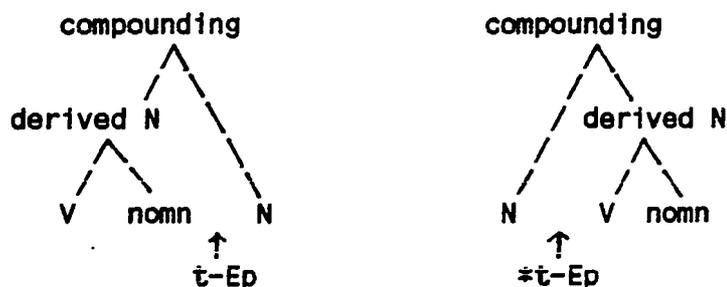
There are two possible ways to handle the case of locative nouns. One way is to exclude the locative nouns from t-Epenthesis account, treating them as a separate source of t. My speculation is that the consonant which is attached to the locative nominals is an adnominal genitive morpheme T. One piece of evidence to support the special treatment of locative nouns comes from the domain of rule application, i.e., while t-Epenthesis is a lexical rule which is not applicable in phrasal level,

the appearance of T in the locative nouns can be observed at the phrasal level, such as in /kyôṭ"-e T salam/ --> [kyôṭ"et=saram] '(side-LOC person), the person who is in near,' /sok-e T mal/ --> [soget=mal] --> [sogemma] 'secret (lit. inside-LOC word).'

A second type of counterexample to the constraint on t-Epenthesis preventing application to right-branching derivative compounds is given in (3b). They are the derivative compounds with pôli 'income' and kôliṁ 'pace.' My speculation is that this peculiar phonological behavior comes from their exceptional lexical status in the lexicon, i.e., among data that I have collected, they are the only derivative nouns which can be used as free morphemes, as in yocṁ pôli-ka ôṭ'ôseyo? 'How is your business, these days?' and kṯ-nṯn kôliṁ-i.p'alṯa 'He walks at quick pace.' Other derivative nouns are all bound nouns which cannot be used alone.

Returning to the right-branching constraint on t-Epenthesis, given the distinct configurations of the two types of derivative compounds shown in (5) below, we can capture the correlation between the directionality of tree branching of words and the applicability of t-Epenthesis:

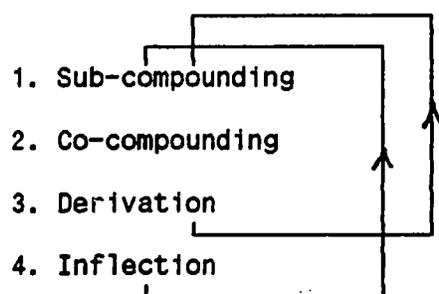
(5)



3.1.2 Looping Approaches

Turning to the perspective of Lexical Phonology, let us explore how this phonological alternation with respect to the word-internal structure can be described within its theoretical assumptions. Adopting Ahn's strata organization, the stratum approach will need more than device of looping from suffixation strata (Derivation and Inflection) to compounding.

(6)

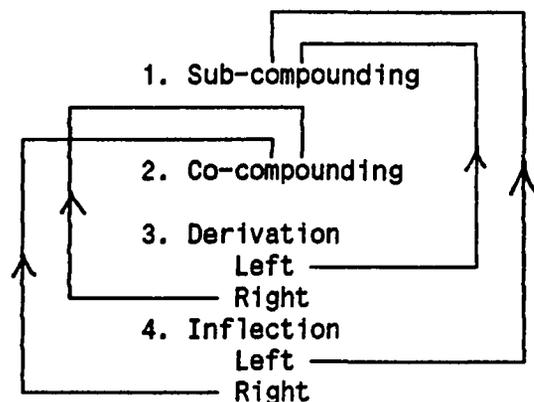


For example, allowing Derivation and Inflection to loop back to Sub-compounding, the looping approach has to exclude t-Epenthesis from the right-branching derivative compounds one way or another. In order to filter out the right-branching derivative compounds, t-Epenthesis has to look back into the word-internal structure of the previous stratum. However, this is not allowed in the theory of LP by virtue of its Opacity Principle/Bracket Erasure. I.e., if the word-internal morphological structure of one stratum is invisible to the next stratum, (i) there is no way to tell the difference between derived nouns and lexical nouns, and further (ii) the distinction between the

left-branching and the right-branching derivations will be impossible to make.

Another rather naive way of handling the problem will be multiplying word-internal strata, while postponing the bracket erasure convention at the end of lexical strata. In this approach, we may use of loops toward two strata, i.e., while the left-branching suffixations may go back to Sub-compounding stratum, the right-branching suffixations go to Co-compounding stratum, as illustrated in the diagram (7) below:

(7)



However, recall that the possibility of regarding the right-branching derivative compounds as co-compounds is nil due to the lack of definitional support from (17) in Chapter 2 and its circular reasoning. For this reason, this would be merely an ad hoc labelling. What I mean by the circularity is that in this approach the destinations of loops are to be determined by surface phonological fact--the existence of t-Epenthesis. This assumes that the left-branching derivative compound nouns which do not show t-Epenthesis are co-compoundings, while the right-branching ones which show t-Epenthesis are sub-compoundings.

Moreover, the given definition (17) in Chapter 2 does not provide any way to distinguish right-branching vs. left-branching structures. By the definition, it is not warranted to call right-branching derivative compounds co-compounds, since there is no coordinate relationship existing between compounding elements. What we are trying to achieve is to predict under what condition t-Epenthesis should (or should not) apply, not merely to label compounds so as to achieve the correct application of a phonological rule. The stratal specification of phonological rules is sound only when there is independent motivation to assign WFRs.

3.1.2 Morphological Reanalysis

As mentioned earlier, Ahn (1985) does not take any of looping approaches that we have explored, but proposes a morphological reanalysis following the analysis proposed by Kiparsky (1983). A typical example of morphological reanalysis is from $[\text{un} [[\text{grammatical}]_A \text{ity}]_N]_N$ to $[[\text{un} [\text{grammatical}]_A]_A \text{ity}]_N$ in order to account for the requirement that *-ity* and *-un* be attached to adjectives. Kiparsky assumes that reanalysis of morphological bracketing is freely permitted at any point of derivations. Adopting this powerful device, Ahn presents the following sample derivations with morphological reanalysis for right-branching derivative compounds:

(8) derivations of morphological reanalysis (from Ahn 1985: 87)

- a. [tot]_V : stem of 'to rise'
 [[tot]_V i]_N : Derivation
 [hæ]_N [tot]_V + i_N]_N : Compounding ('sunrise')
 [[hæ_N tot]_V]_S + i_N]_N : Reanalysis ('sunrise')
- b. [col]_V : stem 'to decrease'
 [[col]_V i]_V : Derivation (causative -i)
 [[[col]_V i]_V m]_N : Derivation (noun forming)
 [cañ]_N [col]_V + m_N]_N : Compounding
 [[cañ_N + col]_{VP} + m_N]_N : Reanalysis ('meat boiled')

The claim is that t-Epenthesis is not applicable since the SD of the rule (viz. between two noun) is no longer met in morphologically reinterpreted structure. Note that by the reanalysis tot and col are no longer a part of nouns but a verb of S or VP.

However, (8) is a clear violation of the Opacity Principle that Ahn assumes, i.e., at the strata of Compounding there should not be any word-internal morphological structure visible by virtue of the Opacity Principle. As the sample derivations in (8) show, Ahn uses the word-internal information which assumes that words' derivational history still exists in compounding stratum, in the forms [tot]_V + i_N] and [col]_V + m_N]. This shows that morphological reanalyses like (8) are achievable only when one ignores or postpones the effect of the Opacity Principle/Bracket Erasure for words which need special treatment. One way to get this selective opacity is to assign [-BE] to forms at need, indicating that Bracket Erasure must not apply to forms with the feature

[-BE]. But, the fundamental question is not solved, since we do not know when or to which form [-BE] feature should be assigned. This problem of unpredictability returns us to the original issue of distinguishing the two distinct word-internal structures.

In a recent version of LP (Mohanan 1986: 127), Mohanan still excludes such word-internal configuration from providing nonphonological information to a phonological rule:

... It is logically conceivable that phonological rules need to refer to bar levels in constructions larger than the word. I have not, however, seen any persuasive evidence that shows that the use of nonphonological information in phonology must include dominance relations or word-internal bar levels. I take it, therefore, that A-C listed above exhaust the nonphonological information within words ...

Here, what Mohanan means by the three types of nonphonological information (A-C) is briefly as follows: (A) information about *features*, which includes [noun], [Latinate], [+/-rule X], (B) information about *concatenation* which includes the edge of a form and the junction between two forms, and (C) information about *module* or *domain* in which rule applies. (cf. Mohanan 1986: Chapter V for details). None of these is functional unless we suppress the effect of the Opacity Principle/Bracket Erasure. Definitely, (A) syntactic features of word-classes or rule features, and (C) module/strata specification will not help to solve the present problem: One may propose the rule feature [-t-Epenthesis] for the structure of ']_N ___[_N v[.' Here, again, not only do we have to see word-internal information, such as 'v[,' but we also run into the objection that this is inferior to the configuration

proposal, since the use of a rule feature makes apparently predictable phenomenon seem as if it were unpredictable. We have already seen that stratal specification fails to predict the phenomenon even by the use of powerful looping devices (cf. (6) and (7)). The use of information about concatenation (B) will not help either, unless we are able to see internal brackets at the compounding level. E.g., since Mohanan's bracketing system (1986: 128-9) of compounds and affixations is identical as to $[[X] [Y]]$, we will have $[[[V][nomn]] [N]]$ and $[[N] [[V][nomn]]]$ for the two derivative compounding structures. The only possible distinction by the edge information is the difference between $']]_['$ and $']_][['$ and again this will be possible only when the rule is able to see word-internal structure.

To conclude the section, we have confirmed that the blocking effect of t-Epenthesis in the right-branching derivative compounds is possible only when the theory allows reference to word-internal configurations as a non-phonological condition of phonological rules.

3.2 Initial Syllable Shortening in Double Compound Nouns

This section deals with vowel shortening in compound nouns in Korean. Studies on vowel length in Korean are relatively rare, although some scattered literature on the topic can be found--i.e., Nam (1954, 1955), Huh (1958, 1959), Chang (1960, 1963), and B.K. Lee (1978), etc. Among these, Chang (1963) provides very extensive data on vowel shortening in compound nouns and verbal suffixation in Korean. Chang (1963) lacks a formal explicit description, although it deals with much valuable data.

Most data used in this section are from Chang (1963), and my major concern is to provide an explicit formal account of the facts with respect to the issue of the syntax-phonology interface, which is the main topic of the thesis.

More than two nouns (either lexical nouns or bound nouns²) can be concatenated to form a compound noun in Korean. The terms single and double compounds will be used for the concatenation of two nouns and that of three nouns. In this section, vowel shortening phenomena, especially that of initial syllable shortening, in double compound nouns will be examined.

The followings are examples of single compound nouns in Korean. Although I use digits to refer to moras here, this is only for classification purposes.³

(9) examples of single compound nouns
3 mora to 2 or 3 mora

a. /1.2/ --> [11]		
/ip.ki:m/	[ik=k'im]	'mouth + steam'
/os.so:m/	[oss'om]	'clothes + cotton'
/pat".ni:l/	[pannil]	'field + work'
/ap".sə:m/	[ap=s'am]	'front + spring'
/ap".t+:l/	[ap=t'+l]	'front + field'
b. /2.1/ --> [11]		
/ka:m.pat"/	[kambat=]	'persimmon + field'
/sə:.cip/	[səjip=]	'bird + house (nest)'
/pa:m.sup"/	[pamsup=]	'chestnut + forest'
c. /2.1/ --> [21]		
/sō:m.kil/	[sō:mk'il]	'island + road'
/so:k.səl/	[so:k=s'al]	'inside + flesh'
/sō:l.nəl/	[sō:l əl]	'New Year + day'
/pa:m.əl/	[pa:ma]	'chestnut + piece'
/nə:.ka/	[nə:k=k'a]	'stream + side'
/nə:.mul/	[nə:mul]	'stream + water'
/pyō:l.t'oŋ/	[pyō:lt'oŋ]	'star + dung (meteor)'
/kə:.t'oŋ/	[kə:t=t'oŋ]	'dog + dung'

4 mora to 2 or 3 mora

d. /2.2/ --> [11]		
/kə:.ca:ñ/	[kəjañ]	'dog + case (house)'
/sə:.ca:ñ/	[səjañ]	'bird + case (cage)'
e. /2.2/ --> [21]		
/i:l.pō:l/	[i:lβōl]	'work + bee'
/si:l.pə:m/	[si:lβəm]	'thread + snake'
/sə:m.so:k/	[sə:ms'ok=]	'spring + inside'
/ye:.ma:l/	[ye:mma]	'past + words (old sayings)'
/twi:.ni:l/	[twi:nnil]	'back (next) + work'
/twi:.tɔ:l/	[twi:t=t'+l]	'back + field'
/tɔ:l.ni:l/	[tɔ:lɪl]	'filed + work'
f. /11.2/ --> [111]		
/uɪl.ma:l/	[urɪmma]	'we + language'
/sanyañ.kə:/	[sanyañk'ə]	'hunting + dog'
/pawɪ.to:l/	[pawit=t'ol]	'rock + stone'
/pañul.pə:m/	[pañulβəm]	'rattle + snake'
/ipul.so:m/	[ibuls'om]	'quilt + cotton'
g. /1.21/ --> [111]		
/tə.ta:mpə/	[tədambə]	'pipe + tobacco'
/mul.o:lɪ/	[murori]	'water + duck'
/pɔm.pə:c"u/	[pɔmp'əc"u]	'spring + cabbage'
/k'oc".pə:kə/	[k'op=p'egə]	'flower + pillow'
/ap".i:mkɔm/	[amniñgɔm]	'front (former) + king'
h. /2.11/ --> [111]		
/kə:.talɪ/	[kədari]	'dog + leg'
/pa:m.namu/	[pamnamu]	'chestnut + tree'
/to:l.pɪnɔl/	[tolbinɔl]	'stone + scale (isinglass)'
/to:l.sokɔm/	[tols'ogɔm]	'stone + salt (rock salt)'
/si:l.k'uɪ/	[silk'uri]	'thread + spindle'
i. /21.1/ --> [111]		
/ta:mpə.tə/	[tambət=t'ə]	'tobacco + pipe'
/k'a:c"i.cɪp/	[k'ac"ijɪp=]	'magpie + house'
/pə:c"u.pat"/	[pəc"ubat=]	'cabbage + field'
/twə:cɪ.uɪ/	[twəjiuɪ]	'pig + fence (pigpen)'
/kye:cɪp.cɪl/	[kejɪp=c'ɪl]	'woman + deed (whoring)'

5 mora to 4 mora

j. /2.21/ --> [211]		
/sō:m.sa:lɔm/	[sō:ms'aram]	'island + person'
/ye:.ko:cañ/	[ye:k=k'ojañ]	'old + village'
/nu:n.sa:lɔm/	[nu:ns'aram]	'snow + man'
/twi:.i:mkɔm/	[twi:nniñgɔm]	'back (next) + king'

k. /21.2/ --> [211]		
/ta:mpə.to:n/	[ta:mbət=t'on]	'tobacco + money'
/kye:cip.ɪ:l/	[ke:jɪmɪl]	'woman + work'

In the process of noun compounding, as shown in (9), underlying non-initial long syllables are shortened without exception, while initial long syllables surface with length alternations. The rule for shortening of non-initial syllables can be formulated as follows:

(10) Non-initial Syllable Shortening (henceforth NISS)

$$V \rightarrow [-\text{long}] / \#(C_0 V C_0)_1 C_0 \text{ ___}$$

(Non-initial long syllables are shortened.)

3.2.1 Initial Syllable Shortening

While NISS adequately describes all surface short non-initial syllables, initial syllable length alternations remain to be accounted for. Notice that some initial syllables of compounds undergo shortening, while some do not (compare (9b/d) with (9c/e), and (9h/i) with (9j/k)). The initial syllable length alternation in trisyllabic single compounds can be described by disjunctive ordering of NISS and Initial Syllable Shortening (e.g. (9h/i) vs. (9j/k), cf. 3.1.2.1), whereas that of disyllabic single compounds seems to be unpredictable (e.g. (9b/d) vs. (9c/e)).

Putting the latter unpredictable alternations aside, we may formulate the polysyllabic initial syllable shortening as follows:

(11) Initial Syllable Shortening (henceforth ISS)

$$V \rightarrow [-\text{long}] / \# C_0 _ C_0 (C_0 V C_0)_2$$

(Initial syllables are shortened if they are followed by more than two syllables.)

In fact, as is exemplified in (12), there is a strong tendency to initial syllable shortening in trisyllabic compounds, while disyllabic compounds show some alternations and monosyllabic words do not undergo the shortening at all:

(12)	monosyllable	disyllable	trisyllable
a. V:		V ~ V:	V
/kæ:/			
[kæ:]		[kəjəŋ]	[kədari]
'dog'		'dog house'	'dog's leg'
		[kæ:t'oŋ]	
		'dog's dung'	
/pɑ:m/			
[pɑ:m]		[pɑmsup=]	[pɑnɑmu]
'chestnut'		'chestnut forest'	'chestnut tree'
		[pɑ:mɑ]	
		'chestnut piece'	
/sə:/			
[sə:]		[səjip=]	[səsək'i]
'bird'		'bird cage'	'bird chicks'
		[sə:bal]	
		'bird's foot'	
b. V:		V:	V
/kɑ:m/			
[kɑ:m]		[kɑ:ms'i]	[kɑnɑmu]
'persimmon'		'persimmon seed'	'persimmon tree'
/tɔ:l/			
[tɔ:l]		[tɔ:lc'ip]	[tɔlt'ɔfi]
'stone'		'stone house'	'stone mass'

3.2.1.1 Disjunctive Ordering of The Two Rules

Notice that ISS applies to a form, when Non-initial Syllable Shortening is not potentially applicable (cf. /211/ --ISS--> [111] as in (17h/i)), but, if both rules are potentially applicable to a form, not only should NISS take applicational precedence over ISS, but ISS may not apply to the output of NISS. (cf. /221/ or /212/ -NISS-> [211] -*ISS-> *[111] as in (17j/k)). In order to account for this type of initial length alternation, the disjunctive ordering of NISS and ISS can be proposed:

(13) Disjunctive Ordering of NISS and ISS

$$V \rightarrow [-\text{long}] / \begin{array}{l} \#(C_0 V C_0)_1 C_0 \text{---} \\ \# C_0 \text{---} C_0 (C_0 V C_0)_2 \end{array} \quad \begin{array}{l} \text{(i) NISS} \\ \text{(ii) ISS} \end{array}$$

(NISS and ISS are disjunctively ordered in the order: NISS before ISS)

3.2.1.2 Disyllabic Compound Nouns

The alternation in the initial syllable of disyllabic compounds (e.g. (9b/d) vs. (9c/e)) appears to be unpredictable at least in the description of the Seoul dialect. In the Kyengsang (Southeastern) dialects of Korean, however, this alternation is predictable by a tonal distinction--the initial long syllable in disyllabic compounds retains its long vowel when it is followed by a syllable of low tone (L), while it is shortened if followed by a syllable of a high tone (H)⁴. The second syllables of examples in (9b/d) contain H, while those of (9c/e) contains L.

In G-R. Kim (1988: 75), another correlation between vowel shortening and tone has been observed in verbal suffixations in the

Taegu dialect, which is one of the Kyengsang dialects of Korean. According to G-R. Kim, monosyllabic stem vowel shortening occurs when suffixes which begin with a vowel are attached, and it always accompanies the tone change of the second syllable from a high tone (H) to low tone (L). Notice that this will be an inverse correlation to ours, if we correlate the vowel length of initial syllable with the surface tone of the second syllable. I.e., initial syllable shortening happens before a low tone (L) in verbal suffixation, whereas the shortening of disyllabic compound nouns occurs before a high tone (H). In order to account for both cases with a single rule, we may stipulate the vowel shortening to precede the tone change (from H to L) in verbal suffixation in the Taegu dialect. Then, the rule of pre-H initial syllable shortening may be able to account for both compound nouns and verbal suffixations of the Taegu dialect. But, for the lack of knowledge on the subject, I must leave the development of such an analysis as an open question for future studies.

The length distinction in the Seoul dialect can be regarded as a trade-off for the loss of tone in the evolution from Middle Korean (the Korean language of approximately from 12th C. to 16th C.) which is known to have been a tone language. That is to say, in the historical development of the Seoul dialect, the tone system might have been lost at the expense of a vowel length distinction. Indeed, the vowel length distinction has become a less important feature in the dialects which maintain the tonal distinction, while tone has become an insignificant element in dialects which have developed vowel length distinction.

Now let us consider initial syllable shortening in double compound

nouns:

(14) examples of Double Compound Nouns
4 mora to 3 mora

a. /1.1.2/ --> [111]
/cip.an.ni:l/ [cipannil] [[house inside] work]
/ap".cip.kə:/ [ap=c'ip=k'ə] [[front house] dog]
/p"um.saks.to:n/ [p"ums'ak=t'on] [[labor pay] money]

b. /1.2.1/ --> [111]
/ap".sə:m.mu:l/ [ap=s'æmmu:l] [front [spring water]]
/kil.ka:.cip/ [kil'at=c'ip=] [[road side] house]
/mə.sə:.pal/ [met=s'əba:l] [[mountain bird] foot]

c. /2.1.1/ --> [111]
/kə:.pap.t"oŋ/ [kəbap=t"oŋ] [[dog food] container]
/pa:m.sup".kil/ [pamsup=k'ɪl] [[chestnut wood] road]

d. /2.1.1/ --> [211]
/sə:.pal.t"op/ [sə:bal't"op=] [bird [foot nail]]

5 mora to 4 mora

e. /2.2.1/ --> [211]
/sō:m.ma:l.s'i/ [sō:mmals'i] [island [word style]]
/twi:.sə:m.mu:l/ [twi:t=s(')æmmu:l]⁵ [back [spring water]]
/twi:.t+1.kil/ [twi:t=t(')+1k'i:l] [back [field road]]

f. /2.1.2/ --> [2.11]
/pyð:l.t'oŋ.pyð:l/ [pyð:lt'oŋbyðl] [[star dung] star]
/nə:.mul.ka:/ [nə:nmul'ka] [[stream water] side]
/kə:.t'oŋ.t+1/ [kə:t'oŋd+1] [[dog dung] field]

5 mora to 3 mora

g. /1.2.2/ --> [111]
/mul.kə:.sō:m/ [mulk'əsōm] [[water dog] island]
/ap".twi:.t+1/ [ap=t'wit=t'ɪ] [[front back] yard]
/kil.ka:.to:l/ [kil'at=t'o:l] [[road side] stone]
/ip.so:k.ma:l/ [ip=s'oŋma:l] [[mouth inside] words]

h. /2.2.1/ --> [111]
/twi:.t+1.kil/ [twit=t'+1k'i:l] [[back yard] road]

i. /2.1.2/ --> [111]
/sə:.cip.so:k/ [səjip=s'ok=] [[bird house] inside]

/ka:m.pat".ni:l/ [kambanni] [[persimmon field] work]

6 mora to 4 mora

j. /2.2.2/ --> [111]
 /twi:.t+:l.ni:l/ [twit=t'+1111] [[back field] work]
 /ye:.sð:m.ma:l/ [yet=s'ðmma] [[old island] words]

6 mora to 5 mora

k. /2.2.2/ --> [211]
 /twi:.t+:l.ni:l/ [twi:t=t'+1111] [next [field work]]
 /ye:.sð:m.ma:l/ [ye:t=s'ðmma] [old [island words]]

NISS takes care of all non-initial syllable short vowels in double compounds. ISS, on the other hand, is not that simple in its applicability. Although the disjunctive ordering of NISS and ISS (henceforth DOC) with cyclic application seems to work for some of the double compounds above (e.g. (14c/e/f/k)), this turns out to be accidental. Careful observation of the data in (14) reveals that DOC is not the correct way to account for the facts in double compounds. For instance, the data in (14d/h/i/j) are counterexamples to DOC. Consider the following derivations of using DOC:

(15) counterexamples to DOC

(14d)

[2[1 1]]			
1 1	N/A	the 1st cycle	

2 1 1	no ISS	the 2nd cycle	

(14h)

[[2 2]1]			
2 1	NISS		
1 1	ISS	the 1st cycle	

1 1 1	N/A	the 2nd cycle	

(14i)	[[2 1]2]		
	2 1	N/A	the 1st cycle

	2 1 1	NISS	the 2nd cycle
	1 1 1	ISS	
(14j)	[[2 2]2]		
	2 1	NISS	the 1st cycle

	2 1 1	NISS	the 2nd cycle
	1 1 1	ISS	

In derivation (14d), ISS fails to apply in the second cycle for no apparent reason. In (14h/i/j), ISS applies despite the fact that this violates the DOC (both NISS and ISS apply in the same cycle). Because of these obvious counterexamples, I abandon DOC, which was to describe single compound nouns, for the description of double compound nouns.

3.2.2 Configuration-Sensitivity

Then, how can we account for the initial syllable length alternations in double compound nouns? Excluding cases in which NISS is enough (cf. (14a/b/g)), still we need to account for the alternations in pairs of (14c) and (14d), (14e) and (14h), (14f) and (14i), and (14j) and (14k). For those alternations, I propose that internal morphological configuration, in addition to phonological factors, conditions ISS.

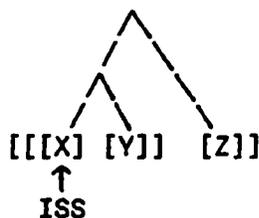
The following is a rearrangement of the remaining four pairs with alternating initial syllables. Notice that the alternation in the first three pairs corresponds to different branching structure, while that of the fourth pair does not:

(15)

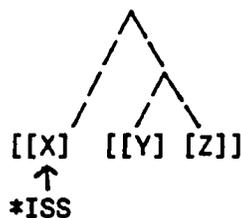
- a. $[[2\ 1]\ 1] \rightarrow 111$ (14c)
 $[2\ [1\ 1]] \rightarrow 211$ (14d)
- b. $[[2\ 2]\ 1] \rightarrow 111$ (14h)
 $[2\ [2\ 1]] \rightarrow 211$ (14e)
- c. $[[2\ 2]\ 2] \rightarrow 111$ (14j)
 $[2\ [2\ 2]] \rightarrow 211$ (14k)
- d. $[[2\ 1]\ 2] \rightarrow 111$ (14i)
 $[[2\ 1]\ 2] \rightarrow 211$ (14f)**

(16)

a. Left-branching



b. Right-branching



(Initial Syllable Shortening is blocked in right-branching double compounds.)

Notice that the initial syllables in (14c/h/j) are shortened, but those of (15d/e/k) retain their long vowels despite the fact that they meet the structural description of ISS. Now the role of morphological configuration comes into play. Double compound nouns can be in configurations of either $[[X\ Y]_N\ Z]_N$ or $[X\ [Y\ Z]_N]_N$ as shown in glosses in (14)--the former will be referred to as left-branching structures and the latter as right-branching structures. From the minimal pair--[[back yard] road] ([111]) and [back [yard road]] ([211]) in (14h) and (14e) respectively--the only possible conditioning factor for the alternation we can detect is the internal configuration of the compound.

The alternations between (14c/h/j) and (14d/e/k) are not chaotic, but closely related to the internal configuration of the compounds, i.e. the application of ISS is limited to left-branching structures. Notice that (14c/h/j) are left-branching, whereas (14d/e/k) are right-branching structures. (16) summarizes the correlation between internal configurations of double compound nouns and the applicability of ISS.

Then, what about the compound nouns in (14f) which constitute counterexamples to my configuration solution? One thing we must notice is that it is not clear whether the initial syllable length alternations between (14f) and (14c/i) are to be handled by ISS or by an unpredictable alternation in the first cycle. Recall that we have seen unpredictable initial syllable length alternation in disyllabic compounds (cf. 3.2.2.2 above):⁶ The examples of (14c/f/i) are copied below:

(14)		
c. /2.1.1/ --> [111]		
/kə:.pəp.t"oŋ/	[kəpəp=t"oŋ]	[[dog food] container]
/pə:m.sʊp".kɪl/	[pəmsʊp=k'ɪl]	[[chestnut wood] road]
f. /2.1.2/ --> [2.11]		
/pyð:l.t'oŋ.pyð:l/	[pyð:l't'oŋbyðl]	[[star dung] star]
/nə:.mʊl.kə:/	[nə:mmʊl'k'a]	[[stream water] side]
/kə:.t'oŋ.tʃ:l/	[kə:t'oŋtʃl]	[[dog dung] field]
i. /2.1.2/ --> [111]		
/sə:.cip.so:k/	[səjɪp=s'ok=]	[[bird house] inside]
/kə:m.pat".nɪ:l/	[kəmbənnɪl]	[[persimmon field] work]

Notice that (14c/f/i) contain (9b/c/d) respectively for their first cycle. (14c/i) are not problematic in either account, but (14f) seems to be a counterexample to my configuration account. However,

because of some doubt that the unpredictable length in the first cycle—the alternation between (9b/d) and (9c/e)—might remain intact in the double compound, (14f) can be seen as an understandable counterexample to my solution.

The following are additional pairs of examples which support the configuration-sensitivity of ISS. Notice that first syllables are all underlyingly long monosyllabic nouns, and each pair shares the identical initial noun:

(17)

a.			
[[twi:.nun] ci]]	[111]	[[back eye] act]	'glancing back'
[twi: [nu:n.pat"]]	[211]	[back [snow field]]	'back snow-field'
b.			
[[so:k.os] an]	[111]	[[inner clothes] inside]	'inside of underwear'
[so:k [ma:l.t'+s]]	[211]	[inner [word meaning]]	'deep meaning of words'
c.			
[[sô:m.nom] t'i]	[111]	[[island man] style]	'islander style'
[sô:m [nyôn.nom]]	[211]	[island [woman man]]	'island women and men'
d.			
[[ye:.sô:m] ma:l]	[111]	[[old island] words]	'words of an old island'
[ye: [sô:m.ma:l]]	[211]	[old [island words]]	'old island's words'
e.			
[[to:l.tam] ki]]	[111]	[[stone wall] road]	'stone-wall road'
[to:l [pap.sot"]]	[211]	[stone [rice kettle]]	'stone rice kettle'
f.			
[[sə:.cip] so:k]	[111]	[[bird house] inside]	'inside of the bird nest'
[sə: [t'oñ.cip]]	[211]	[bird [dung house]]	'bird's gizzard'

g.			
[[twɪ:.paɪ] cɪɪ]	[111]	[[back foot] act]	
		'kicking with heel'	
[twɪ: [sə:m.t"ð]]	[211]	[back [spring site]]	
		'back fountain-site'	
h.			
[[kə:.paɪ] cɪɪ]	[111]	[[dog foot] act]	
		'vain kicking'	
[kə: [paɪ.t"ɒp]]	[211]	[dog [foot nail]]	
		'dog's claw'	
i.			
[[ye:.naɪ] ma:ɪ]	[111]	[[old day] words]	
		'old sayings'	
[ye: [ma:ɪ.s'ɪ]]	[211]	[old [words style]]	
		'old speech style'	

One question that arises at this point is whether ISS, being a configuration-sensitive rule, should refer to the morphological information directly as a condition of the rule. For the purpose of description, somehow ISS has to be restricted to left-branching structures. The restriction may be achieved in an *ad hoc* way, e.g., if one assigns the word boundary (#) for each bracket notation ('[' or ']'), there will be the same number of word boundaries (three #s) between first-branching nodes of the two structures--##X###Y##Z### for [[X] [[Y][Z]]], and ##X##Y###Z## for [[[X][Y]] [Z]]. In order to differentiate the two, one might need to make ### in the latter somewhat weaker than ### in the former in one way or another. One may adopt a readjustment rule which delete #s from a left-branching structure, but not from a right-branching structure. This way of proceeding seems excessively arbitrary.

3.3 Optionality of Post-Obstruent Tensification

Another piece of phonological evidence for the configuration analysis can be observed. That is the optionality of Post-Obstruent Tensification in right-branching constructions. In Korean, lenis obstruents are tensified/glottalized after obstruents. Post-Obstruent Tensification (henceforth POT) may be fed by a rule describing the so-called *Bindungs-s* phenomenon in sub-compounding (t-Epenthesis in our terms), and traditionally POT has been treated as an automatic rule within a word, in the sense that there are supposed to be no apparent failures of application. But if we look at the data in (18), we can see that this claim is not accurate:

(18) the optionality of POT

a.			
/twi:.tʰ:l.ni:l/	[twit=t'+lɪɪɪ]	[[back filed] work]	
	*[twit=t+lɪɪɪ]	'backyard work'	
/twi:.tʰ:l.ni:l/	[twi:t=t+lɪɪɪ]	[back [field work]]	
	~[twi:t=t'+lɪɪɪ]	'next filedwork'	
b.			
/ye:.sɔ:m.ma:l/	[yet=s'ɔmma]	[[old island] words]	
	*[yet=sɔmma]	'old-island words'	
/ye:.sɔ:m.ma:l/	[ye:t=sɔmma]	[old [island words]]	
	~[ye:t=s'ɔmma]	'old island-words'	
c.			
/kuk.pap.cip.kæ/	[kuk=p'ap=c'ip=k'æ]	[[[soup rice] house] dog]	
	*[kuk=pap=cip=kæ]	'the dog of a restaurant'	
/kuk.pap.cip-ke/	[kuk=p'ap=cip=k'e]	[[soup rice] [pick thing]]	
	~[kuk=p'ap=c'ip=k'e]	'tweezers for hot soup'	
d.			
/cuŋkuk.cip/	[cuŋguk=c'ip=]	[China house]	
	*[cuŋguk=cip=]	'Chinese restaurant'	
/cuŋkuk.cip.an/	[cuŋguk=ciban]	[China [house inside]]	
	*[cuŋguk=c'iban]	'Chinese family'	

e.			
/hankuk.koki/	[haŋguk=k'ogi]	[Korea meat]	
	*[haŋguk=kogi]	'Korean local meat'	
/hankuk.koki.kan/	[haŋguk=kogik'an]	[Korea [meat shop]]	
	*[haŋguk=k'ogik'an]	'Korean butcher shop'	
f.			
/mikuk.koki.suip/	[miguk=k'ogisuip=]	[[America meat] import]	
	*[miguk=kogisuip=]	'import of American meat'	
/mikuk.koki.kan/	[miguk=kogik'an]	[America [meat shop]]	
	*[miguk=k'ogik'an]	'American butcher shop'	

Notice that in (18a-c) POT in the second cycle is optional in right-branching double compounds, whereas it applies obligatorily in left-branching structures. This optionality in right-branching constructions seems to be related to the speed or style of speech. I.e., in right-branching structures, POT fails to apply in slow/careful speech, while it may apply in allegro/casual speech. In the left-branching construction, on the other hand, POT applies obligatorily regardless of the speed or style of speech. As in (18d-f), however, when the first nouns contain more than one syllable, the application of POT in the second cycle is unacceptable in right-branching structures.

At first glance, the optionality of POT in right-branching structures seems to be attributable to looser connection of parts in the second cycle of compounding. In other words, we might postulate that POT applies obligatorily in the first cycle because of stronger cohesion, and it becomes optional for further cycles, which have weaker cohesion. Unfortunately, this conjecture turns out to be wrong, as we see from the data below:

(19)

a.

/kuk.pap.cip.kæ/	[kuk=p'ap=c'ip=k'æ] *[kuk=p'ap=cip=kæ] *[kuk=p'ap=cip=k'æ] *[kuk=p'ap=c'ip=kæ]	[[[soup rice] house] dog] 'the dog of a restaurant'
------------------	---	--

/yôp".cip.kæ:/	[yôp=c'ip=k'æ] *[yôp=cip=k'æ] *[yôp=c'ip=kæ]	[[side house] dog] 'neighbor's dog'
----------------	--	--

/twi:.t+:l.kil/	[twit=t'+lk'il] *[twit=t+l'k'il] *[twit=t'+lgil]	[[back filed] road] 'backyard road'
-----------------	--	--

b.

/ap".sæ:m.mu/	[ap=s'æmmu] ~[ap=sæmmu]	[front [spring water]] 'front spring-water'
---------------	----------------------------	--

/twi:.t+:l.kil/	[twit=t'+lk'il] ~[twit=t+l'k'il] *[twit=t'+lgil]	[back [filed road]] 'back filed-road'
-----------------	--	--

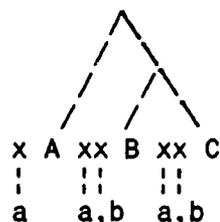
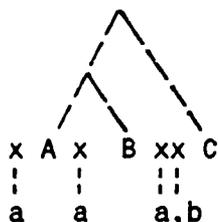
Notice that, in the left-branching structure of (19a), although /kæ:/ 'dog' and /kil/ 'road' are concatenated in a second or third supposedly looser cycle, POT applies obligatorily, not optionally. The weakening of cohesion strength in outer cycles, such as strong/tight first cycle and weak/loose second cycle, cannot capture the obligatoriness of POT in the second cycle for left-branching structures. POT requires reference to left vs. right-branching, as is the case with ISS.

From a different perspective, we may use the following Silent Demibeat Addition, which is a modified version of Selkirk (1986: 314).⁷ It assigns prominent silent demibeats between the first branching elements in right-branching structures, as is illustrated in the following English examples:

(20) **Silent Demibeat Addition for Compounds**

Add a silent demibeat at the beginning of

- a. a word,
- b. a word that is the head of a nonadjunct constituent



(21)

- a. [[x Chinese x lánɡuage] xx téacher]
'a teacher of Chinese language'
- b. [x Chinése x [x lánɡuage xx téacher]]
'a language teacher of Chinese nationality'

That is to say that the stress pattern of (21b) is possible only with two silent demibeats (marked by 'xx') inserted between *Chinese* and *language*, while stress clash happens in (21a) with one demibeat. It is reasonable to suppose that these silent demibeats in a right-branching structure block the application of ISS or POT.

One thing to be mentioned with regard to the silent demibeat account is that the concept *demibeat* must be distinguished from the notion of the *pause* which is supposed to block the application of certain phonological rules. Silent demibeats are seemingly weaker than what used to be called pauses. As is illustrated below, the presence of two demibeats does not prohibit the application of Stop-Nasalization, which has been often described by the absence of pause:

- (22)
- a. [twi: [nu:n bat"]]
 [twi: xx [nu:n xx bat"]]
 [twi: xx [nun xx bat"]]

 [twi:t xx nunbat=]
 [twi:n xx numbat=]
- b. [so:k [ma:l t'+s]]
 [so:k xx [ma:l xx t'+s]]
 [so:k xx [ma] xx t'+s]]

 [soŋ xx ma] xx t'+t=]
- Silent Demibeat Addition
 NISS
 ISS is blocked by 'xx'
 t-Epenthesis, SFN
 Stop-Nasalization, CPA
- Silent Demibeat Addition
 NISS
 ISS is blocked by 'xx'
 Stop-Nasalization, SFN

3.4 Summary

In this chapter, we have seen three configuration-sensitive lexical rules in Korean: t-Epenthesis, ISS, and the optionality of POT in compound nouns.

These three rules all require non-local reference to word-internal dominance/hierarchy in addition to their phonological conditions. This requirement of global (non-local) reference to word-level syntax is a clear violation of the Opacity Principle (Mohanan 1982) or Bracket Erasure (Mohanan 1986). The suppression of the Opacity Principle is inevitable in the differentiation of two types of dominance relations-- left-branching vs. right-branching structure. Within the theory of Lexical Phonology, a selective morphological reanalysis for one type of structure is impossible unless one ignores the Opacity Principle (cf. the morphological reanalysis for the right-branching derivative compounds in Ahn).

Parallel to the syntactic constraint on Modifier Tensing, the same right-branching constraint is required in the description of these three lexical rules. We observed the identical correlation between the

directionality of tree branching and the applicability of rules: they all fail to apply to right-branching structures, while there is no such restriction on the left-branching structure. On the understanding that word-level syntax is not basically different in nature from the structure of the phrase/sentence, such a generalization becomes plausible. In connection with the syntax-phonology interface issue, in Chapter 5, I will reexamine this right-branching constraint in the description of the phrasal domain of three assimilation rules in Korean.

Notes

1. Although the rule by C-W. Kim (cf (23) in Chapter 2) is to exclude the second nouns beginning with a vowel, the locative nouns are in violation of the rule. I exclude the locative nouns, treating the consonant attached to the locative nouns as an adnominal genitive morpheme. Along the same line, Cook (1987) proposes a Gemination analysis, which excludes the cases of locative nouns as a separate source.
2. Bound nouns are sometimes called *postnouns* (cf. Martin et al. 1968). Bound nouns are not used alone, but may follow a noun to form a compound, e.g. /cis/ 'a motion' and /cil/ 'an action/deed (vulgar)' are productive in the word formation process, as in /nun-cis/ 'eye + motion (an eye-signal),' /son-cis/ 'hand + motion (a wave),' /mom-cis/ 'body + motion (a gesture),'; /pal-kil-cil/ 'foot + way + action (a kicking)' /totuk-cil/ 'thief + act (stealing),' /sõnsæN-cil/ 'teacher + act (teaching),' /kyecip-cil/ 'woman + act (whoring),' etc.
3. Chang (1963) presents a mora account of Korean vowel length, proposing four different moraic quantities of vowels--extra-long vowels of 3 mora, long vowels of 2 mora, half-long vowels of 1.5 mora, and short vowels of 1 mora. Since only the short vs. long vowel distinction seems to be distinctive, in the study of vowel shortening in compound, I have used two numbers, 1 and 2, to indicate short and long vowels respectively. Some near phonetic transcriptions are used prior to the proper introduction of the phonological rules involved; however, for the sake of the present discussion, readers may ignore phonetic details except the vowel length alternation.
4. This correlation between vowel length and tone was discovered through the personal discussion with my colleague Y-S. Choi who is a native speaker of one of Kyungsang dialects (Taegu dialect) of Korean.
5. Parentheses are used in the phonetic transcription to indicate the optionality of tensification.
6. In Chang's terminology, it is referred to as "a peculiar excessive shortening" (translation is mine--DSP).
7. Selkirk's Silent Demibeat Addition is to account for syntactic rhythm rules in English, not to account for compounds (cf. Selkirk 1986: 313-319).

Chapter 4

Ordering Paradoxes

To begin our discussion of the interplay between morpho-syntactic structure and ordering paradoxes in Korean, I will examine how linear ordering descriptions have dealt with some ordering difficulties called ordering paradoxes. In linear ordering theory, the ordering relation which governs the operation of a set of phonological rules is specified by giving the rules in a linear list. The characteristics of linear ordering theory can be given by the following four conditions (cf. Anderson 1974: 139):

- a. **Connectedness:** For any pair of rules *A* and *B*, either *A* must precede *B*, or *B* must precede *A*.
- b. **Irreflexivity:** No rule precedes itself.
- c. **Antisymmetry:** If some rule both precedes and follows another rule, it must be the same as that other rule.
- d. **Transitivity:** If *A* precedes *B*, and *B* precedes *C*, then *A* must precede *C*.

Conditions (a) and (c) maintain that the order of two phonological rules will always be unique. But, as Anderson points out, because of the fact that we observe numerous cases where no interaction exists between a pair of phonological rules, condition (a) seems to be too strong a claim. That is, if one rule is neutral to another in terms of rule interaction, there is no need for any fixed order between them. Moreover, with regard to condition (c), the requirement of opposite orders of both *A before B* and *B before A* (a so-called *ordering paradox*)

stands against the idea of an unchanging unique order between each pair of rules.

Condition (b) does not allow any rule to reapply to its own output. In SPE, Chomsky and Halle (1968) adopt the concept of simultaneous application by using a notational operator, $(X)^*$, while Anderson abandons this in favor of iterative reapplication of rules. I will not discuss (b) and (d) in detail, since they are not directly related to the present topic (cf. Anderson 1974: Chapter 9 for details).

As Anderson (1974) points out, many apparent counterexamples to (c) and (d) have been observed in a number of languages, but the description of ordering paradoxes has been dealt with by reformulation of otherwise well-motivated rules, redefinitions of features, and other ad hoc devices in order to satisfy the linear ordering requirement.

In this chapter, I will explore rule interaction between two pairs of phonological rules in Korean which show ordering paradoxes. The ordering paradoxes have led the linear ordering descriptions to separate what is apparently a single process into more than one piece (cf. KR 1974). I claim that these ordering paradoxes are predictable phenomena and are due to syllable-structure assignment which makes reference to the morpho-syntactic structure.

The following two sections 4.1 and 4.2 introduce each pair of the phonological rules in question and discuss the matter in detail. At the end of each section, I present my overall solution for the issue.

4.1 n-Lateralization and l-Nasalization

Korean manifests some interesting phonological phenomena with regard to the two sonorant consonants, /n/ and /l/. There are two opposing phonological rules involving these two sonorant consonants: An alveolar nasal becomes a lateral when it is adjacent to a lateral (n-Lateralization, henceforth n-Lat), and a Sino-Korean lateral becomes an alveolar nasal in syllable-initial position (l-Nasalization, henceforth l-Nas).

4.1.1 n-Lateralization

First, let us look at n-Lat. A formulation of the rule and data are given in (1) and (2) respectively:

(1) n-Lat (mirror image)

n ---> l % l

(An alveolar nasal becomes a lateral when it is adjacent to a lateral. % indicates before or after.)

(2)

a.	/sanlim/ /hwanlak/ /honlan/ /panlan/	[sallim] [hwallak] [hollan] [pallan]	'forest' 'pleasure' 'confusion' 'rebellion'
b.	/cilnyð/ /palno/	[cillyð] [pallo]	'niece' 'getting angry'
c.	/tal.nala/ /tal.nim/ /c"ðl.nata/ /cukil.nom/	[tallara] [tallim] [c"ðllada] [cugillom]	'the land of the moon' 'the moon-hon' 'becomes sensible' 'a rascal'
d.	/c"uðk-ɬl nam-ki-ko.../ memory-ACC remain-caus-conj [ll] 'leaving memories behind...'		

- e.1. /kʰɪn ɪl na-ɔsʰ-ta/
 big event happen-past-decl
 [ɪl]
 'Trouble occurred.'
2. /tanŋsin-tɪ na-nɪn salaŋha-p-ni-ta/
 you-ACC I-TOP love-frm1-ind-decl
 [ɪl]
 'I love you.'

n-Lat, being a contextual assimilation process, applies not only word-internally (cf. (2a/b)) or across the compound boundary (cf. (2c)) but also within a verb phrase or a sentence (cf (2d/e)). In other words, the domain of n-Lat is not restricted at all. One thing to mention is that n-Lat applies obligatorily even at the phrasal or sentential level, regardless of the rate of speech. Even in slow and careful speech, for native speakers of Korean, it seems to be very difficult to suppress n-Lat.

4.1.2 l-Nasalization

Now let us look at the quite opposite phenomenon, l-Nas. Sino-Korean laterals are realized as alveolar nasals in syllable-onset position¹. A rule formulation and some examples are given below:

(3) l-Nas (Sino-Korean)

l ---> n / \$ ___

(Syllable-onset Sino-Korean laterals become alveolar nasals.)

(4)

a.	/loin/	[noin]	'an old person'
	/caŋlo/	[caŋno]	'an elder'
vs.	/colo/	[coro]	'premature old age'

b.	/lakwɔn/	[nagwɔn]	'paradise'
vs.	/k" wəlak/	[k" wərak]	'pleasure'
c.	/sipɫi/	[simni]	'ten miles'
	/simni/	[simni]	'mentality'
vs.	/pɫi/	[piri]	'irrationality'
d.	/kukɫi/	[kuŋni/	'national interest'
	/kuŋɫi/	[kuŋni]	'study'
vs.	/cɔɫi/	[cɔri]	'low interest'

l-Nas rule has been often formulated with the disjunctive environment: either after a word boundary or a consonant ({#, C}____). However, because there is no apparent shared feature between # and C, and for greater generality in the formulation of the rule, I prefer the version with syllable boundary (§). As Hooper (1972) proposes, the use of syllable boundary enables us to eliminate the ubiquitous disjunction {#, C}.

However, there is a substantial difference between the two formulations of l-Nas in the case of intervocalic lateral, and the syllable structure account needs some elaboration. I.e., given the formulation of syllable-onset l-Nas (3), one may ask why intervocalic laterals, which might be interpreted as being in syllable-onset, do not undergo l-Nas (cf (4)). In order to answer this, the ambisyllabicity of intervocalic lateral has been postulated in K-H. Kim 1987. I.e., if an intervocalic lateral is ambisyllabic, it does not fit the SD of l-Nas by exhaustive interpretation of an association line, though it does meet the SD of another rule called l-Weakening, by which a lateral becomes a flap-like liquid /r/.

4.1.3 Rule Interaction between the Two Rules

4.1.3.1 n-Lat before l-Nas

Our principal interest lies in the interaction between the two rules. The competition of the two rules takes place in the sequence of an alveolar nasal and a lateral, /...nɫ.../. On the other hand, for the sequence of a lateral and an alveolar nasal, /...ɫn.../, l-Nas applies vacuously, and the sequence always surfaces as [...ɫɫ...] by n-Lat. For example, see /cɪɫnyð/ → [cɪɫɫyð] 'a niece,' /tɛɫ.nɪm/ → [tɛɫɫɪm] 'the moon,' and /pʰaɫ.namu/ → [pʰaɫɫamu] 'woods to sell,' etc. (cf. (2b/c/d/e) and derivations in (6) below).

Consider the following examples of word-internal n-Lat.

(5) word-internal n-Lat

/sɪɫnyðɲ/	[sɪɫɫnyðɲ]	'ghost'
/sɛɫɫɪm/	[sɛɫɫɫɪm]	'forest'
/mɪɫɫɪ/	[mɪɫɫɫɪ]	'liberal arts'
(cf. /mɪɫɫɪ/	[mɪɫɫɫɪ]	'physics')

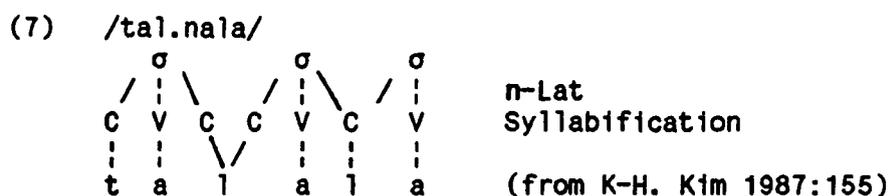
For the word-internal sequence /...nɫ.../, n-Lat must be stipulated to precede l-Nas, otherwise, ungrammatical surface forms of [...nn...] are derived (compare (6a) with (6c) below). In addition to the applicational precedence of n-Lat over l-Nas, l-Nas must be prevented from applying to the output of n-Lat. Otherwise, not only may we derive the ungrammatical form of [...ɫn...], but we will end up with an infinite loop since one rule may feed the other endlessly, under the premise that rules apply whenever their SD is met (cf. (6b)). For the latter blocking effect, the two rules may be disjunctively ordered in the order of n-Lat before l-Nas. But disjunctive ordering of the two

rules does not provide any explanation, though it may correctly describe the facts.

(6)

a.	/sanlim/ sannim ----- *[sannim]	/tal.nim/ ----- tallim [tallim]	l-Nas n-Lat
b.	/sanlim/ sallim salnim sallim salnim :	/talnim/ tallim talnim tallim talnim :	n-Lat l-Nas n-Lat l-Nas :
c.	/sanlim/ sallim ----- [sallim]	/talnim/ tallim ----- [tallim]	n-Lat l-Nas (must be blocked)

The blocking effect of l-Nas after the operation of n-Lat can be achieved more elegantly by the so-called *Geminate Inalterability Principle* (henceforth GIP)², which says roughly that geminate consonants (or long vowels) resist the application of rules that *a-priori* would be expected to apply to them (cf. Hayes 1986). For example, K-H. Kim (1987) adopts an ambisyllabic syllable structure³ for the geminated lateral in which a single lateral segment in the melody tier is associated with two identical nodes in the CV tier (viz. CC here) by his so-called *Shared Feature Convention*⁴. Consider K-H. Kim's sample derivation for /tal.nala/ in (7):



As a result of the assignment of ambisyllabic structure to the geminate lateral, which follows n-Lat, the second lateral is not in exclusively syllable-onset position any longer, and, consequently, under the exhaustive interpretation of association lines by the so-called *Linking Constraint* (cf. Hayes 1986), l-Nas is inapplicable to the structure of this newly-generated geminate.

K-H. Kim also maintains that the extrinsic order of n-Lat before l-Nas is superfluous and predictable, provided that we accept a general principle that syllable structure assignment takes place *only* after the application of syllable structure insensitive rules (ibid.: 153)⁵. By this principle, n-Lat, being a contextual (syllable structure insensitive) rule, applies first and the syllabification follows it, and by the virtue of this latter syllabification, the syllable structure sensitive rule l-Nas applies only after the syllable structure insensitive n-Lat. Adopting the formulation of syllable structure sensitive l-Nas, for word-internal cases, this general principle correctly predicts applicational precedence for the two rules (n-Lat before l-Nas).

4.1.3.2 l-Nas before n-Lat

But the story does not end here. The word-external order between the two rules is opposite to the word-internal order. That is, when an alveolar nasal and a lateral meet across a compound or higher boundary (such as a word or phrasal boundary), which may coincide with a syllable boundary, the opposite order of l-Nas before n-Lat is required to derive the correct surface forms (cf. the data in (9) and the derivation of (10b) below):

(9)

- a. compound nouns
- | | | |
|---------------|--------------|--------------------|
| /hanin.lok/ | [haninnok] | 'Korean directory' |
| /sinmun.lo/ | [simmunno] | 'Sinmun Street' |
| /kipon.lilon/ | [kibonniron] | 'basic theory' |
| /sin.lakwôn/ | [sinnagwôn] | 'new paradise' |
- b. [A N]_{NP}
- | | | |
|-------------------|------------|-------------------|
| /k"ʰn loin/ | [k"ʰnnoin] | 'tall old person' |
| /k"ʰn liyu/ | [k"ʰnniyu] | 'big reason' |
| /ômhan lyulpôp/ | [...nn...] | 'strict law' |
| /coyoñhan lakwôn/ | [...nn...] | 'silent paradise' |
- c. /na-nʰn læl ka-n-ta/
[.....nn.....]
I-TOP tomorrow go-pres-decl
'I am going tomorrow.'

Following are sample derivations of (9). Note that, assuming the ambisyllabicity of the geminate laterals, the two rules potentially bleed each other. Of the two possible derivations, the second bleeding order, l-Nas before n-Lat, is needed to derive the correct surface form (cf. (10b)):

- (10)
- | | | | |
|----|--------------------------------|--------------------------------|-----------------------|
| a. | <u>/hanin.lok/</u>
hanillok | <u>/k"4n loin/</u>
k"4lloin | n-Lat
l-Nas (bled) |
| | *[hanillok] | *[k"4lloin] | |
| b. | <u>/hanin.lok/</u>
haninnok | <u>/k"4n loin/</u>
k"4nnoin | l-Nas
n-Lat (bled) |
| | [haninnok] | [k"4nnoin] | |
- 'Korean directory' 'a tall old man'

Before presenting my analysis, let us look at how this fact has been described within linear ordering theory. In the linear ordering description of KR (1974), the requirement of opposite orders (the potential ordering paradox) seems to be the sole reason for splitting up the rules in question. Due to the theoretical assumption of *Antisymmetry* (1c)--if some rule both precedes and follows another rule, it must be the same as that other rule--KR (1974) has to break up an apparently single phonological process into two pieces. As a matter of fact, although one rule precedes and follows the other, obviously they are not the same rule. KR separates l-Nas after a consonant from that across a compound/phrase boundary (cf. her Delateralization (143) and l-Nas (192') respectively):

- (11) KR's two l-Nas's
a. Delateralization (KR's (143))

$$l \rightarrow n / \left\{ \begin{array}{c} \# \\ \phi \\ ! \end{array} \right\} \text{---}$$

(An l becomes n in phrase initial position, and also after a compound boundary if it is part of Sino-Korean morpheme. Here # stands for a phrasal boundary, ϕ for a compound boundary, and ! for a Sino-Korean morpheme boundary.)

b. l-Nas (KR's (192'))

l --> n / C ____

(A lateral becomes a nasal after a consonant.)

(12) KR's sample derivations

a.	b.	c.	
/kipon.lɪɪon/	/hwanɪak/	/pokɪak/	
nn	----	----	Delateralization (143) ⁶
----	ll	----	n-Lat (188)
----	----	kn	l-Nas (192')
----	----	ɲn	Stop-Nasalization
[kibonniron]	[hwanɪak=]	[poɲnak=]	

As illustrated in the sample derivations in (12), by the separation of l-Nas into two rules, Delateralization (143) and l-Nas (192'), KR may locate the former before n-Lat and the latter after n-Lat so as to escape from the potential ordering paradox. However, the questions unanswered but buried in KR's description are (i) whether this is a real ordering problem, and (ii) whether l-Nas must be two discrete processes for the cases of after a consonant and after a compound/phrase boundary. The answers for both appear to be negative. The problem in KR (1974) is the adoption of the linear ordering hypothesis. This ordering paradox is not a problem, if we do not adhere to the linear ordering requirement, though it may indeed be an ordering problem in linear ordering theory. Moreover, it is unfortunate that the theoretical deficiency of the linear ordering hypothesis forced KR to separate an apparently single process into more than one piece. Theory-internal defects must not be an excuse to multiply the number of phonological rules.

4.1.4 The Solution

The apparent ordering paradox discussed above can be resolved by the correlation between morpho-syntactic structures of forms and the syllable-structure sensitivity of rules.

Notice that the rules in question can be classified by syllable-structure sensitivity: n-Lat, being a contextual mirror-image rule, does not need to refer to syllable structure, while l-Nas, being a syllable onset rule, is syllable-structure sensitive; and syllable-structure insensitive n-Lat, precedes syllable-structure sensitive l-Nas within underived words like /sanlim/, while the opposite order is required across the compound, word, or phrase boundary. Using word boundary which encompasses compound boundary or a higher (i.e. word boundary or phrase boundary), the following generalization can be made:

(13)

Within underived forms or suffixed words⁷, syllable-structure insensitive rules take applicational precedence over syllable-structure sensitive rules, whereas the reverse order of the two types of rule obtained across a word boundary.

There are two possible ways to describe the problem: One way is to use (13) as a principle which warrants the opposite applicational precedence between two types of rules for different structures, letting the syllabification take place any time.

Another more straightforward way to account for the facts is to postpone the syllabification process until after the operation of syllable structure insensitive rules. This late syllabification account is taken by K-H. Kim (1987):

- (14) Syllabification takes place only after the application of syllable-structure insensitive rules.
(from K-H. Kim 1987: 153)

The following sample derivations illustrate how the two principles differ in describing the word-internal order of the two rules:

- (15)
- a. 1. s a n l i m
 $\begin{array}{cc} \backslash \! / & \backslash \! / \\ \sigma & \sigma \end{array}$ Syllabification
2. s a l i m
 $\begin{array}{cc} \backslash \! / & \backslash \! / \\ \sigma & \sigma \end{array}$ n-Lat before l-Nas by (13)
 (no l-Nas by GIP)
- b. 1. s a n l i m (No l-Nas due to no Syllabification by (14))
2. s a l i m
 $\begin{array}{cc} \backslash \! / & \backslash \! / \\ \sigma & \sigma \end{array}$ n-Lat
 Syllabification
 (no l-Nas by GIP)
- 'forest'

In the account based on (13), as illustrated in (15a), Syllabification may take place any time, so that both l-Nas and n-Lat are potentially applicable at stage 1. At this stage, principle (13) comes into play, and it correctly predicts the order required.

On the other hand, as in (15b), K-H. Kim's account by (14) prevents Syllabification until the operation of n-Lat is completed. That is, since the syllable structure is not assigned at the initial stage, syllable structure sensitive rules like l-Nas may not apply while the contextual rule (syllable structure insensitive) n-Lat may, and as a result of the Geminate Inalterability Principle along with the Shared

Feature Convention and the Linking Constraint, 1-Nas is inapplicable to the output of n-Lat. So we obtain the correct word-internal derivation. But, (14) appears to aim at word-internal rule order only. If we apply (14) across a compound or phrase boundary, it would predict wrong order.

Both claims have an *ad hoc* feature. That is to say, for (14) there seems to be no *a-priori* reason for the syllabification process to wait until the syllable-structure insensitive rules finish their operations. Similarly, for (13), there appears to be no *a-priori* reason that syllable-structure insensitive rules must apply before syllable structure sensitive rules for a certain structure, or vice versa.

On the one hand, each account has an advantage over the other. (14) describes the applicability of the rules in question in a more direct way in terms of the assignment of syllable structure, while (13) makes use of a categorization of rules according to syllable-structure sensitivity. In this respect, at least for word-internal cases, (14) is more straightforward and appealing than (13). On the other hand, while (13) is comprehensive enough to hold for the ordering paradox between word-internal and word-external cases, (14) takes care of only word-internal cases. Note that (14) would incorrectly predict n-Lat before 1-Nas for all structures.

As an expository procedure, making up for the deficiency in each, I propose the following instantaneous application of syllable-structure sensitive rules along with the syllable-structure assignment rule:

- (16) a. In Korean, the initial syllabification takes place at the end of the word cycle.
 b. In the presence of a syllable structure, the application of syllable-structure sensitive rules takes place before any other rule.

(16a) is to prevent Syllabification from applying to a stem before it is suffixed to form a full word. For example, syllable-final Consonant Cluster Simplification (CCS) precedes Syllabification across a compound boundary even where the second element of a compound noun begins with a vowel (e.g., [[kaps] [ôc"i]] --> [kabôc"i], *[kapsôc"i] 'worth (lit. price + worth)', but, when the same noun kaps 'price' is suffixed by case markers which begin with a vowel, syllabification precedes CCS (e.g. [[kaps] i] --> [kaps'i] 'the price (nominative),' [[kaps] ɰi] --> [kaps'ɰi] 'the price (accusative)'). This fact may not be well captured by principle (14), because of the fact that both Syllabification and CCS are rules which make reference to syllable structures.

The immediate application of syllable-structure sensitive rules by (16b) captures the fact that the syllable-structure sensitive rule, l-Nas, precedes the contextual rule, n-Lat, across a compound boundary or higher, which I call exocentric structures with "]"["]. Word-internally, on the other hand, the syllable-structure insensitive rule, n-Lat precedes the other, because syllable structure is assigned at the very end of phonological derivations of a word by (16a). The following derivations illustrate this point:

(17)

a. within a word

1. s a n l i m

(No Syllabification by (16a))

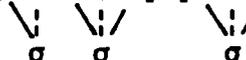
2. s a l i m

n-Lat
(no l-Nas by GIP)

'forest'

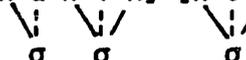
b.1. compound nouns

[h a n i n] [l o k]



Syllabification by (16)

[h a n i n] [n o k]



l-Nas

'Korean directory'

b.2. noun phrases

[k" + n] [l o i n]



Syllabification by (16a)

[k" + n] [n o i n]



l-Nas

'a tall/big old man'

Keeping (16) as a working hypothesis, in the next section, I will examine another pair of rules which shows an ordering paradox.

4.2 Aspiration and Syllable-Final Neutralization

Another pair of phonological rules in Korean which display an ordering paradox are Aspiration and Syllable-Final Neutralization. The next two subsections introduce each rule, and the third section deals with the analysis of the rule interaction.

4.2.1 Aspiration

Any sequence of a lenis stop and /h/ (a stop plus /h/ or /h/ plus a stop) becomes an aspirated stop in Korean (Aspiration, henceforth ASP).

As in (18), this rule has been often treated as a mirror image coalescence rule, while some phonologists describe the phenomenon by two rules, such as Regressive ASP and Progressive ASP (cf. KR 1974). I favor of the mirror image rule.⁸ Following are the rule formulation and sample data:

(18) ASP

$$\left\{ \begin{array}{cc} \left[\begin{array}{c} -\text{tns} \\ -\text{cont} \end{array} \right] & \text{h} \\ 1 & 2 \end{array} \right\} \longrightarrow \left[\begin{array}{c} +\text{asp} \\ 1 \end{array} \right] \quad \emptyset \\ \left\{ \begin{array}{cc} \text{h} & \left[\begin{array}{c} -\text{tns} \\ -\text{cont} \end{array} \right] \\ 2 & 1 \end{array} \right\}$$

(Any sequence of a lenis stop and /h/ becomes an aspirated stop.)

a. lenis stop-h

/pap-ha-ta/	[pap"ata]	'rice-do-decl (cook)'
/kot ha-ð-la/	[kot"ara]	'soon do-inf-imp'
/pukhan/	[puk"an]	'North Korea'
/cök-hi-ta/	[cök"ita]	'write-caus-decl'
/c"akha-ta/	[c"ak"ada]	'good-hearted-decl'
/hakhwe/	[hak"we]	'academic society'

b. h-lenis stop

1. /coh-ta/	[cot"a]	'be good-decl'
/coh-ko/	[cok"o]	'be good-conj'
/coh-ci/	[coc"i]	'be good-susp'
/nah-ta/	[nat"a]	'yield-decl'
/nah-ko/	[nak"o]	'yield-conj'
/nah-ci/	[nac"i]	'yield-susp'
2. /suh.taik/	[sut"ak=]	'a rooster'
/suh.kæ/	[suk"æ]	'a male dog'
/suh.twæci/	[sut"wæji]~[sut=t'wæji]	'a boar'

vs. /suh.holaŋi/	[sut=holaŋi] --> [sut ^h oraŋi]	'a male tiger'
/suh.oli/	[sutoli] --> [sudori]	'a male duck'
/suh.mal	[sutmal] --> [sunmal] --> [summal]	'a male horse'

4.2.2 Syllable-Final Neutralization

In syllable-final position, not only are non-lenis (aspirate or tense) stops neutralized into their corresponding unreleased lenis stops, but also many other obstruents such as a palatal stop /c/, palatal affricate /c"/, alveolar fricatives /s, s'/ and glottal fricative /h/ are realized as an unreleased alveolar lenis stop [t=] (by Syllable-Final Neutralization, henceforth SFN). The following is a segmental sketch of SFN:

- (19) segmental sketch of SFN
- /p, p"/ --> [p=]
 - /k, k", k'/ --> [k=]
 - /t, t", c, c", s, s', h/ --> [t=] /__\$

Notice that, in (19) there are accidental gaps of syllable-coda /p', t', c'/ in Korean. As shown below, the rule formulation of SFN in a feature value change system will be very complex for the changes of /c, c", h/ to [t=], which involve modifications of both place and manner of articulation. For the changes of /s, s'/ to [t=], on the other hand, the unreleased feature [-rel], which leads to [-cont] due to a redundancy rule, is sufficient:

(20) SFN

$$\left[\begin{array}{l} -\text{son} \\ \langle +\text{cor} \rangle_1 \\ \langle +\text{cont}, -\text{ant}, -\text{cor} \rangle_2 \end{array} \right] \longrightarrow \left[\begin{array}{l} -\text{rel} \\ \langle +\text{ant} \rangle_1 \\ \langle +\text{ant}, +\text{cor} \rangle_2 \end{array} \right] / _ _ \$$$

(The redundancy rule [-rel] --> [-asp, -tense, -cont] is assumed here, and the optional features within angle brackets are for the changes of /c, c"/ and /h/ to [t=] respectively.)

The following are sample data for SFN. The data are arranged by the three neutralized surface phones:

(21) examples of SFN

a. [p=]		
/ip/	[ip=]	'mouth'
/ip-ta/	[ip=t'a]	'wear-decl'
/ip"/	[ip=]	'leaf'
/nop"-ta/	[nop=t'a]	'be high-decl'
b. [k=]		
/kak/	[kak=]	'angle'
/hakkyo/	[hak=k'yo]	'school'
/k'ak'-ta/	[k'ak=t'a]	'cut-decl'
/puok"/	[puok=]	'kitchen'
/puok"-kwa/	[puok=k'wa]	'kitchen-conj'
c. [t=]		
/kot/	[kot=]	'soon'
/kut-ta/	[kut=t'a]	'harden-decl'
/k'+t"/	[k'+t=]	'end'
/k'+t"-kwa/	[k'+t=k'wa]	'end-conj'
/nac/	[nat=]	'day'
/kuc-ta/	[kut=t'a]	'be bad'
/kuc-ni/	[kunni]	'be bad-intr'
/nac"/	[nat=]	'face'
/c'oc"-ta/	[c'ot=t'a]	'chase-decl'
/c'oc"-ni/	[c'onni]	'chase-intr'
/nas/	[nat=]	'sickle'
/nas-ta/	[nat=t'a]	'recover-decl'
/nas-ni/	[nanni]	'recover-intr'

/na-ôs'-ta/	[nat=t'a]	'happen-past-decl'
/na-ôs'-ni/	[nanni]	'happen-past-intr'
/hi+h/	[hi+t=]	'the name of letter h'
/nah-ni/	[nanni]	'deliver-intr'
/nah-ta/	[nat"a], *[nat=t'a] ⁹	'deliver-decl'
/coh-ni/	[conni]	'be good-intr'
/coh-ta/	[cot"a], *[cot=t'a]	'be good-decl'
/suh.holañi/	[sut"orañi]	'male tiger'

4.2.3 Rule Interaction between the Two Rules

What, then, are the intrinsic relations between the two rules? SFN potentially feeds ASP by modifying non-lenis stops and other obstruents into the corresponding lenis stops, whereas ASP may bleed SFN by the coalescence of /h/ and a lenis stop to an aspirated stop.

4.2.3.1 SFN before ASP

Now let us see how the two rules interact in reality. For compound nouns like /suh.holañi/ 'male tiger' (cf. (22a) below), SFN precedes ASP (SFN feeds ASP) to derive the correct surface form of [sut"orañi]--i.e., ASP becomes applicable only after the operation of SFN, since SFN creates the SD of ASP by converting the syllable-coda /h/ to [t=]. In the following, (18b2) is copied below for ease of reference:

(22)		SFN	ASP	
a.	/suh.holañi/	[sut=holañi]	--> [sut"orañi]	'a male tiger'
	/suh.oli/	[sut=oli]	--> [sudori]	'a male duck'
	/suh.maɪ	[sut=maɪ]	--> [summaɪ]	'a male horse'
b.	/suh.taɪk/	ASP		'a rooster'
	/suh.kæ/	[sut"ak=]		'a male dog'
	/suh.koyañi/	[suk"ə]		'a male cat'
	/suh.twæci/	[suk"oyañi]		'a male cat'
		[sut"wæji]~[sut=t'wæji]		'a boar'

Interestingly, some compound nouns which require the opposite order are all terms for domestic animals (cf. (22b)). For these forms, the opposite order, ASP before SFN is needed. I hypothesize that this is due to tighter cohesion between compounding elements in frequently used terms: This stronger cohesion may cause the loss of the compound status of these forms, and as a result, the forms in (22b) behave as if they are single lexical items.

The productivity of the given order, SFN before ASP, for the compounding (exocentric) structure is confirmed when we examine novel combinations of /suh-/ 'male' with some wild or exotic animal/animate terms.

(22)	SFN		POT	
/suh-kilin/	[sut=k'irin]	-->	[suk=k'irin]	'a male giraffe'
/suh-cepi/	[sut=cepi]	-->	[sut=c'ebi]	'a male swallow'
/suh-coñtali/	[sut=coñtali]	-->	[sut=c'oñdari]	'a male skylark'
/suh-tok'æpi/	[sut=tok'æpi]	-->	[sut=t'ok'æbi]	'a male ghost'
/suh-kômi/	[sut=k'ômi]	-->	[suk=k'ômi]	'a male spider'
/suh-tuk'ôpi/	[sut=tuk'ôpi]	-->	[sut=t'uk'ôbi]	'a male toad'
/suh-kolilla/	[sut=kolilla]	-->	[suk=k'orilla]	'a male gorilla'
/suh-toksuli/	[sut=toksuli]	-->	[sut=t'oks'uri]	'a male eagle'

4.2.3.2 ASP before SFN

On the other hand, for forms like /coh-ta/ 'be good (declarative)' (cf. (18b1)), ASP precedes (bleeds) SFN. Otherwise we will derive the ungrammatical form *[cot=ta] and will then become *[cot=t'a] by Post-Obstruent Tensification.

(23)

a.	/suh-holañi/ sut=holañi SFN sut"olañi ASP [sut"orañi] l-Weakening	b.	/coh-ta/ cot"a ASP ----- [cot"a] SFN
	(SFN feeds ASP)		(ASP bleeds SFN)

The requirement for opposing orders poses the same problem for linear ordering theory, and, in fact, KR adopts the same policy: the separation of a rule into two pieces to preserve the linear ordering requirement. The separation of ASP into the two rules of Progressive ASP and Regressive ASP allows KR to display them disjointly, one before h-Unrelease and the other after h-Unrelease. As a result of this ad hoc manipulation, KR avoids the ordering difficulty.

KR also separates SFN into two parts. Note that KR's Obstruent Unrelease (her (98)) excludes /h/ to [t=] which she calls h-Unrelease (her (104)). In doing so, she treats syllable-coda /h/ differently from other coda consonants. Consider the following sample derivation from KR:

(24) KR's derivations

a.	/suh.holañi/ ----- ----- ----- suholañi sut=holañi ----- sut"olañi ----- [sut"arañi] [suhorañi]	b.	/cohta/ ----- coht"a ----- cot"a cot=t"a ----- ----- ----- [cot=t"a] [cot"a]	Obst Unrel (98) Prog ASP (113) h-Del (Opt) (115) h-Unrel (104) Reg ASP (117)
----	---	----	--	--

Notice here that KR adds an optional h-Deletion rule (her (115)) with regard to the variations of [suhorañi] and [cot=t"a] (see the second

derivations of (24a) and the first of (24b) respectively.) However, I reject her treatment of h-Deletion for two reasons: First, I do not agree with her judgement of grammaticality in regard to the surface form of [suhoraŋi]. Second, [cot=t"a], as an emphatic pronunciation of [cot"a] can be described by an independently motivated emphatic speech rule, which I will call Homorganic Consonant Insertion, and does not require the separate Progressive ASP found in KR's treatment. The seeming necessity for h-Deletion has partly to do with the nature of KR's Progressive ASP (her (113))--Progressive ASP leaves /h/ behind, whereas Regressive ASP does not (compare (25a) and (25b) below):

(25)

a. Progressive ASP (KR's (113))¹⁰

$$\left[\begin{array}{l} -\text{son} \\ -\text{cont} \end{array} \right] \rightarrow [+\text{asp}] / [+\text{asp}] \underline{\quad}$$

b. Regressive ASP (KR's (117))

$$\begin{array}{cccc} [-\text{voi}] & h & \rightarrow & [+\text{asp}] & \emptyset \\ 1 & 2 & & 1 & 2 \end{array}$$

But this description of emphatic speech is not general enough to capture the relevant facts of Korean. For instance, KR's account can not predict the emphatic pronunciation of [sut=t"oraŋi] 'a male tiger,' although it does predict the emphatic variation [cot=t"a] '(it) is good.' The following is the rule formulation of Homorganic Consonant Insertion (henceforth HCI):

(26) HCI (Empahtic speech)

$$\emptyset \text{ ---> } \left[\begin{array}{l} \text{apos} \\ \text{-son} \\ \text{-cont} \end{array} \right] / \text{V} \text{ --- } \left[\begin{array}{l} \text{apos} \\ \text{+tns} \\ \text{-cont} \end{array} \right]$$

(In emphatic speech, between a vowel and a tense (viz. aspirate or fortis) stop a homorganic consonant is inserted.)

Given the proper emphatic speech style, HCI is so productive that it will not tolerate exceptions. The following is sample data for HCI:

(27)

t'/t" --> t=t'/t=t"

/sat'o/	[sat'o]	[sat=t'o]	'lord'
/ot'uki/	[ot'ugi]	[ot=t'ugi]	'tumbler'
/mat'añi/	[mat'añi]	[mat=t'añi]	'of course'
/put"ak/	[put"ak=]	[put=t"ak=]	'request'
/sat"añ/	[sat"añ]	[sat=t"añ]	'candy'

k'/k" --> k=k'/k=k"

/ðk'æ/	[ðk'æ]	[ðk=k'æ]	'shoulder'
/t"ok'i/	[t"ok'i]	[t"ok=k'i]	'rabbit'
/kap-ni-k'a/	[kamnik'a]	[kamnik=k'a]	'go-ind-intr'
/cok"a/	[cok"a]	[cok=k"a]	'nephew'
/sok"uli/	[sok"uri]	[sok=k"uri]	'basket'
/kalik"ida/	[karik"ida]	[karik=k"ida]	'point out'

p'/p" --> p=p'/p=p"

/kip'4ta/	[kip'4da]	[kip=p'4da]	'be glad'
/ap'a/	[ap'a]	[ap=p'a]	'daddy'
/ap"4ta/	[ap"4da]	[ap=p"4da]	'be sick'
/kap"ar4ta/	[kap"ar4da]	[kap=p"ar4da]	'be steep'

By the elimination of h-Deletion in favor of the description based on HCI, and by the modification of KR's Progressive ASP to the second expansion of ASP (17), the derivations (24) can be simplified as (28):

(28) simplified (24)

a.		b.	
/suh.holañi/		/cohta/	
-----		-----	Obst Unrel
-----		cot"a	Prog Asp
sut=holañi		-----	h-Unrel
sut"olañi		-----	Reg Asp

Arguing against KR's account, now, there seems to be no independent motivation for such proliferation of rules, except for convenience in the specification of a linear ordering. That is to say, the differentiation of the aspiration process in the sequence of h-plus-lenis stop from that of the sequence of lenis stop-plus-h, and the isolation of /h/ to [t=] from the other general neutralization process do not serve to capture any linguistically significant generalization, but rather serve only to allow the linear ordering description to fulfill its mission.

4.2.4 The Solution

Again, I claim that there is no real problem, but we are dealing with a phenomenon predictable by the same syllabification principle (16) proposed in the previous section. Because of the fact that SFN is a syllable structure sensitive rule, and ASP is a syllable-structure insensitive contextual (mirror image)¹¹ rule, (16) correctly predicts the ordering and resolves the paradox:

(29)

<p>a.</p> <p>[[suh][holañi]]</p> <p> V/ \ \ V/ </p> <p> σ σ σ σ</p> <p>sut=holañi SFN</p> <p>sut"olañi ASP (fed)</p> <p>[sut"orañi] l-Weakening</p>	<p>b.</p> <p>[[coh]ta]</p> <p>-----</p> <p>cot"a ASP</p> <p>-----</p> <p>[cot"a] SFN (bled)</p> <p> V \</p> <p> σ σ</p>	<p>Syllabification</p> <p>(16a)</p> <p>Syllabification</p> <p>no Syllabification</p> <p>Syllabification (16a)</p>
---	---	---

This account is superior to an extrinsic ordering account because it predicts both opposing orders. Note that even in local ordering theory (Anderson 1974), while feeding and counterbleeding orders are to be treated as unmarked orders predicted by the Maximal Application Principle, bleeding and counterfeeding orders, being marked, are to be specified in the grammar as ordering constraints.

Anderson (1974: 164) maintains that, in the event that neither order is natural for the given form, the grammar must contain a restriction either *absolute* or *contingent*, depending on the existence of a subclass of forms for which a natural ordering does exist, and on whether the natural ordering in fact obtains for those forms. Notice that since SFN and ASP are in a mutual bleeding relation for forms like /coh-ta/, neither order can be natural, and because of the existence of a natural feeding order in other forms like /suh.holañi/, ASP before SFN will be a *contingent ordering constraint*, whereas a natural order SFN before ASP does not have to be specified in the grammar. While Anderson's local ordering theory needs a (contingent) ordering constraint for the description of this ordering paradox, our solution predicts both orders correctly.

Mohanan (1982: 42) claims that extrinsic rule ordering is necessary independently of stratum ordering. Mohanan (1986: 120-122) observes an ordering paradox between Vowel Lengthening and Stress/Tone in two types of compounds in Malayalam: Vowel Shortening precedes Stress/Tone in sub-compounds, while Stress/Tone precedes Vowel Shortening in co-compounds:

(30) Malayalam Ordering Paradox

$\begin{array}{cc} \text{wadhúugr̄ōham} & \text{wádhuuwáran} \\ \quad & \quad \quad \quad \\ \text{L} \quad \text{H} & \text{L} \quad \text{H} \quad \text{L} \quad \text{H} \end{array}$	

Stratum 2 (Sub-compounding)	
$\begin{array}{cc} [\text{wadhu}] & [\text{gr̄ōham}] \\ & \\ \text{L} & \text{H} \end{array}$	$\begin{array}{cc} [\text{wadhu}] & [\text{wáran}] \\ & \\ \text{L} & \text{H} \end{array}$
[[wadhu][gr̄ōham]]	----- Compounding
[[wadhuu][gr̄ōham]]	----- Vowel Lengthening
$\begin{array}{cc} [[\text{wadhúu}][\text{gr̄ōham}]] & \text{[wádhu] [wáran]} \\ \quad & \quad \\ \text{L} \quad \text{H} & \text{L} \quad \text{H} \end{array}$	Stress/Tone

Stratum 3 (Co-compounding)	
-----	$\begin{array}{cc} [[\text{wádhu}][\text{wáran}]] & \text{Compounding} \\ \quad \quad \quad & \\ \text{L} \quad \text{H} \quad \text{L} \quad \text{H} & \end{array}$
-----	$\begin{array}{cc} [[\text{wádhuu}][\text{wáran}]] & \text{Vowel Lengthening} \\ \quad \quad \quad & \\ \text{L} \quad \text{H} \quad \text{L} \quad \text{H} & \end{array}$
'bride's house'	'bride and bridegroom'

This ordering paradox is treated as further evidence for stratal distinction. Assuming an extrinsic order Vowel Shortening before Stress/Tone, Mohanan describes this ordering paradox by the stratal specification of the two rules: The domain of Vowel Shortening is

specified as being in Stratum 2 (Sub-compounding) and Stratum 3 (Co-compounding), and Stress/Tone in Stratum 2 (Sub-compounding) only.

In a lexical analysis, given two instances of ordering paradoxes in Korean can be described in the same way that Mohanan does with the Malayalam case above: For example, one may make use of extrinsic orders, *SFN before ASP* and *l-Nas before n-Lat*, assigning SFN and l-Nas to Compounding stratum only. Assuming Compounding stratum before Suffixation stratum, the following derivations are possible:

(31)

a. Suffixed or underived forms

[[coh] ta]	[sanlim]	
Stratum 1 (Compounding)		Compounding
[[coh] ta]	[sallim]	Suffixation
[cot"a] ASP	[sallim]	n-Lat
[co t"a]	[s a l i m]	Syllabification
$\begin{array}{c} \swarrow \quad \downarrow \quad \searrow \\ \sigma \quad \sigma \quad \sigma \end{array}$	$\begin{array}{c} \swarrow \quad \downarrow \quad \searrow \\ \sigma \quad \sigma \quad \sigma \end{array}$	

b. Compounds

[suh] [holañi]	[hanin] [lok]	
Stratum 1 (Compounding)		Compounding
[[suh] [holañi]]	[[hanin] [lok]]	Syllabification
[suh ho la ñi]	[ha nin lok]	Syllabification
$\begin{array}{c} \swarrow \quad \downarrow \quad \searrow \quad \downarrow \\ \sigma \quad \sigma \quad \sigma \quad \sigma \end{array}$	$\begin{array}{c} \swarrow \quad \downarrow \quad \searrow \\ \sigma \quad \sigma \quad \sigma \end{array}$	
[sut=holañi] SFN	[haninnok]	l-Nas
[sut"olañi] ASP	[haninnok]	n-Lat
Stratum 2 (Suffixation)		Suffixation

In this approach, *ASP before SFN* or *n-Lat before l-Nas* in underived forms or in verbal suffixation can be achieved by the assignment of Syllabification at the end of a word cycle. However, the opposite order, *SFN before ASP* or *l-Nas before n-Lat*, needs an extrinsic ordering (cf. (31b)).

Again, the point is that while there might be unpredictable ordering paradoxes for which we need an extrinsic ordering, not all ordering paradoxes seem to be unpredictable and need an extrinsic ordering, as in Korean cases discussed above.

4.3 Summary

So far we have confirmed Syllabification (16) with two pairs of phonological rules displaying apparent ordering paradoxes. We have seen the connection between the morphosyntactic structure and the applicational precedence relations between two types of rules. Within underived forms or in suffixation (endocentric structure), syllable-structure insensitive rules precede syllable-structure sensitive rules, whereas across a compounding boundary or word/phrase boundary (exocentric structures) the opposite order is required.

The correlation between syllable-structure sensitivity of a rule and the order of rule application is described by the assignment of syllable structure at the very last stage of a word cycle: Syllabification in Korean does not take place along with suffixational processes, but at the very end of the phonological derivation of a word. This late Syllabification predicts word-internal applicational

precedence of syllable-structure insensitive rules over syllable-structure sensitive rules. The immediate (or obligatory) application of syllable-structure sensitive rules in the presence of syllable structure ensures the opposite order in the exocentric structure.

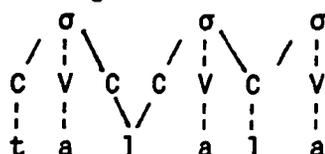
Notes

1. There are no native Korean word which begins with a lateral, except some particles and verbal suffixes, e.g. /lɨl/ 'accusative case marker (ACC),' /lyð/ 'in order to (intention),' etc. These pure Korean syllable-initial laterals undergo the so-called l-Weakening process by which laterals become a flap-like liquid, which is represented as /r/ in this study. Also syllable-initial laterals of other languages such as English and other European languages undergo l-Weakening by naive native speakers of Korean, e.g., 'lighter,' 'lucky,' 'laser,' and 'television' are to be pronounced [rayt"a], [rðk"i], [reyjð] and [t"erebijon].

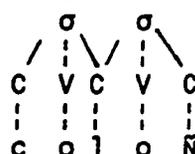
2. The Geminate Inalterability Principle seems to work only for phonemic changes, but not for allophonic rules. For example, when geminate laterals or alveolar nasals are followed by a high front vowel or a palatal glide, only the adjacent lateral or nasal becomes palatalized, e.g. /ðnni/ --> [ðn̥ni] 'an elder sister,' /sillyðk/ --> [silyðk] 'capability,' etc. Note that this palatalization is an allophonic rule, while l-Nas is a phonemic rule.

3. At this moment we need to clarify ambisyllabicity for both intervocalic l and l-geminates. The following different CV-tiers for each are adopted:

a. l-geminates



b. intervocalic-l



4. K-H. Kim's Shared Feature Convention (1987:154) is a modification of Steriade (1982), and it states:

If segments are associated with a certain feature or feature nodes through phonological processes, the other remaining features or feature nodes may also be conjoined with each other unless they are specified with the opposite value or different features.

Here notice that since K-H. Kim (1987) adopts a hierarchical feature organization, as in Clements (1985), he uses the notion of feature node in his Shared Feature Convention.

5. This principle seems to have originated in Kenstowicz and Kisseberth (1973) (henceforth, KK). According to KK (1973: 1-10), there are many cases of so-called *natural bleeding orders* in which phonological rules which affect or determine surface syllable structure apply prior to others which refer to surface syllable structure. The former are rules of epenthesis, copying, and metathesis, and the latter are those of assimilation, neutralization, etc. For instance, in the

Yawelmani dialect of Yokuts, i-Epenthesis intrinsically bleeds Vowel-Shortening, but Vowel-Shortening could be counterbled by i-Epenthesis; and the rule order needed to derive the correct form is the bleeding order, not the counterbleeding order, as illustrated below:

- | | |
|--|--|
| <p>a. /?a:m1-hin/</p> <p>?a:milhin i-Ep</p> <p>----- VS</p> <p>[?a:milhin]</p> <p>(i-Ep bleeds VS)</p> | <p>b. /?a:m1-hin/</p> <p>?aml-hin VS</p> <p>?amil-hin i-Ep</p> <p>*[?amilhin]</p> <p>(VS is counterbled by i-Ep)</p> |
|--|--|

In order to explain the existence of these kinds of so-called unmarked bleeding orders, KK conclude that it is necessary to have a global constraint which warrants that the phonological rules which refer to surface (rather than abstract) syllable structure are to follow the rules which determine surface syllable structure in the language, regardless of their intrinsic relationship. However, in this case, the constraint seems not to be working, since both i-Ep and VS refer to surface syllable structure. Notice that KK's global constraint has a shortcoming. It is not able to predict the applicational precedence between a pair of rules in which there is no such contrast of rule type. That is, if both rules (or neither rule may) create/refer to the surface syllable structure, the constraint makes no prediction.

6. After l-Nasalization, KR (1974) has n-Deletion followed by n-Epenthesis for the derivation of compound nouns, as in:

- | | |
|---------------|-------------|
| /kipon.lilon/ | |
| kipon.nilon | l-Nas (143) |
| kipon.ilon | n-Del |
| kipon.nilon | n-Ep |

Although Korean has an n-Deletion phenomenon (i.e. /n/ is deleted word initially (including after a compound boundary) if it is followed by a high front vowel or a palatal glide (/i,y/), such as in /k"4n#liyu/ --> [k"4niyu] 'a big reason' and /c"ðlhak.liron/ --> [c"ðrañiron] 'a theory of philosophy'), I do not see why we need the same n-Deletion rule for this case, especially if the first noun ends with an alveolar nasal. If we adopt the Geminate Inalterability Principle, the operation of n-Deletion followed by n-Epenthesis can be eliminated.

7. Note that the term "suffixed words" is from the second pair of ordering paradox in 4.2. Syllable-structure insensitive ASP precedes syllable-structure sensitive SFN across a verbal suffixational process (e.g. /coh-ta/ --> [cot"a], cf. 4.2 for details).

8. As a piece of evidence for the separation of ASP, KR cites the optionality of Regressive ASP vs. the obligatoriness of Progressive ASP in the Southwestern dialect (the Cenla dialect), e.g., /pap-hako/ --> [pabago] 'with rice,' /mos-ha-ð/ --> [mode] 'cannot do,' and /mikukhak/ --> [migugak] 'American Studies' are possible, whereas the

Progressive ASP may not fail as in /coh-ta/ --> *[coda], [cot"a] 'be good.'

However, this cannot be a reasonable for the separation of ASP due to the fact that the optionality of Regressive ASP is very much limited to a small number of lexical items, the /h/ in -ha 'do' suffixes attached to nouns or verb-stems. A similar phenomenon can be found in other dialects of Korean, e.g., /taptap-ha-ta/ --> [taptabada] '(someone) is narrow-minded' or /sicak-ha-ô/ --> [sijage] 'Begin (it)' is possible in allegro/casual speech in many dialects including the Seoul dialect, but no dialects in Korean will allow /c"ak-ha-ô/ --> *[c"age] '(someone) is good-hearted' or /pukhan/ --> *[pugan] 'North Korea.' This minor detail does not provide sufficient motivation for the separation of ASP.

9. See more examples in (18b1).

10. Here, the use of feature [+asp] for the environment h is incorrect, since it over-generates ASP. For example, palatal aspirate stop/fricative /c"/ followed by a lenis stop would undergo this Progressive ASP, and generate ungrammatical form--e.g. /c'oc"-ta/ --> *[c'oc"t"a] --> *[c'ot=t"a]. The correct pronunciation is [c'ot=t'a].

11. Notice that ASP is a contextual mirror image rule like n-Lat for which the reference to syllable structure is not necessary.

Chapter 5
The Domain of Phonological Rules
in
Phrasal Phonology

In the current literature on Korean phonology, we find very informal statements about postlexical rule applications, such as that postlexical rule applications are automatic and exceptionless in allegro speech, provided that there is no intervening deliberate pause assignment between words (cf. Ahn 1985: 74, 78-82). This statement is in accordance with Mohanan's claims that the insertion of deliberate pauses interrupts postlexical rules but does not interrupt lexical rules, because pauses are not assigned in the lexicon.

However, although deliberate pause may block the application of phonological rules across words, this does not mean that all postlexical rule applications are automatic or exceptionless with regard to pause. Because the majority of phrasal rule applications occur in natural or allegro speech, the failure of phrasal rule applications in careful or slow speech with or without such deliberate pauses cannot evidence that postlexical rules are all automatic and exceptionless with respect to pauses. Only the success or failure of rule application in natural or allegro speech will provide some evidence to the nature of postlexical rule application.

In the early theory of Lexical Phonology in Mohanan (1982), postlexical rules were characterized not only by blindness to morphological information but by exceptionlessness. But, in the recent revised model of the theory (i.e. Mohanan 1986), the nature of the

postlexical module is substantially modified. The postlexical module is divided into two--syntactic and postsyntactic. The rules applying in the syntactic module may or may not be sensitive to syntactic structure, but they are still blind to morphological information. However, we have seen a morphosyntax-sensitive postlexical rule in Korean, Modifier Tensing (cf. 2.2.1).

The rules applying in the postsyntactic module cannot be sensitive to either morphological or syntactic information, and what comes into play in the postsyntactic module are *phonological phrases* containing purely phonological information (i.e., about segments, syllables, syllable structure, stress, intonation, etc.), but no information about morphological or syntactic features, lexical exception features, word or morpheme class, etc. (from Mohanan 1986: 150).

It is not clear how Mohanan's terminology "phonological phrase" can be related to Selkirk's prosodic category of the phonological phrase, which we will deal with in this chapter. However, within the revised model of Mohanan (1986), now we can say that not all postlexical rules are automatic and exceptionless due to the existence of rules which are sensitive to syntactic structure or phonological phrases.

For the last decade, there has been much discussion on the issue of syntax-phonology interface in many languages. Most notable are Rotenberg (1978) on French liaison, Clements (1978) on Ewe tone sandhi, Napoli and Nespør (1979, 1982) on Italian *raddoppiamento sintattico* (syntactic doubling), Liu (1980) on Mandarin tone sandhi, Odden (1981) on Kimatuumbi vowel shortening, Chen (1985) on Xiamen tone sandhi,

Kenstowicz (1985) on Wh-expressions in Tangale, and Selkirk (1972~1986) on the theory of suprasegmental prosody hierarchy.

In the same vein, Y-M. Cho (1987) and G-R. Kim (1988) explore untapped areas of Korean phrasal phonology, using the notion of phonological phrase proposed by Selkirk (1980, 1984).¹ Their conclusion is that phrasal rule applications are not automatic, but they are limited to a certain prosodic domain, such as a phonological phrase or an intonational phrase which can be defined by mapping rules which may refer to the surface syntactic structure of the phrase or sentence.

Y-M. Cho (1987) describes the domain of some phrasal assimilation rules in Korean--Intersonorant Lenis Stop Voicing, Stop Nasalization, and Nasal Place Assimilation--as a phonological phrase (P), which is defined by a phonological phrase formation rule (cf. Y-M. Cho 1987: 335-337). G-R. Kim (1988: Chapter 5) describes the domain of phrasal tone sandhi rules in the Taegu dialect as a phonological phrase, providing a revised version of phonological phrase formation rule (cf. G-R. Kim 1988: 192).

According to Selkirk (1980b), phonological rules corresponding to two types of representations may exist: labeled bracket domain rules in syntactic representations, and prosodic-domain rules in phonological representations. Our present concern is the latter prosodic-domain rules. In Selkirk (1980a, 1984), prosodic categories such as the syllable (σ), the foot (ϕ), the prosodic word (W), the phonological phrase (P), the intonational phrase (I), and the utterance (U) are hierarchically organized, and mapping rules, which connect the syntactic

representation and the phonological representation of these prosodic structures, are called for.

In Korean, phonological rules bound to four levels of prosodic domains--the syllable (σ), the phonological word (W), and phonological phrase (P), and the utterance (U)--can be observed.² Among these four prosodic categories, there is a fair amount of evidence that the phonological phrase (P) is a privileged domain for the majority of phrasal rule applications in Korean.

The major concern of this chapter is to describe the phrasal domain of three assimilation rules in Korean: they are Intersonorant Lenis Stop Voicing, Stop Nasalization, and Consonant Place Assimilation. 5.1 introduces the data on P-domain rules in Korean. The three subsections (5.1.1. through 5.1.3) explore the phrasal domain of the three phonological rules. 5.2 discusses the task of defining the phrasal domain of the rules in question. In connection with the assumption of a syntax-phonology interface, we will see how much syntactic information is relevant and necessary to define the domain of phrasal application of the phonological rules in question.

Let us start the discussion with the following pairs of sentences in which only a single segment contrasts in its voicing:

(1)

- a. 1. *yesu-ka makwi-l+! c'oc"-as'-ta*
 [g]
 Jesus-NOM Satan-ACC chase away-past-decl
 'Jesus drove away Satan.'
2. *yesu kamakwi-l+! c'oc"as'ta*
 [k]
 Jesus crow-ACC chase away-past-decl
 'Jesus drove away crows.'

- b. 1. apôci-ka pañ-e t+lôka-si-n-ta
 [g]
 father-NOM room-to enter-hon-pres-decl
 'Father enters the room.'
2. apôci kapañe t+lôkasinta
 [k]
 father bag-to enter-hon-pres-decl
 'Father enters the bag.'
- c. 1. cañpi-ka mał t"a-n-ta
 [g]
 Changpi-NOM horse ride-pres-decl
 'Changpi rides a horse.'
2. cañpi kama-l t"a-n-ta
 [k]
 Changpi palanquin-ACC ride-pres-decl
 'Changpi rides a palanquin.'
- d. 1. [[k+ k+līm-+l k+lī-n] koho]
 [g]
 that picture-ACC draw-past Gogh
 'van Gogh who drew that picture'
2. [k+ [[k+līm-+l k+lī-n] koho]]
 [k]
 that picture-ACC draw-pastmod Gogh
 'that van Gogh who drew pictures'

The examples in (1a-1c) show that word-externally the voicing of stops may fail to apply (in this case between a subject and a predicate). Notice that in (1a-c) voiceless stop /k/ as a beginning segment of accusative nominals remains voiceless, although it meets the SD of Intersonorant Lenis Stop Voicing (see (2) below), whereas /k/ of nominative case markers is voiced.

As the examples in (1d) show, voicing appears to be related to the corresponding surface syntactic structure, from which different semantic interpretations arise. At this point, we might reasonably conjecture that the directionality of the syntactic tree branching, which was

introduced in Chapter 3, can be used to describe the voicing alternations in (1d). Note that (1d1) is in a left-branching structure, while (1d2) is in a right-branching structure.

Let us now turn to an examination of the three assimilation rules in Korean which appear to share the same domain, which has been said to be the phonological phrase (P).

5.1 Phonological Phrase Domain Rules in Korean

5.1.1 Intersonorant Lenis Stop Voicing

In Korean, lenis stops (other than aspirate and tense stops) are voiced between voiced segments (Intersonorant Lenis Stop Voicing, henceforth VOI). A formulation of the rule and some examples are given in (2) and (3) respectively:

(2) VOI

$$\left[\begin{array}{l} -\text{cont} \\ -\text{tns} \end{array} \right] \text{--->} [+\text{voi}] / [+\text{voi}] \text{ ____ } [+\text{voi}]$$

(3)

a.	/papo/	[pabo]	'fool'
	/inku/	[ingu]	'population'
	/apôci/	[abôji]	'father'
	/apôci-ka/	[abôjiga]	'father-NOM'
	/kuk/	[kuk=]	'soup'
	/kuk-i/	[kugi]	'soup-NOM'
	/kuk-tl/	[kugtɭ]	'soup-ACC'
	/kuk-ty/	[kugty]	'soup-GEN'
	/talk-êke/	[tagege]	'hen-DAT'
	/kuk-e/	[kuge]	'soup-LOC'
	/sæ-to/	[sædo]	'bird-delm'

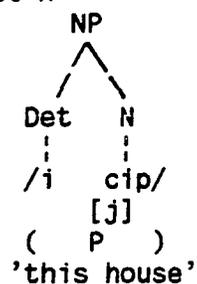
b.	/ka-ta/	[kada]	'go-decl'
	/ka-ta-ka/	[kadaga]	'go-trnsf-pcle'
	/ka-ci/	[kaji]	'go-susp'
	/ka-ko/	[kago]	'go-conj'
	/møk-tɪ/	[møgɪ]	'eat-pros'
	/møk-tɪn/	[møgɪn]	'eat-past'
vs.	/tok'i/	[tok'i]	'axe'
	/ap'a/	[ap'a]	'daddy'
	/kic"a/	[kic"a]	'train'
	/kalik"i-ta/	[karik"ida]	'designate-decl.'

As in the above data, VOI applies within a word, which includes non-lexical items such as noun particles (nominative, accusative, genitive, dative, locative markers, etc.), delimiters, and verbal suffixes.

In natural speech, VOI applies not only word-internally but also across words if certain syntactic conditions are met. To discover the phrasal domain of VOI, let us look at the following examples of noun phrases:

(4) NP (Modifier-Head)

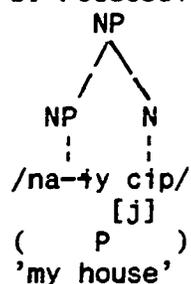
a. Det N



/kɪ cip/
[j]
(P)
'that house'

/cô cip/
[j]
(P)
'that house (over there)'

b. Possessive NP-N



/nô-tɪ cəsan/
[j]
(P)
'your fortune'

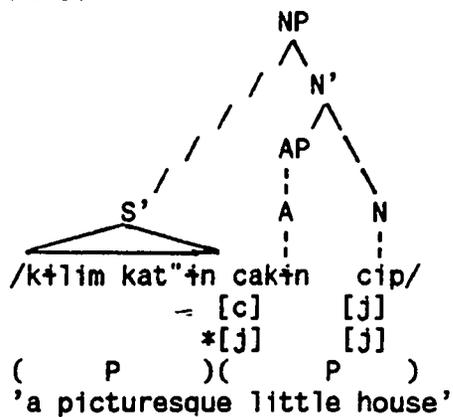
/kɪ-tɪ ton/
[d]
(P)
'his money'

Especially in (4e), where the modifier-head relationship persists to the upper branch of the syntactic tree, we observe that VOI applies within the whole NP.

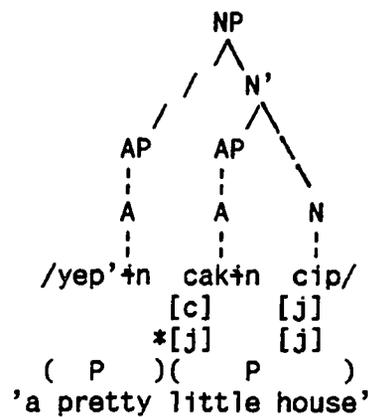
But when a modifier, including a specifier like Det, precedes another modifier-plus-head sequence, the first modifier forms a separate phrasal domain by itself, while an adjacent modifier and its head noun form a domain (cf (5)):

(5) NP (Modifier-Modifier-Head)

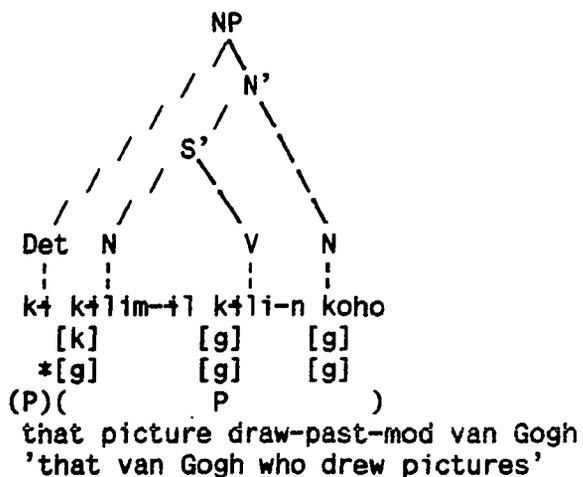
a. RelC]-A-N



b. A-A-N



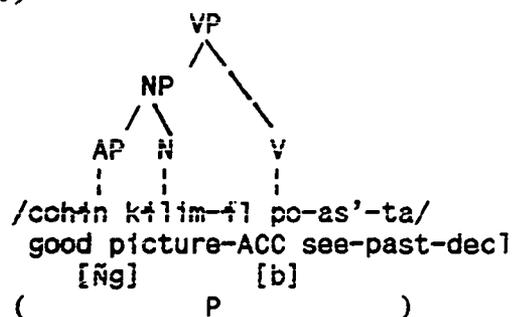
c. [Det [N V]_{S'} N]_{NP}



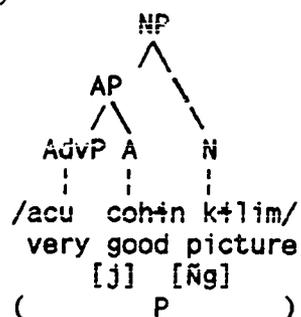
From these observations, we may be able to say that the principle governing the nature of the phonological phrase (P) also appears to be related to the directionality of the syntactic tree branching, as is the case in the domain of the three lexical rules discussed in Chapter 3. Notice that NPs (4d/e) are left-branching structures, whereas those of (5) are right-branching structures. That is to say, the whole left-branching phrase forms a single P, while right-branching structures split into two P's. From a different perspective, the phrasal domain of VOI can be stated in terms of the modifier-head relationship: Between a modifier and its head, VOI applies, while it fails to apply between modifiers (compare (4) and (5)). For convenience, from now on, I will refer to the former as *the configuration approach*, the latter as *the relation-based* or *the dependency approach*. Keeping these two approaches in mind, we will examine more relevant data.

The generalization about the directionality of the syntactic tree branching can be extended when we consider VOI in VP. Parallel to the left-branching NP (4d/e), we may have a left-branching VP with an argument modified by an AP. As expected by the directionality of branching, the whole VP of (6) is the domain of VOI:

(6)



(4d)



Notice also that nasal place assimilation also applies within the same domain (cf. Consonant Place Assimilation in 5.1.3 for detail).

On the other hand, when a VP contains more than one complement, only an adjacent complement and its head verb form a domain. For example, consider the following data of ditransitive constructions in Korean:

(7) VP (Complement-Complement-Head)

- a. [k+ka]_{NP} [côn-êke cip+ɬ cu-ôs'-ta]_{VP}]_S
 he-NOM Chun-DAT house-ACC give-past-decl
 (P) (P) (P)
 [k+ga cônege cib+ɬ cwôt=t'a]
 [k+ga cônege cib+ɬ jwôt=t'a]
 *[k+ga cônege jib+ɬ cwôt=t'a]
 *[k+ga cônege jib+ɬ jwôt=t'a]
 *[k+ga jônege cib+ɬ cwôt=t'a]
 *[k+ga jônege cib+ɬ jwôt=t'a]
 *[k+ga jônege jib+ɬ cwôt=t'a]
 *[k+ga jônege jib+ɬ jwôt=t'a]
 'He gave Chun a house.'
- b. [k+ka]_{NP} [cip+ɬ côn-êke cu-ôs'-ta]_{VP}]_S
 he-NOM house-ACC Chun-DAT give-past-decl
 (P) (P) (P)
 [k+ga cib+ɬ cônege cwôt=t'a]
 [k+ga cib+ɬ cônege jwôt=t'a]
 *[k+ga cib+ɬ jônege cwôt=t'a]
 *[k+ga cib+ɬ jônege jwôt=t'a]
 *[k+ga jib+ɬ cônege cwôt=t'a]
 *[k+ga jib+ɬ cônege jwôt=t'a]
 *[k+ga jib+ɬ jônege cwôt=t'a]
 *[k+ga jib+ɬ jônege jwôt=t'a]
 'He gave a house to Chun.'

As illustrated in (7), VOI fails to apply not only between immediate constituents of S (viz. NP and VP) but between arguments (e.g. between an indirect object NP and a direct object NP) regardless of their linear order. That is, only the argument which is adjacent to the head V conjoins with the head to form a domain of VOI. Notice that, among the

eight logically possible combinations of phonetic forms, only the second string, where VOI applies across an adjacent NP and its head V, is considered to be natural speech.

The configuration approach will capture cases like (7), if we adopt the configurative VP structure (8a), as opposed to the flat structure (8b). That is, VPs in (7) will be of right-branching structure, and, subsequently, they split into two Ps.

- (8)
 a. configurative tree b. flat tree



The identical phenomena are observed in VPs with postpositional phrases (henceforth PP) like directional and locative phrases:

(9) NP PP V and PP NP V

a. Directional PP

1. [[kɨ-ka]_{NP} [cɔn-ɨl cip-ɨlo ponæ-ɔs'-ta]_{VP}]_S
 he-NOM Chun-ACC home-Dir send-past-decl
 (P) (P) (P) (P)
 [kɨga cɔnɨl cibɨro ponæt=t'a]
 [kɨga cɔnɨl cibɨro bonæt=t'a]
 *[kɨga cɔnɨl jibɨro ponæt=t'a]
 *[kɨga cɔnɨl jibɨro bonæt=t'a]
 *[kɨga jɔnɨl cibɨro ponæt=t'a]
 *[kɨga jɔnɨl cibɨro bonæt=t'a]
 *[kɨga jɔnɨl jibɨro ponæt=t'a]
 *[kɨga jɔnɨl jibɨro bonæt=t'a]
 'He sent Chun home.'

2. [[kɨ-ka]_{NP} [cip-ɨlo cɔn-ɨl ponæ-ɔs'-ta]_{VP}]_S
 he-NOM home-Dir Chun-ACC send-past-decl
 (P) (P) (P) (P)
 [kɨga cibɨro cɔnɨl ponæt=t'a]
 [kɨga cibɨro cɔnɨl bonæt=t'a]

*[kɨga	jibɨro	cɔnɨɫ	ponət=t'a]
*[kɨga	jibɨro	cɔnɨɫ	bonət=t'a]
*[kɨga	cibɨro	jɔnɨɫ	ponət=t'a]
*[kɨga	cibɨro	jɔnɨɫ	bonət=t'a]
*[kɨga	jibɨro	jɔnɨɫ	ponət=t'a]
*[kɨga	jibɨro	jɔnɨɫ	bonət=t'a]

'He sent Chun home.'

b. Locative PP

1. [[kɨka]_{NP} [cɔnɨɫ cip-e katu-ɔs'-ta]_{VP}]_S
 he-NOM Chun-ACC home-Loc confine-past-decl
 (P) (P) (P)

[kɨga	cɔnɨɫ	cibe	kadwɔt=t'a]
[kɨga	cɔnɨɫ	cibe	gadwɔt=t'a]
*[kɨga	cɔnɨɫ	jibe	kadwɔt=t'a]
*[kɨga	cɔnɨɫ	jibe	gadwɔt=t'a]
*[kɨga	jɔnɨɫ	cibe	kadwɔt=t'a]
*[kɨga	jɔnɨɫ	cibe	gadwɔt=t'a]
*[kɨga	jɔnɨɫ	jibe	kadwɔt=t'a]
*[kɨga	jɔnɨɫ	jibe	gadwɔt=t'a]

'He confined Chun to home.'

2. [[kɨka]_{NP} [cip-e cɔnɨɫ katu-ɔs'-ta]_{VP}]_S
 he-NOM home-Loc Chun-ACC confine-past-decl
 (P) (P) (P)

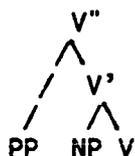
[kɨga	cibe	cɔnɨɫ	kadwɔt=t'a]
[kɨga	cibe	cɔnɨɫ	gadwɔt=t'a]
*[kɨga	jibe	cɔnɨɫ	kadwɔt=t'a]
*[kɨga	jibe	cɔnɨɫ	gadwɔt=t'a]
*[kɨga	cibe	jɔnɨɫ	kadwɔt=t'a]
*[kɨga	cibe	jɔnɨɫ	gadwɔt=t'a]
*[kɨga	jibe	jɔnɨɫ	kadwɔt=t'a]
*[kɨga	jibe	jɔnɨɫ	gadwɔt=t'a]

'He confined Chun to home.'

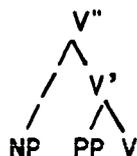
Notice that, also in (9), only a phrase adjacent to the head verb (either PP or NP) conjoins with the head to form a phrasal domain of VOI, while the subject NP or non-adjacent phrase in a VP is isolated as a separate domain. Adopting a configurative tree structure like (10), the correlation between the directionality of tree branching and the formation of domain may hold true:

(10) Trees of (9)

a.



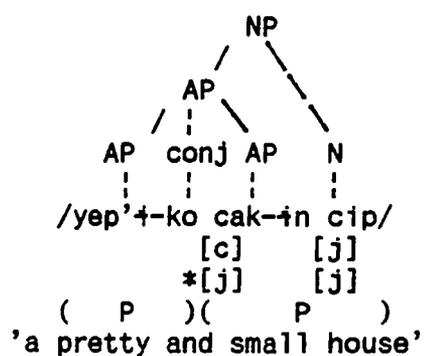
b.



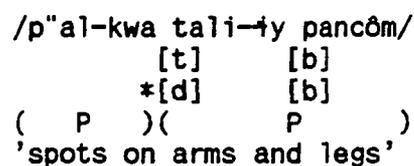
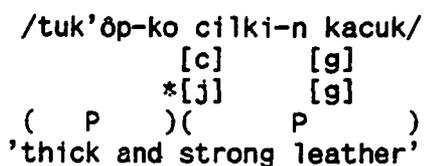
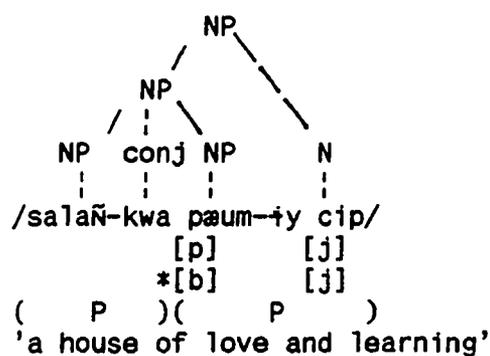
While the left- and right-branching distinction in the configuration approach may hold for the cases we have examined so far, it encounters a difficulty with coordinate structures in Korean:

(11) Coordinate structures

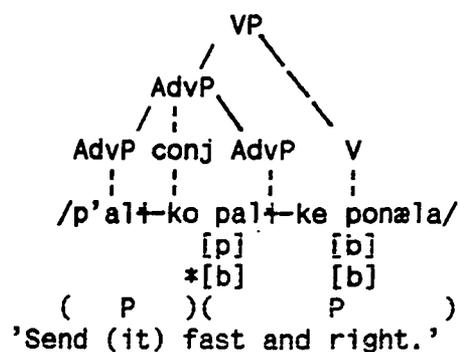
a. A-conj-A-N



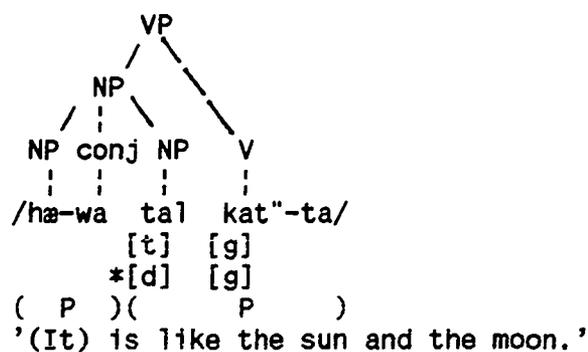
b. N-conj-N-N



c. Adv-conj-Adv-V



d. N-conj-N-V

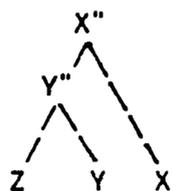


When a lexical head of N or V is preceded by coordinate complements (of either APs, NPs, or AdvPs), only an adjacent modifier or argument (a complement as a cover term) conjoins with the head to form a domain, not a whole complement phrase. Notice that the coordinate complements are divided into two Ps, despite their left-branching structure, attaching a conjunction (-ko or -(k)wa) to the first phrase. As a consequence of its incorrect prediction in the coordinate structure, the correlation between directionality of tree branching and the domain formation turns out to be inadequate and needs to be elaborated.

The following diagrams are a schematic summary of P-formation and its syntactic structure.

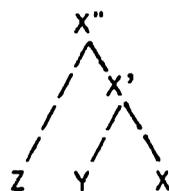
(12)

a. left-branching structure
(4d/e) (6) -



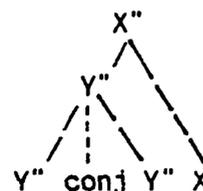
NP: [[Adv A] N]
VP: [[AP N] V]
(P)

b. right-branching structure
(5) (7) (9)



[A [A N]]
[NP [NP V]]
(P) (P)

c. coordinate structure
(11)



[[AP-conj AP] N]
[[AdvP-conj AdvP] V]
(P)(P)

While the configuration approach works for the distinctive P-formations between the left-branching structure (12a) and the right-branching structure (12b), obviously, it fails to describe the division of left-branching coordinate structures into two Ps.

For the P-formation of coordinate structures, the relation-based approach, which uses the concept of dependency relationship (viz. modifier-head or complement-head relation), seems to be superior to the configurational approach. We may use the dependency relationship as a necessary condition for P-formation. Note that there is no dependency relationship between coordinate elements in (12c), on the other hand, every pair of elements in a P hold a dependency relationship. Then we may say that VOI applies between words which hold a dependency relation, such as that the rule applies between two words which hold a modifier-head or a complement-head relation. Reserving detailed discussion for the next section, suffice it to say that the configuration approach has a problem with the coordinate structure. With this much in mind, let us look at more relevant data.

5.1.2 Stop Nasalization

Another phonological rule in Korean which is bound to the same domain P is Stop Nasalization. Stop Nasalization refers to nasalization of pre-nasal obstruents (henceforth NASN).

This regressive manner assimilation is fed by Syllable-Final Neutralization (SFN): in syllable-final position, not only are non-lenis (aspirate or fortis) stops neutralized into their corresponding unreleased lenis stops, but also palatal stop /c/, palatal affricate /c"/, alveolar fricatives /s, s'/ and glottal fricative /h/ are realized as an unreleased alveolar lenis stop [t=]. By virtue of SFN, not only alveolar stops but other obstruents /c, c", s, s', h/ are realized as

[n] before a nasal (cf. examples of (15c) below). Given below are a segmental sketch of SFN and its rule formulation (cf. 4.2.2. also):

(13)
 /p, p"/ --> [p=]
 /k, k", k' / --> [k=]
 /t, t", c, c", s, s', h/ --> [t=] / ____ \$

(14) SFN

$$\left[\begin{array}{l} -\text{son} \\ \langle +\text{cor} \rangle_1 \\ \langle +\text{cont}, -\text{ant}, -\text{cor} \rangle_2 \end{array} \right] \text{--->} \left[\begin{array}{l} -\text{rel} \\ \langle +\text{ant} \rangle_1 \\ \langle +\text{ant}, +\text{cor} \rangle_2 \end{array} \right] / \text{---} \$$$

(The redundancy rule [-rel] --> [-asp, -tense, -cont] is assumed here, and the optional features within angle brackets are for the changes of /c, c"/ and /h/ to /t=/ respectively.)

Being fed by SFN, the rule formulation of NASN will be as follows:

(15) NASN

$$\left[\begin{array}{l} -\text{son} \\ -\text{rel} \end{array} \right] \text{--->} [+\text{nas}] / \text{---} [+\text{nas}]$$

The following are examples of SFN and NASN. The first two of each group are examples of SFN and the third of each is of NASN:

(16)

a. [p=]		
/ip/	[ip=]	'mouth'
/ip-ta/	[ip=t'a]	'wear-decl'
/ip-ni/	[imni]	'wear-intr'
/ip"/	[ip=]	'leaf'
/nop"-ta/	[nop=t'a]	'be high-decl'
/nop"-ni/	[nomni]	'be high-intr.'

b. [k=]		
/kak/	[kak=]	'angle'
/hakkyo/	[hak=k'yo]	'school'
/k'ak'-ta/	[k'ak=t'a]	'cut-decl'
/k'ak'-ni/	[k'aŋni]	'cut-intr'
/puðk"/	[puðk=]	'kitchen'
/puðk".mun/	[puðŋmun]	'kitchen door'
c. [t=]		
/kot/	[kot=]	'soon'
/kut-ta/	[kut=t'a]	'harden-decl'
/kut-ni/	[kunni]	'harden-intr'
/k'ɨt"/	[k'ɨt=]	'end'
/k'ɨt"-kwa/	[k'ɨt=k'wa]	'end-conj'
/k'ɨt"nə/	[k'ɨnnə]	'finally'
/nac/	[nat=]	'day'
/kuc-ta/	[kut=ta]	'be bad'
/kuc-ni/	[kunni]	'be bad-intr'
/nac"/	[nat=]	'face'
/c'oc"-ta/	[c'ot=t'a]	'chase-decl'
/c'oc"-ni/	[c'onni]	'chase-intr'
/nas/	[nat=]	'sickle'
/nas-ta/	[nat=t'a]	'recover-decl'
/nas-ni/	[nanni]	'recover-intr'
/nas'-ta/	[nat=t'a]	'happen-decl'
/nas'-ni/	[nanni]	'happen-intr'
/hiɨh/	[hiɨt=]	'the name of alphabet h'
/nah-ta/	[nat"a], *[nat=t'a] ³	'deliver-decl'
/nah-ni/	[nanni]	'deliver-intr'
(17) NASN in compound nouns		
/ip.mosɨp/	[immosɨp=], *[ip=mosɨp=]	'shape of mouth'
/mat.myðnɨli/	[manmyðnɨri] ⁴ , *[mat=...]	'1st daughter-in-law'
/suh.mal/	[sunmal] ⁴ , *[sut=mal]	'male horse'
/puðk".mun/	[puðŋmun], *[puðk=mun]	'kitchen door'
/sakak.moca/	[sagaŋmoja], *[sagak=moja]	'college cap'

As in (16) and (17), NASN applies not only word-internally but also across compound boundary. It seems to be impossible for native speakers of Korean to suppress word-internal (including compounds) NASN, e.g., /hakmun/ 'studies' and /mat.myðnɨli/ 'the first daughter-in-law' can

never be realized as [hak=mun] and [mat=myõntri], but always surface as [hañmun] and [manmyõntri] even in very slow, careful, or emphatic speech.

While word-internal NASN may not fail to apply regardless of the rate of speech, word-external NASN may fail to apply especially in careful, slow, or emphatic speech. (18a) and (18b) illustrate this point:

(18)

a. word-internal NASN

/os-man tɬl-õs'-ni/
 clothes-del_m be included-past-intr
 [onmand+rõnni], *[ot=mand+rõnni]
 'Are there only clothes?'

/kɬ səñkək-man ha-n-ta/
 that thought-del_m do-pres-decl
 [kɬsəñgañmananda], *[kɬsəñgak=mananda]
 'I am thinking of that only.'

b. word-external NASN

/os mantɬl-õs'-ni/
 clothes make-past-intr
 [ot=mand+rõnni]~[onmand+rõnni]
 'Did you make the clothes?'

/c"õlhak mol-ɬn-ta/
 philosophy be ignorant-pres-decl
 [c"õrak=morɬnda]~[c"õrañmorɬnda]
 '(I) don't know philosophy.'

Some might say that NASN is optional for phrasal applications. But the use of the term "optional" here appears to be inaccurate and misleading: the fact that NASN must apply in a certain rate/style of speech (namely, allegro/natural speech) indicates that it is not optional but obligatory, given proper rate/style of speech in the description. The fact that NASN is an allegro speech rule in its phrasal application, and

that NASN fails to apply in slow/careful speech does not provide any positive evidence about the phrasal domain of NASN. Therefore, pronunciations of allegro/natural speech should be considered as the subject of our investigation.

Turning to our main interest, the phrasal domain of NASN, consider the following NPs which involve NASN:

(19) NP (A-N)

- | | |
|---|---|
| <p>a. /micôk mucí/
 [Ñ]
 (P)
 'artistic ignorance'</p> | <p>b. /cicôk mi/
 [Ñ]
 (P)
 'intellectual beauty'</p> |
| <p>c. /c"ôihakcôk munce/
 [Ñ]
 (P)
 'a philosophical problem'</p> | <p>d. /ôhakcôk munce/
 [Ñ]
 (P)
 'a linguistic problem'</p> |

(19) shows that NASN may apply between an adjacent modifier adjective and its head noun. On the other hand, as in (20), when more than one modifier precedes the head noun, NASN does not apply between those two modifiers:

(20) NP (A-A-N, SAdv-A-N)

- a. [[cicôk micôk] mucí]
 intellectual artistic ignorance
- | | | | | |
|----|----|----|----|---|
| 1. | [| k= | Ñ |] |
| 2. | *[| Ñ | k= |] |
| 3. | *[| Ñ | Ñ |] |
- (P)(P)
 'intellectual and artistic ignorance'
- a'. [[cicôk mi] -ty] kyôiyô]
 intellectual beauty-GEN lack'
 [Ñ s]
 (P)
 'lack of intellectual beauty'

- b. [[kyôlkuk] [micôk mucî-ta]]
 eventually artistic ignorance
 1. [k= Ñ]
 2. *[Ñ Ñ]
 3. ≠[Ñ k=]
 (P)(P)
 'Eventually, (it is) artistic ignorance.'
- b'. [[muc"ôk masîs'n+n] mañko]
 very delicious mango
 [Ñ m]
 (P)
 'very delicious mango.'
- [[hîmk'ôs na.ka-n+n]] c"a]
 with all strength go out-pres car
 [n]
 (P)
 'a car which is running with all its strength'

In natural/allegro speech, NASN does not apply between two modifiers. Notice that the modification phrase of (20a) is in a coordinate structure. As is the case in VOI, NASN does not apply between coordinate elements (cf 5.2 for detailed discussions). In the left-branching structures (20a') and (20b'), as expected, NASN applies between an adjacent modifier and the head noun. That is, the domain of NASN, P, is the whole left-branching phrase of 'lack of intellectual beauty,' whereas the coordinate structures like 'intellectual and artistic ignorance' split into two P's.

Sentential adverbs behave differently from lexical adverbs. For example, NASN applies between a lexical Adv and A, as well as between A and its head N, whereas the rule fails to apply between the sentential Adv and the following A (cf. (20b) and (20b') respectively). Given below are some similar minimal pairs:

- (21)
- a. /ðnðhakcðk munce-+y hækyðl/
 [[linguistic problem-GEN] solution]
 [N̄]
 (P)
 'the solution of a linguistic problem'
- b. /ðnðhakcðk munce-+y hækyðl/
 [linguistic [problem-GEN solution]]
 1. [k=]
 2. *[N̄]
 (P)(P)
 'the linguistic solution of a problem'
- c. /ðnðhak munce hækyðl/
 linguistics problem solution]
 [N̄]
 (P)
 'linguistics problem solving'

NASN is applicable to the left-branching structure of "the linguistic solution of a problem," but not to the right-branching reading of "the solution of a linguistic problem" (cf. (21a) and (21b)). On the other hand, although the left-branching reading is preferred for the double compounding structure of (21c), NASN may apply to either the left- or right-branching interpretation. This suggests that the domain of NASN is larger than a compound.

Now let us look at NASN in VP. As shown in (22e), NASN may not apply between adverbs while it does apply between an adverb and the head verb (cf. (22a-d)):

- (22) VP (Adv-V)
- | | |
|---|---|
| <p>a. /k'ok na.ka-ia/
 by all means go out-impr
 [N̄]
 (P)
 'Don't forget to go out.'</p> | <p>b. /kot manna-ca/
 soon meet-prop
 [n]
 (P)
 'Let us meet soon.'</p> |
|---|---|

c.
/maimk'òs mòk-ò-la/
till full eat-inf-impr
[n]
(P)
'Eat all you can.'

d.
/kyesok na.o-n-ta/
continuously come out-pres-decl
[N]
(P)
'(it) is coming out continuously.'

e.
/kot mak naka-lyò-tôn t'æ/
soon just go out-intr-retr time
*[n] [N]
[t] [N]
(P)(P)
'when I was just about to step out'

NASN also applies between an adjacent complement and its head V, while it may not apply between complements, such as NP and PP. Compare (23a-c) with (23d):

(23) VP (NP-V)

- a. /c"òlsu.cip mol+-ni/
Chulsoo house do not know-intr
[m]
(P)
'Don't you know Chulsoo's house?'
- b. /pap mòk-òs'-ni/
meal eat-past-intr
[m]
(P)
'Did you eat?'
- c. /os mant+l-òs'-ni/
clothes make-past-intr
[m]
(P)
'Did you make the clothes?'
- d. /pap molæ-e pòliò-la/
rice sand-LOC throw away-impr
*[m]
[p]
(P)(P)
'Throw away the rice to the sand.'

5.1.3 Consonant Place Assimilation

Another P-domain rule in Korean is Consonant Place Assimilation (henceforth CPA): Consonants are assimilated to the point of articulation of the following consonant. This regressive place assimilation is restricted mainly to alveolar consonants, although less frequently, labials may change to velars, but not vice versa. The following are some examples of CPA:

(24) e.g. of CPA

UR	slow speech	allegro speech	
a. alveolar --> labial / ___ labial			
/yôspota/	[yôt=p'oda]	[yôp=p'oda]	'to peep'
/sinmun/	[sinmun]	[simmun]	'newspaper'
/sinpal/	[sinbal]	[simbal]	'shoes'
b. alveolar --> velar / ___ velar			
/icko/	[it=k'o]	[ik=k'o]	'forget and'
/pat" kwa/	[pat=k'wa]	[pak=k'wa]	'field and'
/inku/	[ingu]	[iŋgu]	'population'
c. labial --> velar / ___ velar			
/papkaps/	[pap=k'ap=]	[pak=k'ap=]	'board'
/kamki/	[kamgi]	[kaŋgi]	'cold/flu'
d. *labial --> alveolar / ___ alveolar			
*velar --> alveolar / ___ alveolar			
*velar --> labial / ___ labial			
/papto/	[pap=t'o]	*[pat=t'o]	'rice also'
/kaŋto/	[kaŋdo]	*[kando]	'robber'
/kukmul/	[kuŋmul]	*[kummul]	'soup'

The rule formulation of CPA in the feature-value changing theory, as in SPE, will look inelegant as shown below:

(25) CPA

a. alveolar to labial/velar

$$\begin{bmatrix} +\text{ant} \\ +\text{cor} \end{bmatrix} \text{ ---> } \begin{bmatrix} \alpha\text{ant} \\ \beta\text{cor} \end{bmatrix} / \text{ --- } \begin{bmatrix} \alpha\text{ant} \\ \beta\text{cor} \end{bmatrix}$$

(Alveolar consonants are assimilated to the point of articulation of their following sounds.)

b. labial to velar

$$\begin{bmatrix} +\text{ant} \\ -\text{cor} \end{bmatrix} \text{ ---> } \begin{bmatrix} -\text{ant} \\ -\text{cor} \end{bmatrix} / \text{ --- } \begin{bmatrix} -\text{ant} \\ -\text{cor} \end{bmatrix}$$

(Labials are assimilated to velars.)

Mainly alveolars are assimilated to the place of articulation of the following sounds, while, more optionally⁵, labials are assimilated to velars, but not vice versa, and moreover velar consonants are not subject to the place assimilation at all. This unidirectionality of the process calls for a more explanatory description.

Chin-W. Kim (1973) maintains that a list of phonological rules in Korean including CPA, is governed by the so-called *centrifugal force* by which alveolar sounds ([-grave] in his feature system) tend to change to labials or velars ([+grave]), but the reverse phenomenon does not occur. While this elucidates why alveolars are the most susceptible to the CPA, it does not provide the answer for the unidirectionality of labial assimilation to velars.⁶

Because of the lack of phrasal obstruent place assimilations in Korean, I will use mainly the data on nasal assimilation (henceforth NA):

(26) examples of NA

a. word internal NA

/ɪnpu/	[ɪmbu]	'worker'
/ɪnku/	[ɪŋgu]	'population'
/kankyɔk//	[kaŋgyɔk=]	'space'
/sɪm-ko/	[sɪŋk'o]	'plant and'
/ɪmkɪm/	[ɪŋgɪm]	'king'

b. compounds

/c"am kilɪm/	[c"aŋgirɪm]	'sesame oil'
/sɪmun kɪca/	[sɪmmungɪja]	'newspaper reporter'

Although NA has been treated as an optional process with respect to the rate of speech, here the use of the word "optional" is misleading, as is the case in CPA. NA does not fail to apply word-internally in natural speech (cf. (26)). For native speakers of Korean, it seems to be very difficult to suppress word-internal NA at a normal rate of natural speech, while phrasal application of NA may fail to apply in careful, slow, and emphatic speech.

Parallel to the adjective-plus-noun case in (27a), NA may apply between a modifier/relative clause and its head noun as exemplified in (27b):

(27) NP (Modifier-Head)

a. A-N

/k"ɪn kil/	[k"ɪŋgil]	'big street'
/c"an pap/	[c"ambap=]	'cold rice'
/c'an mul/	[c'ammul]	'salty water'

b. RelCl-N

1. [[pusan-e ka-n]_S, [papo]_N]_{NP}
 [m]
 'the fool who went to Pusan'

2. [[ɔmɔni-k'esɔ tɪllyɔcusitɔn]_S, [malsɪm]_N]_{NP}
 [m]
 'the story that (my) mother used to tell'

However, as in (28), if the head noun is modified by more than one modifier (of adjectives or relative clauses), NA applies only between an adjacent modifier and the head, but fails to apply between modifiers:

(28) NP (Modifier-Modifier-Head)

a.

1. [[okan+n]_A [[manh+n]_A [ma+lsalamt+l]_N]_{N'}]_{NP}
 [n] [m]
 *[m] [m]
 *[m] [n]
 'many village people who come and go'

2. [[yðlilin+n]_A [[manh+n]_A [kɪl]_N]_{N'}]_{NP}
 [n] [Ñ]
 *[m] [Ñ]
 *[m] [n]
 'many ways which are opening'

3. [[h+l+n+n]_A [[malk+n]_A [kaÑ]_N]_{N'}]_{NP}
 [n] [Ñ]
 *[m] [Ñ]
 *[m] [n]
 'clear running river'

4. [[okan+n]_A [kapyðun]_A [palkðl+m]_N]_{N'}]_{NP}
 [n] [m]
 *[Ñ] [m]
 *[Ñ] [n]
 'light footsteps which come and go'

b. [ReICl [ReICl-N]_{N'}]_{NP}

1. [[[pusan-e ka-n]_S, [[papo kat"-+n]_S, [paks'i]_N]_{N'}]_{NP}
 [n] [m]
 *[m] [m]
 *[m] [n]

- [[[papo kat"-+n]_S, [[pusan-e kan]_S, [paks'i]_N]_{N'}]_{NP}
 [n] [m]
 *[m] [m]
 *[m] [n]
 'foolish Mr. Park who went to Pusan'

2. [[[ðmðni-ka t+llyðcusitðn]_S, [[manh+n]_A [mals+m]_N]_{N'}]_{NP}
 [n] [m]
 *[m] [m]
 *[m] [n]
 'many stories that (my) mother used to tell'

(30) Korean P-Phrase Formation Rule (Y-M. Cho 1987: 335)⁷

- a. In [...Y" X]_{X"}, where X is the head of X" and Y" is an adjacent complement, the sequence Y" X forms a phonological phrase.
- b. All phonological words unaffected by (a) form phonological phrases.

Note that this relation-based approach (30) uses the cover term *complement* for a modifier in an NP and an argument in a VP. Now, let us examine whether this P-mapping rule correctly predicts the facts. A closer examination of (30) raises a question about the restructuring of phonological phrases. That is, for a left-branching structure like [[AdvP A]_{AP} N]_{NP} (4d) or [[AP N]_{NP} V]_{VP} (6), a single application of (30) yields incorrect P-formation.

For example, a single bottom-to-top application⁸ of (30a) to the inner phrase AP (4d), we will end up with two Ps: AP would form a separate P, since A is the head of AP and AdvP is an adjacent complement of the head A, while the head of the whole NP, N, which is not affected by (30a) would form yet another P by (30b). But this does not accord with the facts. The phrasal domain of the rules in question is the whole NP, not the AP in (4d). On the other hand, the application of (30) to the whole NP will result in the correct P-formation.

In order to rectify this problem, Y-M. Cho might need an extra device to exclude smaller Ps in the presence of bigger Ps, such as a principle which says that the adjunct phrase should not form a P by itself. The top-to-bottom application of (30) may rescue the left-branching structure, but this possibility is out, because this mode of application will produce the incorrect P-formation, the whole coordinate

structure as a single P. One may think of keeping (30), maintaining that the cyclic (bottom-to-top) restructuring is only for the left-branching structure. Then, the question that arises is why the restructuring is limited to the left-branching structure?

Another logically possible path one can explore is to redefine the implication of P to the rule application. That is, if we assume that the rules in question can apply between two elements whenever (30) yields a P, we can save the left-branching structure (29a) which has a successive complement-head relationship, as well as the coordinate structure (29c).

As an effort to remedy this shortcoming, G-R. Kim (1988: 175) proposes a revised phonological phrase formation rule (31) below. Although G-R. Kim (1988: Chapter 5) mainly describes the domain of phrasal tone sandhi rules in the Taegu dialect of Korean as a phonological phrase (P), she further proceeds to the claim that P is not only the domain of suprasegmental rules (like her tone sandhi rules) but also the domain of the segmental rules considered here (cf. G-R. Kim 1988: 222-235).

(31) P-Phrasing of Taegu Dialect (G-R. Kim 1988: 175, 192)

A P-phrase is a P-word X and, if X is a head of the maximal projection XP, a preceding P-phrase in the XP. (The emphasis is mine--DSP.)

One thing we notice is that while both versions refer to the notion of headedness of a word X, G-R. Kim (1988) utilizes the immediately lower prosodic structure, the phonological word (W), as a primary input of P,

whereas Y-M. Cho (1987) uses the purely syntactic notion of the adjacent phrasal complement Y".

The early work of Selkirk (1980) proposes to form a higher prosodic unit by means of its immediately lower units--e.g., P consists of one or more W in this case. This device has been called the Strict Layer Hypothesis by Selkirk (1984) and Nespor & Vogel (1986):

(32) **The Strict Layer Hypothesis**

A category of a level *i* in the hierarchy immediately dominates a (sequence of) categories of level *i-1*.

(Selkirk 1981)

The prosodic categories are ordered in a hierarchy, and in phonological representation they are strictly organized into layers according to that hierarchy, i.e. prosodic constituents of a same category are not nested.

(Selkirk 1984)

Then, Let us examine how G-R. Kim's revision can account for the same data. (31) is able to describe the correct phrasal domain P. The most ingenious and difficult part to read in (31) is the use of the conditional clause with the conjunction 'and', which is ultimately to handle the restructuring problem that Y-M. Cho's version (30) has.

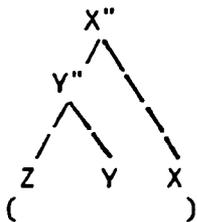
Here, some interpretation is needed to comprehend what (31) says. The *and* in (31) must be read as *plus* or *and the X conjoins with*. According to G-R. Kim, the rule states that every phonological word (W) is a potential phonological phrase (P) under one condition of expansion, which requires the notions of head of the maximal projection and adjacency. Notice that the restructuring P's can be a violation of the Strict Layer Hypothesis, which prevents the same category from nesting. For this matter, G-R. Kim assumes the restructuring process by the

conditional clause as a simultaneous operation with respect to the process which precedes it. That is, for left-branching structures like (4d) and (6), the restructuring effect of P is achieved by the simultaneous interpretation of (31). In other words, the formation of a P^1 and P^2 is to be done at the same time (cf. the diagram (34a') below).⁹

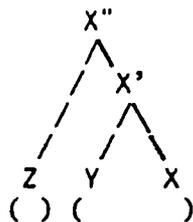
For the right-branching structure, on the other hand, P fails to expand up to the first complement due to the condition for expansion. The condition says that a phonological word X (which is equivalent to non-phrasal X^0 in X-bar notation, not X') is the head of its maximal projection XP, a P includes a preceding P within XP. Also in the coordinate structure, the head adjoins only with its adjacent complement to form a P, assuming there is no head (or a dependency relation) between coordinate elements. The following diagram shows the restructuring effect by (31) for the three typical structures:

(33) Restructuring effect of (31)

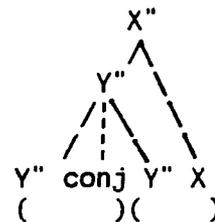
a. left-branching structure

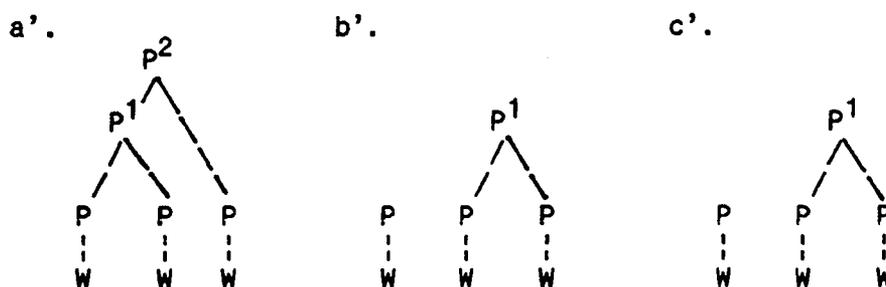


b. right-branching structure



c. coordinate structure





(Here, P^1 and P^2 stand for the first and second restructuring of Ps.)

So far we have seen that the P-mapping rule (31) is superior to (30) in its prediction power. To summarize, Y-M. Cho's P-mapping rule is inadequate and needs some elaboration with regard to the restructuring problem, while G-R. Kim handles the restructuring problem by her ingenious statement. G-R. Kim does not resolve the restructuring problem, but handles it well.

In the next section, I will explore alternative solutions to the P-mapping problem in terms of the notion of c-command, in which this restructuring problem does not arise at all.

5.2.2 The C-command Condition

Kaisse (1985: Chapter 7) reanalyzes various previous analyses of syntactic conditions on rules of external sandhi in diverse languages in terms of the c-command requirement. The work includes the Left-Branch Condition on Italian syntactic doubling (Napoli and Nespors 1979), the Right-Branch Condition on French liaison (Rotenberg 1978), Kimatuumbi Vowel Shortening (Odden 1981), Gilyak lenition (Kenstowicz and Kisseberth 1979), and Ewe tone sandhi (Clements 1978), etc. To cite one

relevant example, Kaisse (1985: 162-170) demonstrates that an edge condition, the Right-Branch Condition on French liaison (Rotenberg 1978), can be successfully restated in terms of the c-command condition.¹⁰

How can we state the syntactic condition for Korean phrasal rules in terms of the c-command notion? First of all, we have to choose one specific definition of c-command which fits our purpose, since several versions of c-command definitions are available in current literature. Among many, the following simplest definition of c-command seems to be sufficient for present purposes.

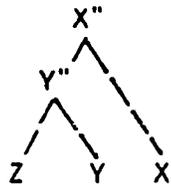
- (34) **c-command**
 α c-commands β if the first branching node dominating α also dominates β .

We may simply restate the previous P-mapping rules like (30) and (31) as follows:

- (35) **c-command condition**
 The rules apply between two words α and β if β c-commands α .

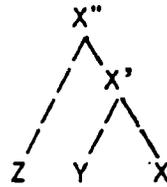
Now let us examine how (35) works for the data.

(36) a. left-branching structure



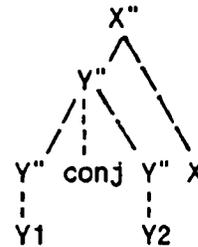
()
 Y c-commands Z
 X c-commands Y

b. right-branching structure



() ()
 X c-commands Y

c. coordinate structure



() ()
 X c-commands Y2
 Y2 c-commands Y1**

This definition of c-command enables us to eliminate the restructuring problem from the description of applicability of phrasal rules in Korean, since we are now dealing with applicability between each pair of words, instead of defining the phrasal domain P. Then, let us examine how the c-command condition works for the data.

For the left-branching structure, the application of the rules between the words under the preterminal categories Z and Y, as well as between those of Y and Z is captured by this c-command condition. (From now on, "the word under the preterminal categories X, Y, or Z" will be expressed as X, Y, and Z for the sake of brevity.) Notice that in (36a) Y c-commands Z, and also X c-commands Y.

In the right-branching structure, on the other hand, X does not c-command Z, since Z is not under the immediately dominating branching node of X. Notice also that since the c-command condition (35) is defined on nonphrasal category words only, α or β excludes any phrasal category such as X'. That is, the fact that the phrasal category X' may c-command Z in the right-branching structure is not accessible from the

definition. Also, Y does not c-command Z, since the first branching node of Y (viz. X') does not dominate Z.

The problematic case for the c-command account is coordinate structures. If we apply (35) strictly to coordinate structures like (36c), Y2 may c-command Y1 as well (Y1 and Y2 indicate words under the preterminal category Y"). But this does not accord with the facts. The apparatus needed here appears to be the distinction between the complement-head structure and the coordinate structure. The dependency relationship of complement-head seems to be the main factor here. Notice that there is a dependency relationship (modifier-head or complement-head) in all c-commanding cases in (36), whereas there is no such dependency relationship between coordinate elements. That is, both elements in a coordinate structure may be treated as heads, or, in reverse, neither element may be called the head. The question is whether the notion of head or complement should be added on top of the c-command notion, as exemplified below:

(37) **c-command condition (revised)**

The rules apply between two words α and β if β c-commands α , and if β is the head of its maximal projection.

β c-commands α if the first branching node dominating β also dominates α .

However, considering the fact that Korean is a head-final language, one may think it is unnecessary labor to introduce the notion of headedness for the right edge element. Under the binary branching assumption, since all words (including heads) are on the edge of some constituent, the reference to edge is a mere artifact. In other words,

heads are by nature generated at the edge of their containing constituent according to the language-specific parameter.

For this reason, one may propose instead the revised version of c-command in the spirit of the coordinate structure constraint as Kaisse (1985: 168) does:¹¹

- (38) **revised definition of c-command**
 β c-commands α if the first branching node dominating β also dominates α *where β is not itself contained in a coordinate structure.*

In sum, while the c-command version proposed above has a significant advantage over the previous P-mapping rules--the elimination of restructuring problem--but, the definition of c-command becomes very ad hoc, including the coordinate structure constraint within the definition. In other words, as is the case of our early configuration approach, the c-command approach treats the coordinate structure as an exception.

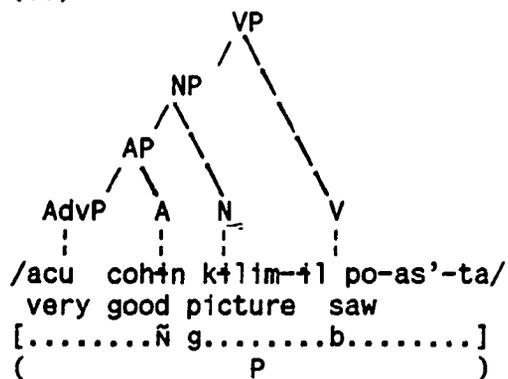
In the next section, we will discuss some more restructuring problems in the P-mapping accounts, and 5.2.4 presents a rather simple solution which resolves both the restructuring problem and the difficulty regarding the coordinate structure that the c-command condition has.

5.2.3 More Restructuring Problems

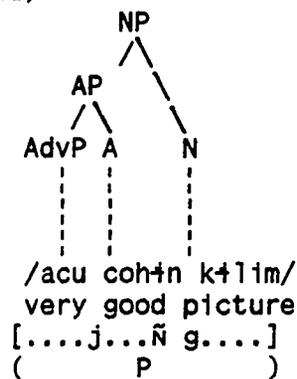
In the left-branching structure, as we have already seen in the P-mapping accounts, if there is a successive dependency relationship

between sister nodes, the restructuring of P is needed, and this very fact has been well captured by the c-command condition and the dependency condition. For example, when we add a predicate 'saw' to an NP like (4d), the restructuring of P's will predict VOI between NP and V (cf. (39)). Then, one practical question that arises at the moment is how far/high a restructuring we can get, providing the dependency relationship persists in successively higher nodes. Although there is no restructuring problem in the c-command solution, from now on, I will use the term "restructuring" from the P-mapping approaches' perspective.

(39)



(4d)



Although neither Y-M. Cho (1987) nor G-R. Kim (1988) pursues the restructuring issue in detail, their descriptions of the NP modified by a relative clause are different. They claim different formations of Ps for the same structure: Y-M. Cho (1987: 336) maintains that the verb in a relative clause adjoins to the head noun *only if* it has not already adjoined with its complement in the VP, whereas G-R. Kim (1988: 180) claims that the verb in a relative clause, which behaves like a lexical modifier adjective, adjoins *only* with its head noun, even if there is a

complement within the VP. Y-M. Cho presents the P-formations of (40a1) and (40b1), while G-R. Kim's theory will derive the P-formations of (40a2) and (40b2). Consider the following data which is cited in Y-M. Cho (1987):

(40)

a. [[[sõnsaŋnim-k'esõ cu-si-n]_S, kɨlim-ɨl]_{NP} po-õs'-ta]_S
 teacher-NOM give-Hon-mod picture-ACC see-past-decl

1. (P) ([c] [ŋ] P) (P)
 [g] [p]

2. (P) ([c] [ŋ] [g] P)
 [b]

'(I) saw the picture that the teacher gave.'

b. [[[[sõnsaŋnim-k'esõ [haksaŋ-eke cu-si-n]_{VP}]_S, kɨlim-ɨl]_{NP} po-õs'-ta]_S
 teacher-NOM student-DAT give-hon-mod picture-ACC see-past-decl

1. (P) (P) (P)
 [j] [n] [k] [b]

2. (P) (P) (P)
 [c] [ŋ] [g] [b]

3. (P) ([j] P [ŋ] [g]) (P)
 [p]

4. (P) ([j] [ŋ] P [g])
 [b]

'(I) saw the picture that the teacher gave to the student.'

As in (40a), when there is no non-subject complement of the verb in a relative clause, both P-mapping analyses result in the same P-formation (40a1). But the question is whether the second and the third Ps can combine to form a single P as in (40a2), on the basis of the fact that the dependency relation exists not only between the head noun and its preceding modifier, but also between the head verb and its complement.

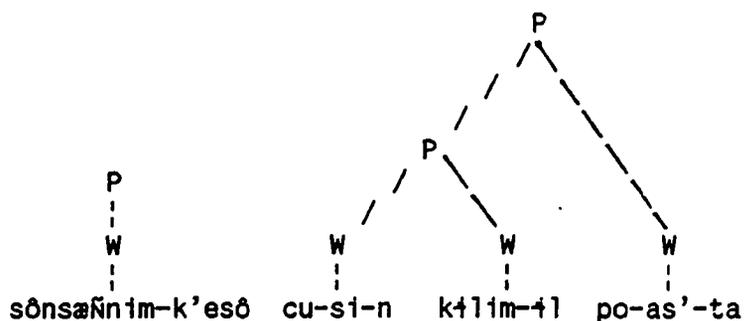
By virtue of this dependency, it is reasonable to allow the restructuring, and, in fact, it accords with the observation about VOI and CPA (cf. (41) below), and this is what the c-command condition predicts.

Notice that if we substitute the accusative case marker for the topic marker $-(n)+n$,¹² NA (a part of CPA, cf. 5.1.3), may apply not only between the predicate of the relative clause and the head noun, but also between the topicalized accusative nominal and the verb:

- (41)
 [[sõnsæñnim-k'esô cu-si-n]_S, k+lîm-+n]_{NP} po-ô's'-ta]_S
 teacher-NOM give-hon-mod picture-TOP see-past-decl
 (P) (P)
 [c] [Ñ] [g] [m] [b]
 '(I) saw the picture that the teacher gave.'
 '(lit. As for the picture that the teacher gave, I saw it.)'

The major disagreement between the claims of Y-M. Cho and G-R. Kim lies in the construction in which the verb of a relative clause contains a complement (cf. (40b)). Y-M. Cho's claim maintains the P-formation of (40b1), while G-R. Kim predicts that of (40b2): Y-M. Cho's version does not allow the restructuring between the predicate of the relative clause and the head noun, while G-R. Kim does. G-R. Kim, on the other hand, does not allow the concatenation of a complement (a dative nominal in (40b)) and the predicate of the relative clause, while Y-M. Cho does. However, both claims turn out to be inaccurate, in view of the fact that we observe the applications of the rules within the P-formations of (40b3) and (40b4).¹³

c.

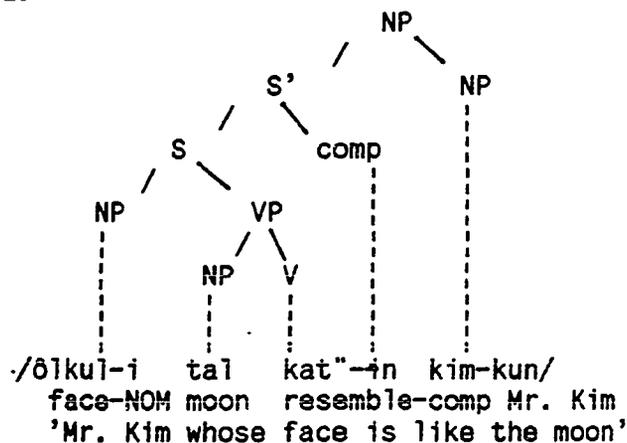


According to G-R. Kim (1988: 178-179), since this newly formed AP is no longer the head of VP, it does not conjoin with its preceding subject NP to form a P, but the head noun adjoins with its preceding phonological phrase AP (cf. (42c)).

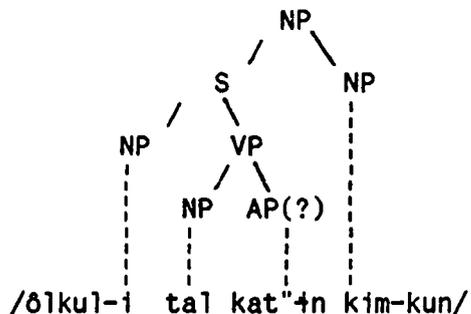
Though this may accord with the phrasal domain of tone sandhi in the Taegu dialect, the segmental rules we are concerned with do not follow her claim. That is, if a relative clause contains a non-subject complement (such as, a dative or accusative NP), VOI and CPA may apply between the complement and what she calls AP (cf. (40b3/4) above and (43c2) below):

(43) RelCl-N

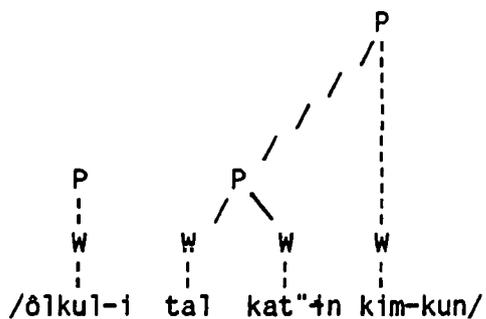
a.



b.



c.



1. *[.....t....k....ñ g.....]
 (P)(P)(P)
2. [.....t....g....ñ.g.....]
 (P)(P)

The AP in (43b) must be treated as V, the head of VP, to derive the correct P-formation (43c). To prevent this V (her AP) in (42b) from conjoining with its preceding subject NP, G-R. Kim might have to modify the maximal projection condition of her (31) to the first/immediately dominating node, as is the case in my c-command condition. Recall that, in her P-mapping rule (31), copied below, for a phonological word (W) to conjoin with its preceding P to form a P, it must be the head of its maximal projection:

(31) P-mapping rule (from G-R. Kim 1988: 175, 192)

A P-phrase is a P-word X and, if X is a head of the maximal projection XP, a preceding P-phrase in the XP. (The emphasis is mine--DSP.)

If we adopt V'' for S, the maximum projection of V is the whole sentence. This seems to be the reason that she calls the predicate of relative clauses AP. But, the relabelling like this will not be necessary, if the maximal projection condition is weakened by the first dominating node XP:

(44) P-mapping rule (modified (31))

A P-phrase is a P-word X and, if X is a head of its first dominating node XP, a preceding P-phrase in the XP. (The emphasis is mine--DSP.)

Now, the predicate of relative clauses, V, is the head of VP, and may conjoin with its adjacent sister complement like a dative or accusative NP, but not with its subject NP.

5.2.4 The Dependency Condition

In an effort to eliminate the restructuring problem and to resolve the difficulty of coordinate structure, I propose the following dependency condition as an overall solution for the phrasal applicability of the rules in question. Here, I use the cover term "complements" for both "modifier" and "argument" as the relation-based account does (e.g. Y-M. Cho's (30)):

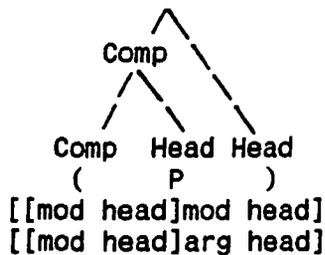
(45) The Dependency Condition

The rules apply between two words which hold a complement-head relationship.

The complement-head relationship refers to both modifier-head or argument-head relations.

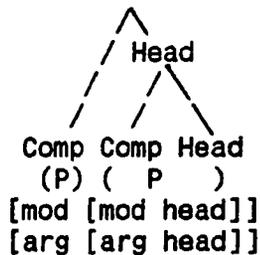
(46)

a. left-branching structure



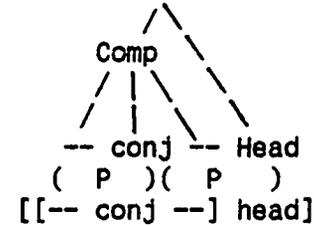
[[Comp Head]comp Head]

b. right-branching structure



[Comp [Comp Head]]

c. coordinate structure



[[-- conj --]Comp Head]

The dependency condition (45) correctly predicts that the rules fail to apply between coordinate elements, which do not hold a dependency relation, but the rules apply between the second (more accurately, the last) coordinating element and the head, which hold a dependency relation.

The dependency condition predicts the failure of the rule application between two modifiers or complements in any structure: the sequence of modifier-plus-modifier or complement-plus-complement is possible in both right-branching structures and coordinate structures, and the rules fail to apply between them, because there is no dependency relation between the two words.

In the left-branching structure, since there are successive dependency relations as in [[AdvP A]_{AP} N]_{NP}, the rules apply both between Adv and A, as well as between A and NP. Also, in the right

branching structure, the rules does not apply between two modifiers or arguments which do not hold a dependency relationship, while between the adjacent modifier or argument and its head, the rules apply.

As is the case in the c-command condition, since the dependency condition deals with the applicability of the rules between two words, the restructuring problem automatically vanishes.

5.3 Summary

In this chapter, we have discussed the phrasal domain of the three assimilation rules in Korean, which has been defined as a phonological phrase (P). The P-mapping rules governing the nature of internal structure of P have to refer to the surface syntactic structure somehow indirectly, since the prosodic domain P is not always isomorphic with the corresponding surface syntactic structures, i.e. often P does not correspond to any syntactic constituents of the surface syntactic tree.

As we try to extend the generalization about the direction of syntactic tree branching to P-formation, it fails to capture the division in coordinate structures, which is apparently left-branching. This has suggested that we need more than just configurational distinction to describe P-formation.

The examination of the two previous P-mapping rules (Y-M. Cho 1987, G-R. Kim 1988) reveals that there is a restructuring or reinterpretation problem with regard to P-formation. In an effort to eliminate this restructuring problem, the c-command account was explored. However, the c-command condition that we examined also fails

to capture the P-formation in coordinate structure, complicating the definition with the coordinate structure constraint.

The dependency condition, which uses the concept of "the complement-head relationship" between two forms will be sufficient to predict the phrasal domain of the rules in question. As is the case in the c-command condition, since the dependency condition deals with the applicability of two adjacent words, the restructuring problem automatically disappears.

The dependency relationship can be related to the configuration approach proposed to account for the configuration-sensitive lexical rules in Chapter 3. That is, in the view that compounding involves word-level syntax, and that word-level syntax is not different from phrasal structure in essence, we can make the following generalization: Left-branching double compound nouns are compatible with a successive dependency relationship, [mod head]mod head], or the coordinate structure, [[--conj--]mod head], while right-branching double compound nouns are parallel with syntactic right-branching structure, [mod [mod head]].

To conclude, the configuration-sensitive phonological rules in both compound nouns and in phrasal phonology can be described by the dependency condition. If we call the domain of the three phonological rules in compound nouns the phonological word (W), the condition of W-Formation can be stated simply by the dependent condition, too: A head conjoins with its preceding modifier to form a W, and the head must not be a compound noun.

One main difference between the domain of phonological rules in compound nouns and that of P-domain rules discussed so far is in coordinate modifier structures. Unlike the splitting domain of phrasal coordinate modifiers, coordinate modifiers in double compound nouns (viz. co-compounds) go parallel with left-branching structures, and does not create any problem.

Notes

1. Fundamentally, I support these two pioneering works on phrasal phonology in Korean, though I may not agree in some details. I am especially indebted to Y-M. Cho (1987), the first work in Korean phrasal phonology, which gave me an impetus to pursue this work.
2. This chapter discusses only P-domain rules in Korean, not others. I leave the comprehensive classification for future studies, but here I will name a few rules for other categories:
 - a. σ -domain rules: Syllable-Final Neutralization (cf. 4.2.2)
l-Nasalization (4.1.2), etc.
 - b. W-domain rules: t-Epenthesis (cf. 2.3.1.3)
t-Palatalization (cf. 2.3.5)
Predicate-Tensification (cf. 2.4.2)
Umlaut (cf. 2.3.3)
Glide-Insertion (e.g. /he- δ -ci-ki/ --> [hey δ jigi])
etc. word-level rules will fall into this category
 - c. U-domain rules: n-Lateralization (cf. 4.1.1)
l-Weakening (cf. 4.1.1)
3. For word-internal sequences of /h/ and a lenis stop, Aspiration precedes Syllable-Final Neutralization (see section 4.2.3.2 for details).
4. By Consonant Place Assimilation, [manmy δ ntri] and [sunmal] will become [mammy δ ntri] and [summal] (see section 5.2.3 for details).
5. What I mean by "more optionally" is to express that there is a difference in the degree of easiness in the processes between (18a) and (18b), i.e., while the pronunciation of an unassimilated sequence of alveolar plus velar/labial sounds (e.g., [...nk..], [...np..], or [...nm..]) is much more difficult than that of assimilated ones (e.g., [... \tilde{N} k..], [...mp..], or [...mm..]), the sequence of labial plus velar (e.g., [...pk..], or [...mk..]) is not that much difficult to say than that of assimilated ones (e.g., [...kk..], or [... \tilde{N} k..]).
6. K-H. Kim (1987) describes this unidirectional change as the underspecification of alveolar consonants. That is, since alveolar consonants are represented with their place feature unspecified, they are most susceptible to change. The alveolar assimilation is described by underspecification of place features in alveolar segments, and the less frequent labial assimilation is described by the optional pre-velar labial feature delinking before a regressive feature spreading.
7. Y-M. Cho's (1987) P-formation rule is the mirror image of Hayes' (1984). Hayes (1984) uses the following relation-based phonological phrase formation rule for Chi Mwini vowel shortening:

Chi Mwini P-phrase Formation

- a. In $[X' Y'' \dots]X''$, where X' is the head of X'' and Y'' is an adjacent complement, the sequence $X=Y''$ forms a P-phrase.
- b. All clitic groups unaffected by (a) form P-phrase.
8. This seems to be what she assumes (cf. Y-M. Cho 1987, footnote 4).
9. This is from my personal discussion with the author.
10. Kaisse (1985) concludes that while French liaison may successfully restatable by the domain c-command requirement, Italian syntactic doubling appears to require both an edge and a c-command specification. For the cases where c-command notion may substitute for edge conditions, he also argues that the notion of *edge* and *adjacency* is superfluous. I.e., under the assumption of binary branching tree, all words are on the edge of some constituent, so that the recurrence of reference to edge is mere artifact. And since we are dealing with the applicability of phonological rules between words which are adjacent to each other, the notion of adjacency is also trivial, too (from Kaisse 1985: 188, 190).
11. This is the way by which Kaisse excludes the coordinate structure from French liaison. Kaisse proposes a revised definition of c-command condition (viz. the domain c-command for French Liaison, cf. Kaisse 1985: 168).
12. As positional variants, /n+n/ follows a noun ending in a vowel, while /4n/ follows a noun ending in a consonant.
13. Various P-formations like (40b) suggest that P-formations in sentence-level are much freer than those of phrase-level. Note that if we adopt V'' for S, both (30) and (31) predict that the rules in question will apply even between the subject NP and its predicate in case of intransitive construction. With regard to this question, one may cite short intransitive sentences where the rules indeed apply between the subject/topic NP and its predicate, such as /na-n+n ka-n-ta/ --> [naŋganda] 'I am going (I-TOP go-pres-decl)' or /na-n+n mol-i-n-ta/ --> [nammorinda] 'I don't know (I-TOP be ignorant of-pres-decl),' etc. But the application of NA in short sentences like this should be attributed to the length of utterance. For example, between the topic NP modified by a long relative clause and its predicate, or between a short NP and long predicate, NA will not apply:

/tosokwan-i+n koŋpuha-n+n kot+iŋhaksæŋ-t+i-l-lo kat+kha-ôs'-ta/
 *{N}

library-TOP study-presmod high school student-pl-with be full-past-decl
 'The library was full of high school students who are studying'

/namsan-e sælo cis-i+n sipc"-iŋ-c'ali tosokwan-i+n kôtaha-ta/
 *{N}

Mt. Nam-LOC newly build-pastmod 10-storied library huge-decl

Bibliography

- Ahn, Sang-Choel. (1985) *The Interplay of Phonology and Morphology in Korean*. Doctoral dissertation. University of Illinois at Urbana-Champaign. Seoul: Hanshin Publishing Co.
- _____. (1987) "On the Development of Lexical Phonology and Morphology." *Ene* [Linguistic Journal of Korean Linguistics] 12.2: 295-318.
- Ahn, Sang-Choel, and Chin-W. Kim. (1984) "Vowel Harmony in Korean, A Multi-tiered and Lexical Approach." in Gilbert Youmans and Donald M. Lance (eds.). *In Memory of Roman Jakobson: Proceedings of the 1984 Mid-American Linguistics Conference at the University of Missouri*. 17-26. Columbia, MO: Linguistic Area Program.
- Anderson, Stephen R. (1974) *The Organization of Phonology*. New York: Academic Press.
- _____. (1977) "On the Formal Description of Inflection." *Chicago Linguistic Society* 13: 15-44.
- _____. (1982) "Where is Morphology?" *Linguistic Inquiry* 13: 571-612.
- _____. (1984) "On Representations in Morphology: Case, Agreement and Inversion in Georgian." *Natural Language and Linguistic Theory* 2: 157-218.
- _____. (1985) "Inflectional Morphology." in T. Shopen (ed.) *Language Typology and Syntactic Description*. 150-201. Cambridge: Cambridge University Press.
- _____. (1986a) "Morphological Theory." ms. to appear in F. Newmeyer (ed.) *Linguistics: The Cambridge Survey*. Cambridge: Cambridge University Press.
- _____. (1986b) "Morphological Change." ms. to appear in F. Newmeyer (ed.) *Linguistics: The Cambridge Survey*. Cambridge: Cambridge University Press.
- _____. (1986c) "Disjunctive Ordering in Inflectional Morphology." *Natural Language and Linguistic Theory* 4: 1-31.
- _____. (1987) "Inflection." ms. to appear in M. Hammond and M. Noonan. *Theoretical Morphology*. Orlando: Academic Press.
- Aronoff, Mark. (1976) *Word Formation in Generative Grammar*. Cambridge, Mass.: MIT Press.

- Chang, Tae Jin. (1960) "Moumcangtaney kwanhaye [On the Vowel Length Alternation in Korean]" *Kwukekwukmwunhak* 22: 319-324.
- _____. (1963) "Kwukeyu umcangkwa mora [The (Vowel) Length and Mora in Korean]." *Emwunhak* 9: 112-133.
- Chen, Matthew Y. (1985) "The Syntax of Phonology: Xiamen Tone Sandhi." ms. University of California, San Diego.
- Cho, Young-mee Yu. (1987) "Phrasal Phonology of Korean." *Harvard Studies in Korean Linguistics II: Proceedings of the 1987 Harvard Workshop on Korean Linguistics*. 328-340. Seoul: Hanshin Publishing Co.
- Choe, Jae-Woong (1985) "Syllabification and Consonant Cluster Simplification in Korean." ms. University of Massachusetts.
- Chomsky, Noam, and Morris Halle. (1968) *The Sound Pattern of English*. New York: Harper and Row.
- Christdas, Prathima. (1987) "On Constraining the Power of Lexical Phonology: Evidence from Tamil." *NELS* 17: 122-146.
- Chung, Kook. (1980) *Neutralization in Korean: A Functional View*. Doctoral dissertation. University of Texas at Austin. Seoul: Hanshin Publishing Co.
- Clements, George N. (1978) "Tone and Syntax in Ewe." in Donna J. Napoli (ed.) *Elements of Tone, Stress and Intonation*. 21-99. Washington, D.C.: Georgetown University Press.
- _____. (1985) "The Geometry of Phonological Features." *Phonology Yearbook* 2: 225-252.
- _____. (1986) "Compensatory Lengthening in Luganda." in Leo Wetzels and Engin Sezer (eds.) *Studies in Compensatory Lengthening*. 37-77. Dordrecht: Foris Publications.
- Clements, George N., and Samuel J. Keyser. (1983) *CV Phonology: A Generative Theory of the Syllable*. Cambridge, MA: MIT Press.
- Cole, Jennifer. (1987) "The Interaction of Phonology and Morphology in Seri." *NELS* 17: 147-159.
- Cook, Eung-Do (1987) "Sai-sios is a Geminated Consonant." *Harvard Studies in Korean Linguistics II: Proceedings of the 1987 Harvard Workshop on Korean Linguistics*. 360-366. Seoul: Hanshin Publishing Co.
- Cook, Eung-Do (1988) "Hardening in Korean." *Korean Linguistics*. Journal of the International Circle of Korean Linguistics. 5: 31-43.

- [Donnegan] Miller, Patricia D. (1973) "Bleaching and Coloring." in C. Corum et al. (eds.) *Papers from the Ninth Regional Meeting*. 386-397. Chicago: Chicago Linguistics Society.
- Donegan, Patricia J. (1978) *On the Natural Phonology of Vowels*. Doctoral dissertation. Ohio State University.
- Donegan, Patricia J., and David Stampe. (1978) "The Syllable in Phonological and Prosodic Structure." in A. Bell and J. B. Hooper (eds.) *Syllables and Segments*. 25-34. North-Holland Publishing Co.
- Goldsmith, John (1984) "Meeussen's Rule." in Mark Aronoff and Richard T. Oehrle (eds.) *Language Sound Structure*. 245-259. Cambridge, Mass.: MIT press
- Halle, Morris. (1973) "Prolegomena to a Theory of Word Formation." *Linguistic Inquiry* 4.1: 3-16.
- Hayes, Bruce. (1986) "Inalterability in CV Phonology." *Language* 62.2: 321- 351.
- Hooper, Joan B. (1972) "The Syllable in Phonological theory." *Language* 48: 525-540.
- _____. (1976) *An Introduction to Natural Generative Phonology*. New York: Academic Press.
- Howard, Irwin. (1969) "Kasem Nominal Revisited." *University of Hawaii Working Papers in Linguistics* 1: 13-34.
- _____. (1970) "Kasem Nominals and the Ordering of Phonological rules." *University of Hawaii Working Papers in Linguistics* 2.3: 113-129.
- _____. (1972) *A Directional Theory of Rule Application in Phonology*. Doctoral dissertation. Massachusetts Institute of Technology. also reproduced by the Indiana University Linguistics Club (1973).
- Hyman, Larry M. (1975) *Phonology: Theory and Analysis*. New York: Holt, Rinehart and Winston.
- _____. (1986) "Luganda and the Strict Layer Hypothesis." ms. to appear in *Phonology Yearbook* 4.
- Iverson, Gregory K. (1973) "A Guide to Sanguine Relationships." paper presented at the Indiana University Conference on Rule Ordering. mimeographed. Indiana University Linguistics Club.
- Iverson, Gregory K. (1985) "The Revised Alternation Condition in Lexical Phonology." ms. Linguistic Society of America 1985, Seattle.

- Iverson, Gregory K. and Kee-Ho Kim. (1987) "On Word-initial Avoidance in Korean." *Harvard Studies in Korean Linguistics II: Proceedings of the 1987 Harvard Workshop on Korean Linguistics*. 377-393. Seoul: Hanshin Publishing Co.
- Kahn, Daniel (1976) *Syllable-based Generalization in English Phonology*. Doctoral dissertation. Reproduced by the Indiana University Linguistics Club.
- Kaisse, Ellen M. (1985) *Connected Speech: The Interaction of Syntax and Phonology*. Orlando: Academic Press.
- Kenstowicz, Michael (1985) "The Phonology and Syntax of Wh-Expressions in Tangale." *Studies in the Linguistic Sciences* 15.2: 79-91.
- Kenstowicz, Michael, and Charles Kisseberth. (1977) *Topics in Phonological Theory*. New York: Academic Press.
- Kim, Chin-W. (1968) "The Vowel System of Korean." *Language* 44.3: 516-527.
- _____. (1970a) "Boundary Phenomena in Korean." *Papers in Linguistics* 2: 1-26
- _____. (1971) "Kwuke umwunloney isseseuy kongmosseng [Conspiracy in Korean Phonology]." *Emwunyenkwu* 7: 87-94.
- _____. (1972a) "Regularity of the So-called Irregular Predication in Korean." in C. Kisseberth (ed.) *Studies in Generative Phonology*. 104-113. Edmonton, Alberta, Canada: Linguistic Research Inc.
- _____. (1972b) "Two Phonological Notes: A-sharp and B-flat." in M. K. Brame (ed.) *Contributions to Generative Phonology*. 155-170. Austin: University of Texas Press.
- _____. (1973) "Gravity in Korean Phonology." *Language Research* 9.2: 274-281.
- _____. (1976) "Kwuke umwunloney isseseuy moumumcanguy kinung [The Function of Vowel Length in Korean Phonology]." *Emwunyenkwu* 9: 47-56.
- _____. (1977) "Vowel Length in Korean." *Studies in the Linguistic Sciences* 7.2: 154-190.
- _____. (1979) "Neutralization in Korean Revisited." *Studies in the Linguistic Sciences* 9.1: 147-155.
- _____. (1982a) "Epenthesis and Elision in Metrical Phonology." The Linguistic Society of Korea (ed.) *Linguistics in the Morning Calm*. 439-452. Seoul: Hanshin Publishing Co.

- _____. (1982b) "The Rise and Rite of Non-linear Phonology." The Linguistic Society of Korea (ed.) *Linguistics in the Morning Calm*. 93-108. Seoul: Hanshin Publishing Co.
- _____. (1983) "The Rhythmic Structure of *Sijo*: A Metrical Account." *Papers in East Asian Languages* 1: 10-32.
- Kim, Gyung-Ran (1988) *The Pitch-Accent System of the Taegu Dialect of Korean with Emphasis on Tone Sandhi at the Phrasal Level*. Unpublished doctoral dissertation. University of Hawaii at Manoa.
- Kim, Jong-mi. (1985) "Outline of a Non-Lexical Analysis of Morpho-Phonology." *Harvard Studies in Korean Linguistics: Proceedings of the 1985 Harvard Workshop on Korean Linguistics*. 247-256. Seoul: Hanshin Publishing Co.
- _____. (1986) *Phonology and Syntax of Korean Morphology*. Doctoral dissertation. University of Southern California. Seoul: Hanshin Publishing Co.
- _____. (1986b) "Phrasal Phonology in Korean." *Ene* 12.1: 75-103.
- _____. (1987) "Modifier Tensing in Korean: Interface between Phonology, Lexicon, and Syntax." *Ene* 11.2: 219-232.
- Kim, Kee-Ho. (1987) *The Phonological Representation of Distinctive Features: Korean Consonantal Phonology*. Doctoral dissertation. University of Iowa. Seoul: Hanshin Publishing Co.
- Kim, Soo-Gon. (1976) *Palatalization in Korean*. Doctoral dissertation. University of Texas at Austin. Seoul: Pagoda Press.
- Kim, Young-Seok. (1984) *Aspects of Korean Morphology*. Doctoral dissertation. University of Texas at Austin. also published by Seoul: Pan Korea Book Corp. (1985).
- Kim-Renaud, Young-Key. (1973) "Irregular Verbs in Korean." *Language Research* 9.2: 205-225.
- _____. (1974) *Korean Consonantal Phonology*. Doctoral dissertation. University of Hawaii at Manoa. also published by Seoul: Pagoda Press (1985)
- _____. (1975) "On h-Deletion in Korean." *Kwukchak* 3: 45-64.
- _____. (1975) "Palatalization in Korean." in Ho-min Sohn (ed.) *The Korean Language: Its Structure and Social Projection: Occasional Papers of the Center for Korean Studies* 6. The Center for Korean Studies. University of Hawaii at Manoa.
- _____. (1977) "Syllable Boundary Phenomena in Korean." *Korean Studies* 1: 243-273.

- _____. (1977) "Syllable-Boundary Phenomena in Korean." *Korean Studies* 1: 243-273.
- _____. (1982) "ㄷ-Deletion in Korean." The Linguistic Society of Korea (ed.) *Linguistics in the Morning Calm*. 478-488. Seoul: Hanshin Publishing Co.
- Kiparsky, Paul. (1968) "Linguistic Universal and Linguistic Change." in E. Bach and R. Harms (eds.) *Universals in Linguistic Theory*. 170-202. New York: Holt, Rinehart, and Winston.
- _____. (1968b) "How Abstract is Phonology?" ms. Massachusetts Institute of Technology. also in Kiparsky (1982) *Explanation in Phonology*. 119-163. Dordrecht: Foris Publications.
- _____. (1972) "Elsewhere in Phonology." in S. Anderson and P. Kiparsky (eds.) *A Festschrift for Morris Halle*. New York: Holt, Rinehart, and Winston.
- _____. (1982) *Explanation in Phonology*. Dordrecht: Foris Publications.
- _____. (1982) "Lexical Morphology and Phonology." The Linguistic Society of Korea (ed.) *Linguistics in the Morning Calm*. 3-92. Seoul: Hanshin Publishing Co.
- Kisseberth, Charles, and M.J. Kenstowicz. (1971) "Unmarked Bleeding Orders." *University of Illinois Studies in the Linguistic Sciences* 1. also in C. Kisseberth (ed.) *Studies in Generative Phonology*. 1-12. Linguistic Research Inc. (1973).
- Koutsoudas, Andreas, G. Sanders, and C. Noll. (1971) "On the Application of Phonological Rules." ms. Indiana University. also published in *Language* 50: 1-28. (1974)
- Koutsoudas, Andreas. (1973) "Unordered Rule Hypothesis." paper presented at the Indiana University Conference on Rule Ordering. mimeographed. Indiana University.
- Lee, Byung-Gun. (1973) *Underlying Segments in Korean Phonology*. Doctoral dissertation. Indiana University. also published in Korean under the title of *Hyentay hankwueuy sayngseng umwunlon* [Generative Phonology of Modern Korean]. Seoul: Ilcisa (1976).
- _____. (1977) "Hyentay hankwueuy kwukayumhwa kyuchik [Palatalization in Modern Korean]." *Linguistic Journal of Korea* 2: 1-24.
- _____. (1982) "A Well-formedness Condition on Syllable Structure." The Linguistic Society of Korea (ed.) *Linguistics in the Morning Calm*. 489-506. Seoul: Hanshin Publishing Co.

- Lee, Chung-Min (1972) "Boundary Phenomena in Korean Revisited." *Papers in Linguistics* 5.3: 454-485.
- Lee, Dong Jae (1988) "l-Deletion Verbs in Korean." *Papers from the Sixth International Conference on Korean Linguistics*. International Circle of Korean Linguistics. 359-380. Seoul: Hanshin Publishing Co.
- Lee, Gregory. (1975, 1976) "Natural Phonological Descriptions." University of Hawaii Working Papers in Linguistics 7.5 (1975): 85-125 and 8.3 (1976) 25-61.
- _____. (1976) "Interpretive Phonological Rules." Working Papers in Linguistics, University of Hawaii at Manoa 8.3: 11-24.
- Lee, Gregory, and Irwin Howard. (1974) "Another Mouthful of Divinity Fudge." *Papers from the Parasession on Natural Phonology*. Chicago: Chicago Linguistics Society.
- Lee, Ik-Hwan. (1976) "Korean Vowel System: Abstract Solution?" *Texas Linguistic Forum* 4: 57-70. also published in *Korean Linguistics* 1 (1978): 19-44.
- Lee, Kang-Hoon. (1982) "Kwukeuy pokhapmyengsaeyseuy kyengumhwa hyensang [Tensification Phenomena in Compound Nouns in Korean]." *Ene* 7.2: 299-321.
- Lee, Kee-dong (1973) "On the So-called s-irregular and t-irregular Verbs in Korean." *University of Hawaii Working Papers in Linguistics* 5.6: 129-138.
- Lee, Ki-Moon. (1972) *Kwuke umwunsa yenkwu* [A Study on the History of Korean Phonology] Seoul: Tower Press.
- _____. (1978) *Kwukesa kayseŭl* [Introduction to the History of Korean Language]. revised edition. Seoul: Tower Press.
- Lee, Sang-Ock (1979) "Sengcowa umcang [Tone and Length]." *Language Research* 15: 123-139.
- Martin, Samuel E. (1951) "Korean Phonemics." *Language* 27: 519-533.
- _____. (1954) *Korean Morphophonemics*. Baltimore, MD: Linguistic Society of America.
- Martin, Samuel E., Yang Ha Lee, and Sung-Un Chang (ed.) (1968) *New Korean-English Dictionary*. Seoul: Minjungseorim.
- Mohanan, Karuvannur P. (1982) *Lexical Phonology*. Doctoral dissertation. Massachusetts Institute of Technology. Reproduced by the Indiana University Linguistics Club.

- _____. (1986) *The Theory of Lexical Phonology*. Dordrecht: D. Reidel Publishing Co.
- Nam, Kwang Wu. (1954) "Cangtanumko (sang) [On Length (Part I)]." *Kwukekwukmwunhak* 12: 5-9.
- _____. (1955) "Cangtanumko (ha) [On Length (Part II)]." *Kwukekwukmwunhak* 13: 203-216.
- Nespor, Marina, and Irene Vogel. (1982) "Prosodic Domains of External Sandhi Rules." in H. van der Hulst and N. Smith (eds.) *The Structure of Phonological Representations (Part I)*. 225-255. Dordrecht: Foris Publications.
- _____. (1986) *Prosodic Phonology*. Dordrecht: Foris Publications.
- Oh, Jeong-Ran. (1987) "Kwuke pokhape naypuuy kyengumhwa hyensang [Tensification Phenomenon in Korean Compounds]." *Ene* 12.1: 35-53.
- Pullum, Geoffrey K., and Arnold M. Zwicky. (1987) "The Syntax-Phonology Interface." ms. to appear in the Cambridge University Press encyclopaedia *Linguistics: The Cambridge Survey*.
- _____. (1986) "The Principle of Phonology-Free Syntax: Introductory Remarks." *Ohio State University Working Papers in linguistics* 32: 63-91.
- _____. (1986) "Two Spurious Counterexamples to the Principle of Phonology-Free Syntax." *Ohio State University Working Papers in linguistics* 32: 92-99.
- _____. (1983) "Cliticization vs. Inflection: English *n't*." *Language* 59.3: 502-513.
- _____. (1983) "Phonology in Syntax: the Somali Optional Agreement Rule." *Natural Language and Linguistic Theory* 1.3: 385-402. Dordrecht: D. Reidel Publishing Co.
- _____. (1986) "Phonological Resolution of Syntactic Feature Conflict." *Language* 62.4: 751-774
- _____. (1987) "Plain Morphology and Expressive Morphology." to appear in Proceedings of the 1987 Berkeley Linguistics Society.
- Roeper, Thomas and Muffy E.A. Siegel. (1978) "A Lexical Transformation for Verbal Compounds." *Linguistic Inquiry* 9.2: 199-260.
- Selkirk, Elisabeth O. (1972) *The Phrase Phonology of English and French*. Unpublished doctoral dissertation. Massachusetts Institute of Technology.

- _____. (1974) "French Liaison and the \bar{X} -notation." *Linguistic Inquiry* 5: 573-590.
- _____. (1980a) "On Prosodic Structure and its Relation to Syntactic Structure." Indiana University Linguistics Club.
- _____. (1980b) "Prosodic Domains in Phonology: Sanskrit Revisited." in M. Aronoff and M. Kean (eds.) *Juncture*. 107-130. Saratoga, CA: Anma Libri and Co.
- _____. (1980c) "The Role of Prosodic Categories in English Word Stress." *Linguistic Inquiry* 11: 563-605.
- _____. (1984) *Phonology and Syntax: The Relation between Sound and Structure*. Cambridge, Mass.: MIT Press.
- _____. (1986) "On Derived Domains in Sentence Phonology." ms. University of Massachusetts. to appear in *Phonology Yearbook 3*
- Sohn, Hyang-Sook. (1985) "Korean Irregular Verbs and Nonlinear Phonology." *University of Illinois Studies in the Linguistic Sciences* 15.1: 157-193.
- _____. (1987) *Underspecification in Korean Phonology*. Doctoral dissertation. University of Illinois at Urbana-Champaign. Seoul: Hanshin Publishing Co.
- Stampe, David (1969) "The Acquisition of Phonetic Representation." Papers from the Fifth Regional Meeting of the Chicago Linguistic Society. 443-454.
- _____. (1972) *A Dissertation on Natural Phonology*. Doctoral dissertation. University of Chicago. also published by New York: Garland Publishing Co. (1979)
- _____. (1984) "On Phonological Representations." ms. also appears in W. Dressler and J. Pfeiffer (eds.) *Phonologica*. Cambridge: Cambridge University Press.
- Stanley, Richard (1973) "Boundaries in Phonology." in Stephen R. Anderson and Paul Kiparsky (eds.) *A Festschrift for Morris Halle*. 185-206. New York: Holt, Rinehart and Winston.
- Whitman, John (1985) "Syllabification and Consonant Cluster Simplification." *Harvard Studies in Korean Linguistics: Proceedings of the 1985 Harvard Workshop on Korean Linguistics*. 280-290. Seoul: Hanshin Publishing Co.
- Zwicky, Arnold M. (1986) "How to Describe Inflections." *Berkeley Linguistic Society* 11: 372-386.