# Government and Elements in Korean Phonology

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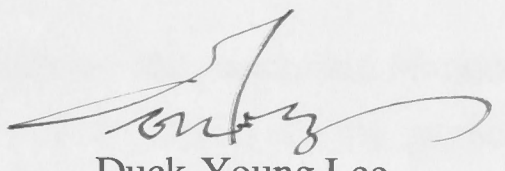
of
The Australian National University.

# Statement

Except where otherwise acknowledged, this thesis is entirely my own work.



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# Abstract

This thesis presents an attempt to investigate certain phonological phenomena in Korean from the perspective of Government Phonology (Kaye, Lowenstamm & Vergnaud 1985, 1990; Kaye 1985, 1990a; Harris 1990; Charette 1990a, 1991).

In Chapter One, I present an introduction to some theoretical aspects of Government Phonology. The concept of government, some basic principles, and elements are presented.

In Chapter Two, I consider the internal structure of segments in Korean. For the vowel inventory, I argue for an eight-vowel system against a nine- or a ten-vowel system. After considering the representations of consonants, I discuss the syllabic status of glides, and provide evidence that glides in Korean must be analysed as light diphthongs in which a glide and a following vowel are attached to a single nuclear point.

In Chapters Three and Four, we focus on issues which involve vocalic segments. Chapter Three discusses vowel harmony, and addresses some unsolved problems in previous analyses, which include the issue of so-called neutral vowels. This is followed by discussion of vowel coalescence and glide formation in Chapter Four. An attempt is made to show that a phonological operation called Nuclear Fusion (Yoshida 1991) and asymmetry in the spreading properties of the vocalic elements 'I' and 'U' have a crucial role in the analysis.

Chapters Five and Six will be devoted to discussion of phonological processes involved in consonantal clusters, such as neutralisation, tensification, *i*~zero alternation, nasalisation and the paradigms of irregular verbs. An analysis of these phenomena is given in connection with examination of the syllabic structure of consonantal clusters. Concretely, I will argue that consonantal clusters in Korean should be analysed as two onsets rather than coda-onset. In addition, it will be shown that these two onsets form a governing relation if certain requirements are satisfied.

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## 4 Vowel Coalescence and Glide Formation

## 5 Interaction of Consonants

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# 1

# Government and Elements in Phonology

## 1.1 Overview

This thesis presents an attempt to investigate certain phonological phenomena in Korean from the perspective of Government Phonology (Kaye, Lowenstamm & Vergnaud (KLV, henceforth) 1985, 1990; Kaye 1985, 1990a; Charette 1990a, 1991; Harris 1990, 1992a). For the past two decades, Korean has been investigated mainly within the framework of Generative Phonology, which is based on rules and distinctive features. Government Phonology is fundamentally different from this approach. It dispenses with rewrite rules of the type A → B / C__ D and attempts to explain phonological phenomena by using principles and parameters. For segmental representation, Government Phonology rejects distinctive features and uses instead elements that are privative units. The ultimate goal of this thesis is therefore to provide a new interpretation for phonological phenomena in Korean within a principle and element-based framework.

This thesis contains six chapters. The first chapter presents an introduction to some theoretical aspects of Government Phonology. The concept of government, some basic principles, and elements are presented.

In Chapter Two, we consider the internal structure of segments in Korean. For the vowel inventory, I argue for an eight-vowel system against a nine- or a ten-vowel system. After considering the representations of consonants, I discuss the syllabic status of glides, and show that glides in Korean must be analysed as light diphthongs in which a glide and a following vowel are attached to a single nuclear point.

In Chapters Three and Four, we focus on issues which involve vocalic segments. Chapter Three discusses vowel harmony, which has traditionally been viewed as the result of the harmonic opposition between 'light vowels' and 'dark vowels'. I point out that this traditional vowel division is not capable of dealing with certain vowel harmonic patterns, and then provide an element-based analysis, demonstrating that all vowel harmonic patterns in Korean are explainable without exception from the perspective of an element theory. This is followed by Chapter Four, where we deal with vowel coalescence and glide formation. An attempt is made to show that a phonological operation called Nuclear Fusion (Yoshida 1991) and asymmetry in the spreading properties of the vocalic elements 'I' and 'U' have a crucial role in the analysis. I also address the question of long vowels in this chapter, and provide evidence that the standard view that modern Korean has a vowel length distinction should be revised.

Chapters Five and Six will be devoted to discussion of phonological processes involved in consonantal clusters, such as neutralisation, tensification, *i*~zero alternation, nasalisation and the paradigms of irregular verbs. An analysis of these phenomena is given in connection with examination of the syllabic structure of consonantal clusters. Concretely, I will argue that consonantal clusters in Korean should be analysed as two onsets rather than coda-onset. In addition, it will also be shown that these two onsets form a governing relation if certain requirements are satisfied.

Throughout this thesis, the term 'Korean' indicates, unless specified, the standard Korean spoken in Seoul and the central districts of the Korean peninsula.

## 1.2 Constraints on Well-formed Syllabic Structure

### 1.2.1 Government in phonology

Within the framework of Government Phonology (GP henceforth), a well-formed phonological representation is viewed as satisfying highly strict constraints coherent through prosodic and autosegmental levels. The constraints are established on the basis of the asymmetric relationship

between two phonological units. This asymmetric relationship is defined in terms of licensing.

(1) **Licensing Principle** (Kaye 1990a: 306)

All phonological positions save one must be licensed within a domain. The unlicensed position is the head of this domain.

The occurrence of any phonological position within a domain is dependent on some other position, with the exception of the head which may occur by itself.

Government is one special type of licensing. It defines the licensing relationship of two given phonological positions. For a governing relation to hold, the following two conditions must be satisfied (KLV 1987, 1990; Kaye 1990b).

(2) **Strict Adjacency Condition**

The governor must be adjacent to the governee at the $p^0$ projection, i.e. the projection containing every skeletal point.

**Strict Directionality Condition**

Directionality of government at the skeletal level is universal and not subject to parametric variation:

(i) Constituent government is head-initial.
(ii) Interconstituent government is head-final.

These two conditions allow us to derive the binary theorem (Kaye 1992b: 293) which states that constituents are maximally binary.[1] Consider, for example, the configuration (3) where an anonymous constituent C dominates three skeletal points.

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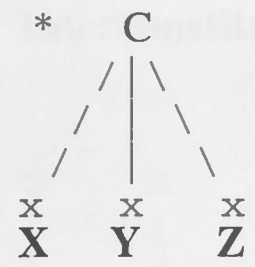
1 See KLV (1990) and Kaye (1992b) for an argument against the existence of ternary branching onsets with which word-initial S+C+L in Indo-European languages would be represented in the standard theory.

(3)

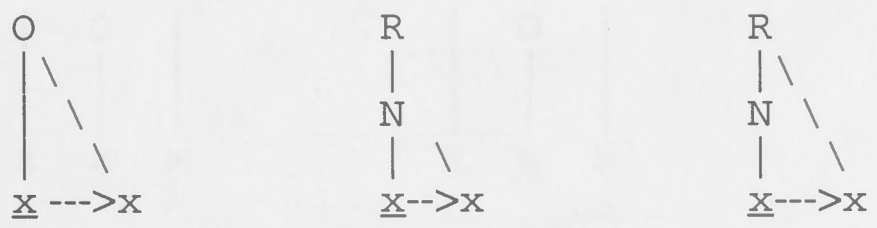



Given three possible heads, X, Y and Z, all possibilities are illicit because they cannot satisfy the Strict Directionality Condition and the Strict Adjacency Condition. Suppose that the first skeletal point X is a head. This point cannot then license Z as it violates the Strict Adjacency Condition. Y in the middle also cannot be a head. If it licenses X it would violate the Strict Directionality Condition, by which a head must appear at the left of its governee within constituent government. The possibility of Z being a head is also eliminated: the directionality would be right to left, and X is not next to Z.

There are three constituents: Rhyme (R), Nucleus (N) and Onset (O).[2] Each constituent may or may not branch, subject to parametric variation. The licensing relationship holding between two constituents is Interconstituent Government, and within branching constituents is Constituent Government. (4a) illustrates three constituent governing domains: (i) branching onset, (ii) branching nucleus, and (iii) branching rhyme. As the Strict Directionality Condition indicates, government operates from left to right (heads are underlined).

(4) a. **Constituent governing domains**

(i) (ii) (iii)

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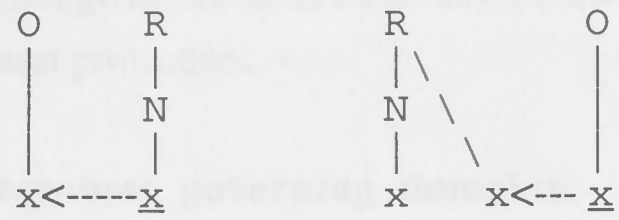
2 The 'syllable' and 'coda' are abandoned within the framework of GP. The terms 'syllable' and 'coda', however, will be freely used with the general concept of 'a sequence of onset-nucleus' and 'a complement of a rhyme', respectively, throughout this thesis for the benefit of descriptive convenience.

b. **Interconstituent governing domains**

(i) (ii)




The representations in (4b) show interconstituent government which holds between two skeletal points belonging to two heterogenous constituents. In each structure, a head appears to the right of its complement. The government in (4b-i) is onset licensing (KLV 1990; Charette 1991; Cyran 1994). The typical manifestation of this government can be found, for example, in palatalisation which involves spreading of [palatality] from a nucleus to its onset. (4b-ii) illustrates a governing domain where an onset governs a preceding post-nuclear rhymal position ('coda' in traditional terms). This government manifests itself in phonotactics involved in consonantal clusters such as geminates and homorganic nasal-obstruent clusters (Harris 1990; Yoshida 1991).

In addition to these governing domains at the skeletal level, there are two more types of government present at the projection level. They are internuclear government and interonset government. The configurations in (5) are internuclear governing domains involving two nuclei that are adjacent at the level of nuclear projection.

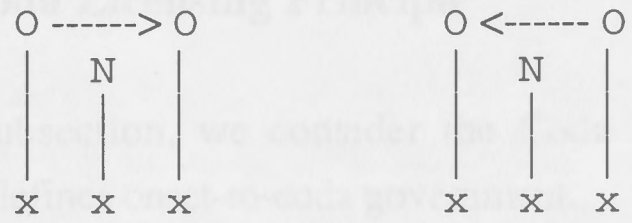
(5) **Internuclear governing domains**


In internuclear government, the Strict Adjacent Condition applies strictly, but the Strict Directionality Condition is laxed and is subject to parametric variation (Kaye 1990b; Harris 1992a). A manifestation of internuclear government is found in various prosodic phenomena such as stress (Harris 1990), tone (Y. Yoshida 1994), vowel harmony (Denwood 1993; Cyran

1994), and vowel syncopation (Kaye 1990b; Charette 1991; Gussmann & Kaye 1993; Yoshida 1993).

Interonset government is established between two adjacent onsets at the level of onset projection.

(6) **Interonset governing domains**

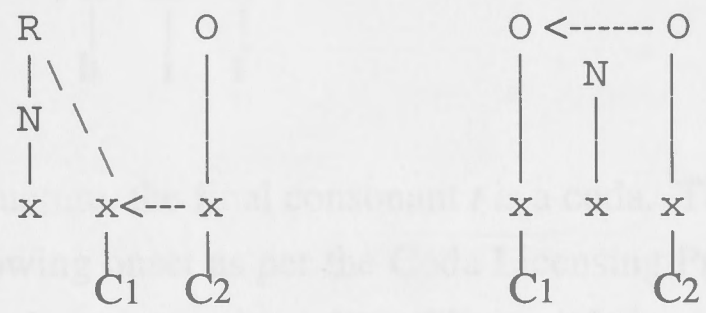



Like internuclear government, its directionality varies according to the parametric setting. (6a) and (6b) show head-initial and head-final interonset governments, respectively. The former is discussed in Gibb (1992), and the latter is attested in Guerssel & Lowenstamm (1988), Kaye (1990a), Cyran (1994), Yoshida (1991, 1993). Interonset government manifests itself in phonotactics involving consonantal clusters such as geminates and homorganic nasal-obstruent clusters.

In connection with head-final interonset government, I would like to point out that its directionality is identical to onset-to-coda government.

(7) **Consonantal clusters involving head-final government**

a. b.




(7a) is onset-to-coda government, and (7b) is head-final interonset government. In both structures, the governor C2 appears to the right of its governee C1. Thus, if consonantal clusters [C1C2] show phonotactic constraints which involve a head-final governing relation, their syllabic structure should be inspected with two possibilities, a coda-onset structure

and a head-final onset-onset structure. This issue is directly related to our analysis of the syllabic structure of consonantal clusters in Korean, since Korean consonantal clusters involve head-final government. Detailed discussion of this issue will be given in Chapter Five.

### 1.2.2 Coda Licensing Principle

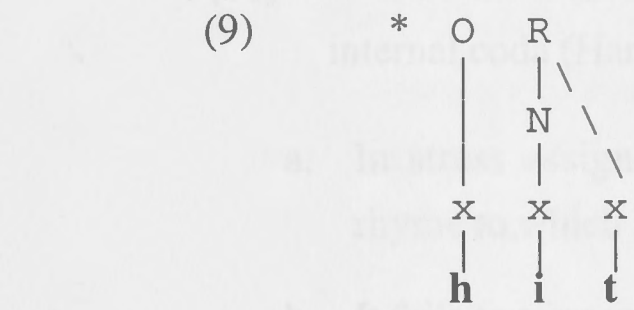
In this subsection, we consider the Coda Licensing Principle, which formally defines onset-to-coda government.

(8) **Coda Licensing Principle** (Kaye 1990a: 311)

A post-nuclear rhymal position must be licensed by a following onset.

This principle provides an explicit view in determining the syllabic status of a word-final consonant. Suppose a branching rhyme occurs in word-final position, then a word that ends with a consonant, for example, the English word *hit* would have the following representation.

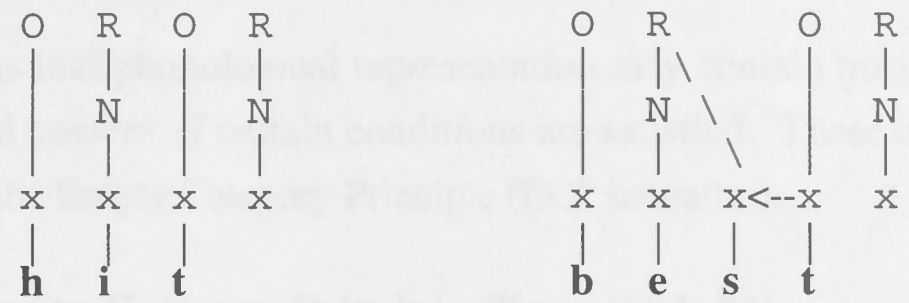
(9)




In this structure, the final consonant *t* is a coda. The coda must be licensed by a following onset as per the Coda Licensing Principle. However, there is no licensing onset to its right and hence it is in violation of the principle.

The correct form of *hit* is given in (10a). The representation of the word *best* in (10b) is also presented for the purpose of illustrating a branching rhyme.

(10) a. [hit] b. [best]




Both representations are well-formed. In (10a), the final consonant *t* is associated with an onset. There is no requirement of the Coda Licensing Principle here, and the onset with *t* is licensed by a following nucleus. Structure (10b) shows that the final consonant *t* occupies an onset that is licensed by the following nucleus. The onset position linked with *t* further licenses the preceding coda which is occupied by *s*, and thus the requirement of the Coda Licensing Principle is satisfied.

Likewise, word-final consonants are syllabified in onsets rather than codas. Harris (1992a, 1992b) provides empirical support in favour of this onset view, pointing out that final consonants behave differently from those in internal codas.

(11) Word-final consonants behave like an internal onset, not like an internal coda (Harris 1992b):

a. In stress assignment, it fails to contribute to the weight of the rhyme to which it supposedly belongs (extrametricality).

b. It fails to trigger closed-syllable shortening in the rhyme to which it supposedly belongs.

c. Alleged final coda clusters frequently contravene otherwise general sonority sequencing constraints.

d. The phonotactics of final consonant clusters parallel those of internal coda-onset clusters or branching onsets.

### 1.2.3 Empty Category Principle

GP claims that phonological representation may contain positions with no segmental content, if certain conditions are satisfied. These conditions are stated in the Empty Category Principle (ECP hereafter).

(12) **Empty Category Principle** (Kaye 1993: 94)

a. The Phonological ECP: A p-licensed (empty) category receives no phonetic interpretation.

b. P-licensing:
1. Domain-final (empty) categories are p-licensed (parameterised)
2. Properly governed (empty) nuclei are p-licensed.
3. A nucleus within an inter-onset domain is p-licensed.

Regarding domain-final empty nuclei, (12b-1) states that whether or not they remain without receiving phonetic interpretation is subject to parametric variation. In a language which licenses domain-final empty nuclei, words may end with a consonant. English, Thai, French belong to this group. If a language does not license final empty nuclei, they must receive phonetic realisation. Japanese, Italian, Kikuyu represent this type of languages.

(12b-2) indicates that proper government is responsible for phonetic realisation/non-realisation of domain-internal empty nuclei. (13) gives the details of proper government.

(13) **Proper Government** (Kaye 1993: 94)

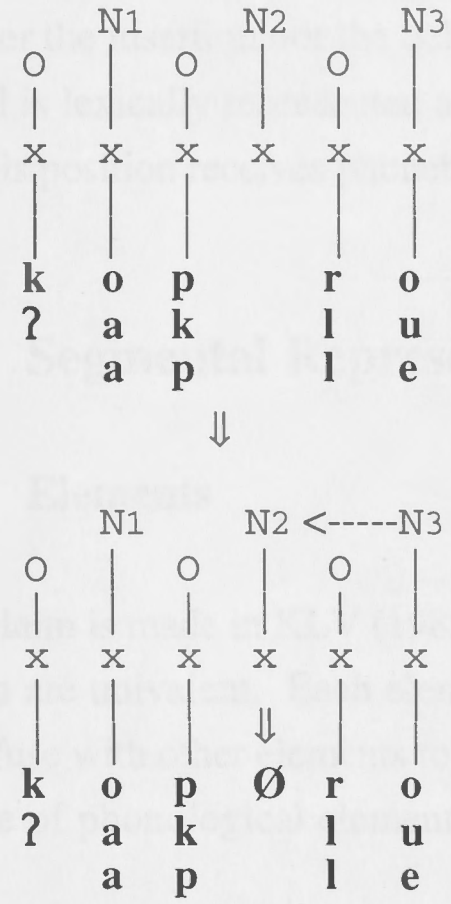
A nuclear position $\alpha$ properly governs a nuclear position $\beta$ iff
(i) $\alpha$ is adjacent to $\beta$ on its projection
(ii) $\alpha$ is not itself licensed
(iii) No governing domain separates $\alpha$ from $\beta$

To demonstrate how proper government operates, we consider the following selected examples which involve a vowel~zero alternation.

| | | | |
|---|---|---|---|
| (14) | Polish (e~Ø): | koper | 'drill' |
| | | kopr-o | 'to drill' |
| | Palestinian Arabic (i~Ø): | ʔakil | 'food' |
| | | ʔakl-u | 'his food' |
| | French (ɛ~Ø): | apɛl | 'a call' |
| | | apl-e | 'to call' |

The alternating vowels in these languages are viewed as lexically empty, as discussed in Gussmann & Kaye (1993) for Polish, Yoshida (1993) for Palestinian Arabic, and Charette (1992) for French. The process of these alternations is illustrated in (15) below. In the first structures in (15a) and (15b), N2 does not contain any segmental materials, and in addition the rightmost nucleus N3 is also empty in (15b). Being empty nuclei, their phonetic realisation is subject to the ECP.

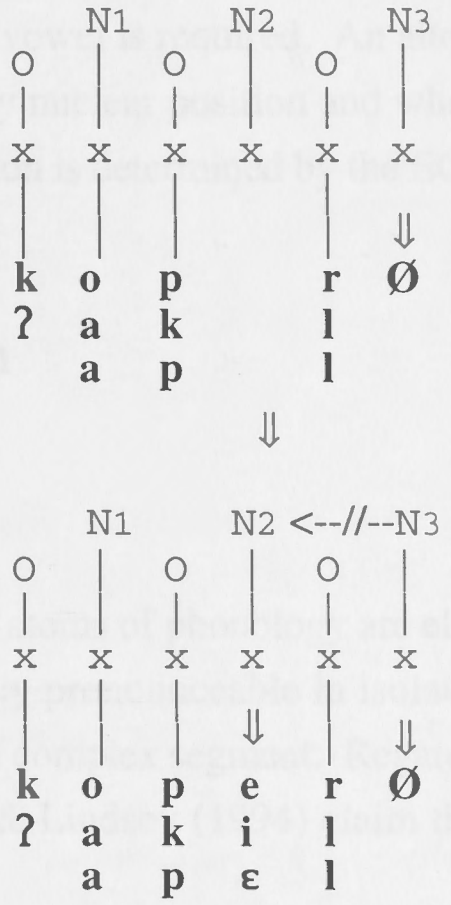
(15) a.




CVCØCV → [CVCCV]

(<--- : proper government)

b. Final Empty Nuclei Parameter [ON]




CVCØCØ → [CVCVC]

In (15a), the empty nucleus N2 is domain-internal, and thus its phonetic realisation/non-realisation is dependent on whether or not it is properly governed by the following nucleus N3. First, the locality condition is satisfied as these two nuclei N2 and N3 are adjacent at the nuclear projection level, and no governing domain separates these two nuclei N2 and N3. Further, N3 is filled with a lexical vowel (and therefore it is not itself licensed). N2 is properly governed by N3, and the licensed empty nucleus N2 does not receive phonetic interpretation and the phonetic pattern [CVCCV] obtains. Turning now to (15b), where N2 and N3 are empty, the domain-final N3 is licensed by virtue of the fact that these languages license domain-final empty nuclei. For the domain-internal N2, unlike N2 in (15a), it is not properly governed here since the following nucleus N3 is itself licensed and cannot serve as a proper governor. As shown in the second structure, the unlicensed N2 is phonetically realised, yielding a pattern of surface form [CVCVC]. The vowels *e*, *i* and *ɛ* in the above examples are phonetic realisations of unlicensed empty nuclei in each languages.[3]

To summarise, GP views a vowel~zero alternation as a phonological phenomenon which involves phonetic interpretation of an empty nucleus. Neither the insertion nor the deletion of a vowel is required. An alternating vowel is lexically represented as an empty nuclear position and whether or not this position receives phonetic realisation is determined by the ECP.

## 1.3 Segmental Representation

### 1.3.1 Elements

The claim is made in KLV (1985) that the atoms of phonology are elements, which are univalent. Each element is fully pronounceable in isolation and may fuse with other elements to produce a complex segment. Regarding the nature of phonological elements, Harris & Lindsey (1994) claim that they

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3 The way of phonetic realisation of unlicensed empty nuclei varies from language to language. See Yoshida (1993) for details concerning the manner of phonetic realisation of unlicensed empty nuclei.

are defined in terms of the cognitively-represented sound [sic] pattern which is shared by both speaker and hearer.[4]

> "The elements of phonological representation are cognitive categories by reference to which listeners parse and speakers articulate speech patterns. These categories are not mappable in the first instance into articulations but rather are constituted by sound [sic] patterns — universal expectations regarding the structures to be inferred from acoustic signals and to be mimicked in the course of articulatory maturation." (Harris & Lindsey 1994: 37)

The elements proposed by KLV (1985, 1987) and refined by Harris (1990), Harris & Lindsey (1994) are given with their salient properties below.

(16)

| Element | Salient property | Phonetic interpretation |
|---|---|---|
| A | lowness | [a] |
| I | frontness, palatality | [i] |
| U | roundedness, labiality | [u] |
| R | coronality | [ɾ] |
| v | none, velarity | [ɯ][5] |
| ʔ | occlusion | [ʔ] |
| h | friction | [h] |
| N | nasality | [ɯ̃] |
| H | stiff vocal cords | high tone |
| L | slack vocal cords | low tone |

In addition to the above elements, the ATR element '$\text{ɪ}^{+}$' was proposed along with the positive charm value in KLV's original element theory.[6] In

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4 See Harris & Lindsey (1994), Williams & Brockhaus (1992) for details of the nature of direct mapping between elements and signals within an acoustic analysis of elements.

5 When 'v' appears in an empty nucleus, its phonetic realisation differs from language to language, subject to different phonetic interpretations of a particular language.

6 According to the charm theory (KLV 1985, 1987), elements are divided into three classes: positively charmed elements ($\sigma^{+}$: $A^{+}$, $N^{+}$, $\text{ɪ}^{+}$), negatively charmed elements ($\sigma^{-}$: $H^{-}$, $L^{-}$), and charmless elements ($\sigma^{\circ}$: $I^{\circ}$, $U^{\circ}$, $R^{\circ}$, $v^{\circ}$, $ʔ^{\circ}$, $h^{\circ}$).

this original theory, charm acted as a constraint to delimit the combinational possibilities of elements. According to this constraint, elements of like charm may not combine and thus fusion of positively charmed elements, for example, $A^+$ and $N^+$ is prohibited. Nevertheless counterexamples are found in languages as exemplified by the following French words. (The examples are taken from Cobb 1993.)

(17) a. bã (banc) 'bench'
ãfã (enfant) 'child'

b. $*(N^+ \bullet A^+) = [\tilde{a}]$

The ATR element $ɪ^+$ raises another problem against the claim that the charm value of a complex segment is that of a head (KLV 1985). '$ɪ^+$' always contributes positive charm to representations in which it is involved, even when this element is not a head. An alternative view to the puzzling element $ɪ^+$ has been proposed in recent work (Charette & Göksel 1994; Cobb 1993; Harris & Lindsey 1994). In these works, the ATR element $ɪ^+$ (and the charm theory) is dispensed with, and instead the opposition of ATR and non-ATR vowels is expressed in terms of the headship of segments: ATR vowels have an active element as the head, while lax vowels are empty headed, i.e. headless. (An empty head is expressed by __ in (18).)

(18) Harris & Lindsey (1994)

| a. **ATR** | | b. **Non-ATR** | |
|---|---|---|---|
| (I) | i | (I•__) | ɪ |
| (U) | u | (U•__) | ʊ |
| (A•I) | e | (A•I•__) | ɛ |
| (A•U) | o | (A•U•__) | ɔ |

Further, the combinatorial possibilities of elements are controlled by a set of licensing constraints in a given language. To be more explicit, the inventory of melodic expressions of a language is determined by a set of segment-internal constraints in the language; that is to say, what elements may be heads, and whether the heads may license operators, i.e. non-

headed elements. For example, Charette & Göksel (1994: 38) propose the following licensing constraints for Turkish.

(19) **Licensing constraints of Standard Turkish**

i. 'U' must be head
ii. 'I' does not license operators
iii. Operators must be licensed

Constraint (19i) explains the non-existence of expressions in which 'U' is an operator, e.g. *(U•I), *(U•A). What the constraint (19ii) indicates is that 'I' can be the head of an expression only when it occurs alone, i.e. *i* =(I), and segments having 'I' as the head and another element as an operator, e.g. *(A•I), are eliminated from the language. 'I' can occur as an operator of expressions in which an active element is a head, e.g. ɛ=(I•A), *ü*=(I•U) and œ=(A•I•U). Constraint (19iii) excludes any empty-headed expressions which have an active element as an operator, e.g. *(I•__), *(U•__), *(A•__). These three constraints determine all and only the lexical expressions present in Turkish.

(20) **The phonological expressions in Standard Turkish**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| i | (I) | ü | (I•U) | u | (U) | ɨ | (__) |
| ɛ | (I•A) | œ | (A•I•U) | ɔ | (A•U) | a | (A) |

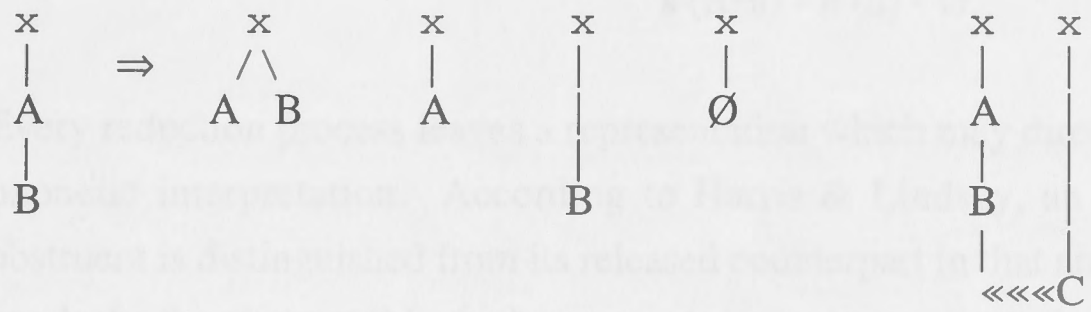
The revision is not limited to the vocalic elements. The coronal element 'R' has also been under revision where it is not present in the phonological system (Bakery 1993; Brockhaus 1994; Cyran 1994). While Bakery claims the absence of 'R' without a substituted element, Brockhaus and Cyran propose 'A' as the alternative element to 'R'. This issue will be discussed in Chapter Two, where we consider the representations of segments in Korean.

Throughout this thesis, (X) indicates the internal structure of a simplex segment (X = an element). A complex segment consisting of X and Y is expressed as (X•Y), where the head appears to the right of '•'. A headless complex segment is represented as (X•__).

### 1.3.2 Composition and decomposition

Within the element-based framework, individual phonological phenomena are expressed by phonological operations by which positions lose or gain one or more elements. These operations are known as Composition and Decomposition (KLV 1987; Harris 1990; Harris & Lindsey 1994).

(21) a. **Decomposition** b. **Composition**




(A, B, C = elements)

(21a) illustrates the effects of decomposition: a breaking by which elements form a contour structure without loss of elements; or loss of one or all elements from the internal structure of a segment. (21b) shows the composition process: a segment obtains some other element through spreading.

These processes contrast with orthodox feature-based approaches whereby segmental changes are expressed not only by having different phonological primes but also by different values, i.e. plus vs. minus.[7] Remember that each of the elements is monovalent and fully interpretable, and also that each segment is identified simply by elements participating in their internal structure. This representationally autonomous nature of elements enables us to deal with phonological representations as being directly interpretable at every level. The interpretability of elements is presented in Kaye (1993).

(22) **Uniformity Condition** (Kaye 1993: 92)

Phonological representations are directly interpretable at every level.

---

[7] See Harris & Lindsey (1994) for detailed discussion about the difference between features and elements.

Consider the examples in (23) cited in Harris & Lindsey (1994). They show two lenition trajectories which may be expressed as the three-way alternations *t-t˺-ʔ* and *s-h-zero*, respectively. (*t˺* indicates the unreleased coronal stop).

(23) a. English: ge[t] no - ge[t˺] no - ge[ʔ] no
**t** (R•ʔ•h) - **t˺** (R•ʔ) - **ʔ** (ʔ)

b. Central American Spanish: mes - meh - me 'month'
**s** (R•h) - **h** (h) - Ø

Every reduction process leaves a representation which may directly receive phonetic interpretation. According to Harris & Lindsey, an unreleased obstruent is distinguished from its released counterpart in that an unreleased one lacks the element 'h' which represents noisy component. In the English example in (23a), the loss of the element 'h' from *t* leads to a representation that is phonetically interpreted as *t˺*. The representation obtained by the further loss of 'R' surfaces as *ʔ*. The Spanish example in (23b) shows that the conversion of *s* to *h* is simply accounted for as the loss of the element 'R'. The loss of the other element 'h' leaves the representation containing no active elements and hence no actual phonetic realisation.

## 1.4 Predictability of the Theory

### 1.4.1 Constraints on syllabification

So far, we have considered well-formed syllable structures and segmental representation. In 1.4.1, we now consider constraints on syllabification. Let us first look at the following constraint.[8]

---

8 KLV (1987) proposes a stronger version of the Complexity Condition, which states that a governor must be more complex than its governee.

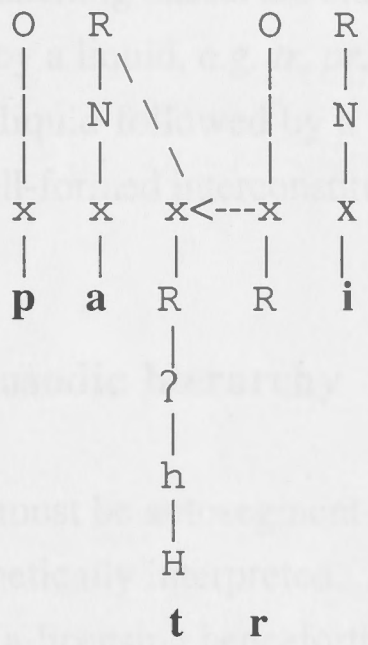
(24) **Complexity Condition** (Harris 1990: 274)

> Let α and β be segments occupying the positions A and B, respectively. Then if A governs B, β must be no more complex than α.

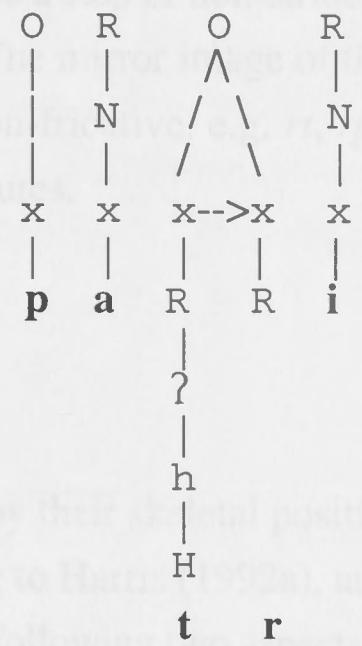
According to Harris, the complexity of a segment is calculated by counting the number of participating elements. Therefore, given a governing domain, a segment in a governed position cannot contain a greater number of elements than its governor.

Consider, for example, the syllabic structure of the French word *patrie* [patri] 'native land' and *parti* [parti] 'party', which are discussed in Charette (1991). Taking the cluster *tr* in the former, it cannot form an interconstituent structure where *t* and *r* would occur in a coda and a following onset, respectively, as in (25a). Within an interconstituent governing domain, an onset must license the preceding coda, as imposed by the Coda Licensing Principle. If *r* (R) occurs in the governing onset, it would have to govern the coda that is linked to *t* (R•ʔ•h•H). Notice that *t* is more complex than *r*, and this violates the Complexity Condition.

(25) *a.




b.

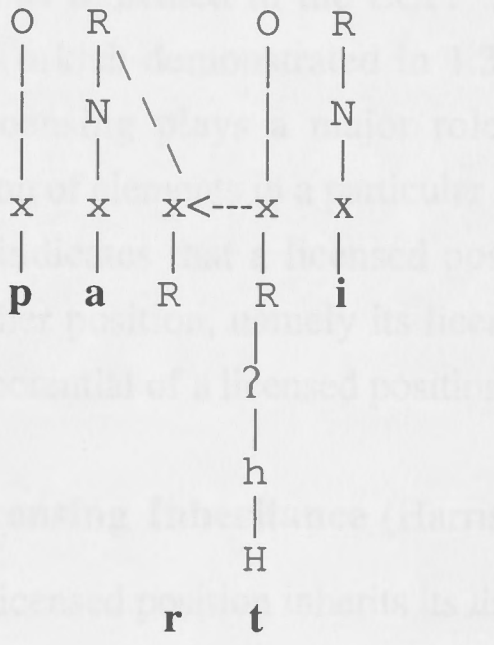



The sequence *tr* forms a branching onset in which a head appears to the right of its complement within a branching onset as in (25b). The head position

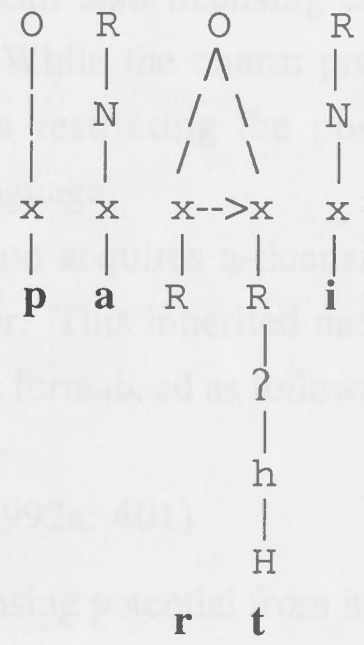
is occupied by *t* which is more complex than its governee *r*, hence the Complexity Condition is satisfied.

The sequence *rt* in [parti], on the other hand, occurs as an interconstituent structure and never forms a branching onset. The well-formedness of the coda-onset structure is verified by the fact that the governing onset contains *t* and the governed coda contains the less complex *r*.

(26) a.




*b.




To summarise, the Complexity Condition predicts that typical well-formed branching onsets are clusters where a stop or non-strident fricative is followed by a liquid, e.g. *tr*, *pr*, *kr*, etc. The mirror image of these clusters, namely a liquid followed by a stop or non-fricative, e.g. *rt*, *rp*, *rk*, etc, are typical well-formed interconstituent structures.

### 1.4.2 Prosodic hierarchy

Elements must be autosegment-licensed by their skeletal positions, in order to be phonetically interpreted. According to Harris (1992a), autosegmental licensing (a-licensing henceforth) has the following two aspects:

(27) **A-licensing potential** (Harris 1992a: 384)

The a-licensing potential of a skeletal position refers to its ability either

a. to directly a-license a melodic expression, or

b. to confer a-licensing potential on another position.

With regard to (27a), skeletal positions may not dominate any melodic materials, as indicated in the ECP. Recall also licensing constraints in standard Turkish demonstrated in 1.3. While the charm property is not used, a-licensing plays a major role in restricting the possibilities of combination of elements in a particular language.

(27b) indicates that a licensed position acquires a-licensing potential from another position, namely its licenser. This inherited nature of the a-licensing potential of a licensed position is formalised as follows:

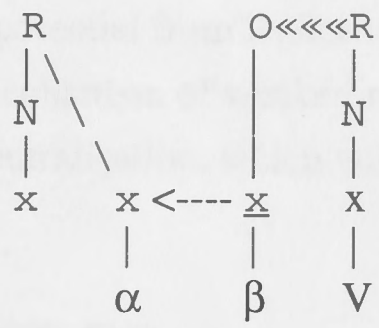
(28) **Licensing Inheritance** (Harris 1992a: 401)

A licensed position inherits its licensing potential from its licenser.

A significant implication of this statement is that there is a prosodic hierarchy by which a licensed position inherits an a-licensing capacity weaker than that of its licenser. Harris has demonstrated that it is possible to capture lenition processes in dispersed contexts in an unified way, in terms of the prosodic hierarchy. Look at the following interconstituent lenition site proposed by Harris. (Segments tend to be weakened in $\alpha$ position.)

(29) **Preconsonantal lenition**

Interconstituent Government

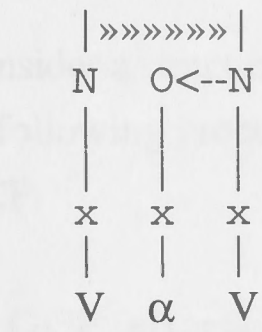



As noted before, this structure involves onset-to-coda government. What is relevant to the weakening of α is that it occurs in a position the licenser of which is itself licensed by another position. That is, its a-licensing potential is weakened as it is inherited along the licensing path {nucleus → onset → coda}. This weak a-licensing potential allows the coda position to dominate only limited segments of a language.

The following structures illustrate lenition processes in intervocalic and word-final positions. These contexts have been identified as classic lenition contexts together with the above preconsonantal position (Harris 1992a).

(30) a. **Intervocalic lenition** b. **Word-final lenition**

Internuclear Government




Final-empty nuclei parameter [ON]


Lenition processes in these contexts are also explained in terms of Licensing Inheritance. (30a) shows that a left-headed binary foot is constructed on the two nuclei. The weak a-licensing potential of the onset is attributable to the fact that its licenser, i.e. the following nucleus, is governed by the preceding nucleus. The governed nucleus transmits only a limited a-licensing potential to its onset and, as a result, the onset cannot dominate all underlying

segmental materials. In (30b), a final empty nucleus is licensed by the parametric setting. The empty nucleus is identified as a weak a-licensing licenser, as it does not dominate any segmental material. The lenition of α in the onset position is due to the fact that this position obtains only weak a-licensing potential from its licenser, the following empty nucleus.

The mechanism of weakening processes is important for the analysis of Korean neutralisation, which will be discussed in Chapter Five.

## 1.5 OCP Effects

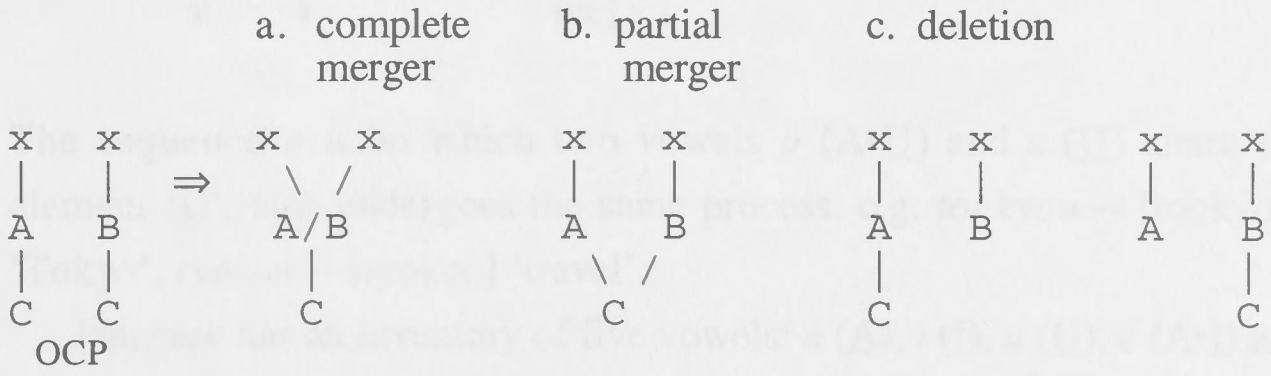
The Obligatory Contour Principle (OCP) was first proposed by Leben (1973), and has subsequently been taken up in a considerable number of articles (McCarthy 1986; Odden 1986; Yip 1988, and others). It has been shown within the framework of GP that this principle applies to individual elements (Charette 1991; Gibb 1992; Yoshida 1993; Y Heo 1994), as well as to two identical segments. From the element-based point of view, the OCP may be formulated as follows:

(31) **Obligatory Contour Principle**

Identical elements are prohibited from being adjacent at the level of $p^0$ projection, i.e. the projection containing every skeletal point.

Consider a structure where two segments share a certain element C. One of the following processes may take place in order to avoid the violation of the OCP.

(32) **OCP effects**




(A, B, C = some elements, A/B = A or B)

(32a) and (32b) show that two segments which contain the common element C merge completely into a single segment as in (32a), or partially as in (32b). In (32c), C is deleted from one of segments involved. In what follows I will provide some examples of each case.

### 1.5.1 Merger

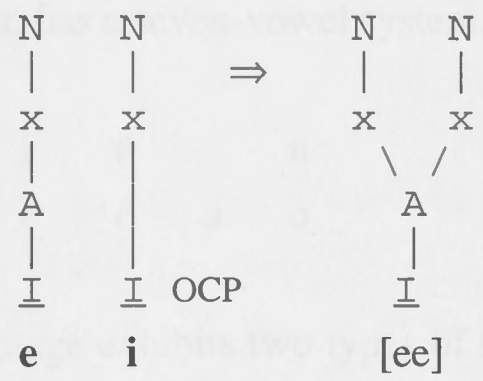
Let us first consider complete merger. In standard Japanese the two vowels *e* and *i* are not permitted to be adjacent when there is no intervening morpheme boundary.

(33)

| **Orthography** | | **Pronunciation** | |
|---|---|---|---|
| eikyou | --- | [eekyoo] | 'effect' |
| keisatsu | --- | [keesatsɯ] | 'police man' |
| kirei | --- | [kiree] | 'pretty' |

Even if the sequence *e-i* underlyingly occurred, it is monothongised by the OCP. Both segments *e* (A•I) and *i* (I) have the common element 'I'. This 'I' triggers the OCP, resulting in complete merger.

(34) **Japanese *e-i* sequence**



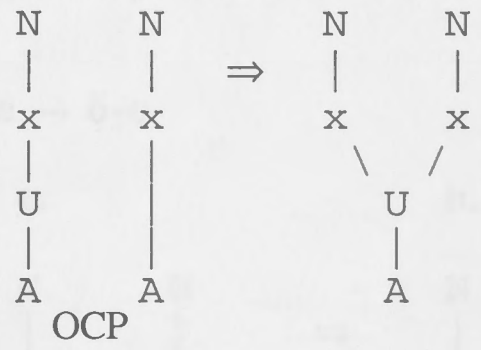

The sequence *o-u*, in which two vowels *o* (A•U) and *u* (U) share the element 'U', also undergoes the same process, e.g. *toukyou* -- [tookyoo] 'Tokyo', *ryokou* -- [ryokoo] 'travel'.

Japanese has an inventory of five vowels: *a* (A), *i* (I), *u* (U), *e* (A•I) and *o* (A•U). Notice that the common elements 'I' in *e-i* and 'U' in *o-u* are

heads in each segment. When two vowels do not share an identical head, they may be adjacent to each other. Thus, for example, the A-headed *a* (A) can occur next to *e* (A•I) or *o* (A•U), e.g. *kaeru* 'flog', *kaori* 'smell'. In this way, these Japanese OCP effects take place only when participating segments share an identical element as a head. Yoshida (1991) refers to this type of OCP as the Common Head OCP.

Yokuts rounding harmony also presents the OCP effect of complete merger. As noted in Mester (1988), when a root vowel is rounded and shares a property [nonhigh] with a suffix vowel, the suffix becomes rounded, e.g. *suug-al* 'might pull out', *xat-al* 'might eat', but *hotn-ol* 'might take the scent'. This process is triggered by the common element 'A' in both the root and the suffix vowels, and results in the sharing of the element 'U'.

(35)




**hotn-ol**

Next, we consider rounding harmony in Khalkha Mongolian as an example of partial merger. As cited in Goldsmith (1985), Khalkha Mongolian has a seven-vowel system.

(36)

| | | | | |
|---|---|---|---|---|
| i | ü | | | u |
| e | ö | a | | o |

This language exhibits two types of harmonic processes. The first type is backness harmony by which all vowels of a word must agree in backness, so that they are either all back vowels, e.g. *ulaang* 'red', *oyuun* 'wisdom, intellect', *galuu* 'goose', or front vowels, e.g. *xöxüür* 'wineskin', *ünee* 'cow', *enüün* 'this, it, she, he'.

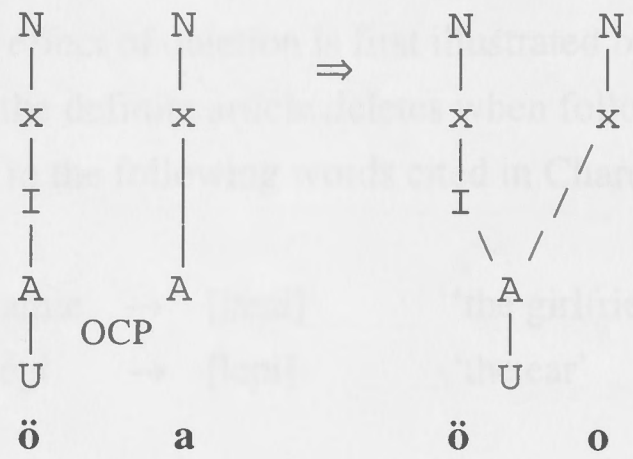
Relevant to the present discussion of partial merger is the second type, rounding harmony, by which unrounded vowels become rounded. What is

interesting is that only the nonhigh vowels *e* and *a* participate in this process, and the high vowels *u, i* do not undergo or trigger the harmony. According to Goldsmith, the rounding harmony is expressed as below.

(37) $\left\{ \begin{matrix} o \\ ö \end{matrix} \right\} C_0 \left\{ \begin{matrix} e \\ a \end{matrix} \right\} \Rightarrow \left\{ \begin{matrix} ö \\ o \end{matrix} \right\}$

(37) indicates that the unround nonhigh vowels *e* and *a* are converted to *ö* and *o*, respectively, after the round nonhigh vowel *o* or *ö*. This harmonic process reflects the OCP effect of partial merger. Note that the nonhigh vowels {e ö a o} are distinctive from the high vowels {i ü u} in that they contain the element 'A' which specifies lowness. It is thus clear that only the vowels containing 'A' participate in the rounding harmony. The rounding harmony in the case of *ö-a*, for example, is illustrated as follows.

(38) **ö-a → ö-o**




In (38a) the two nuclei are linked with vocalic segments which contain 'A'. These nuclei are adjacent at the level of nuclear projection. Containing the identical element 'A', the structure is under influence the OCP effect of partial merger. This partial merger yields a structure where the vowels involved share 'U', as shown in (38b).

Two types of harmony, i.e. backness harmony and rounding harmony, are illustrated by the examples below. (The examples are taken from Goldsmith 1985.)

(39) a. yaba-yaa 'let me go'
nee-yee 'let me open'
oro-yoo 'let me enter'
ögö-yöö 'let me give'

b. suu-yaa 'let me sit down'
nüü-yee 'let me move'

The examples in (39a) show that the suffix *-yaa* is realised as *-yoo* or *-yöö* when preceded by a root that has a rounded vowel, while it maintains the underlying form when preceded by the unrounded vowel *a*. The conversion of *-yaa* to *-yee* in the second example (as well as in the second example in (39b)) is due to the backness harmony. In (39b), the suffix is not rounded, showing that the high rounded vowel *u* does not trigger the rounding harmony.

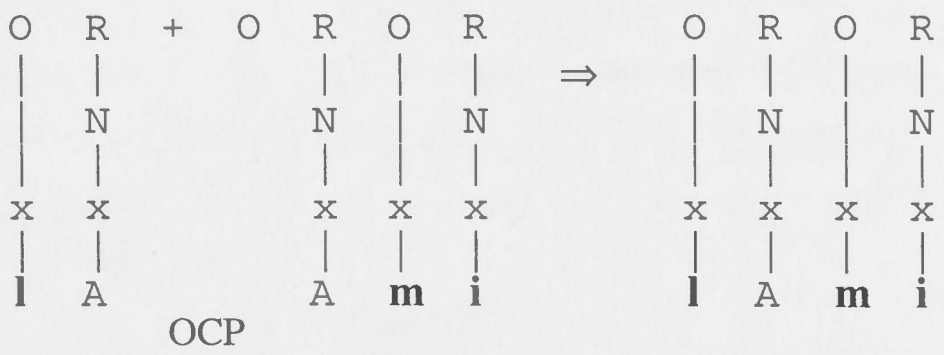
## 1.5.2 Deletion

The OCP effect of deletion is first illustrated by French data. In French, the vowel of the definite article deletes when followed by a vowel-initial word, as shown in the following words cited in Charette (1991).

(40) la amie → [lami] 'the girlfriend'
le épi → [lepi] 'the ear'

According to Charette, this deletion is due to the OCP. The derivation of the word *lami* is given below.

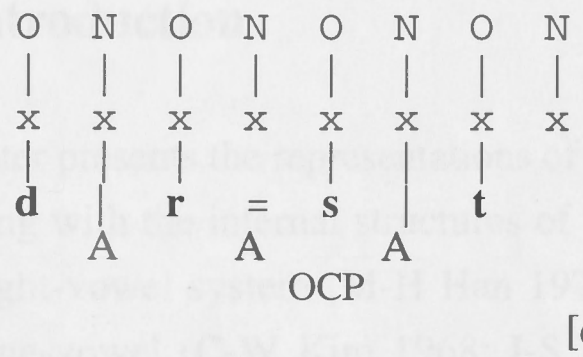
(41)



The first representation shows that two identical vowels *a* are adjacent to each other, hence the structure is ill-formed in terms of the OCP. One of the vowels is deleted yielding the second structure, where the structure no longer violates the OCP.

Palestinian Arabic also exhibits the deletion effect. When a word such as *daras* 'studied (3 singular, masculine)' is followed by the suffix *-u* (plural) the stem-final *a* is not deleted, and thus *darasu* obtains. However, when it is followed by the suffix *-at* (singular, feminine), the stem-final *a* is deleted, giving rise to the surface form *darsat.* Yoshida (1993) shows that the deletion of the stem-final *a* is due to the OCP.

(42)




[darsat]

# 2

# Representations of Segments in Korean

## 2.0 Introduction

This chapter presents the representations of segments in Korean. In section 2.1, dealing with the internal structures of vowels, I advocate that Korean has an eight-vowel system (M-H Han 1979; H-S Sohn 1987, etc) rather than a nine-vowel (C-W Kim 1968; I-S Jeong 1973, etc) or ten-vowel system (W. Heo 1965; B-G 1979, etc).

Section 2.2 and 2.3 discuss the representations of consonants. Regarding the representation of coronal segments, Bakely (1993) proposes that coronal segments are non-specified for articulatory place, while Brockhaus (1994) and Cyran (1994) claim that 'A' presents coronality in non-nuclear positions. In favour of the latter claim, I will provide evidence that coronals must be analysed as having an active element for their place of articulation.

In section 2.4 I will investigate the syllabic status of glides in Korean. Glides have been treated as part of either a branching onset (S-C Ahn 1985; S-H Park 1990, etc) or a branching nucleus (H-S Sohn 1987; C-W Kim & H-Y Kim 1991, etc). I will argue that neither of these is appropriate for the syllabic status of glides in Korean. It will be shown that relevant data suggest that a glide and a following vowel form a light diphthong in which the glide and the vowel are attached to a single nuclear position.

## 2.1 Vowels

There is a disagreement among Korean phonologists with respect to the number of monophthongs in modern standard Korean.

(1)

| | | | | |
|---|---|---|---|---|
| i | (ü) | ɨ | | u |
| e | (ö) | ə | | |
| ɛ | | | o | |
| | | a | | |

The disagreement is due to different views as to whether or not Korean has the front round vowels *ü* and *ö*. There are three different views:

(2) (i) **10-vowel system**: Both *ü* and *ö* are monophthongs.
(W. Heo 1965; K-H Lee 1977; B-G Lee 1979; S-C Ahn 1985; C-G Kim 1993)

(ii) **9-vowel system**: *ö* is a monophthong but *ü* is a diphthong.
(C-W Kim 1968; I-S Jeong 1973)

(iii) **8-vowel system**: Both *ü* and *ö* are diphthongs.
(W-J Kim 1972; Fujisaki & Kim 1973; M-H Han 1979; H-S Sohn 1987; Magen & Blumstein 1993; Umeda 1994)

These different views are further due to a different interpretation of the effects of historical monophthongisation, which took place in Middle Korean. It is true that the vowels *ɛ* and *e* in modern Korean are derived from the diphthongs *ai* and *əi* through the historical monophthongisation (W. Heo 1965; W-J Kim 1971; K-M Lee 1982). It is claimed by advocates of nine- and ten-vowel systems that *ü* and *ö* are also historically derived from the diphthongs *ui* and *oi*, respectively. In the ten-vowel system both *ui* and *oi* are claimed to have been monophthongised and in the nine-vowel system only *oi* has been monophthongised.

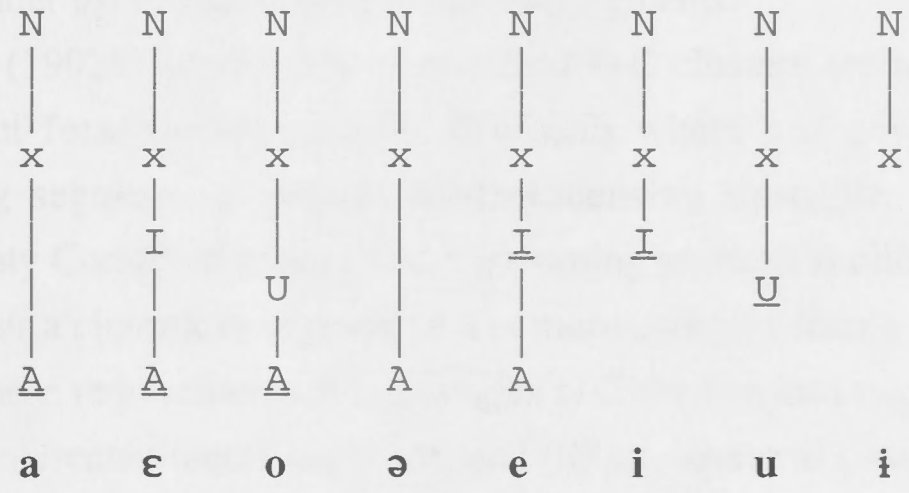
Aside from the historical change, there is no doubt that the vowels *ɛ* and *e* are monophthongs in modern Korean. As for *ü* and *ö*, however, their monophthongal status is unacceptable. First of all, there is no evidence which supports the monophthongal status of *ü* and *ö*. Note also that for the phonetic value of *ö* and *ü*, even some phonologists who propose the nine-

or ten-vowel systems acknowledge that these two vowels are realised as monophthongs only in a limited environment; that is, when preceded by a coronal consonant such as *n, t, s, c,* $c^h$ (W. Heo 1965; I-S Jeong 1973). However, they do not provide an explanation as to why these vowels are monophthongs only in such an environment.

While the existence of *ü* and *ö* is dependent on the assumption of the historical monothongisation rather than their phonetic value, studies based on experimental phonetics reveal that these two vowels are not monophthongs but diphthongs (M-H Han 1979).

As there is no evidence in favour of the nine- or ten-vowel system, I will respect experimental results and adopt the eight-vowel system. (3) illustrates the representations of monophthongs in Korean. (Heads are underlined; a segment without an underlined element is empty headed.)

(3) **Representations of vowels**




Regarding the vowel *ɨ*, I assume that this vowel is the phonetic manifestation of an empty nucleus. Put differently, empty nuclei are phonetically realised as the vowel *ɨ* in Korean, in certain conditions. The conditions on phonetic realisation/non-realisation of empty nuclei will be discussed in Chapters Five and Six.

For the representations of other vowels, I propose the following licensing constraints.

(4) **Licensing constraints in Korean**

a. 'I' and 'U' cannot be combined.
b. 'U' does not license operators.

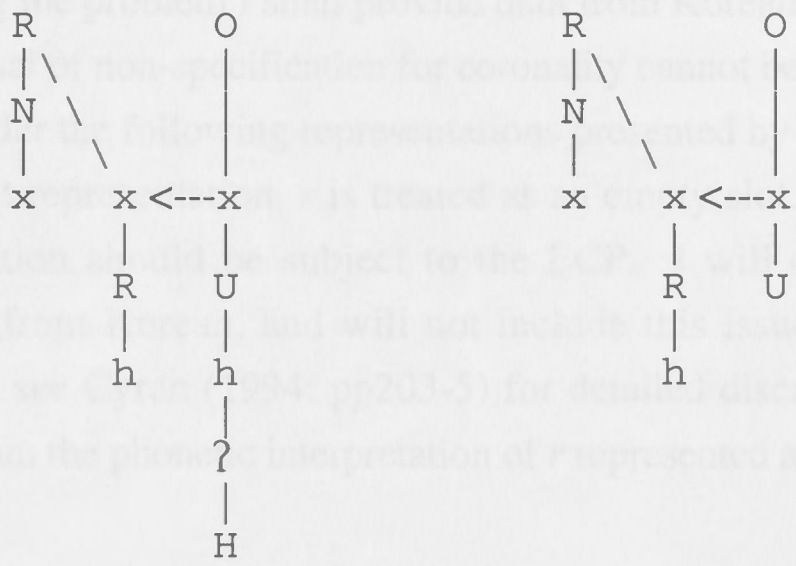
Constraint (4a) indicates the non-existence of vowels which contain 'I' and 'U'. The absence of the expressions *(A•I•U)=*ö* and *(I•U)=*ü* is captured by this constraint. Korean has three-way contrast in front vowels, i.e. *i-e-ɛ*, while back vowels have only two-way contrast, i.e. *u-o*. This asymmetry is due to the constraint (4b), which indicates that 'U' cannot be a head of a complex expression, and thus, the segment *(A•U), as well as *(A•I•U), is eliminated from the vowel inventory. The validity of these constraints and representations of vowels will be discussed in Chapter Three, where we consider vowel harmony.

## 2.2 Representation of Coronal Segments

Before presenting the internal structure of the Korean consonants, we will first consider the representation of coronal segments.

Kaye (1992b) shows that word-initial s+C clusters are not branching onsets but form interconstituent structures where *s* is governed by the following segment, as per the Coda Licensing Principle. Charm and Complexity Condition require that a governing segment is either a charmed segment or a charmless segment that is more complex than *s* (R•h). In the light of these requirements, Kaye divides s+C clusters into two groups: (i) a natural (interconstituent) sequence, and (ii) an unnatural (interconstituent) sequence (For more details, see Bakely 1993 and Cyran 1994). (5) gives illustrations of each group ((5b) is taken from Bakely 1993: 304).

(5) a. **-sp-** b. **-sw-**

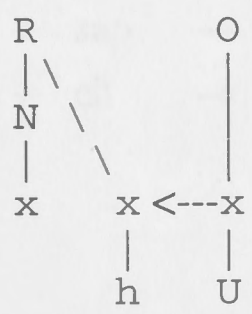



spell swim

(5a) illustrates the 'natural' s+C sequence. Sequences such as *sp*, *sk*, and *st* belong to this group. They are indisputably recognised as being interconstituent structures, as an obstruent in the governing position is charmed as well as being more complex than the complement *s*. The 'unnatural' sequence, which is illustrated in (5b), includes *sr*, *sj* and *sw*. In these sequences *s* is still treated as occurring in the governed coda position, despite the less complexity of the second segment which occupies the governing onset.

To solve the problem of the 'unnatural' sequence, Bakely (1993) proposes that the coronal element 'R' does not exist in phonological representation. Under this proposal, *s* is represented as a single element 'h'. Accordingly, the 'unnatural' sequence is no longer ill-formed, as *s* is now represented as being a simplex segment and no more complex than a governor, for example, the simplex segment *w* in a particular cluster *sw*.

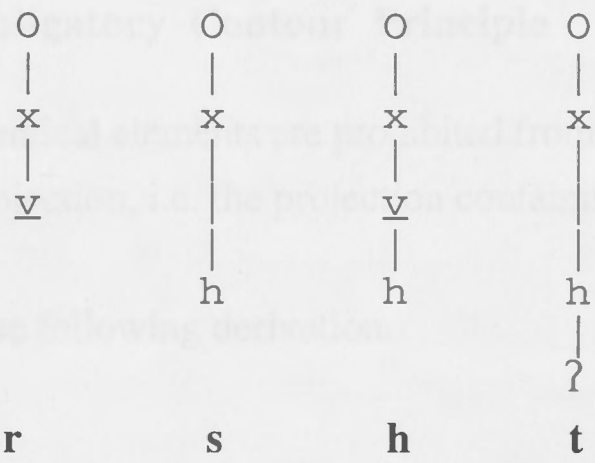
(6) **-sw-** (Bakely 1993: 310)



Although this proposal would solve the immediate problem of 'unnatural' sequences, the overall results now lead to another problem. Below, in discussing the problem I shall provide data from Korean which suggest that the proposal of non-specification for coronality cannot be accepted.

Consider the following representations presented by Bakely. As shown in the first representation, *r* is treated as an empty slot. Thus its phonetic interpretation should be subject to the ECP. I will concentrate on the evidence from Korean, and will not include this issue in my argument. However, see Cyran (1994: pp203-5) for detailed discussion of problems arising from the phonetic interpretation of *r* represented as an empty onset.

(7)




('v̲' indicates an empty head.)

Given that the coronal consonants are represented with coronality left unspecified, we now have no means of characterising the common property of these segments. This raises the problem of how we handle processes involving only coronals. Observe the following data involving historical liquid-deletion found in compound nouns in Korean.

(8)

| | | | | | | |
|---|---|---|---|---|---|---|
| a. | sor | + | namu | → | sonamu | 'pine+tree' |
| | kyəur | + | nɛ | → | kyəusɛ | 'winter+during' |
| | pur | + | sap | → | pusap | 'fire+shovel' |
| | panɨr | + | cil | → | panɨcil | 'needle+action' |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| b. | sor | + | paŋul | → | solpaŋul | *sopaŋul | 'pine+bell' |
| | kyəur | + | param | → | kyəulparam | *kyəuparam | 'winter+wind' |
| | pur | + | koki | → | pulkoki | *pukoki | 'fire+meat' |
| | panɨr | + | man | → | panɨlman | *panɨman | 'needle+only' |

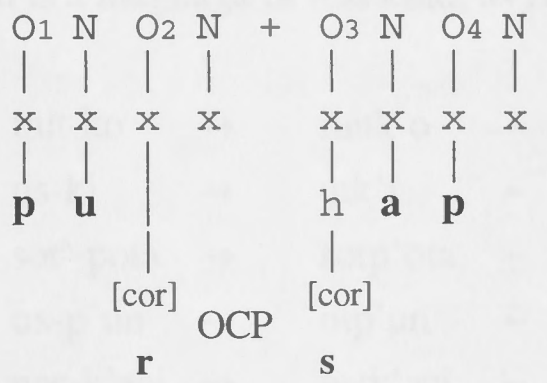
(8a) shows that the final liquid *r* of the first word is deleted when followed by a coronal consonant, whilst it remains and is converted to *l* when the following consonant is non-coronal as shown in (8b).[1] This process is captured in terms of the OCP, which prohibits identical elements from being adjacent.[2]

(9) **Obligatory Contour Principle**

Identical elements are prohibited from being adjacent at the level of $p^0$ projection, i.e. the projection containing every skeletal point.

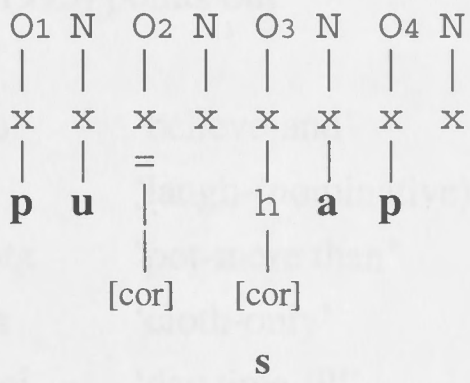
Look at the following derivation.

(10) a.




( [cor] = coronality)

b.




[pusap]

In (10a), segments in the two onsets O2 and O3 share an identical property, i.e. [coronality]. Since the nucleus in the middle has no segmental material, two onsets directly face each other. These [coronality]s are affected by the OCP, and the result is the deletion of the first [coronality] as shown in (10b) above. Verbal forms in modern Korean also exhibit an identical process.

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1 In preconsonantal position, *r* is realised as *l*. Details of the distribution of liquids are given in Chapter Six.

2 See 1.5 for detailed discussion of OCP.

| | | | | | |
|---|---|---|---|---|---|
| (11) | ar 'know' | -sita | '(honorific)' | → | asita |
| | | -nik'a | 'because' | → | anik'a |
| | | -camaca | 'as soon as' | → | acamaca |
| | | -ko | 'and' | → | alko |
| | | -myən | 'if' | → | almyən |
| | | -a | '(infinitive)' | → | ara |

Needless to say, the OCP effect of deletion discussed above presupposes that the participants have a certain property in common. According to Bakely's representation, *r* and *s* possess no such property: *r* is represented as having no active elements and *s* contains only 'h'. With these representations we encounter difficulty in dealing with the OCP effect of deletion on coronal segments.

Let us next consider coronal assimilation, which is provided by Bakely as supporting evidence of his proposal. Bakely argues that coronal assimilation, in which coronal segments assimilate to another place of articulation, is due to the lack of the place-defining element 'R' in coronals. Korean is a language of this kind, as Bakely (1993) points out.

| | | | | | | |
|---|---|---|---|---|---|---|
| (12) | mit-ko | → | mitk'o | ~ | mikk'o | 'believe-and' |
| | us-ki | → | utk'i | ~ | ukk'i | 'laugh-(nominative)' |
| | sot$^{h}$-pota | → | sotp'ota | ~ | sopp'ota | 'pot-more than' |
| | os-p'un | → | otp'un | ~ | opp'un | 'cloth-only' |
| | nac-k'aci | → | natk'aci | ~ | nakk'aci | 'day time-till' |

The words in (12) show that stem/noun-final coronals are optionally assimilated to the following segments. However, this assimilation does not immediately indicate the lack of a place element for *r*-sounds. In Korean, as indicated by a number of researchers (W. Heo 1965; B-G Lee 1979 and others), labial segments also lose their identity when followed by a velar segment.

| | | | | | | |
|---|---|---|---|---|---|---|
| (13) | cap-ko | → | capk'o | ~ | cakk'o | 'catch-and' |
| | tərəp-ko | → | tərəpk'o | ~ | tərəkk'o | 'dirty-and' |
| | sip-k'aci | → | sipk'aci | ~ | sikk'aci | 'ten-till' |
| | kamki | → | kamki | ~ | kaŋki | 'influenza' |

What this data shows is that the assimilation of coronal segments to bilabial or velar segments is not because of the lack of a place-defining property. If the assimilation is really to be attributed to the non-existence of the place element, we would expect that only coronal segments would be influenced by the process, and that bilabial segments would not be, since they contain the active element 'U'.[3]

In fact, Bakely (1993: 312) provides the following example (14a) to show that labials are not affected by velars. (There is an error in the transcription. The correct forms for the given meaning are shown in (14b).) However, as illustrated in (14b), *pakk'wa* is also possible.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (14) | a. | pap-ko | → | papk'o | ~ | *pakko | 'rice-and' |
| | b. | pap-kwa | → | papk'wa | ~ | pakk'wa | 'rice-and' |

To sum up, Bakely's proposal takes the problem with the 'unnatural' s+C clusters as a starting point. Under the assumption that s+C clusters have an interconstituent structure, *s* must be governed by the following C, but in sequences *sw*, *sj* and *sr*, *s* has a greater complexity than its governor *w*, *j* or *r*. The solution which Bakely adopts is to assume the special status of *s* — *s* is unspecified for articulatory place.

There is, however, another possibility in dealing with this problem. That is to assume that the 'unnatural' s+C clusters such as *sl*, *sw*, *sj* have a different representation from the 'natural' s+C clusters, i.e. *st*, *sp* and *sk*, etc. In fact, these two types of clusters have different distributions in English. As pointed out by Cyran (1994: 197), the 'unnatural' sequences must always be followed by a vowel, but the 'natural' sequences are not restricted to this context. Hence, word-final s+C clusters are limited to the 'natural' sequences *st*, *sp* and *sk*. A similar type of restriction is found in

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[3] This asymmetric assimilation can be explained in terms of a certain hierarchy expressed as { velar > labial > coronal }.

Irish with the exception that every word-final *sl* is broken by a vowel, e.g. *uasal* [uəsəl] 'noble' (Cyran 1994). In light of the distributional facts in English, and bearing the s+C clusters in Irish in mind, Cyran concludes that the 'unnatural' s+C clusters cannot structurally be viewed as identical with the 'natural' sequences.

So far, I have argued that *r*-sounds cannot be analysed as being non-specified for articulatory place, i.e. coronality. This, however, does not immediately suggest that we should return to the original representation and again use 'R'. Regarding the possibility of re-adoption of 'R', it is worth noting that, as pointed out by Bakely (1993), in the original version of element theory, 'R' was treated as an exceptional element among the group of elements informally referred to as resonance or place-defining elements, comprising 'I', 'U', 'A', 'v' as well as 'R' itself. First, 'R' is never seen as an active element in harmony processes, whereas there is little difficulty in finding spreading processes of other resonance elements. Secondly, among these resonance elements, 'R' is the only one which specifies consonantal articulatory place that has no corresponding vocalic equivalent. Moreover, the 'R' element is also treated as an exception in element fusion. Other resonance elements can freely combine with each other to yield complex vocalic expressions in accordance with language-specific parameters. 'R', however, does not participate in fusion with other vocalic elements. These facts therefore suggest that the re-adoption of 'R' is undesirable, since if we choose this option and adopt again the once abandoned element 'R', we will continue to be faced with this unnatural behaviour of 'R'.

Another conceivable option is to produce a completely new element for coronality. This option is, however, not likely to be reasonable, either. In connection with the point that 'R' specifies only consonantal articulatory place, I suggest that any proposal in favour of a newly-postulated element would provide no more advantage over re-adoption of 'R'. No matter which element is accepted, the element should be one that represents the class of coronal segments as well as a certain property of vocalic segments, which is represented by other resonance elements, i.e. 'I'. 'U', 'A' and 'v'. It seems, however, that there is no appropriate candidate to replace 'I', 'U', 'A' or 'v' in representing vocalic segments in the present representation system.

Up to this point, I have pointed out that neither re-adoption of 'R' nor creation of a new element for coronality is desirable. It should be noted here that there is a claim that 'A' represents coronality in non-nuclear positions. Broadbent (1991) discusses the possibility that 'linking' and 'intrusive' *r* in English can be analysed as A-glide, that is, a manifestation of the element 'A' in a non-nuclear position. Further, Brockhaus (1994) has argued that *r* in German (Northern Standard) contains 'A' in its representation. The presence of 'A' in coronal segments of Munster Irish has also been discussed in Cyran (1994).

If we choose the element 'A' to represent coronality, the problems of 'R' will disappear. The presence of 'A' in phonological representation is well-attested, as can be illustrated by A-element height harmony observed in, for example, Pasiego Spanish and some central Bantu languages (Harris & Lindsey 1994). By assuming 'A' as a property representing coronality in non-nuclear positions, we also obtain a representation system which allows no resonance element that represents only consonantal articulatory place without having a corresponding vocalic equivalent. To conclude, I would like to adopt 'A' as an element that specifies coronality in non-nuclear positions, and present the class of coronal segments in Korean as 'A'.

## 2.3 Consonants

The following diagram (15) shows the consonantal inventory of Korean. There is a three-way phonation contrast for stops and affricates, namely neutral (C), aspirated ($C^h$), and tensed segments (C'). For fricatives, neutral *s* and tensed *s'* are found in addition to the glottal fricative *h*. Korean also has three nasals, *n*, *m* and *ŋ*, and the liquid *r*.

(15)

| | | | | | |
|---|---|---|---|---|---|
| **Stops/Affricates**: | p | t | c | k | |
| | p' | t' | c' | k' | |
| | $p^h$ | $t^h$ | $c^h$ | $k^h$ | |
| **Fricatives**: | | s | | | h |
| | | s' | | | |
| **Nasals**: | m | n | | ŋ | |
| **Liquid**: | | r | | | |

The ternary opposition of stops and affricates is illustrated below.

(16)

| | | | | |
|---|---|---|---|---|
| pul | 'fire' | | tal | 'Moon' |
| p'ul | 'hone' | | t'al | 'daughter' |
| $p^h$ul | 'grass' | | $t^h$al | 'mask' |
| kɛ-ta | 'clear' | | ca-ta | 'sleep' |
| k'ɛ-ta | 'wake up' | | c'a-ta | 'squeeze' |
| $k^h$ɛ-ta | 'dig out' | | $c^h$a-ta | 'kick' |

The neutral segments are slightly aspirated. The aspirated segments are heavily aspirated sounds, and the tensed segments are produced with great tension of the vocal cords and unaspirated.[4]

KLV (1987) suggest that the neutral consonants in Korean are produced with the vocal cords in a neutral state and may or may not vibrate, subject to the surrounding energy level. Following their suggestion, I assume that neutral obstruents contain neither 'H' nor 'L', which represent 'stiff vocal cords' and 'slack vocal cords', respectively. For the tensed and aspirated consonants, what is relevant to their representations is the high tone element 'H'. This element is responsible for the fully voiceless or fortis articulation. While the fully voiceless aspirated consonants are represented as a non-contour structure, I will represent the tensed consonants involving strong fortis as having a contour structure.

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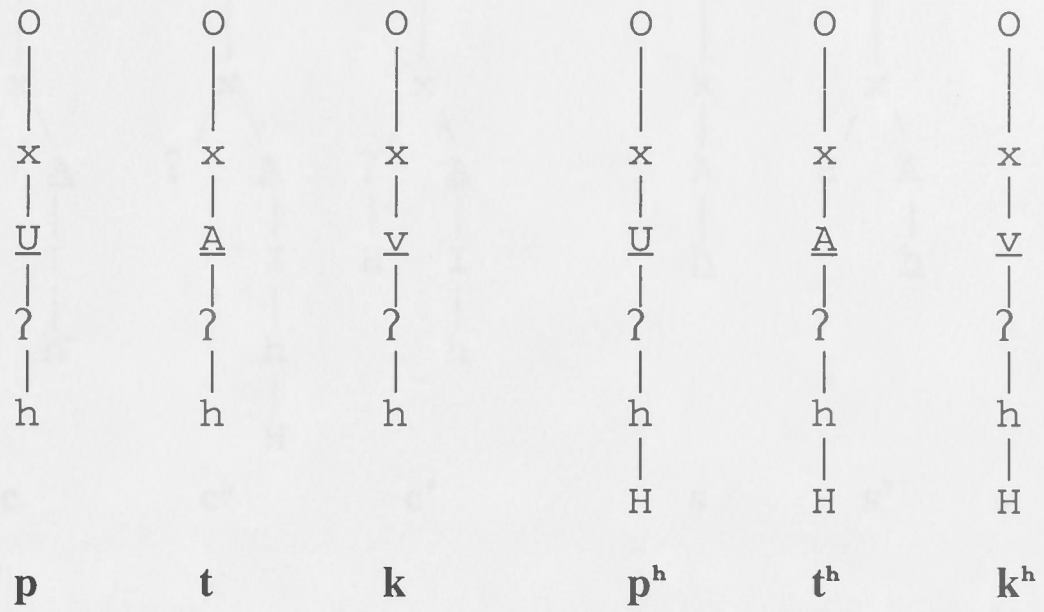
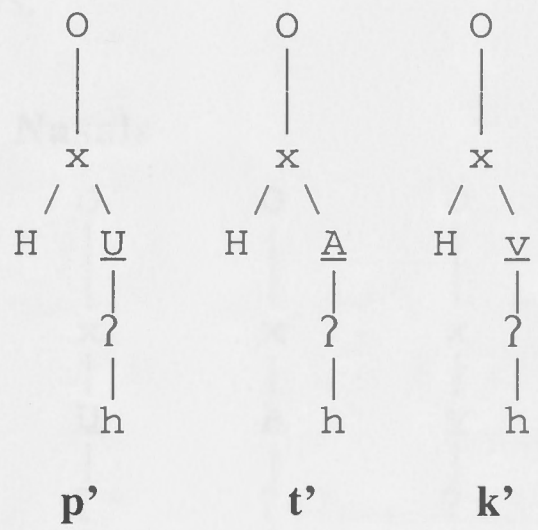
4 See C-W Kim (1970), M-S Han & Weitzman (1970), Y-S Kim (1972), Y-T Lee (1984) and Silva (1993), for detailed discussions of the difference in articulation of these three segments.

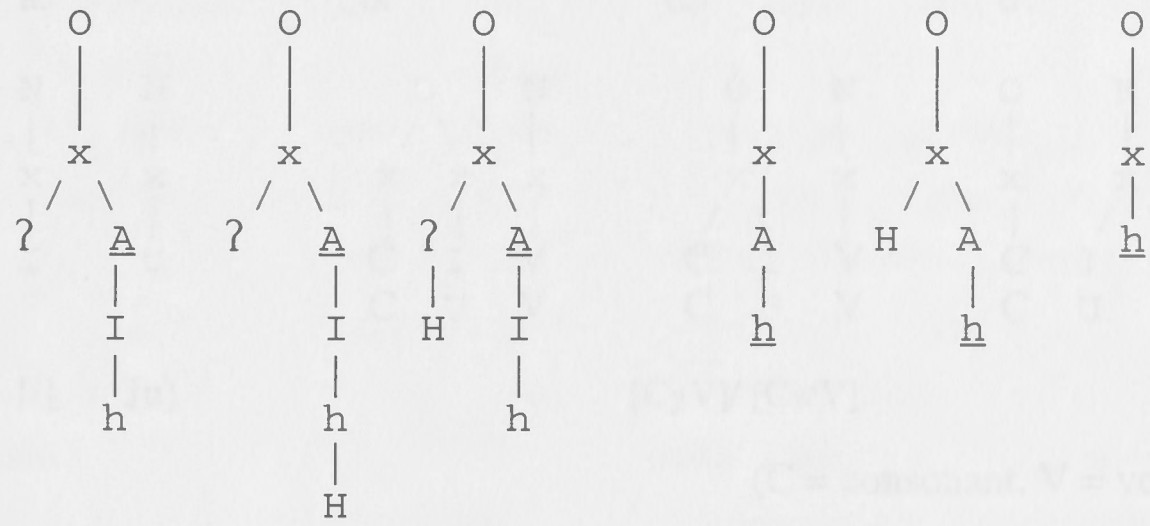
(17) **Stops**



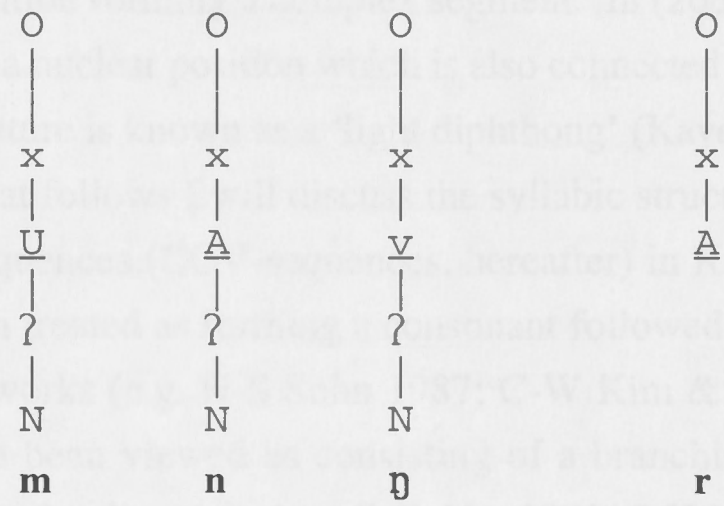

Let us now consider the representation of affricates. Harris (1990) shows that an affricate can be derived from a stop without an elemental loss. What is involved in affrication is the breaking of the internal structure (of a stop) into a contour structure. I adopt the representation of affricates in Harris and propose that affricates in Korean have a contour structure where the element '?' (and 'H' for tensed one) is linked with a skeletal point separately from the other elements involved. The internal structures of affricates appear as in (18). The representations of fricatives are also given.

(18) **Affricates** **Fricatives**




The representations of three nasals, *m*, *n* and *ŋ*, and the liquid *r* are as follows.

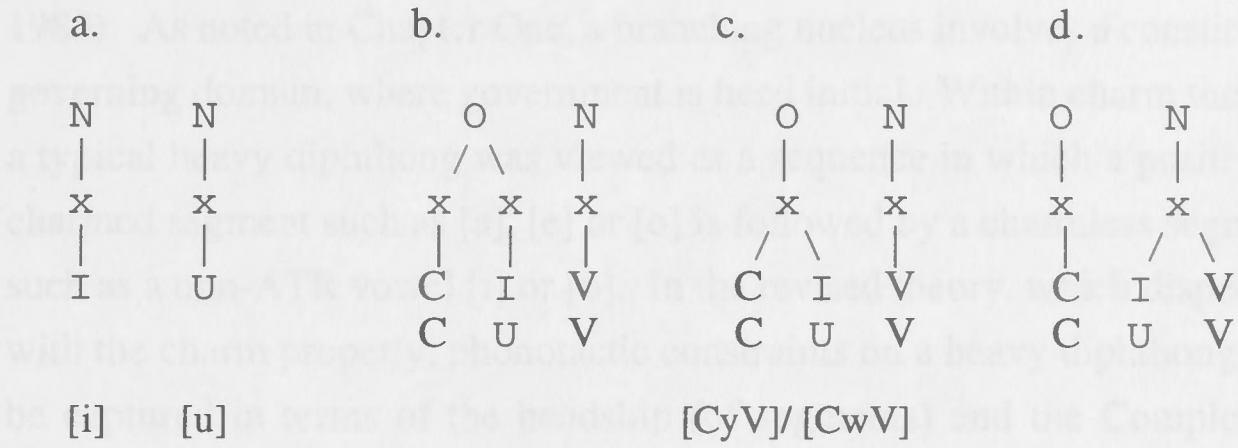
(19) **Nasals** **Liquid**




## 2.4 The Syllabic Status of Glides

Korean has the palatal glide *y* and the labio-velar glide *w*. Within an element-based framework *y* and *w* are represented as the elements 'I' and 'U', respectively. Notice that the vowels *i* (I) and *u* (U) also involve these elements. Whether the elements 'I' and 'U' are realised as glides or vowels is determined by the status of the syllabic position with which these elements are associated.

(20)




[i] [u] [CyV]/ [CwV]

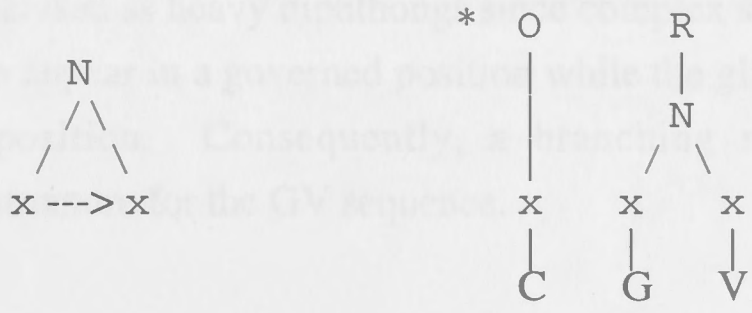
(C = consonant, V = vowel)

(20a) is the representation of the vowels *i* and *u*, in which the element 'I' or 'U' occupies a nucleus on its own. (20b)~(20d) illustrate three possibilities for the representation of the glides. (20b) is a branching onset. The element 'I' or 'U' is associated with the second skeletal point of the branching onset. (20c) shows that 'I' or 'U' and a preceding consonant are linked with an onset position forming a complex segment. In (20d), the element 'I' or 'U' occurs in a nuclear position which is also connected with a following vowel. This structure is known as a 'light diphthong' (Kaye 1985).

In what follows I will discuss the syllabic structure of consonant-glide-vowel sequences (CGV-sequences, hereafter) in Korean. CGV-sequences have been treated as forming a consonant followed by a branching nucleus in some works (e.g. H-S Sohn 1987; C-W Kim & H-Y Kim 1991), while they have been viewed as consisting of a branching onset followed by a vowel by other linguists (e.g. S-C Ahn 1985; S-H Park 1990).

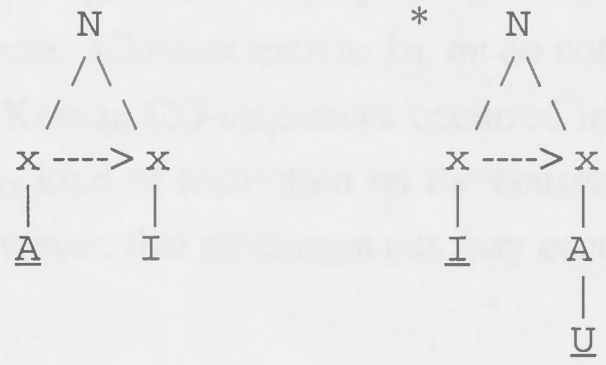
Let us first examine the possibility of a branching nucleus. Notice that a branching nuclear structure is not included in (20) above. In fact a GV sequence (in CGV) cannot be interpreted as a branching nucleus in any way.

(21) **Branching nucleus**



This branching nuclear structure is identified as a 'heavy diphthong' (KLV 1985). As noted in Chapter One, a branching nucleus involves a constituent governing domain, where government is head initial. Within charm theory, a typical heavy diphthong was viewed as a sequence in which a positively charmed segment such as [a], [e] or [o] is followed by a charmless segment such as a non-ATR vowel [ɪ] or [ʊ]. In the revised theory, which dispenses with the charm property, phonotactic constraints on a heavy diphthong can be captured in terms of the headship (of segments) and the Complexity Condition (cf. 1.3.1). Recall that tensed vowels are element-headed and lax vowels are empty-headed, and also that a segment in a governed position must be no more complex than that in the governing position. Thus, typically well-formed heavy diphthongs are those in which the first segment is a tensed vowel, whilst the second segment is simplex and empty-headed. Such sequences *uo*, *ue*, *io*, *ia* do not form a heavy diphthong, since the first segment is less complex than the following vowel. Well-formed and ill-formed branching nuclei are illustrated below.

(22)




The claim that a GV sequence forms a branching nucleus forces us to assume that a glide occurs in a governing position. Glides, however, cannot be governors, as they are simplex and headless. Moreover, GV sequences in Korean include, for example, *yo* and *ye*. Such sequences cannot be analysed as heavy diphthongs since complex segments *o* (U•A), *e* (A•I) have to appear in a governed position while the glide *y* (I) occurs in a governing position. Consequently, a branching nucleus is not an appropriate structure for the GV sequence.

Let us now examine the three possibilities given in (20) above.[5] To verify the first possibility, i.e. a branching onset for CG, we should recall that a branching onset involves head-initial government.

(23) **A branching onset**


Harris (1990) shows that there are severe restrictions in the quality and quantity of segments which may occur in a branching onset. A sequence of segments that share more than one element does not have a branching-onset structure (Harris 1990: 271). Clusters such as *dl*, *tl* cannot form a branching onset, since two members of each sequence share two elements 'A' and '?'. Further, a governee cannot contain more than two elements within a branching onset (Harris 1990: 277). Thus a nasal is not an appropriate segment occurring in a governed position as it has more than two elements. Clusters such as *kn*, *tm* do not form a branching onset.

If the Korean CG-sequences occurred in a branching onset, we would expect this kind of restriction on the consonant and following glide. The fact is, however, that all consonants may occur before a glide.

(24)

| | | | | |
|---|---|---|---|---|
| **Stops**: | kyəul | 'winter' | sakwa | 'apple' |
| | pyə | 'rice plant' | p'yocok | 'protruding' |
| | tityə | 'step on (inf.)' | t'wita | 'run (base)' |
| **Affricates**: | $c^h$wə | 'cold (inf.)' | cwi | 'mice' |
| | s'wa | 'fire off (inf.)' | swita | 'rest (base)' |
| | hyə | 'tongue' | hwa | 'disaster' |
| **Nasals**: | nwa | 'put on (inf.)' | myəniri | 'daughter-in-law' |
| **Liquids**: | səllyəŋ | 'although' | kyərwə | 'contend (inf.)' |

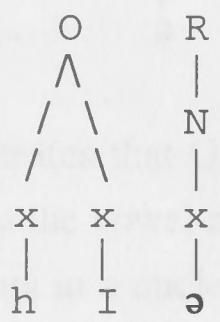
(inf. = infinitive, base = base form)

---

5 In verifying these three possibilities, I adopt the methodology from Yoshida (1991).

Crucially, (24) shows that even a simplex segment such as *h* (h) or *r* (ɹ) may cooccur with a glide. This distribution illustrates that CG-sequences in Korean do not form branching onsets. (25) illustrates the ill-formed branching onset structure for the word *hyə* 'tongue'.

(25) *




Let us now test the second and third possibilities, i.e. a complex segment and a light diphthong. These two possibilities can be verified in terms of the Principle of Free Cooccurrence (Kaye 1985).

(26) **Principle of Free Cooccurrence** (Kaye 1985)

> For a given language, every possible onset (defined in terms of skeletal points, not in terms of segments) occurs with every possible rhyme.

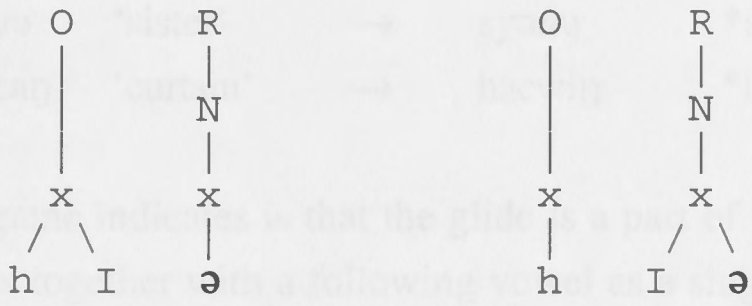
If CG clusters (in CGV-sequences) in Korean form a complex segment within an onset, a following vowel solely belongs to a nucleus (CG.V). Therefore, as stated in the Principle of Free Cooccurrence, it would be expected that any vowel may coexist freely with CG clusters. Possible glides in Korean are given below.

(27) Cye Cyɛ Cyə Cya Cyo Cyu
Cwi Cwe Cwɛ Cwə Cwa

(Korean vowels: a ɛ o ə e u i ɨ)

As shown, not all vowels in the inventory may appear after the CG cluster. This restriction in the cooccurrence of vowels with CG clusters denies the possibility of a complex segment for CG clusters as in (28a).

(28) *a. b.




(28b) illustrates that GV sequences form a light diphthong, where the element 'I' and the vowel ə are linked to a single nuclear point. Since a GV sequence occurs in a nucleus separate from a preceding onset (i.e. C.GV), the initial consonant C should cooccur freely with a following GV sequence as predicted by the Principle of Free Cooccurrence. The distributional fact that any consonants may cooccur with a GV sequence fulfils this requirement. Consequently, we reach the conclusion that GV-sequences in Korean are syllabified into a nucleus forming a light diphthong.

(29) **Korean Glides**

Glides in Korean form a light diphthong with a following vowel.

This light diphthongal structure is further supported by a language game which is supplied by H-S Sohn (1987). As demonstrated by Sohn, native speakers of Korean switch heterosyllabic vowels around without affecting other parts of the syllable. (Examples (30) and (31) are taken from Sohn 1987.)

| | | | | |
|---|---|---|---|---|
| (30) | hopak | 'pumpkin' | → | hapok |
| | pica | 'visa' | → | paci |
| | caŋc$^{h}$i | 'devices' | → | ciŋc$^{h}$a |

The same results are obtained in words which include glides, and GV sequences are systematically switched as a whole with a heterosyllabic vowel. The switching never creates the forms in the last column.

| | | | | | |
|---|---|---|---|---|---|
| (31) | karyəŋ | 'if' | → | kyəraŋ | *kəryaŋ |
| | hɛyəl | 'cooling' | → | hyəɛl | *həyɛl |
| | sunyə | 'sister' | → | syənu | *sənyu |
| | hwicaŋ | 'curtain' | → | hacwiŋ | *hwaciŋ |

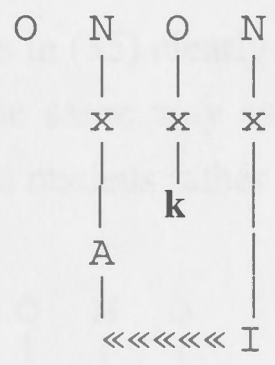
What this game indicates is that the glide is a part of the nucleus, and the glide moves together with a following vowel as a single unit. If the glide belonged to an onset, the glide would behave independently from the following vowel. Thus we would gain the results in the last column where the glide is left over from the switched vowels.

Umlaut provides further evidence in favour of the light diphthongal structure. The data in (32) shows that the vowels *a* and *ə* become respectively *ɛ* and *e* under the influence of the following vowel *i*.

| | | | | |
|---|---|---|---|---|
| (32) | aki | ~ | ɛki | 'baby' |
| | soncapi | ~ | soncɛpi | 'handle' |
| | məkita | ~ | mekita | 'eat (causative)' |
| | əmi | ~ | emi | 'mother' |

This process is interpreted as the regressive spreading of the element 'I' from the vowel *i* to a preceding vowel.

(33)



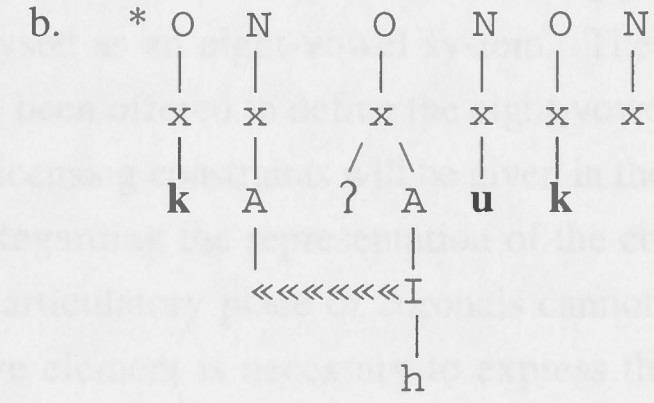

[ɛki]

We recall here that affricates in Korean contain the element 'I'. If 'I' in an onset also participates in the process, we would expect to observe the same result as in nucleus-to-nucleus spreading, with the vowels *ə* and *a* being converted to *e* and *ɛ* respectively when followed by an affricate, as shown in (34b) . The words in (34a), however, show that 'I' in an onset does not trigger the process.

(34) a.

| | | | |
|---|---|---|---|
| kəkc'əŋ | ~ | *kekc'əŋ | 'anxiety' |
| acumma | ~ | *ɛcumma | 'aunt' |
| kacuk | ~ | *kɛcuk | 'skin' |

b.




*[kɛcuk]

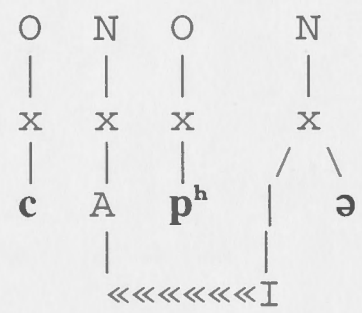
What is relevant to the present discussion of glides is the effect of the palatal glide *y* (I) on umlaut. Since the process involves nucleus-to-nucleus spreading, if the glide *y* belongs to a nucleus, we will expect that it will also trigger the process. If it is part of an onset, on the other hand, we will expect that this process does not take place.

(35)

| | | | |
|---|---|---|---|
| kaŋyət | ~ | kɛŋyət | 'water candy' |
| məkyə | ~ | mekyə | 'eat (infinitive)' |
| cap$^{h}$yə | ~ | cɛp$^{h}$yə | 'catch (passive)' |

The words in (35) clearly show that the glide affects the preceding vowel in exactly the same way as the vowel *i* does, demonstrating that the glide occurs in a nucleus rather than in an onset.

(36)




[cɛp$^{h}$hyə]

## 2.5. Conclusion

In this chapter, we have discussed representations of segments in Korean. For its vowel system, I pointed out that Korean does not have the front round vowels *ü* and *ö*, and accordingly the vowel inventory should be analysed as an eight-vowel system. The licensing constraints in Korean have been offered to define the eight-vowel system. Detailed discussion of the licensing constraints will be given in the next chapter.

Regarding the representation of the coronal consonants, I have argued that articulatory place of coronals cannot be non-specified, and hence an active element is necessary to express the property. The element 'A' is adopted for coronality in favour of the recent work in Brockhaus (1994) and Cyran (1994).

The syllabic status of glides in Korean has also been investigated. It was shown that glides cannot be analysed as either part of a branching nucleus or a branching onset, but form light diphthongs with a following vowel.

# 3

# Vowel Harmony

## 3.0 Introduction

The purpose of this chapter is to provide an element-based analysis of vowel harmony (VH hereafter) in Korean. Traditionally, VH in Korean has been viewed as the result of the harmonic opposition between 'light vowels' and 'dark vowels' (W. Heo 1965; Kim-Renaud 1976). Within feature-based approaches, VH has been treated as a process which involves either spreading of [±low] (B-G Lee 1977; McCarthy 1983; H-S Sohn 1987; S-H Park 1990), or spreading of [±ATR] (B-G Lee 1985; M-H Cho 1993).

In this chapter, I point out that the traditional vowel division between light vowels and dark vowels is not capable of dealing with all harmonic vowel patterns. The feature-based analyses, which adopt the traditional vowel grouping, also fail to provide an adequate account for certain vowel patterns. To address the problem, I propose an element-based solution, and show that all harmonic vowel patterns in Korean are explainable without exception from the perspective of an element theory.

This chapter is organised as follows. Sections 3.1 and 3.2 set out problems in the traditional vowel division and feature-based analyses. In sections 3.3 ~ 3.6, I propose an alternative solution and demonstrate how it works. Section 3.7 discusses a set of constraints on representations of Korean vowels in connection with vowel harmony.

## 3.1 Traditional Treatments

### 3.1.1 {light vowels} *vs.* {dark vowels}

Central to the traditional analysis of VH is the assumption that vowel harmonic grouping is determined by a semantic contrast of 'lightness' and 'darkness', according to which vowels are classified as 'light vowels' and 'dark vowels'.

(1) **Traditional vowel grouping**

| | | | | | |
|---|---|---|---|---|---|
| Light vowels | a | ɛ | o | | |
| Dark vowels | ə | e | u | i | ɨ |

This harmonic opposition is morphologically conditioned as it applies only to two particular morphological contexts; (i) sound symbolic (SS) words, and (ii) between a verbal stem-final vowel and an infinitive suffix. I shall call VH in these two contexts SSVH and INFVH, respectively.

Most SS words are disyllabic or polysyllabic words. In SSVH, all vowels belong to the same group as the initial vowel (henceforth, V1) does. Thus, if V1 is a dark vowel then non-initial vowels, i.e. second or third vowels (henceforth, V2), should also be dark, and if V1 is a light vowel then V2 should be light.

(2) **Sound symbolic words**

| *light* | *dark* | *Gloss* |
|---|---|---|
| k'aŋcʰoŋ | k'əŋcʰuŋ | 'skipping' |
| cʰals'ak | cʰəls'ək | 'lapping' |
| panc'ak | pənc'ək | 'flashing' |
| k'olk'ak | k'ulk'ək | 'swallowing' |
| sokt'ak | sukt'ək | 'whispering' |
| p'ɛcok | p'icuk | 'protruding' |
| cɛlkaŋ | cilkəŋ | 'chewing' |
| talkatak | təlkətək | 'rattling' |
| comollak | cumullək | 'kneading' |

Words that contain dark vowels express heavy and slow nuances, while words with light vowels express more or less light and fast nuances.

### 3.1.2 High-vowel transparency

There are two exceptional cases to which the light/dark vowel grouping does not apply. Data in (3) illustrates the first case, which involves the vowels *i* and *ɨ*.

(3) a. **In V1 position**

| | | |
|---|---|---|
| *t'ɨk'am | t'ɨk'im | 'sting' |
| *sɨlc'ak | sɨlc'ək | 'without notice' |
| *tiroŋ | tiruŋ | 'swaying' |
| *cik'al | cik'əl | 'chattering' |

b. **In V2 position**

| | | |
|---|---|---|
| paŋkɨs | pəŋkɨs | 'smiling' |
| salkɨm | səlkɨm | 'without noisy' |
| taŋsil | təŋsil | 'dancing' |
| t'ɛŋkɨraŋ | t'eŋkɨrəŋ | 'clanging' |
| k'okicak | k'ukicək | 'crumpling' |

(3a) shows that light vowels {a ɛ o} cannot occur in V2 when V1 is the dark vowel *i* or *ɨ*. Words in (3b), however, show that *ɨ* and *i* may be V2 even though V1 is a light vowel. The sequences {a ɛ o}-{i ɨ} are illicit from the viewpoint of the traditional vowel grouping. For this reason, these sequences are treated as exceptional, and the two vowels *ɨ* and *i* are labelled as 'neutral vowels' (W. Heo 1965; Kim-Renaud 1976; B-G Lee 1985; S-H Park 1990 and others).

Let us look at the following rules proposed by Kim-Renaud (1976), where lightness and darkness are represented as semantic diacritic features [light] and [dark], respectively.

(4) a. $[+syll] \rightarrow [+light] \;/\; [C_0 \underset{[+light]}{\_\_\_} \ldots]^{SS}$

(A dark vowel in an initial syllable becomes light in a SS morpheme with light meaning.)

b. $\begin{bmatrix} +high \\ -round \end{bmatrix} \rightarrow [-dark] \;/\; [C_0VC_0(VC_0) \_\_\_ \ldots]^{SS}$

(In a SS morpheme, *i* and *ɨ* are neutral in a noninitial syllable.)

(4a) is the general rule which accounts for SSVH. (4b) is added to exclude {a ɛ o}-{ɨ i} from the rule (4a). Kim-Renaud does not explain why the vowels *ɨ* and *i* are neutral in the V2 position. As these rules illustrate, any rule-based approach which adopts the traditional vowel division must treat the occurrence of the sequences {a ɛ o}-{ɨ i} as accidental.

The second case which the traditional analysis cannot deal with concerns the high rounded vowel *u*. The traditional claim that this vowel belongs to the dark-vowel group is not true as evidenced by numerous words in which *u* may cooccur with the light vowels {a ɛ o}.

(5)

| a. **In V2 position** | | b. **In V1 position** |
|---|---|---|
| k'aŋc$^h$uŋ | 'skipping' | *t'upak |
| napus | 'fully' | *k'ukɛs |
| omcuk | 'shivering' | *mullaŋ |
| p'ɛcuk | 'protruding' | *c'ukol |
| kɛkul | 'croak' | *k'umt$^h$ol |

In (5a), *u* is preceded by a light vowel. The words in (5b) show that *u* in V1 does not allow light vowels to appear in V2.[1] Notice that this distribution of the vowel *u* is identical to that of the so-called neutral vowels *i* and *ɨ*. The three high vowels, *i*, *ɨ* and *u*, are distinguished from other vowels in that they do not have the element 'A', which represents the property 'lowness', and it is this which accounts for their cooccurrence

---

[1] This aspect of the distribution of *u* is also pointed out by B-G Lee (1985) and M-H Cho (1993).

restriction. The role of the element 'A' in Korean VH will be discussed further in sections 3.3~3.5.

### 3.1.3 Inapplicability of the lightness-darkness contrast to infinitive vowel harmony

Another problem of the traditional analysis is that the contrast of lightness and darkness is not applicable to INFVH.

(6) **Infinitive VH**

| | | | |
|---|---|---|---|
| cap- a | 'grasp' | mək- ə | 'eat' |
| nok- a | 'melt' | cu- ə | 'pick up' |
| cɛ- ə | 'measure' | s'ɨr- ə | 'sweep' |
| me- ə | 'carry' | mil- ə | 'push' |

The examples above show that the VH in this context involves the alternation of *a* and *ə*. When the final vowel of the stem is *a* or *o*, the suffix is realised as *a*; elsewhere, *ə* appears. An interesting fact in this VH is that when the stem vowel is *ɛ* the suffix is *ə* rather than *a*, showing a harmonic grouping different from that of the SSVH.[2]

(7) SSVH: a ɛ o *vs.* ə e i u ɨ
INFVH: a o *vs.* ɛ ə e i u ɨ

It should be noted that verbs and adjectives do not involve the semantic contrast of darkness and lightness. The verb stem *cap-*, for example, expresses the meaning 'grasp', but does not have a light nuance or feeling although it contains the light vowel *a*. Nor does it have a dark counterpart word *cəp-* for this meaning. Therefore, under the traditional treatment, a separate account is needed for INFVH, since we have to limit the semantic contrast to SSVH only. I shall show that VH in both contexts is controlled by an identical phonological process.

---

[2] Additional data and detailed discussion of INFVH will be given in 3.5.

## 3.2 Problems in Feature-based Approaches

Since the 1980's Korean VH has been investigated by a number of linguists within a distinctive feature-based framework. Most of them adopt the feature [±low] (McCarthy 1983; H-S Sohn 1987; S-H Park 1990) and some adopt the feature [±ATR] (B-G Lee 1985; M-H Cho 1993). These feature-based approaches inherit the traditional vowel harmonic grouping, and fail to handle the vowel patterns {a ɛ o}-{i ɨ u}, which are regarded as exceptions in the traditional analysis.

Let us first consider the proposal which adopts [±low]. According to this proposal, vowels are divided as follows.

(8)

| | | | | | | |
|---|---|---|---|---|---|---|
| | ə | e | u | i | ɨ | [-low] |
| | a | ɛ | ɔ | | | [+low] |

This vowel division is identical to the traditional treatment, except that [+dark] and [-dark] are replaced by [-low] and [+low]. Consider the exceptional sequences {a ɛ o}-{i ɨ u}. {a ɛ o} are [+low] and {i ɨ u} are [-low]. These sequences clearly violate the claim that all vowels within a harmonic domain should agree with respect to the value of the feature [low]. What follows is the rule (9) proposed by S-H Park (1990).

(9) **Feature-based approach**: S-H Park (1990)

$$V \rightarrow [\alpha\ \text{low}] / [\ C_0 \begin{bmatrix} +\text{nuc} \\ \alpha\ \text{low} \end{bmatrix}_{SSW} \_\_\_\_ \begin{bmatrix} \_\_\_\_\_ \\ /n\ \text{high}\backslash \\ \backslash +\ \text{rnd}\ / \end{bmatrix} \text{---- \&}$$

(n<4, & : stem boundary)

S-H Park interprets this rule as follows:

> "A vowel in the stem of a sound symbolic word, <u>if it is not neutral</u> (4 high and unrounded), takes the same low feature as that of the nuclei element of the word, regardless of what intervenes."
>
> (underlining added)

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>
> (underlining added)

As indicated by the underlined clause, an additional condition is necessary to eliminate the exceptional cases {a ɛ o}-{i ɨ u}.

Let us now consider B-G Lee (1985), who employs [±ATR]. Couched in the Theory of Underspecification (Kiparsky 1982, 1985; Pulleyblank 1983; Archangeli 1984), B-G Lee proposes that the vowels are specified with respect to ATR as follows.[3]

(10) **Vowels in B-G Lee (1985)**

| | a | ə | i | u | ɛ | e | o | ɨ |
|---|---|---|---|---|---|---|---|---|
| ATR | − | + | | + | − | + | − | |

('+' = [+ATR], '−' = [−ATR])

As shown, the ATR value of the two vowels *i* and *ɨ* is not specified. B-G Lee claims that both vowels are realised as [+ATR] in V1, but as [−ATR] in V2. Such a treatment is arbitrary, as there is no phonetic difference in the pronunciation of these vowels in initial and non-initial positions.

This arbitrary treatment reflects again the distributional fact that the two vowels (as well as *u*) in V1 coexist only with {ə e u ɨ i}, which are specified as [+ATR] in the proposal, but they may occur freely in V2 when V1 is {a ɛ o}, which are specified as [−ATR]. According to Lee's proposal, the latter cases are impossible since they involve a sequence of [−ATR] followed by [+ATR]. Thus, the ATR value of {i ɨ} is arbitrarily assigned to justify the proposal, despite the fact that these vowels are phonetically not different in V1 and V2.

To sum up, feature-based approaches, either a [±low]-spreading account or a [±ATR]-spreading account, cannot deal with the sequences {a ɛ o}-{i ɨ u}. It is also not the case that such sequences are rare, as illustrated in the following table which shows vowel patterns of 638 SS words based on the data in K-K Kim (1970).[4]

---

[3] B-G Lee (1985) proposes a ten-vowel system. Since this thesis accepts the eight-vowel system only the above eight vowels are presented. See 2.1 for details of the Korean vowel system.

[4] More than 1000 SS words are displayed in K-K Kim (1970). For our discussion only disyllabic words are counted, since there is no difference to be recognised between disyllabic words and polysyllabic words with respect to VH patterns.

(11)

| V2 | | a | o | ɛ | ə | e | i | ɨ | u |
|---|---|---|---|---|---|---|---|---|---|
| V1 | a | 160 | 34 | 8 | 1 | 0 | 34 | 88 | 39 |
| | o | 89 | 25 | 5 | 0 | 0 | 17 | 31 | 7 |
| | ɛ | 20 | 5 | 3 | 0 | 0 | 48 | 4 | 20 |

In the table, each Arabic numeral indicates the number of SS words containing a particular sequence of V1-V2. This table confirms the general claim that [+low] vowels {a ɛ o} in V1 may freely cooccur with the same [+low] vowels, but do not allow [-low] vowels, {ə e}, to occur in V2. While the sequence *a*-ə (1 occurrence) may be regarded as an accidental exception, the number of sequences where V2 is {i ɨ u} is significant. The table clearly shows that the words which consist of the sequence {a ɛ o}-{i ɨ u} are no less common than many other words. To the best of my knowledge, all previous researches treat the occurrence of these sequences as accidental, and no attempt has been made to explain why only these three high vowels systematically show behaviour different from other vowels.

So far, we have sketched problems in previous analyses. The following questions are a summary of problems to be addressed with regard to VH in Korean:

(i) Are the sequences {a ɛ o}-{i ɨ u} really exceptional?
(ii) Why are only high vowels involved in exceptional vowel patterns?
(iii) How can we deal with ɛ, which behaves differently in SSVH and INFVH?

Bearing these questions in mind, I shall discuss VH from an element-based perspective.

## 3.3 A-head Alignment Harmony

### 3.3.1 Vowel grouping

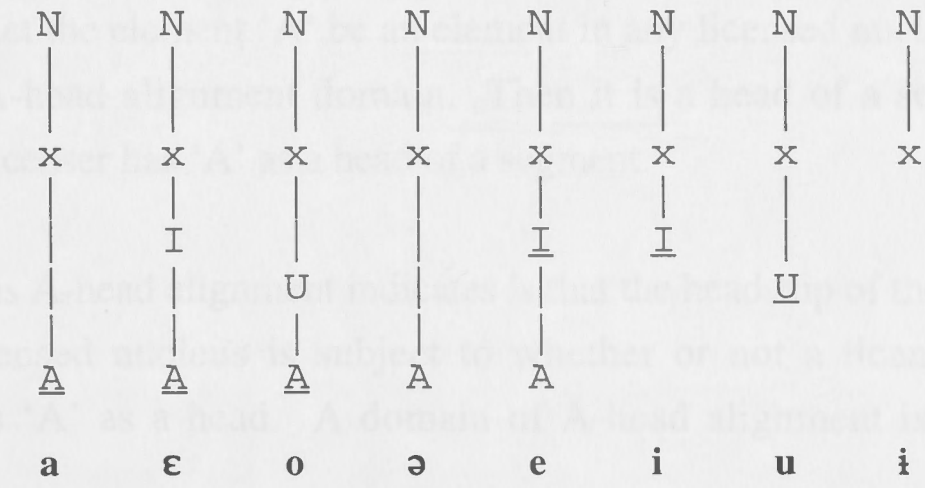
The following table shows the possibilities of vowel cooccurrence within SS words. The vertical and horizontal axes indicate V1 and V2 respectively, and plus (+) or minus (–) indicate the presence or absence of a sequence.

(12)

| | | V2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | a | ɛ | o | ə | e | u | i | ɨ |
| V1 | a | + | + | + | – | – | + | + | + |
| | ɛ | + | + | + | – | – | + | + | + |
| | o | + | + | + | – | – | + | + | + |
| | ə | – | – | – | + | + | + | + | + |
| | e | – | – | – | + | + | + | + | + |
| | u | – | – | – | + | + | + | + | + |
| | i | – | – | – | + | + | + | + | + |
| | ɨ | – | – | – | + | + | + | + | + |

The table suggests that vowels are divided into three groups, namely {a ɛ o}, {ə e} and {u i ɨ}. To identify the class of each vowel group, let us take a close look at the internal structures of vowels in Korean, which were presented in 2.1 and are reproduced as (13) below. (Heads are underlined. Segments without an underlined element are headless.)

(13) **Representations of vowels**



The low vowel *a* is represented as a headed 'A'. The central vowel ə also involves the same element 'A' but is non-headed. Vowels {ɛ o}, which may freely coexist with *a*, are A-headed, and {e}, which belongs to the same harmonic group as ə, is non-A-headed. The three vowels {u i ɨ} do not contain the element 'A'.

(14) **Vowel grouping**

| | | A-headed | | | Non-A-headed | | |
|---|---|---|---|---|---|---|---|
| 'A' | present | a | ɛ | o | ə | e | |
| | | (A) | (I•A) | (U•A) | (A•_) | (A•I) | |
| | absent | | | | u | i | ɨ |
| | | | | | (U) | (I) | (_) |

The vowel harmonic grouping above is based on two criteria: (i) whether or not a segment contains the element 'A', and (ii) whether or not 'A' is a head. These criteria imply that 'A' has an important role in VH processes in Korean.

### 3.3.2 A-head alignment

To capture the VH process in Korean, I propose the A-head alignment, which is stated as follows:

(15) **A-head alignment**

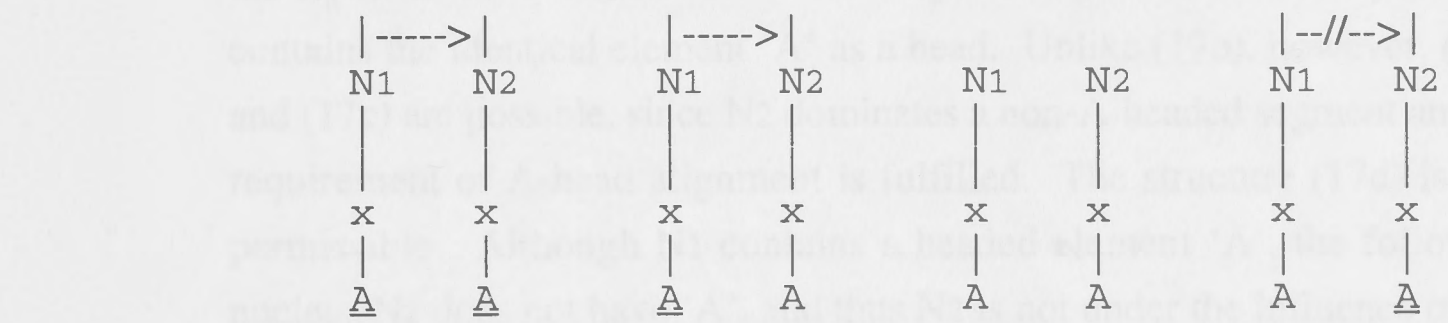
> Let the element 'A' be an element in any licensed nucleus within an A-head alignment domain. Then it is a head of a segment iff its licenser has 'A' as a head of a segment.

What this A-head alignment indicates is that the headship of the 'A' element in a licensed nucleus is subject to whether or not a licensing nucleus contains 'A' as a head. A domain of A-head alignment is within a SS

word.[5] Further, following the general claim that an initial vowel is the trigger of SSVH, I assume that the licenser of A-head alignment is an initial nucleus. Therefore, A-head alignment predicts that if an initial nucleus contains the element 'A' as a head, 'A' in a non-initial nucleus must also be a head. If not, — that is, if an initial nucleus contain 'A' as an operator (i.e. non-headed element) or does not contain this element — then 'A' in a non-initial nucleus must be an operator.

Consider the following structures, where both a licensing nucleus N1 and a licensed nucleus N2 contain 'A'.

(16) a. *b. c. *d.




( ---> = A-head alignment licensing)

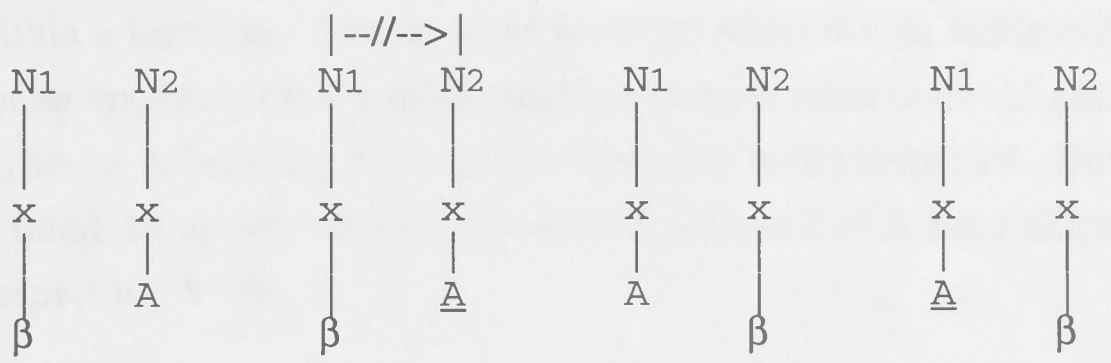
The structure (16a) is well-formed. The licensing nucleus N1 has 'A' as a head, and the headship of 'A' in the licensed nucleus N2 is supported by this head element 'A' in N1. (16b) is ill-formed. 'A' in N2 is not a head, despite the fact that the identical element 'A' in N1 is a head, hence this structure violates the A-head alignment. In both (16c) and (16d), 'A' is an operator in N1. The lack of a headed 'A' in N1 restricts 'A' in N2 to being an operator. This restriction is satisfied in the well-formed structure (16c), but not in (16d).

Let us look at the following configurations where either N1 or N2 dominates β, a certain vocalic element other than 'A'.

---

5 It will be shown shortly that A-head alignment is also applicable to infinitive forms and other monomorphemic words (monomorphemic words rather than SS words).

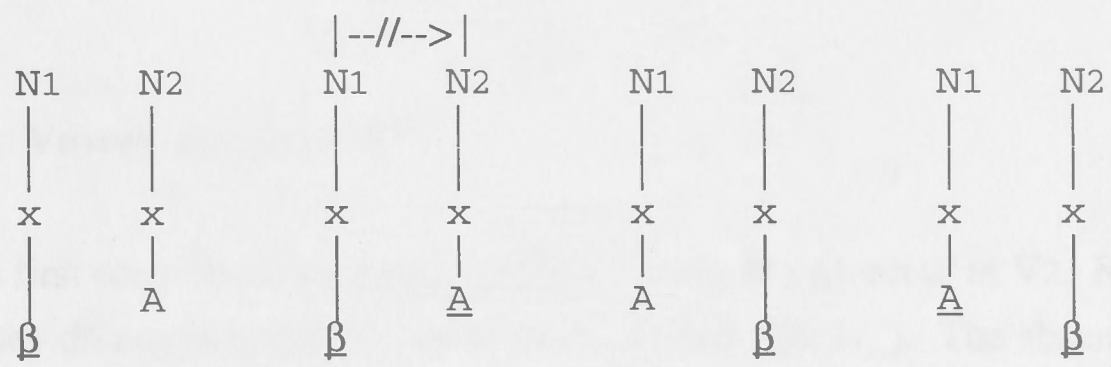
(17) a. *b. c. d.




In (17a), (17b) and (17c), N1 is linked with a non-A-headed segment. (17b) is illegal, as the segment in N2 is A-headed. Again, such headship of the element 'A' is sustainable in N2 only when it is sanctioned by N1 that contains the identical element 'A' as a head. Unlike (17b), however, (17a) and (17c) are possible, since N2 dominates a non-A-headed segment and the requirement of A-head alignment is fulfilled. The structure (17d) is also permissible. Although N1 contains a headed element 'A', the following nucleus N2 does not have 'A', and thus N2 is not under the influence of N1.

(18) shows a set of instances where β is a head. The structures (18a), (18c) and (18d) are all well-formed. Their well-formedness may be explained by the fact that A-head alignment operates to restrict the headship of the element 'A', whereas headship of β is not affected by A-head alignment.

(18) a. *b. c. d.




In (18b), 'A' is a head in N2. To retain the headship of this element 'A' it is necessary that the licensing nucleus N1 contains a headed element 'A'. The structure is ruled out, since N1 lacks the headed 'A' and cannot license N2 to dominate a headed 'A'.

To summarise, A-head alignment constrains the possibilities of the headship of the element 'A' within a SS word. According to this constraint, 'A' within a harmonic domain must have the same status, being either a head or an operator. On the other hand, an element other than 'A' does not participate in A-head alignment, so its headship is not restricted. Bearing this in mind, let us now examine the present proposal of A-head alignment with respect to SSVH.

## 3.4 Vowel Harmony in Sound Symbolic Words

The following (19) summarises the attested and non-attested vowel patterns.

(19) a. *{i ɨ u}-{a ɛ o} {a ɛ o}-{i ɨ u}
{i ɨ u}-{ə e} {ə e}-{i ɨ u}
{i ɨ u}-{i ɨ u}
b. {a ɛ o}-{a ɛ o} {ə e}-{ə e}
*{a ɛ o}-{ə e} *{ə e}-{a ɛ o}

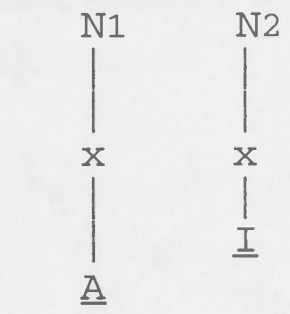
The ultimate goal of this chapter is to clarify the distributional constraints in (19). First, we address the presence and absence of sequences in (19a) that involve the high vowels {i ɨ u}. Consideration of the remaining sequences in (19b) will follow.

### 3.4.1 Vowels without 'A'

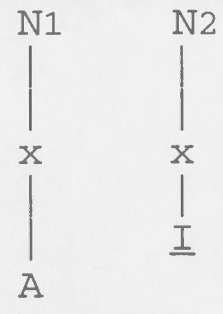
Let us first consider cases where the high vowels {i ɨ u} occur in V2. Recall that they do not have the 'A' element, i.e. *i* (I), *u* (U), *ɨ* (_). The absence of 'A' in their internal structures allows them to occur in N2, even when N1 is A-headed. Further, these vowels may also appear in N2 when N1 is non-A-headed. These two cases, i.e. {A-headed}-{i ɨ u} and {Non-A-headed}-{i ɨ u}, are illustrated by the representation of the words, *kaci* 'various' and

*pəŋsil* 'smiling'. (For presentational convenience, only internal structures of nuclear segments are presented.)

(20) a. b.




k **a** c **i**

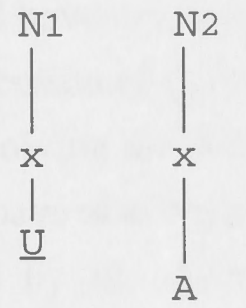



p **ə** ŋ s **i** l

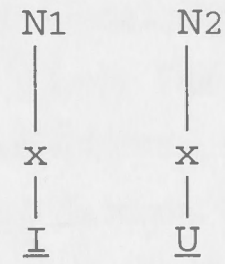
In both structures, N2 does not dominate 'A'. Nothing prevents *i* from occurring in N2, since the headship of 'I' is not affected by A-head alignment. Likewise, when N2 contains a vowel that does not have 'A', N1 can be occupied by any type of vowels. In particular, (20a) illustrates that the existence of the sequences {a ɛ o}-{i ɨ u}, which have previously been treated as exceptions, is not special or exceptional from the viewpoint of A-head alignment.

Next, we turn to the case where the vowels {i ɨ u} occur in N1. In such a case, the vowel in N2 must not be A-headed, since non-A-headed {i ɨ u} cannot permit 'A' in N2 to be headed. Look at the following representations of the words *k'ulk'ək* 'swallowing' and *p'icuk* 'protruding'.

(21) a. b.




k' **u** l k' **ə** k



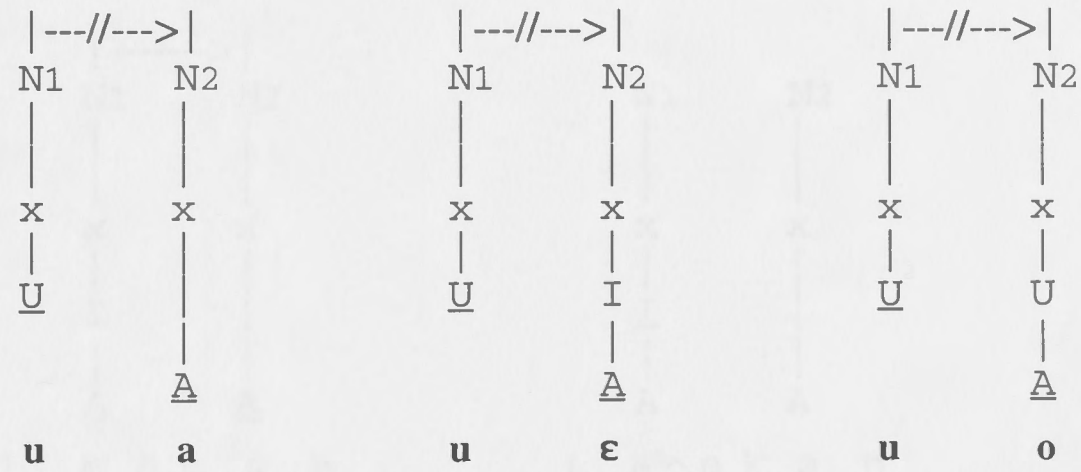

p' **i** c **u** k

These structures are well-formed. In (21a), both N1 and N2 are non-A-headed: N1 does not contain 'A', and 'A' in N2 is an operator. In (21b), neither N1 nor N2 contain the 'A' element, so A-head alignment is not

invoked. This accounts for the presence of the sequences {i ɨ u}-{Non-A-headed}.

The absence of the sequences {i ɨ u} followed by A-headed {a ɛ o} is also due to the internal structure of {i ɨ u} not containing a headed 'A'. Imagine a structure where N1 is *u*, representing the group {i ɨ u}, and N2 is {a ɛ o}.

(22) *a. *b. *c.




In these structures, N2 is associated with an A-headed segment. This headship must be sanctioned by N1. However, N1 cannot serve as a licenser since it does not have the headed 'A', explaining why such sequences are impossible.

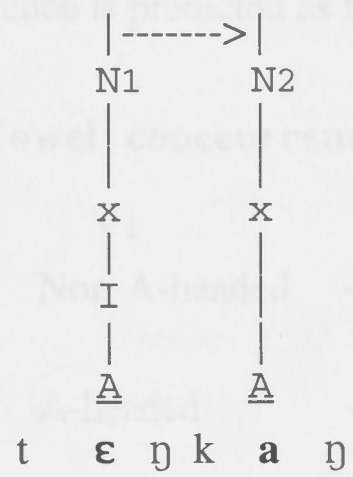
### 3.4.2 Vowels with 'A'

In 3.4.1, I have demonstrated the effect of A-head alignment with regard to the distribution of the three high vowels {i ɨ u}. The apparent exceptional cases involving the so-called neutral vowels, *i* and *ɨ*, and the high rounded vowel *u* have also been addressed. Sequences where these high vowels are preceded by the A-headed vowels {a ɛ o} are in fact just one of the predictable consequences of the present proposal based on A-head alignment.

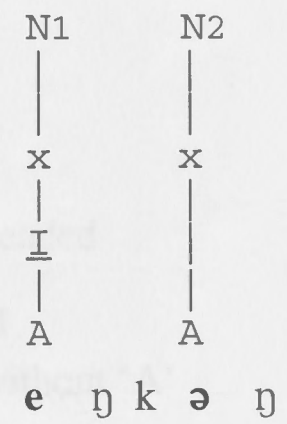
I now investigate the distribution of {a ɛ o} and {ə e}. The vowels {a ɛ o} and {ə e} do not coexist in any combination: {a ɛ o}-{a ɛ o}, {ə e}-{ə e} are allowed but *{a ɛ o}-{ə e}, *{ə e}-{a ɛ o} are not. This

distributional restriction is attributable to the fact that these vowels contain the element 'A': *a* (A), *ɛ* (I•A), *o* (U•A) *vs.* *ə* (A•_), *e* (A•I). Recall that within a harmonic domain all vowels containing 'A' must agree with respect to their headship, as per A-head alignment. Consequently, only the following two types of representations are possible for sequences where both vowels have 'A'.

(23) a. **A-headed**



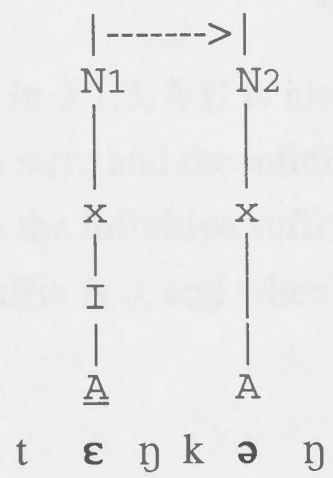

b. **Non-A-headed**



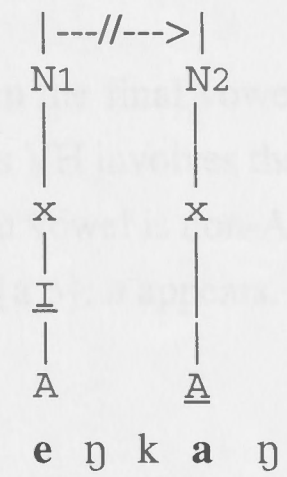

(23a) is a representation of the word *tɛŋkaŋ* 'dripping (light)', (23b) of the word *teŋkəŋ* 'dripping (dark)'. In the former, 'A' is a head in the two segments involved, whereas it is an operator in the latter. A-head alignment correctly predicts the well-formedness of these structures.

A-head alignment further explains the absence of the sequences *{A-headed}-{Non-A-headed} and *{Non-A-headed}-{A-headed}, when participating segments contain 'A'.

(24) *a.




*b.



In short, the structures in (24) are disallowed, because the headship is not aligned. Such heterogeneous headship is prohibited by A-head alignment. Two vocalic segments in these forms would undergo A-head alignment and come to share identical headship.

In summary, this section has discussed SSVH. I have proposed A-head alignment and illustrated its operation. The present analysis has the advantage over previous feature-based analyses that A-head alignment can account for vowel cooccurrence in SS words without exception. Vowel cooccurrence is predicted as follows:

(25) **Vowel cooccurrence**

| $V_1$ | | $V_2$ |
|---|---|---|
| Non-A-headed | ----- | Non-A-headed |
| A-headed | ----- | A-headed<br>vowels without 'A' |

If $V_1$ is non-A-headed, then $V_2$ cannot be an A-headed vowel. If $V_1$ has the element 'A' as a head, $V_2$ is either an A-headed segment or a segment that does not contain 'A'.

In the following section, we discuss INFVH. It will be shown that INFVH is also controlled by the A-head alignment. In addition, however, it will also be shown that this context involves a different type of phonological process which concerns the switching of headship of a segment.

## 3.5 Vowel Harmony in Infinitive Forms

As noted in 3.1.3, VH is also found between the final vowel of a verb (or adjective) stem and the infinitive suffix. This VH involves the alternation of *a* and ə in the infinitive suffix: when the stem vowel is non-A-headed {ə e u i ɨ} the suffix is ə, and when it is A-headed {a o}, *a* appears.

| | | | | |
|---|---|---|---|---|
| (26) | mək- ə | 'eat' | cap- a | 'grasp' |
| | cuk- ə | 'die' | nok- a | 'melt' |
| | me- ə | 'carry' | | |
| | ki- ə | 'crawl' | | |
| | nɨc- ə | 'be late' | | |

A problematic fact in this VH context is that the A-headed vowel *ɛ* (I•A) unexpectedly takes *ə* (A•_) rather than *a* (A).

| | | | | |
|---|---|---|---|---|
| (27) | cɛ- ə | 'measure' | mɛc- ə | 'associate' |
| | kɛ- ə | 'clean up' | tɛ- ə | 'to touch' |

In addition, when the stem vowel is the A-headed *a* or *o*, the suffix form may be *ə* as well as *a*.

| | **Stem** | **Infinitive form** | | | |
|---|---|---|---|---|---|
| a. | mak- | makə | ~ | maka | 'defend' |
| | cap- | capə | ~ | capa | 'catch' |
| | kwerow- | kwerowə | ~ | kwerowa | 'painful' |
| | arɨmtaw- | arɨmtawə | ~ | arɨmtawa | 'beautiful' |
| b. | cɛ- | cɛə | ~ | *cɛa | 'measure' |
| | mək- | məkə | ~ | *məka | 'eat' |
| | cup- | cupə | ~ | *cupa | 'pick up' |
| | me- | meə | ~ | *mea | 'carry' |

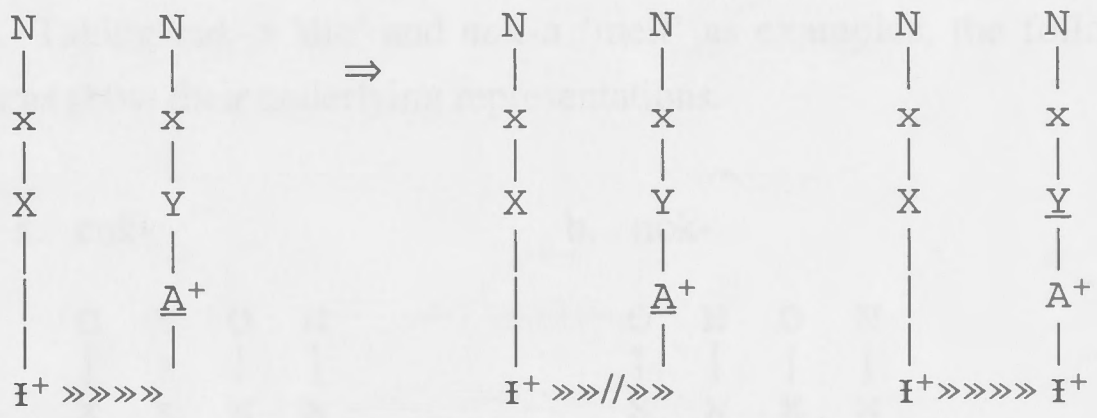
The above infinitive forms show that the suffix may be either *a* or *ə* when the final vowel of the stem is *a* or *o* as in (28a), while it is always *ə* elsewhere as in (28b). Therefore, the following three issues need to be addressed with regard to INFVH:

(i) The alternation of *a* and *ə*.
(ii) The unexpected behaviour of the vowel *ɛ*.
(iii) Free variational forms in the cases of the stem vowel *a*, *o*.

### 3.5.1 Switching of headship

Before presenting an analysis of the alternation of *a*~*ə*, let us first consider a phonological operation called headship switching, which is proposed in KLV (1985). In their article, the possibility of fusion of elements/segments is constrained by charm value, according to which a combination of like charm is impossible. Thus, for example, the ATR element ɪ$^+$ cannot fuse with another positively charmed element A$^+$. Observe the first representation in (29) below. ɪ$^+$ spreads and is about to associate with A$^+$.

(29) a. b.



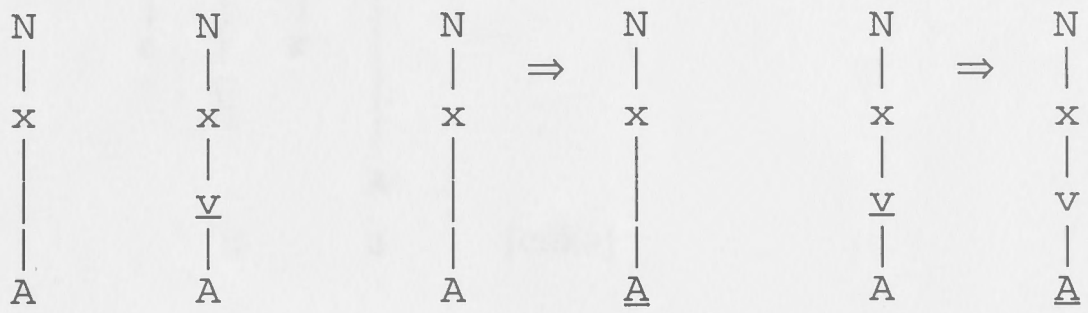

( X, Y = certain elements, »»»»» = spreading)

KLV propose that in such a situation, there are two possibilities: (i) the positive charm of A$^+$ prevents association; (ii) the roles of the operator and the head are reversed and a charmless expression is formed in the second nucleus, to which the positive ATR element can associate. These are illustrated in (29a) and (29b), respectively. KLV show that Quebec French provides an instance of the former possibility, and alternation of *a*~*ə* in Kpokolo an instance of the latter. The latter, which is referred to as headship switching, is important for our discussion of the alternation of *a* and *ə*.

Note also that the headless expression (A•_) in (30a) can be depicted as in (30b). (30a) is a structure adopted in this thesis to represent a segment that is headless with an operator 'A', and (30b) shows an identical segment where headlessness is expressed by '$\underline{v}$', which indicates an empty head.

(30) **Headship switching**

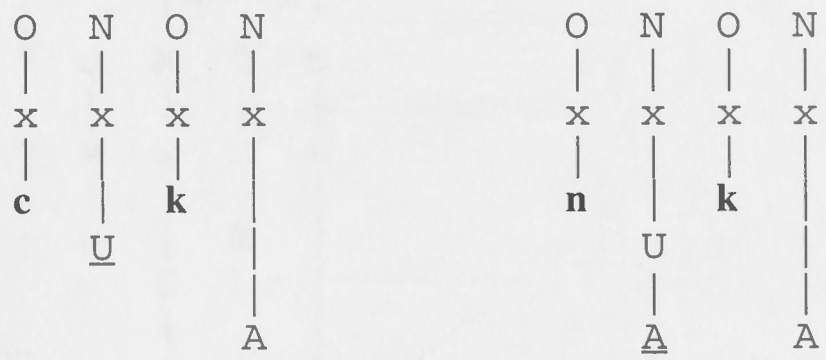
a. b. c. d.




While headship switching of the structure (30b) is expressed as in (30d), that of (30a) can be illustrated as in (30c).

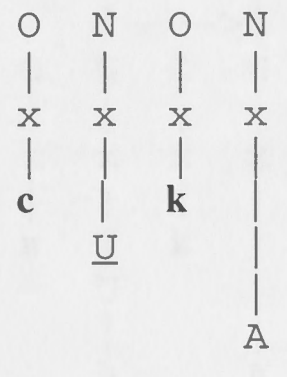
Let us now begin our analysis of the alternation of *a*~*ə* in the infinitive forms. Taking *cuk-ə* 'die' and *nok-a* 'melt' as examples, the following structures show their underlying representations.

(31) a. cuk- b. nok-




The second nucleus is associated with the element 'A'. Look at the final vowel of the stem, which triggers this VH. In (31a) the vowel *u* (U) is non-A-headed, whereas in (31b) the vowel *o* (U•A) is A-headed. Remember that a licensed nucleus can contain 'A' only as an operator when a licensing nucleus does not have a headed 'A'. Thus, the element 'A' in the rightmost nucleus remains as non-headed in the structure (31a). This structure (31a) itself is phonetically realised as a surface form, since there are no other processes to apply.

(32)

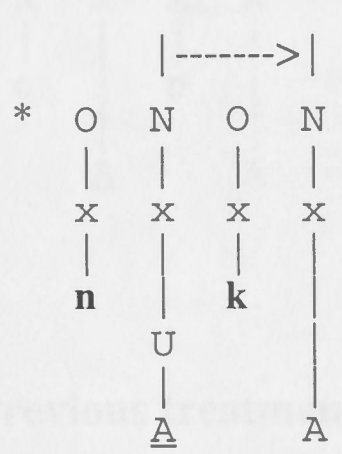



[cukə]

Needless to say, the occurrence of the suffix ə in cases where the stem vowel is another non-A-headed segment {ə e i ɨ} is also due to the same reason.

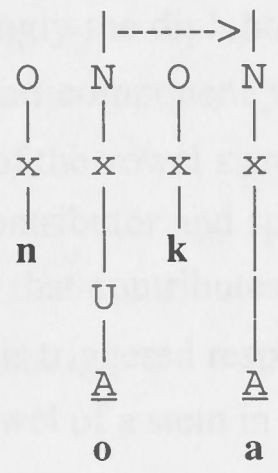
In contrast, in the form *nok-A* in (31b) above, the situation is different. Because the stem vowel *o* in the first nucleus is A-headed, the element 'A' in the second nucleus must also be a head, in accordance with A-head alignment, and thus the structure appears to be ill-formed.

(33)




I shall propose that headship switching is employed in this structure. The headship of the expression (A•_) of the suffix is switched from empty-headed (headless) to element-headed (the active element 'A' is a head). As a result, the expression is reformed as A-headed (A), yielding the following representation in (34), where the suffix surfaces as *a*.

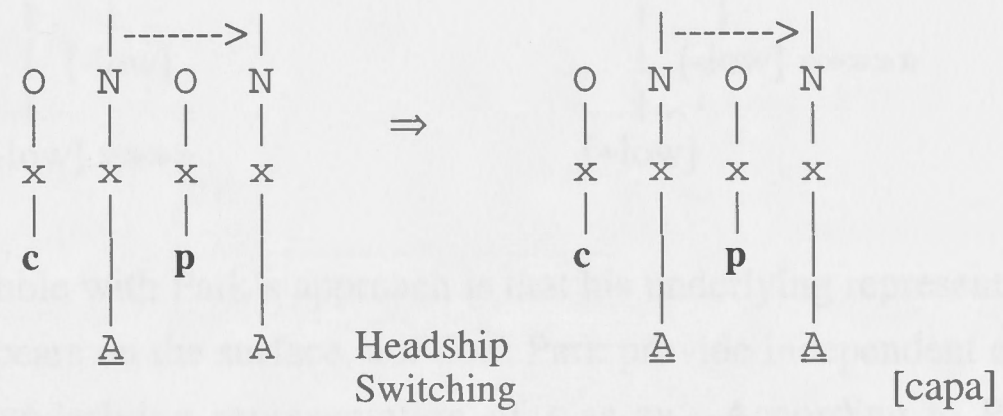
(34)




[noka]

In this structure, the element 'A' in both N1 and N2 is a head, and thus A-head alignment is satisfied. The suffixal form *a* with a stem vowel *a*, which is another A-headed vowel, is also achieved via the identical process.

(35)




### 3.5.2 Previous treatments of the vowel ɛ

I am now in a position to address the second problem remaining in INFVH, that is, the unexpected behaviour of the vowel ɛ (I•A). As noted earlier, this vowel takes ə (A•_) rather than *a* (A), despite the fact that ɛ is A-headed. First of all, let us consider how this issue has previously been treated.

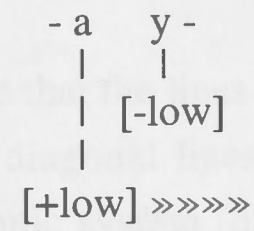
Previous analyses have attempted to account for this inconsistent behaviour of the vowel ɛ in the following two ways:

(36) (i) Establishing an abstract underlying form for the vowel
(ii) Establishing two levels of the VH system

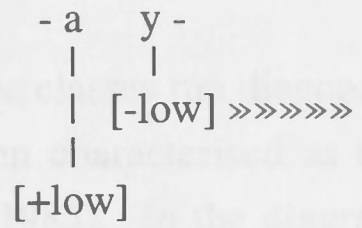
S-H Park (1990) is an example of the case (i). Park assumes that the vowel *ɛ* is underlyingly the diphthong *ay*, where the first component *a* is [+low] and the second component *y* is [–low].[6] According to this proposal, the dual aspects of the vowel *ɛ* are accounted for as follows: the first component *a* acts as a contributor and spreads [+low] in SSVH, while it is the second component *y* that contributes [–low] in INFVH. This idea is based on the fact that VH is triggered respectively by an 'initial' vowel in SSVH and by the 'final' vowel of a stem in INFVH, which may be expressed as follows.

(37) **S-H Park** (1990)

a. **SSVH**
(initial vowel is trigger)




b. **INFVH**
(final vowel is trigger)




A trouble with Park's approach is that his underlying representation *ay* never appears on the surface, nor does Park provide independent evidence for this underlying representation of *ɛ* as *ay*. According to Park, the underlying form *ay* surfaces as *ɛ* through monophthongisation: e.g. *t'aykol* → [t'ɛkol] 'rolling'. What is necessary to obtain the correct surface form is that this monophthongisation must be obligatory. The following words are supplied by Park to support his claim.[7]

(38)

| | | | | |
|---|---|---|---|---|
| | sai | ~ | sɛ | 'between' |
| | ai | ~ | ɛ | 'child' |
| | sanai | ~ | sanɛ | 'manly person' |

---

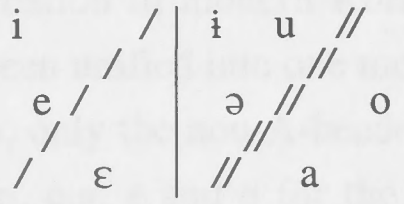
6 S-H Park (1990) uses *i* for the underlying form of the high-front glide *y*.

7 In S-H Park (1990), the sequence *ai* in the examples is presented as the heavy diphthong *ay* (i.e. say, ay, sanay). However, as pointed out also by Park himself (p. 490), heavy diphthongs ('off-glides' in Park's terminology) do not exist in Korean, and thus I use the sequence *ai* to show that two vowels in the sequence are not tautosyllable, but disyllable. *ɛ* is represented as *æ* by Park.

Note that these words show free variation between the sequence *a-i*, i.e. (A)-(I), and the vowel ɛ, i.e. (I•A). Therefore, they cannot serve as support for obligatory monophthongisation, which is crucial to the proposal of the underlying representation as *ay*.

Concerning the second case (ii) in (36) above, a representative example is given by Ahn & Kim (1985), who use the feature [±L] replacing [±low]. Ahn & Kim propose the following harmonic system.[8]

(39) **Vowel harmonic system**: Ahn & Kim (1985)




Notice that the lines dividing the harmonic classes run diagonally. Due to these diagonal lines, Korean VH is often characterised as a 'diagonal' harmonic system (e.g. Aoki 1968, Ahn 1985). In the diagram (39), the double line separates the harmonic classes of INFVH. Only {a, o} belong to [+L]. The double and single lines together indicate the harmonic divisions for SSVH, according to which ɛ is added to the [+L] group among front vowels. This harmonic system merely re-expresses the VH division, where ɛ behaves differently between INFVH and SSVH, and does not have any explanatory power. Moreover, the vowel ɛ is treated as [+L] in SSVH but at the same time as [-L] in INFVH.

### 3.5.3 Diachronic aspects of INFVH

The preceding subsection has shown that neither the proposal of abstract underlying representation nor the proposal of a diagonal system is appropriate for accounting for the inconsistent behaviour of the vowel ɛ. I claim that the inconsistent behaviour of the vowel ɛ should be accounted for in association with the morphological difference between SS words (SSVH)

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8 Ahn & Kim (1985) adopt the ten-vowel system. They also represent the vowel ɛ as æ.

and infinitive forms (INFVH); more specifically whether or not the VH domain includes a morpheme boundary. SSVH takes place within a morpheme, whilst INFVH takes place across a morpheme boundary. Significantly, VH in these two contexts has been influenced differently by a diachronic process in Korean.

As noted by W-J Kim (1971) and others, in Middle Korean, VH obligatorily applied even across a morpheme boundary, and many suffixes, including the infinitive suffix (*ə~a*), exhibited harmonic alternation, e.g. locative; *e~ɛ*, volitive; *u~o*, etc. Among these, only the infinitive suffix *ə~a* shows an alternation in modern Korean, and alternative forms of other suffixes have been unified into one morpheme. Interestingly, as a result of this unification, only the non-A-headed allomorphs have been retained in modern Korean, e.g. *e* and *u* for the locative and volitive, respectively. Thus, from a diachronic point of view, Korean VH may be characterised as follows:

> Korean VH has historically reduced its contexts to morpheme-internal position, and alternative forms of verbal suffixes have been unified into non-A-headed allomorphs through historical change.

In line with this characterisation, I assume that modern Korean is at the final stage of this historical process, and the infinitive form, which had resisted this process, has also come to be under the influence of this historical change.

It is important to note here that unlike in modern Korean, a stem vowel *ɛ* took the A-headed suffixal allomorph *a*, as in *kɛ-a* 'clear up (infinitive)', in Middle Korean (J-K O 1980; S-H Park 1990).[9] The case of the stem vowel *ɛ* in modern Korean turns to be an manifestation of the historical change by which only the non-A-headed allomorph *ə* is used.

It should also be recalled that the stem vowel *a*, *o* may take *ə* in addition to *a*, e.g. *makə ~ maka* (← *mak*-A 'defend (Infinitive)'), *kwerowə ~ kwerowa* (← *kwerow*-A 'painful (Infinitive)'). This free variation is further

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[9] According to J-K O (1978), some dialects, such as the Kimhae dialect in South-East Korea, exhibit the stem-final vowel *ɛ* taking *a* rather than *ə* in this alternation.

evidence in favour of our claim that modern Korean is at the final stage of the historical change. That is, the occurrence of the suffix form *a* is due to the fact that VH still operates in infinitive forms, while the lexical form *ə* is also allowed to appear by virtue of the fact that the VH operating across a morpheme boundary is vanishing in modern Korean.

## 3.6 Vowel Harmony in Monomorphemic Words

So far, I have attributed the dual behaviour of *ɛ* and the free variation in the case of the stem vowel *a, o* to the historical change in VH whereby harmonic contexts have been reduced to morpheme-internal position. The validity of this account is further verified by a harmonic process observed in monomorphemic words.

It has been believed in general that VH is found only in two limited contexts: SS words and infinitive forms. This belief, however, rests on the basis of the traditional view of dark vowels versus light vowels. From the perspective of A-head alignment, VH is observed also in other monomorphemic words, i.e. monomorphemic words rather than SS words.

(40) **V1 is non-A-headed**

| | | | |
|---|---|---|---|
| məcəri | 'idiot' | kəci | 'beggar' |
| əlkul | 'face' | səlle- | 'excited' |
| kikəp | 'surprise' | sik'ɨntuŋ- | 'unhappy' |
| puək | 'kitchen' | musəp- | 'scary' |
| cepi | 'swallow' | mecu | 'fermented beans' |

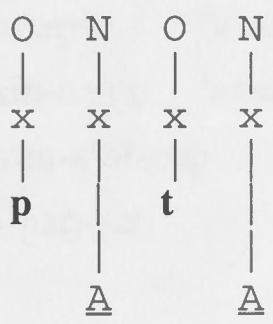
**V1 is A-headed**

| | | | |
|---|---|---|---|
| pata | 'sea' | namu | 'tree' |
| p'allɛ | 'washing' | masi- | 'drink' |
| kolmok | 'sideway' | homi | 'hoe' |
| pɛki- | 'resist' | cɛmi | 'fun' |
| mahɨn | 'forty' | kɛun- | 'feel fresh' |

(40) shows that the vowels in each word also respect A-head alignment, which plays a major role in SSVH and INFVH. To illustrate this, let us consider the following representations of the words *pata*, *homi* and *məcəri*.

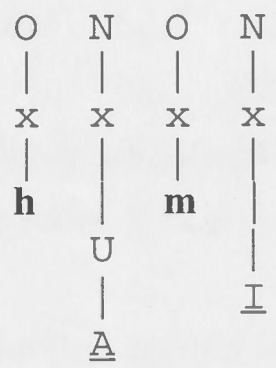
(41)

a.



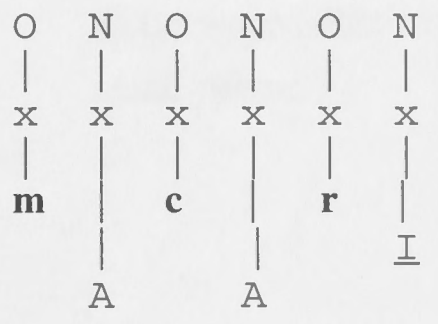

[pata]

b.




[homi]

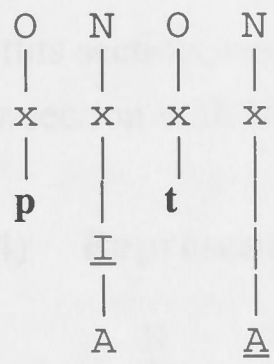
c.



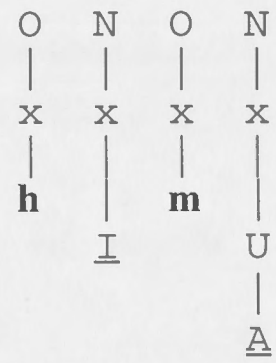

[məcəri]

A-head alignment predicts that when V1 is A-headed, V2 may be either an A-headed segment or a segment that does not contain 'A', as illustrated in (41a) and (41b), respectively. On the other hand, if V1 is non-A-headed, V2 must also be non-A-headed. This accounts for the well-formedness of the structure (41c), where a headed 'A' is absent from all nuclei involved. Such words as *[peta], *[himo], *[məcari], which are ill-formed in terms of A-head alignment, cannot occur as monomorphemic words.[10]

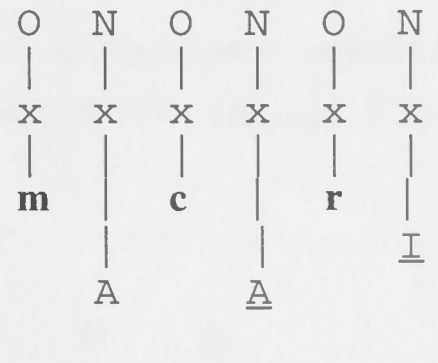
(42)




*[peta]




*[himo]




*[məcari]

The contextual condition that the scope of the VH is within a morpheme in modern Korean is further illustrated by compound words.

---

10 There are some counterexamples, e.g. *nuna* 'older sister', *ilkop* 'seven'. However, such words are just a handful, and may be regarded as accidental exceptions.

(43)

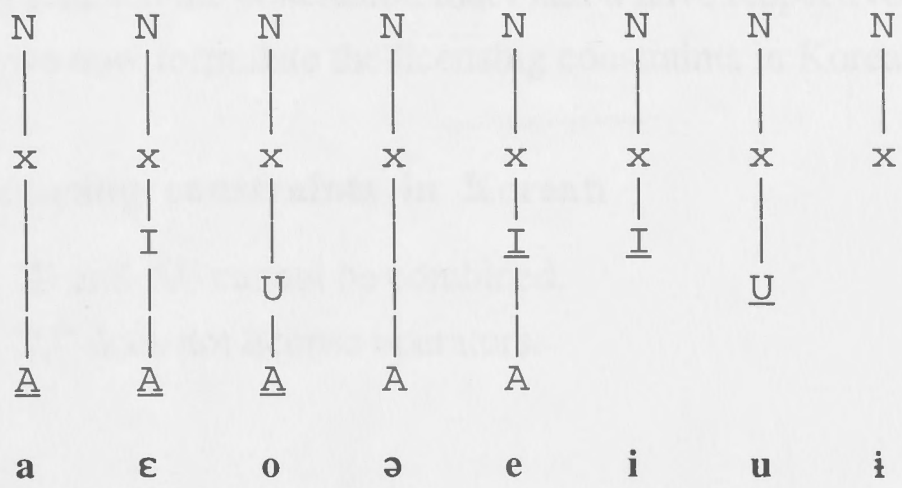
| | | | | |
|---|---|---|---|---|
| cʰam-mal | 'true-word' | *vs.* | kəcis-mal | 'false-word' |
| pom-pi | 'spring-rain' | *vs.* | kyəul-pi | 'winter-rain' |
| caraŋ-hata | 'pride-do' | *vs.* | cucʰum-hata | 'hesitation-do' |
| məkə-pota | 'eat (infinitive)-try' | *vs.* | capa-pota | 'catch (infinitive)-try' |
| sul-caŋsa | 'alcohol-trade' | *vs.* | sul-k'un | 'alcohol-specialist' |
| cakɨn-namu | 'small-tree' | *vs.* | cakɨn-cip | 'small-house' |
| həyən-s'al-pap | 'white-(raw) rice-(boiled) rice' | | | |
| ses-paŋ-sari | 'lent-room-living' | | | |

The examples in (43) show that vowels in the second or third morpheme in compound words are not affected by V1 in the first morpheme. In Korean, there are various compound words combining native Korean words, Sino-Korean words, or both. As these words include a morpheme boundary (or boundaries), VH does not apply to them. The general view that VH exists only in SS words and infinitive forms is in fact due to overlooking this characteristic. I claim that this view must be revised and A-head alignment harmony is also applicable to monomorphemic words in general.

## 3.7 Licensing Constraints in Korean

In this section, we consider the Licensing Constraints for Korean vowels in connection with VH. (44) shows the internal structure of vowels (cf. 2.1).

(44) **Representations of vowels**



For the headship of the segments that contain 'A', the harmonic grouping of {a ɛ o} and {ə e} suggests that members of each group are identical with regard to the headship of 'A'. To be more explicit, 'A' is a head in {a ɛ o} and is an operator in {ə e}. If one of {a ɛ o} is not A-headed, it would be impossible to explain the free cooccurrence of each vowel. Suppose *o* has 'A' as an operator, then the sequence *o-a* will be illicit. In such a sequence, the headship of *a* (A) should be sanctioned. However, if *o* in a licensing nucleus is not A-headed, i.e. *(A•U) or *(U•A•_), *o* would not be able to support its nucleus to license the headship of *a* in a licensed nucleus. In the same line of argument, {ə e} are assumed to be non-A-headed. If *e* is A-headed, i.e. *(I•A), the sequence '*ə-e*' would be illegal, since the non-A-headed ə (A•_) cannot support the headship of 'A' in *e*.

Aside from the vowel *i*, which is the phonetic manifestation of an empty nucleus, the representations of *i* (I) and *u* (U) may be the subject of debate. A-head alignment harmony operates on the element 'A' only, and does not provide any clue to justify the I- and U-headed structures for *i* and *u*. However, I am in favour of these structures for the following two reasons. First, ATR vowels have an active element rather than 'A' as a head, while lax vowels are headless (Charette & Göksel 1994; Cobb 1993; Harris & Lindsey 1994). In the case of the Korean vowels *i* and *u*, as pointed out by B-G Lee (1985), both segments are ATR (cf. 3.2). Secondly, the high vowels *i* and *u* are respectively I- and U-headed in many languages which do not possess an ATR opposition, for example, Turkish (Charette & Göksel 1994) and Japanese (Yoshida 1991). As in these languages, the Korean vowels *i* and *u* lack non-ATR counterparts, namely ɪ and ʊ. It is therefore reasonable to assume that 'I' and 'U' are heads in *i* and *u*.

Having reached the conclusion that *i* and *u* have respectively 'I' and 'U' as a head, we now formulate the licensing constraints in Korean.

(45) **Licensing constraints in Korean**

a. 'I' and 'U' cannot be combined.

b. 'U' does not license operators.

As discussed in 2.1, Korean does not have vowels that contain both 'I' and 'U', such as *(A•I•U)=*ö* and *(I•U)=*ü*. The non-existence of such vowels is captured by constraint (45a) which prohibits the combination of 'I' and 'U'. Constraint (45b) indicates that 'U' cannot be a head of a complex expression. Thus, segments where the headed 'U' dominates an operator, such as *(A•U), *(A•I•U), are eliminated from the vowel inventory.

## 3.8 Conclusion

In this chapter, we have discussed Korean VH within an element-based approach, and offered evidence that Korean VH is a purely phonological phenomenon which involves A-head alignment. The issue of the so-called neutral vowels, *i* and *ɨ*, and the high rounded vowel *u* has been addressed: their distribution, which previously has been treated as accidental, is phonologically well-motivated in terms of A-head alignment.

A-head alignment applies within a morpheme. In conjunction with this VH contextual condition, I have attempted to show that VH is found not only in SS words, but also in other native Korean words, as far as this condition is met. INFVH appears to be an exception to this environment. It was shown however that the infinitive suffix is at the final stage of a diachronic change whereby VH has been limited within a monomorphemic word. This diachronic aspect of Korean VH solved the problem of the inconsistent behaviour of the vowel *ɛ*, and the free variation of the infinitive suffix *a-ə* in the case of the stem vowel *a, o*.

# 4

# Vowel Coalescence and Glide Formation

## 4.0 Introduction

In this chapter, we investigate phonological processes which take place to avoid vowel hiatus in Korean. The focus will be on vowel coalescence and glide formation. We also deal with a vowel length distinction in Korean, since vowel coalescence and glide formation are viewed as involving vowel lengthening in a number of studies, e.g. *a-i* → *ɛː*, *i-ə* → *yəː* (B-G Lee 1979; E-J Han 1990; K-M Ko 1991; C-G Kim 1993).

Section 4.1 addresses the question of long vowels in Korean, and attempts to show that the standard view that Korean has a vowel length distinction should be revised. Sections 4.2 and 4.3 discuss vowel coalescence and glide formation. In 4.2, we outline the feature-based approach proposed by S-H Sohn (1987), and point out that the proposal fails to explain why certain sequences undergo vowel coalescence, e.g. *ə-i* → *e*, while others undergo glide formation, e.g. *i-ə* → *yə*. In section 4.3 a government-based analysis of the relevant processes is presented. It will be shown that a phonological operation called Nuclear Fusion (Yoshida 1991), and asymmetry in the spreading properties of the elements 'I' and 'U', have a crucial role in the analysis.

## 4.1 The Question of Long-short Vowel Contrast

It is generally claimed that Korean has distinctive vowel length (S-N Lee 1959; H. Sohn 1977; Kim-Renaud 1986; Lee & Zhi 1987; C-G Kim 1993;

Umeda 1994). Korean is also frequently cited as a language which has a phonemic vowel length contrast for almost all of its vowel inventory (Ladefoged 1982; Maddieson 1984). The words in (1) illustrate minimal pairs purportedly distinguished by vowel length. (The examples are taken from H. Sohn 1977: 52.)

| | | | | |
|---|---|---|---|---|
| (1) | mal | 'horse' | ma:l | 'word' |
| | nun | 'eye' | nu:n | 'snow' |
| | pal | 'foot' | pa:l | 'bail' |
| | pam | 'night' | pa:m | 'chestnut' |

There is a restriction in the distribution of long vowels, in that a long vowel may occur only in the first syllable (H-B Lee 1973; B-G Lee 1979; Kim-Renaud 1982; C-G Kim 1993; Umeda 1994). Therefore, when a word containing a long vowel is postposed to another word to form a compound, the long vowel is shortened. (The examples are cited in C-G Kim 1993: 35.)

| | | | | |
|---|---|---|---|---|
| (2) | k'oc$^h$+nu:n | → | k'oc$^h$nun (*k'oc$^h$nu:n) | 'flower+snow', |
| | ku:n+pa:m | → | ku:npam (*ku:npa:m) | 'grill+chestnut' |

The above is a summary of the standard view of the vowel length contrast in Korean phonology. In reality, however, the question of whether or not contemporary Korean (Seoul dialect) has such a contrast is highly controversial. First of all, it is doubtful that native speakers of Korean can really perceive the phonemic vowel length contrast. I have conducted an interview with eight native speakers of Korean.[1] In the interview, the informants were orally given four pairs of sentences which included the minimal pairs shown in (1) above. Each set of sentences were identical except for the vowel length of the minimal pairs, as exemplified below.

---

[1] Many thanks to Young-Joon Lee and Hung-Soo Jun for organising and assisting with the interview. The informants were aged between 19-26.

(3) * ɔce, pam-ɨl sanninde ... *'I bought night yesterday ...'
'yesterday-night (objective)-bought'

ɔce, paːm-ɨl sanninde ... 'I bought chestnuts yesterday ...'
'yesterday-chestnuts (objective)-bought'

The informants were asked to choose the correct sentence with respect to vowel length. If the informants could not intuitively recognise the correct one, they were asked to say so. According to the standard view, the informants would have been expected to recognise easily the appropriate vowel length for each sentence. The results however appear to contradict this standard view, as the informants responded that they could not identify the correct answers for any sentences given. In fact, five informants gave up answering the questions in the middle of the interview. In discussion after the interview, they revealed that they could not 'remember' which one they were 'taught' as being long at school.

This contradiction concerning the standard view is strengthened by a report by S-O Lee (1979: 136), which investigates the treatment of vowel length in thirty-five pairs of words in nine monolingual Korean dictionaries. The report shows that the dictionaries agree on the length of fourteen pairs only; for the remaining twenty-one pairs, some dictionaries treat them as minimal pairs while others do not. If the standard view is correct, how can we explain such different treatment for so many words?

It is then not unreasonable to consider the possibility that vowel length is in fact not distinctive in contemporary Korean. In addition, phonological processes which are commonly viewed as involving vowel length distinction are in fact not in favour of contrastive vowel length, either. (4) lists some phonological processes of this kind.

(4) (i) Compensatory lengthening in glide formation
(ii) A long stem-final vowel in irregular verbs
(iii) A long vowel blocking umlaut

Below, I will show that these processes in fact fail to provide evidence for the short-long vowel distinction.

First, regarding (4i), it is claimed that a long vowel is created when a stem-final vowel and a following suffix-initial vowel form a light diphthong, as illustrated by the data in (5) taken from B-G Lee (1979).

| | | | | |
|---|---|---|---|---|
| (5) | tu- ə | → | twəː | 'put on (infinitive)' |
| | po- a | → | pwaː | 'see (infinitive)' |

Many researchers (B-G Lee 1979; E-J Han 1990; K-M Ko 1991; C-G Kim 1993) refer to this vowel lengthening as 'compensatory lengthening' on the grounds that this lengthening takes place in order to 'compensate' the stem-final vowel for losing [+syll]. However, again the perception of long vowels in this case is not absolute. Some researchers do not accept vowel lengthening in these words, and instead posit the following forms with short vowels (J-W Kim 1976; H-S Sohn 1987).

| | | | | |
|---|---|---|---|---|
| (6) | tu- ə | → | twə | 'put on (infinitive)' |
| | po- a | → | pwa | 'see (infinitive)' |

In addition, the stem-final vowel in the examples below is not initial, and thus when it becomes a glide, the following vowel ə cannot be treated as a long vowel, since as noted before, only the initial vowel is permitted to be long. Thus, ə in these words must be shorter than *ə/a* in the above words *twəː* or *pwaː*.

| | | | | |
|---|---|---|---|---|
| (7) | katu- ə | → | katwə | 'imprison (infinitive)' |
| | karɨcʰi- ə | → | karɨcʰyə | 'teach (infinitive)' |

Yet Korean native speakers do not recognise any difference in vowel length between the vowel ə in these words and the vowel ə in *twə* (*twəː*) which is conventionally regarded as long.

Regarding the second phonological process (4ii), namely, long stem-final vowels in irregular verbs, let us take *p*-irregular verbs as an example. (8a) and (8b) show some examples of inflection of *p*-irregular verbs and *p*-

regular verbs, respectively. In the first column, the suffix-initial obstruent *k* is tensified to *k'*. We ignore this process here, as it is irrelevant to the present discussion (see Chapter Five for details on tensification).

| (8) | -ko 'and' | -ə/a '(infinitive)' | Gloss |
|---|---|---|---|
| a. | topk'o | towa | 'help' |
| | mipk'o | miwə | 'hate' |
| b. | capk'o | capa | 'catch' |
| | ipk'o | ipə | 'wear' |

The forms in (8a) show that *p*-irregular verbs involve *p~w* alternation. The stem-final segment is realised as *p* before a consonant-initial suffix, and as the glide *w* before a vowel-initial suffix. In the *p*-regular verbs in (8b), the stem-final segment remains as *p* before both consonant-initial and vowel-initial suffixes. Some phonologists have accounted for this difference by assuming that a stem-final vowel is long in irregular verbs but short in regular verbs (H. Sohn 1977; Kim-Renaud 1986).

(9) H. Sohn (1977: 53)

p → w / V: ___ V

However, there are a number of counterexamples to this account. Consider, for example, the conjugation of *arɨmtap-* 'beautiful', *tərəp-* 'dirty' and *musəp-* 'scary', which have polysyllabic stems. The stem-final vowel should be short, as a long vowel may occur only in the first syllable. Therefore, these verbs must be regular, and should not show the *p~w* alternation.

| (10) | -ko 'and' | -ə/a '(infinitive)' | Gloss |
|---|---|---|---|
| | arɨmtapk'o | arɨmtawa | 'beautiful' |
| | tərəpk'o | tərəwə | 'dirty' |
| | musəpk'o | musəwə | 'scary' |

However, as illustrated by the infinitive forms in the second column, these verbs involve the alternation, refusing the claim that the stem-final vowel is long in irregular verbs.

There is in fact another way of dealing with the paradigm of irregular verbs. This is to assume that the stem of irregular verbs has an underlying representation different from that of regular verbs (C-G Kim 1971; C-W Kim 1973; B-G Lee 1977). In Chapter Five, adopting the basic spirit of this assumption, I will present a government-based approach to the paradigm of irregular verbs.

Finally, I shall consider the third phonological process, that is, where a long vowel blocks umlaut. The following examples are cited in Charette (1989) as examples of Korean umlaut.

| (11) | **Radical** | **Nominative** | **Gloss** |
|---|---|---|---|
| a. | pam | pɛm-i | 'night' |
| | tam | tɛm-i | 'wall' |
| b. | paːm | paːm-i | 'chestnut' |
| | taːm | taːm-i | 'energy' |

In (11a), the stem vowel *a* is assimilated to the following high vowel *i* and becomes *ɛ* when the stem vowel is short. By contrast, in (11b), the stem vowel is long and resists the assimilation.

I would like to point out that the words *pam* 'night' and *tam* 'wall', and indeed nouns in general, do not in fact undergo the umlaut process triggered by the nominative suffix *i* in standard Korean (Seoul dialect).[2]

| (12) | **Radical** | **Nominative** | | | **Gloss** |
|---|---|---|---|---|---|
| a. | par | par-i | ~ | *pɛr-i | 'foot' |
| | cam | cam-i | ~ | *cɛm-i | 'sleep' |
| | sap | sap-i | ~ | *sɛp-i | 'shovel' |
| | an | an-i | ~ | *ɛn-i | 'inside' |

---

[2] Umlaut in this context, i.e. noun-suffix, is found in some dialects such as Kyengsang dialect. The data in (11) is deemed to be taken from such dialects.

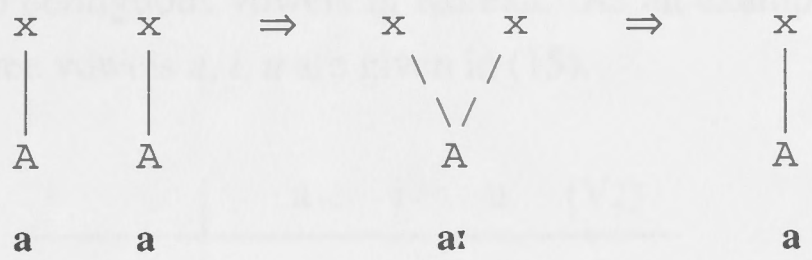
| | | | | | |
|---|---|---|---|---|---|
| b. | cakar | cakar-i | ~ | *cakɛr-i | 'gravel' |
| | saram | saram-i | ~ | *sarɛm-i | 'people' |
| | mataŋ | mataŋ-i | ~ | *matɛŋ-i | 'yard' |
| | supak | supak-i | ~ | *supɛp-i | 'watermelon' |

The words in (12a) illustrate that the stem vowel *a* is not affected by the nominative suffix *i*. By the same token, *pɛm-i* 'night (nominative)' and *tɛm-i* 'wall (nominative)' are not appropriate forms in standard Korean. Aside from the words in (12a) in which the stem vowel is initial, the words in (12b) show that the suffix vowel *i* is preceded by the vowel *a* that occurs in the second syllable and thus short. Yet, this stem vowel *a* is not influenced by the suffix vowel *i*, revealing the invalidity of the claim that it is long vowels which block umlaut.

So far, I have argued that native speakers of Korean do not intuitively recognise distinctive vowel length, and phonological processes also do not support the existence of long vowels. Experiment-based studies have also been conducted to address the short-long distinction in Korean (M-S Han 1964; Lee & Zhi 1987; Magen & Blumstein 1993). Among these, Magen & Blumstein (1993) deserve special attention as their research is based on a reasonable amount of data: four native speakers of Korean served as subjects, and the target items were fifty-nine short/long word pairs. They investigate the effect of speaking rates on vowel length, and suggest that the vowel length distinction is not productive in contemporary Korean.

In light of the arguments presented above, I conclude that contemporary Korean does not have phonemic vowel length distinction. Further, even though a long vowel structure as in (13b) is produced in the course of a phonological derivation, e.g. *ka-a* 'go-(infinitive)' → *kaː*, it is shortened, e.g. *kaː* → *ka*, by reducing the skeletal points with which a segment is associated, as in (13c).

(13) a. b. c.

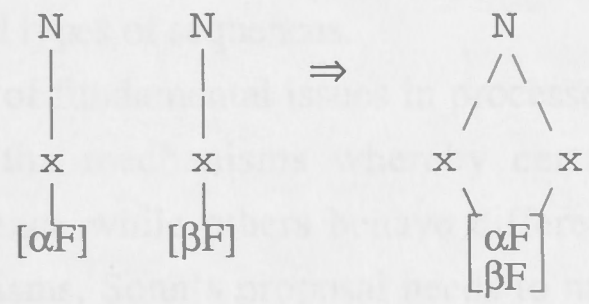



What is the reason for the gap between the standard view and our observations? It is worth noting that some researchers indicate that the vowel length contrast is still maintained in the older generation, but is neutralised or disappearing in the younger generation (H-B Lee 1973; I-J Kong 1987; C-G Kim 1993; Magen & Blumstein 1993; Umeda 1994). The vowel shortening above can be regarded as reflecting a historical change in Korean, which is currently affecting the contemporary language. The structure (13b) corresponds to the pronunciation of the older generation, and this structure is converted to (13c) in the pronunciation of younger speakers aged up to 40~45.

## 4.2 Problems with Sohn's Proposal

We are now ready to discuss vowel coalescence and glide formation. Let us first consider vowel coalescence, which can informally be characterised as a process whereby two vowels are merged into one. H-S Sohn (1987), in a feature-based framework, proposes Nucleus Gemination to account for vowel coalescence in Korean.

(14) **Nucleus Gemination** (Sohn 1987)



Based on this operation, Sohn predicts possible outcomes from combination of two contiguous vowels in Korean. As an example, mergers involving the three vowels *a*, *i*, *u* are given in (15).

(15)

| | | a | i | u (V2) |
|---|---|---|---|---|
| (V1) | a | a | ɛ | ɔ |
| | i | ɛ | i | ü |
| | u | ɔ | ü | u |

However, it is not the case that two contiguous vowels are always merged into a single vowel in reality, and the output in (15) is true only for some sequences. Compare (15) with the following chart (16), which shows the outcomes actually observed in sequences of the vowels *a*, *i* and *u*.

(16) **Actual output of V1-V2**

| | | a | i | u (V2) |
|---|---|---|---|---|
| (V1) | a | a | ɛ | au (*ɔ) |
| | i | ya (*ɛ) | i | iu (*yu/*ü) |
| | u | wa (*o) | wi (*ü) | u |

(16) indicates that sequences can be divided into three types according to their outcomes: those which undergo (i) vowel coalescence, e.g. *a-i*, *a-a*, (ii) glide formation, e.g. *i-a*, *u-a*, *u-i*, and (iii) neither vowel coalescence nor glide formation, e.g. *a-u*, *i-u*. It is clear that there are mismatches between the output predicted by Nuclear Gemination and the actual outcomes; more specifically, Nuclear Gemination does not cover the second and third types of sequences.

One of fundamental issues in processes involved in vowel hiatus is to clarify the mechanisms whereby certain sequences undergo vowel coalescence while others behave differently. In order to capture these mechanisms, Sohn's proposal needs to make clear under what principles Nuclear Gemination operates. In what follows we observe how Sohn deals with this matter.

(17) illustrates representations of Korean vowels proposed by Sohn on the basis of the framework of Underspecification Theory (Pulleyblank 1983; Archangeli 1984; Kiparsky 1985; Archangeli & Pulleyblank 1987).

(17) **Underspecification of Korean vowels** (Sohn 1987)

| | i | e | ɛ | a | ə | o | u | ɨ |
|---|---|---|---|---|---|---|---|---|
| high | | – | | | – | – | | |
| back | – | – | – | | | | | |
| round | | | | | | + | + | |
| low | | | + | + | | | | |

Each vowel is underlyingly specified only with certain features as shown in (17). Features which are not specified in the underspecified system are filled in by a set of redundancy rules, comprising both default and complement rules.

This underspecified system has an advantage over an orthodox feature-based approach in dealing with vowel coalescence. Taking the merger of *ə-i* to *e* as an example, this would be expressed as follows within an orthodox feature-based framework.

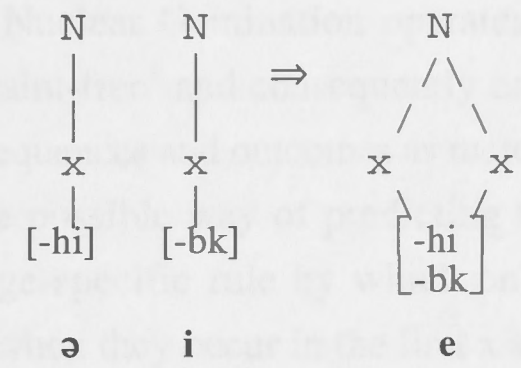
(18)

| ə | | i | | | e |
|---|---|---|---|---|---|
| -high | | +high | | | -high |
| +back | | -back | | ⟶ | -back |
| -round | | -round | | | -round |
| -low | | -low | | | -low |

(18) shows that there is no principled relationship between the features of input vowels and those of an output vowel; that is to say, the choice of [-high] in the output vowel is ad hoc since there is no principled reason why this feature should be selected rather than [+high]. Thus, the orthodox feature-based framework cannot provide a means to predict the process.

By contrast, the underspecified system makes it possible to express vowel coalescence in a desirable manner. (19) illustrates how the merger of *ə-i* to *e* is accounted for within the underspecified system.

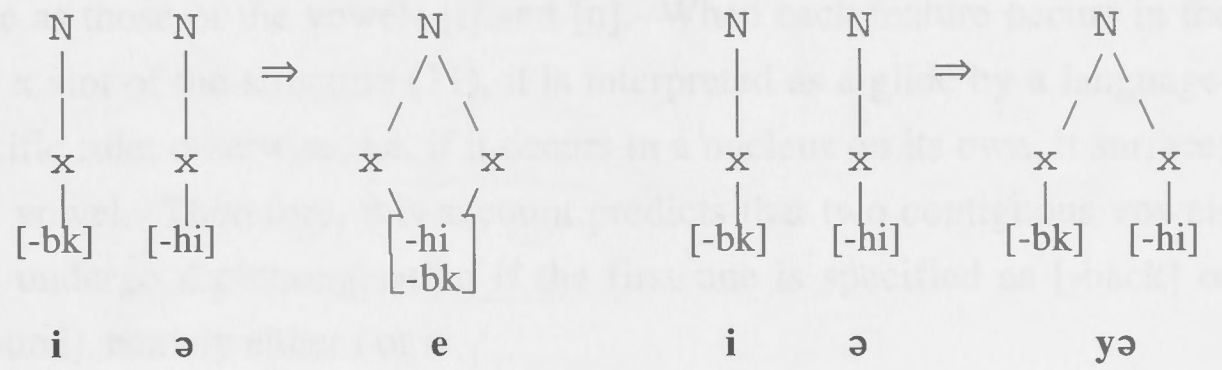
(19)




The input vowels *ə* and *i* are specified only with [-high] and [-back], respectively, the sum of which coincides with the underspecified features of the output vowel *e*.

Although Sohn's proposal correctly describes vowel coalescence by adopting the underspecification theory, the question as to why certain sequences undergo vowel coalescence while others do not still remains unresolved. Consider, for example, the sequence *i-ə*. According to Nuclear Gemination, these two vowels would also be expected to merge into the vowel *e* as shown in (20a).

(20) *a. b.



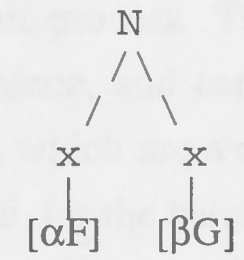

In fact, however, the sequence undergoes glide formation creating the diphthong *yə* as shown in (20b).

Given that Nuclear Gemination wrongly predicts the outcome of sequences which derive diphthongs, Sohn's proposal cannot explain the mechanisms which distinguish sequences undergoing vowel coalescence from others. This lack of explanatory power in Sohn's proposal is due to the fact that the feature-based framework does not supply the equipment necessary to restrict the possible input sequences which trigger Nuclear Gemination. Put differently, there are no constraints on the principles under

which Nuclear Gemination operates. In this regard, Sohn's proposal is 'constraint-free' and consequently one must treat the relationship between input sequences and outcomes as merely accidental.

One possible way of predicting these different outcomes is to posit a language-specific rule by which only certain features are interpreted as glides when they occur in the first x slot within a branching nucleus, and to let the rule work to filter out sequences that undergo glide formation. Look at the following representation of diphthongs proposed by Sohn.

(21) **Diphthong** (Sohn 1987)




According to Sohn, if the two x slots are specified with hetero-feature matrices, they are realised as a diphthong. The feature specification for the glides [y] and [w] are [-back] and [+round], respectively, which are the same as those of the vowels [i] and [u]. When each feature occurs in the first x slot of the structure (21), it is interpreted as a glide by a language-specific rule; otherwise, i.e. if it occurs in a nucleus on its own, it surfaces as a vowel. Therefore, this account predicts that two contiguous vowels will undergo diphthongisation if the first one is specified as [-back] or [+round], namely either *i* or *u*.

This account, however, does not work well for the actual processes. Taking the sequences *u-i* and *i-u*, for example, the first vowel is [+round] in the former and [-back] in the latter. Thus, both sequences would have to undergo glide formation, yielding the diphthongs *wi* and *yu*, respectively. However, the correct result is obtained only in the former case *u-i*, e.g. *nu-i-ta ~ nwi-ta* 'excrete (causative-base form)', and in the case of *i-u* glide formation does not take place, e.g. *kari-u-ta ~ *karyu-ta* 'hide (causative-base form)', despite the [-back] specification of the first vowel.

In addition, the sequence *i-ə* undergoes glide formation, e.g. *ki-ə ~ kyə* 'crawl-(infinitive)', and comparison of this sequence *i-ə* (*~yə*) with *i-u* (*~*

**yu*) suggests that not only the quality of the first vowel but also the relationship between the two vowels is relevant in determining sequences undergoing glide formation. This fact reveals the invalidity of an account which is dependent on the interpretation of an underspecified feature for the first vowel.

Above, I have pointed out that Sohn's proposal cannot provide a satisfactory solution for the relevant processes. As an additional defect of this proposal, the underspecified system itself can be criticised for being inadequate to capture vowel harmony in Korean. As discussed in Chapter Three, vowels are grouped as {a o ɛ}, {ə e}, {i u ɨ} according to the harmonic process. The underspecified system is meant to deal with vowel coalescence, and cannot provide the natural classes for these harmonic groups, which are a crucial factor in accounting for vowel harmony. For example, for the harmonic group {a o ɛ}, *a* is specified with [+low], *o* with [-high] and [+round], and *ɛ* with [-back] and [+low], and thus there is no common property shared by these vowels.

To sum up, observation of the relevant data suggests that sequences can be categorised into three types, which are summarised again below.

(22) Sequences which involve;

a. vowel coalescence: a-i, ə-i, etc.
b. glide formation: i-a, u-ə, o-i, etc.
c. neither processes: a-u, i-u, e-u, etc.

These three types of sequences raise the following questions to be answered:

(i) What determines the different outcomes in vowel coalescence and glide formation?
(ii) Why do sequences in (22c), where the second vowel is *u*, undergo neither vowel coalescence nor glide formation?

The remainder of this chapter will be devoted to providing a government-based analysis of the processes in vowel hiatus, and to addressing these two questions.

## 4.3 A Government-based Analysis

Before presenting a government-based analysis of the relevant data, we display again the internal structures of Korean vowels for convenience (see 2.1 and 3.6 for details of the representations of the vowels).

(23)

| | | |
|---|---|---|
| a (A) | ɛ (I•A) | o (U•A) |
| ə (A•_) | e (A•I) | |
| u (U) | i (I) | ɨ (_) |

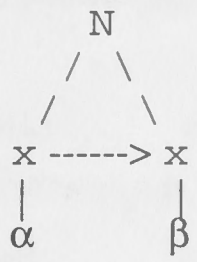
### 4.3.1 Conditions on vowel coalescence

Yoshida (1991) shows that vowel coalescence is triggered by Nuclear Fusion, which is formalised as follows.

(24) **Nuclear fusion** (Yoshida 1991)


Although the formalism of Nuclear Fusion is similar to that of Sohn's Nuclear Gemination, Nuclear Fusion crucially differs from it in that its operation is controlled by generally (universally) defined constraints. To see what kind of constraints are involved, it is necessary to note that Nuclear Fusion yields a branching nucleus which involves a constituent governing domain. Recall that a first position governs a second position within a constituent governing domain. In the structure (25), the governor α is either tensed (element-headed) or a segment that is not less complex than its governee β.

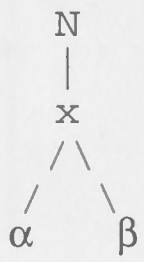
(25) **Heavy diphthong**




The structure (25) manifests itself as a 'heavy diphthong' (KLV 1985). Typically well-formed heavy diphthongs are *ay, aw, oy, ow*, etc. in which the first segment is low or complex, whilst the second segment is lax (empty-headed) and simplex.

Light diphthongs are a further type of diphthong. Unlike a heavy diphthong, a light diphthong does not involve constituent government, and thus the first segment may not be low or complex, which are necessary to be a governor.

(26) **Light diphthong**




Rather, the constraints involved in constituent government restrict the first segment of a light diphthong to be lax and simplex; sequences where the first segment is low or complex would form a heavy diphthong. The typical light diphthongs are *ya, yo, wa, we*, where the first segment is the glide *y* (I) or *w* (U).

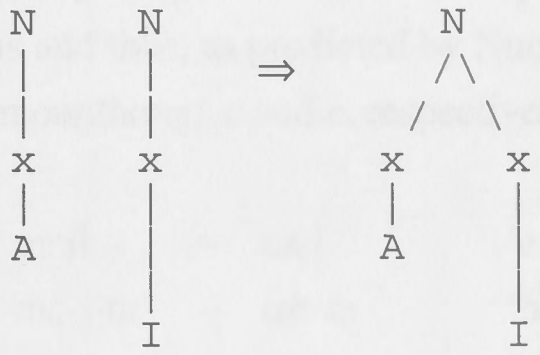
Bearing these constraints in mind, Yoshida proposes that sequences which trigger Nuclear Fusion are limited to those whose members are suitable to form a branching nucleus. Sequences consisting of a non-high vowel followed by a high vowel, e.g. *a-i* , *ə-i*, *e-i*, trigger Nuclear Fusion and undergo vowel coalescence, but the reverse sequences, e.g. *i-a, i-ə, i-e*, do not.

Vowel coalescence in Korean is derived through Nuclear Fusion too. Observe the following data for the vowel sequences *a-i* and *ə-i*.

| | | | | | |
|---|---|---|---|---|---|
| (27) | a. | əiku | ~ | eku | 'Oh, no' |
| | | irɨlt$^{h}$əimyən | ~ | irɨlt$^{h}$emyən | 'for example' |
| | | səi | ~ | se | 'three' |
| | b. | sai | ~ | sɛ | 'between' |
| | | sanai | ~ | sanɛ | 'manly person' |
| | | ca-iu-ta | ~ | cɛutu | 'sleep (causative, base form)' |

In (27a), two successive vowels *ə* and *i* are fused into *e*, and in (27b) *a* and *i* become *ɛ*. In each sequence, the high vowel *i* is preceded by a non-high vowel. One possible surface form derived from these sequences would be a heavy diphthong, namely *əy* or *ay*.

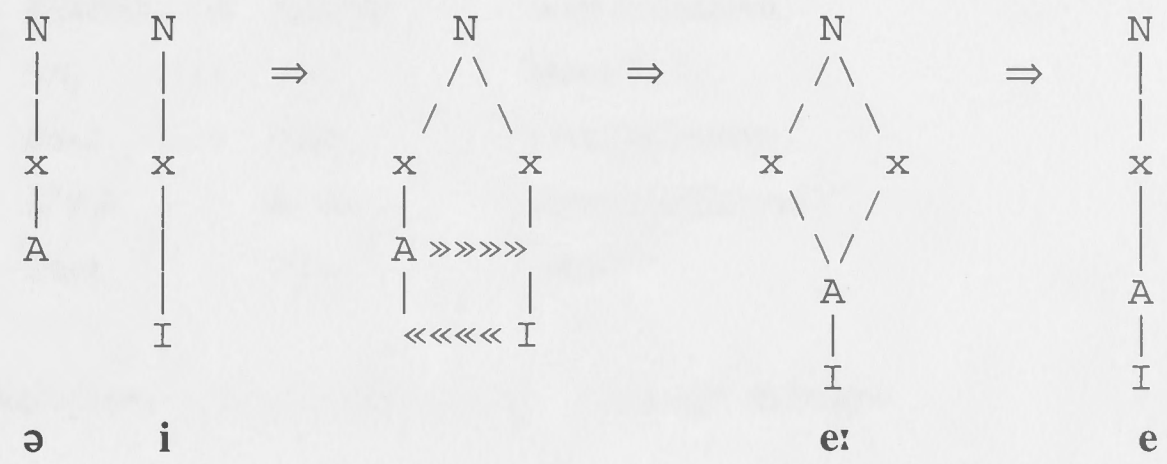
(28)




With respect to this possibility it should be noted that, as widely recognised, Korean does not have the diphthongs *ay, aw, oy, ow*, etc. (W. Heo 1965; S-H Sohn 1987), which are identified as heavy diphthongs. The absence of heavy diphthongs in Korean serves to restrict the outcomes of Nuclear Fusion, i.e. Nuclear Fusion does not create a heavy diphthong.

One of the typical manifestations of government is the spreading of some element(s) involved. The vowels *e* (← *ə-i*) and *ɛ* (← *a-i*) are derived by spreading of the elements 'A' and 'I': 'A' spreads from a governing position to a governed position, and 'I' spreads from a governed position to a governing position, as shown in (29b).

(29) a. b. c. d.




These spreadings yield a long vowel as in (29c), which is found in the pronunciation of the older generation. The skeletal points are reduced to one as in (29d) for the pronunciation of the younger generation, where the long-short vowel distinction disappears.

The sequences *ɛ-i* and *e-i* are also composed of a non-high vowel followed by a high vowel. These sequences are eligible to form a branching nucleus and thus, as predicted by Nuclear Fusion, they may also be merged to the monothongs *ɛ* and *e*, respectively.

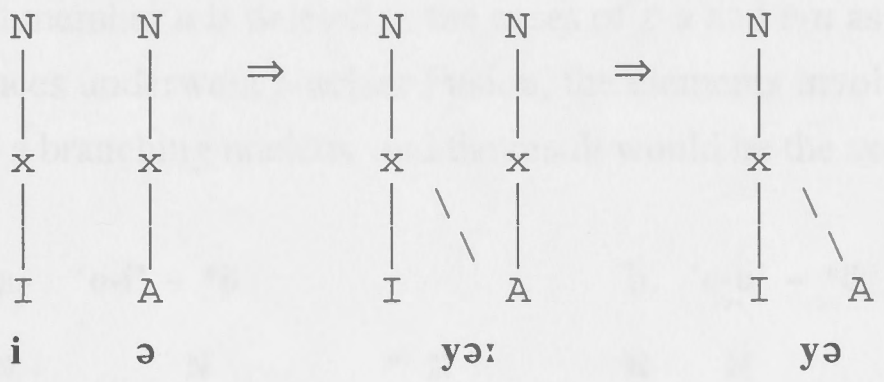
| | | | | |
|---|---|---|---|---|
| (30) | mɛil | ~ | mɛl | 'everyday' |
| | mɛ-i-ta | ~ | mɛ-ta | 'hang up-(passive)-(base form)' |
| | ceil | ~ | cel | 'number one' |
| | pe-i-ta | ~ | pe-ta | 'cut-(passive)-(base form)' |

Let us now consider a sequence of *ə* and *i* where the order of the vowels is reversed, i.e. *i-ə*. This sequence is distinct from the sequence *ə-i* in that the two members are inappropriate to form a branching nucleus, since the first segment is a high vowel *i* (I), which cannot occur in a governing position within a branching nucleus when followed by a heterogeneous segment. The sequence cannot trigger Nuclear Fusion, but undergoes glide formation.

| | | | | |
|---|---|---|---|---|
| (31) | ki-ə | ~ | kyə | 'crawl (infinitive)' |
| | kitari-ə | ~ | kitaryə | 'wait (infinitive)' |
| | iəŋ | ~ | yəŋ | 'straw' |
| | cu-ə | ~ | cwə | 'give (infinitive)' |
| | k'u-ə | ~ | k'wə | 'dream (infinitive)' |
| | muə | ~ | mwə | 'what?' |

The derivation of the diphthong *yə* (← *i-ə*) is given below.

(32) a. b. c.




It should be recalled here that glides occur in a nucleus, forming a light diphthong with a following vowel in Korean (see 2.4 for details). In (32b), the 'A' element spreads into the preceding nucleus, which is already occupied by the element 'I'. The 'I' element surfaces as the glide *y* in this light diphthongal structure. In the speech of the younger generation, *yəː* is shortened to *yə*, as in (32c).

### 4.3.2 Asymmetry between 'I' and 'U'

So far, I have demonstrated that vowel coalescence is triggered when a sequence consists of a non-high vowel followed by a high vowel, which can form a branching nucleus, while the result is glide formation when a sequence is composed of a high vowel followed by a non-high vowel. There are, however, cases where sequences do not undergo vowel coalescence, although a non-high vowel is followed by a high vowel. (33) illustrates these cases: (33a) is the case of the sequences *o-i*, and (33b) of *ɛ-u* and *e-u*.

(33) a.

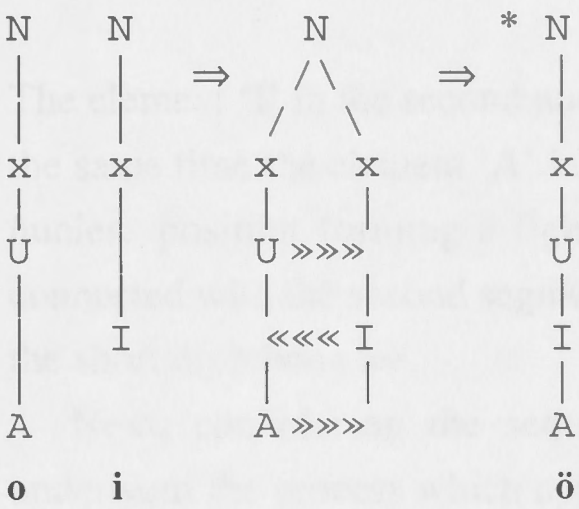
| | | | |
|---|---|---|---|
| ko-i-ta | ~ | kwe-ta | ‘gather (passive-base form)’ |
| co-i-ta | ~ | cwe-ta | ‘tighten (causative-base form)’ |
| soinne | ~ | swenne | ‘I (humble)’ |
| moi | ~ | mwe | ‘bait’ |

b.

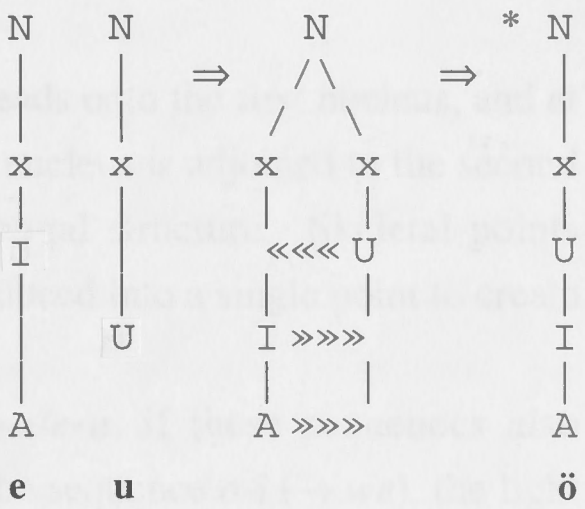
| | | | |
|---|---|---|---|
| t’ɛu-ta | ~ | t’ɛ-ta | ‘cover (base form)’ |
| pɛu-ta | ~ | pɛ-ta | ‘learn (base form)’ |
| teu-ta | ~ | te-ta | ‘warm up’ |
| meu-ta | ~ | me-ta | ‘fill’ |

The sequence *o-i* is converted to the diphthong *we* as in (33a), and the second member *u* is deleted in the cases of *ɛ-u* and *e-u* as in (33b). If these sequences underwent Nuclear Fusion, the elements involved would spread within a branching nucleus, and the result would be the vowel *ö*.

(34) a. **‘o-i’ ~ *ö**




b. **‘e-u’ ~ *ö**




The impossibility of the merger to *ö* in these cases is captured by the following Licensing Constraints in Korean, which were independently proposed to define the vowel inventory (cf. 3.7).

(35) **Licensing Constraints in Korean**

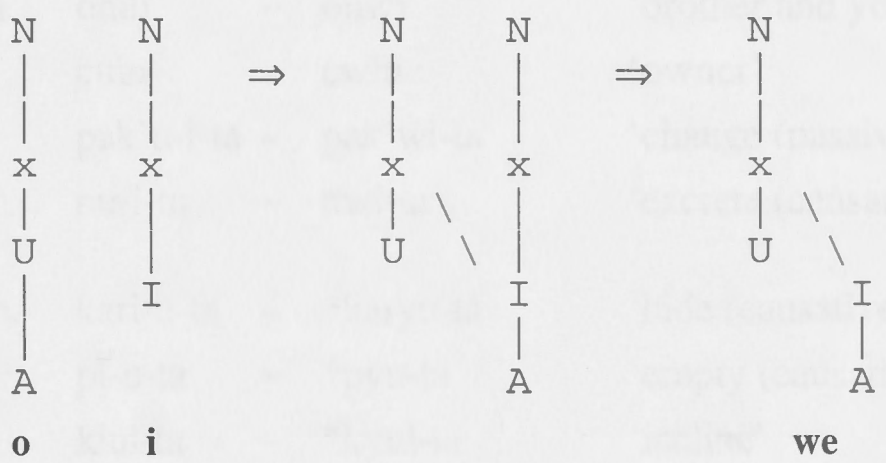
a. ‘I’ and ‘U’ cannot be combined.
b. ‘U’ does not license operators.

As these constraints state, the combination of the elements ‘I’ and ‘U’ is prohibited. Nor can ‘U’ be a head when there is an element to be licensed.

The conversion of the sequences *o-i*, *ɛ-u*, *e-u* to the vowel *ö* (A•I•U) would be in violation of these constraints.

While the Licensing Constraints exclude the possibility of merger to *ö*, the sequences select other options to avoid vowel hiatus. It was exhibited in (33a) that the sequence *o-i* is converted to the diphthong *we*. (36) illustrates the derivation of *we*.

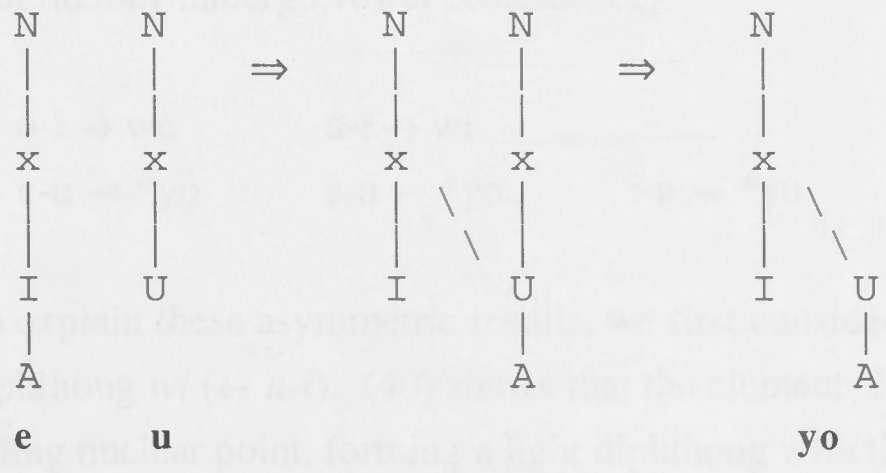
(36) a. b. c.




The element 'I' in the second nucleus spreads onto the first nucleus, and at the same time the element 'A' in the first nucleus is adjoined to the second nuclear position forming a light diphthongal structure. Skeletal points connected with the second segment are reduced into a single point to create the short diphthong *we*.

Next, considering the sequences *ɛ-u/e-u*, if these sequences also underwent the process which applies to the sequence *o-i* (→ *we*), the light diphthong *yo* would be the result.

(37) a. b. *c.



However, as displayed in (33b), diphthongisation is not invoked in these sequences, e.g. *t'ɛu-ta ~ *t'yo-ta*, *pɛu-ta ~ *pyo-ta*, and instead the second vowel *u* is deleted, e.g. *t'ɛu-ta ~ t'ɛ-ta*, *pɛu-ta ~ pɛ-ta*. What is the reason for the different output between *o-i* and *ɛ-u/e-u*?

Similarly, the sequences *i-u* and *u-i* also exhibit different results, despite the fact that both sequences are composed of high vowels and would thus be expected to yield a diphthong in identical fashion.

| | | | | | |
|---|---|---|---|---|---|
| (38) | a. | onui | ~ | onwi | 'brother and younger sister' |
| | | cuin | ~ | cwin | 'owner' |
| | | pak'u-i-ta | ~ | pak'wi-ta | 'change (passive-base form)' |
| | | nu-i-ta | ~ | nwi-ta | 'excrete (causative-base form)' |
| | b. | kari-u-ta | ~ | *karyu-ta | 'hide (causative-base form)' |
| | | pi-u-ta | ~ | *pyu-ta | 'empty (causative-base form)' |
| | | kiul-ta | ~ | *kyul-ta | 'incline' |
| | | ius | ~ | *yus | 'neighbour' |
| | | mium | ~ | *myum | 'dislike' |

As shown above, the sequence *u-i* undergoes glide formation resulting in the light diphthong *wi* as in (38a), while the sequence *i-u* does not, as in (38b).

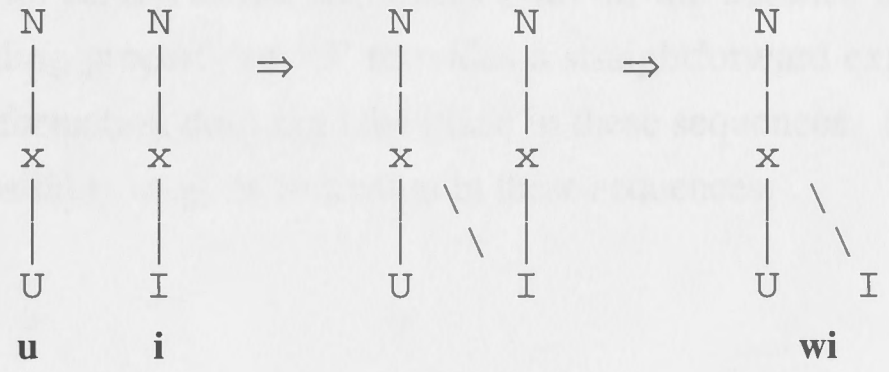
To summarise the facts observed above, the sequences *o-i, u-i, ɛ-u, e-u* and *i-u* are divided into two groups: i.e. {o-i, u-i} and {ɛ-u, e-u, i-u}. The second vowel is *i* in the former group, and *u* in the latter. What is of interest in these sequences is that there is certain asymmetry between *i* and *u*. That is, the sequences {o-i, u-i} undergo glide formation, but {ɛ-u, e-u, i-u} do not (nor do they undergo vowel coalescence).

| | | | |
|---|---|---|---|
| (39) | o-i → we | u-i → wi | |
| | ɛ-u → *yo | e-u → *yo | i-u → *yu |

To explain these asymmetric results, we first consider the derivation of the diphthong *wi* (← *u-i*). (40) shows that the element 'I' spreads onto the preceding nuclear point, forming a light diphthong with the element 'U', so

that 'U' is interpreted as the glide *w*. Reduction of skeletal points linked with 'I' yields the diphthong *wi*.

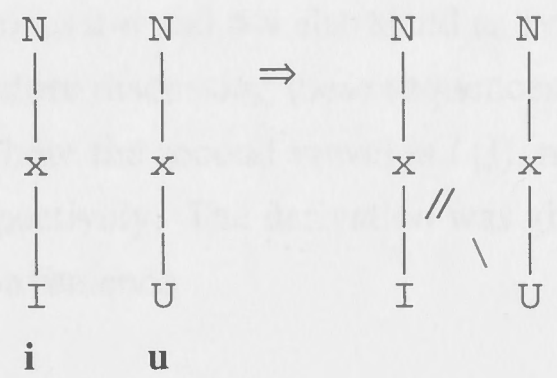
(40) a. b. c.




Turning now to the sequence *i-u*, which does not undergo glide formation, let us note first of all that Korean has the lexical diphthong *yu*, e.g. *hyuŋnɛ* 'imitation', *yunanhi* 'remarkably', and thus the impossibility of glide formation in this case cannot be attributed to the absence of the diphthong *yu* in the language. To investigate what exactly makes the sequence *i-u* (~**yu*) behave differently from *u-i* (~*wi* ), it is necessary to take a closer look at the derivation in (40) again. (40b) shows that glide formation is achieved by the spreading of the element 'I', which occurs in the second nucleus. To be more explicit, the element 'I' spreads from right to left, and this leftward spreading enables the element to connect with the skeletal point of the preceding nucleus. It is therefore clear that leftward spreading of the second segment is crucial for glide formation.

Following this line of argument, I claim that the impossibility of glide formation in the case of *i-u* (as well as *ɛ-u*, *e-u*) is due to the absence of the leftward spreading property in the element 'U' in Korean.

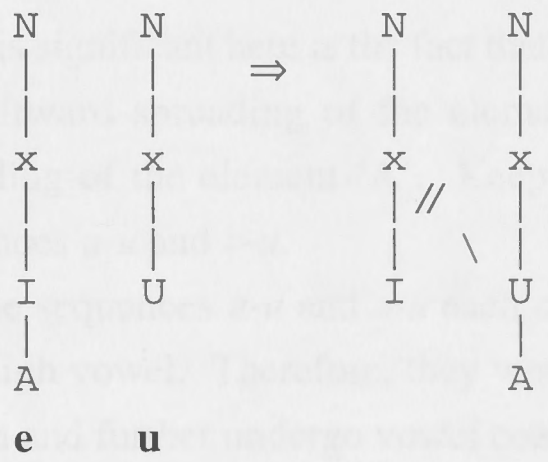
(41) a. b.



As illustrated, in order to produce the diphthong *yu*, leftward spreading of the second vowel *u* (U) is necessary, but the element 'U' lacks this property and thus diphthongisation cannot occur.

With regard to the sequences *ɛ-u/e-u*, the absence of the right-to-left spreading property of 'U' provides a straightforward explanation for why glide formation does not take place in these sequences. (42) illustrates the impossibility of glide formation in these sequences.

(42) a. b.

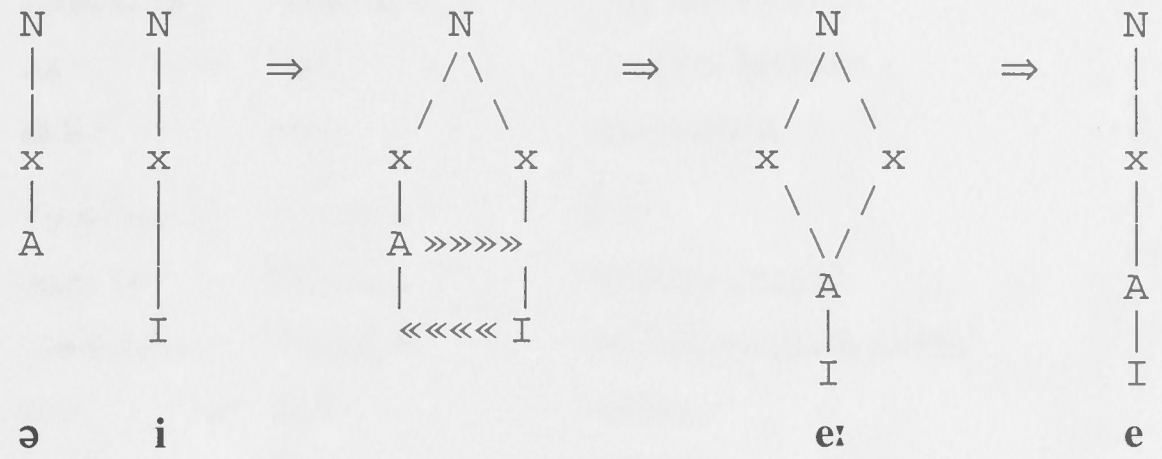



Again, 'U' must spread onto the preceding nuclear point to form a light diphthong. The diphthongisation is however impossible as 'U' does not have this spreading property. The sequences *ɛ-u/e-u* may select another option, but as noted before these sequences cannot undergo vowel coalescence, for the combination of the elements 'I' and 'U' is prohibited in Korean. In these cases the second vowel *u* is deleted to avoid vowel hiatus, e.g. *t'ɛu-ta ~ t'ɛ-ta, meu-ta ~ me-ta.*

In short, we have accounted for the impossibility of glide formation in the cases of *i-u, ɛ-u* and *e-u* , where the second vowel is *u* (U), in terms of the absence of the leftward spreading property of the element 'U'. The sequences *a-u* and *ə-u* also stand as evidence in favour of this account.

Before discussing these sequences, we recall that the sequences *a-i* and *ə-i*, where the second vowel is *i* (I), may be converted to the vowels *ɛ* and *e*, respectively. The derivation was given in 4.3.1, and is reproduced below for convenience.

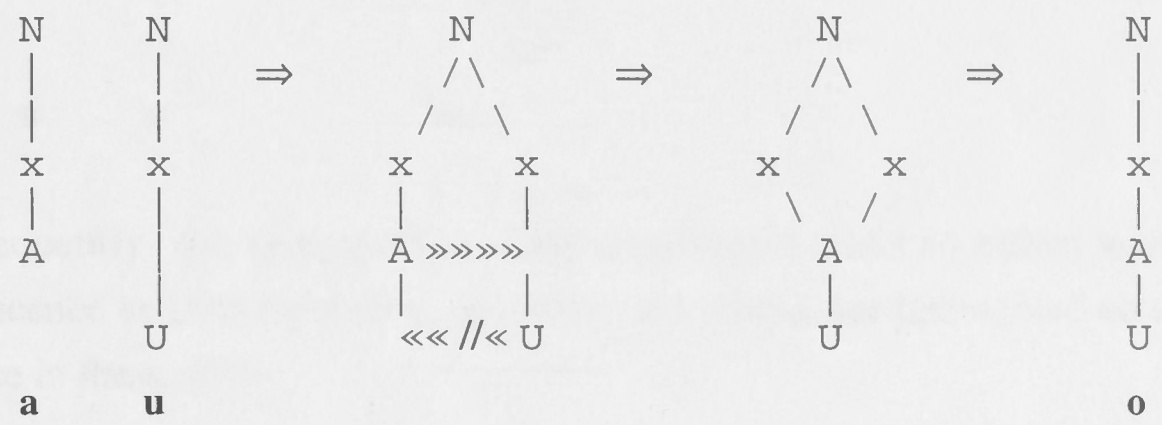
(43) a. b. c. d.




What is significant here is the fact that the vowel coalescence is achieved by the leftward spreading of the element 'I', in addition to the rightward spreading of the element 'A'. Keeping this in mind, let us consider the sequences *a-u* and *ə-u*.

The sequences *a-u* and *ə-u* each consist of a non-high vowel followed by a high vowel. Therefore, they would be expected to enter into Nuclear Fusion and further undergo vowel coalescence, creating the vowel *o* (U•A). However, this merger presupposes leftward spreading of the element 'U'.

(44) a. b. *c. *d.

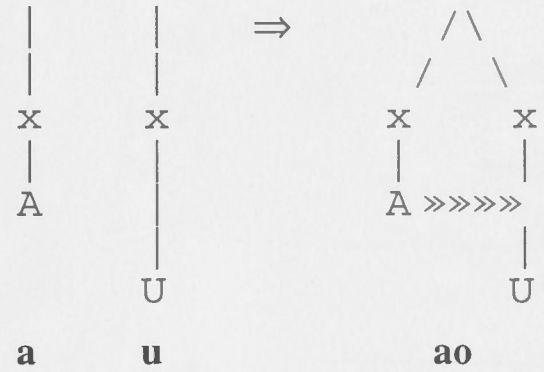



The lack of the leftward spreading property of 'U' predicts that such a merger is impossible, as illustrated in (44b). This prediction is verified by the data in (45), which shows that the sequences *a-u*, *ə-u* resist vowel coalescence.

| | | | | |
|---|---|---|---|---|
| (45) | s'aum | ~ | *s'om | 'fight' |
| | cauk-hata | ~ | *cok-hata | '(fog is) thick' |
| | au | ~ | *o | 'younger brother' |
| | aullə | ~ | *ollə | 'additionally' |
| | musəum | ~ | *musom | 'fear' |
| | əulli-ta | ~ | *olli-ta | 'fit (base form)' |
| | səun-hata | ~ | *son-hata | 'not happy (base form)' |
| | cəul | ~ | *col | 'measure' |
| | kəul | ~ | *kol | 'mirror' |

The single spreading of 'A' is also impossible, since such spreading would derive an ill-formed structure where a governed position is occupied by a segment which is more complex than that of a governing position.

(46) a. *b.




Consequently, the sequences *a-u* and *ə-u* do not undergo either vowel coalescence or glide formation. In reality, the vowels are maintained on the surface in these cases.

## 4.4 Conclusion

Phenomena involved in vowel hiatus have been accounted for in this chapter. It was shown that a government-based approach provides the equipment necessary to deal with the relevant phenomena. In particular,

Nuclear Fusion acts as a determiner of different outcomes between vowel coalescence and glide formation.

I have also proposed that the element 'U' does not have the right-to-left spreading property in Korean. The absence of this leftward spreading property explains the impossibility of vowel coalescence and glide formation in sequences where the second vowel is *u*.

# 5

# Interaction of Consonants

## 5.0 Introduction

In Chapters Five and Six, I discuss such phonological phenomena as tensification, obstruent lenition, epenthesis of the vowel *i*, and nasalisation, which are observed in verbal and nominal suffixations when a consonant-ending verb/noun is followed by a consonant-initial suffix. An analysis of these phenomena is given in connection with the special consideration on the syllabic structure of consonantal clusters. Concretely, I argue that consonantal clusters in Korean should be analysed as two onsets that are separated by an empty nucleus, i.e. onset-Ø-onset (Ø = empty nucleus). In addition, an attempt is made to show that these two onsets form a governing relation if certain requirements are satisfied.

In this chapter, the focus is on cases where verbs and nouns end with an obstruent. These cases involve obstruent lenition, tensification and epenthesis of the vowel *i*. Section 5.1 presents the relevant data, and sketches previous accounts of these phenomena. In the next section, 5.2, I discuss the epenthesis of *i* in cases where the suffix pattern is either -C## or -CCV. Then in sections 5.3, 5.4 and 5.5, I consider the mechanisms of obstruent lenition and tensification from the perspective of a government-based framework, and provide an analysis of cases of obstruent-ending verbs/nouns. In section 5.6, I investigate the paradigms of three types of verbs, which show certain alternations that are traditionally viewed as unpredictable. It will be shown that these paradigms are fully predictable within a government-based approach.

## 5.1 The Data and Previous Treatments

### 5.1.1 The data

It is well-known that a neutral obstruent is tensified when preceded by a stop in Korean. Some examples are given in (1).

(1)

a. **Verb-suffix**

| Verb | -ə/a '(inf.)' | -ca 'let us' | -ko 'and' | -təra '(recol.)' | Gloss |
|---|---|---|---|---|---|
| cap | capa | capc'a | capk'o | capt'əra | 'catch' |
| mak | maka | makc'a | makk'o | makt'əra | 'defend' |
| mit | mitə | mitc'a | mitk'o | mitt'əra | 'believe' |
| ka | ka | kaca | kako | katəra | 'go' |

b. **Noun-suffix**

| Noun | -e '(loc.)' | -coc$^{h}$a 'even' | -to 'also' | -put$^{h}$ə 'from' | Gloss |
|---|---|---|---|---|---|
| cip | cipe | cipc'oc$^{h}$a | cipt'o | cipp'ut$^{h}$ə | 'house' |
| kuk | kuke | kukc'oc$^{h}$a | kukt'o | kukp'ut$^{h}$ə | 'soup' |
| tari | tarie | taricoc$^{h}$a | tarito | tariput$^{h}$ə | 'leg' |

(inf. = infinitive, recol. = recollective, loc. = locative)

Underlying neutral obstruents in suffix-initial position are realised as their tensed counterparts after a stop-ending verb/noun, whilst their neutral status remains intact after a vowel-ending verb/noun. The case of a stop-ending verb/noun also involves lenition (of verb/noun-final obstruents). For presentational purposes, the data for lenition will be surveyed in 5.3.

Let us now look at cases where the verb/noun ends with a sonorant. Interestingly, when a suffix-initial obstruent is attached to a nasal-ending verb/noun, different outcomes obtain for verbal and nominal forms: a suffix-initial obstruent is tensified in verbal forms, but not in nominal

forms. These different outcomes are illustrated by the words in the first and second rows in (2a) and (2b).

(2)

a. **Verb-suffix**

| Verb | -ca<br>'let us' | -ko<br>'and' | -təra<br>'(recollective)' | Gloss |
|---|---|---|---|---|
| nam | namc'a | namk'o | namt'əra | 'remain' |
| sin | sinc'a | sink'o | sint'əra | 'wear shoes' |
| mil | milca | milko | miltəra | 'push' |

b. **Noun-suffix**

| Noun | -coc$^{h}$a<br>'even' | -to<br>'also' | -put$^{h}$ə<br>'from' | Gloss |
|---|---|---|---|---|
| som | somcoc$^{h}$a | somto | somput$^{h}$ə | 'cotton' |
| sin | sincoc$^{h}$a | sinto | sinput$^{h}$ə | 'shoes' |
| pal | palcoc$^{h}$a | palto | palput$^{h}$ə | 'foot' |

By contrast, the words in the third rows show that tensification is not triggered in either verbal or nominal forms when the verb/noun ends with a liquid. (3) summarises the contexts in which tensification takes place.

(3) **Tensification**

| Final segment | suffix-initial obstruent<br>verb-suffix | <br>noun-suffix |
|---|---|---|
| stop | + | + |
| nasal | + | – |
| liquid | – | – |
| vowel | – | – |

('+' = suffix-initial obstruent is tensified, '–' = is not)

Above, we have examined the data where the suffix-initial segment is an obstruent. Let us now observe cases where the suffix-initial segment is a sonorant. These involve epenthesis of the vowel *i*.

(4) **Verb-suffix**

| Verb | -ni 'because' | -ma 'I will' | -rə 'in order to' | Gloss |
|---|---|---|---|---|
| cap | capɨni | capɨma | capɨrə | 'catch' |
| mək | məkɨni | məkɨma | məkɨrə | 'eat' |
| mit | mitɨni | mitɨma | mitɨrə | 'believe' |
| sum | sumɨni | sumɨma | sumɨrə | 'hide' |
| sin | sinɨni | sinɨma | sinɨrə | 'wear shoes' |
| po | poni | poma | porə | 'see' |

**Noun-suffix**

| Noun | -ro 'with' | Gloss |
|---|---|---|
| cip | cipɨro | 'house' |
| kuk | kukɨro | 'soap' |
| pat$^{h}$ | pat$^{h}$ɨro | 'rice field' |
| kwaŋ | kwaŋɨro | 'storeroom' |
| son | sonɨro | 'hand' |
| tari | tariro | 'leg' |

The examples in (4) show that the vowel *ɨ* is present when the verb/noun ends with a consonant, but absent when the verb/noun ends with a vowel.

The data displayed so far all contain suffixes beginning with a consonant followed by a vowel (-CV). It has been shown that obstruent-initial suffixes and sonorant-initial suffixes involve tensification and vowel epenthesis, respectively. This fact suggests that whether affixation involves tensification or vowel epenthesis is determined by the quality of the suffix-initial consonant, if suffixes have the pattern -CV. However, when the suffix is composed of a single consonant (-C##), or begins with a bi-consonantal sequence (-CCV), the result is always epenthesis of the vowel *ɨ* regardless of the quality of the suffix-initial consonant.

(5) **Suffixal pattern -C## or -CCV**

**Verb-suffix**

| Verb | -n '(noun modifier)' | -ps'ita 'let us (polite)' | Gloss |
|---|---|---|---|
| cap | capɨn | capɨps'ita | 'catch' |
| mək | məkɨn | məkɨps'ita | 'eat' |
| mit | mitɨn | mitɨps'ita | 'believe' |
| sum | sumɨn | sumɨps'ita | 'hide' |
| sin | sinɨn | sinɨps'ita | 'wear shoes' |
| po | pon | pops'ita | 'see' |

**Noun-suffix**

| Noun | -n '(topicaliser)' | -l '(accusative)' | Gloss |
|---|---|---|---|
| cip | cipɨn | cipɨl | 'house' |
| kuk | kukɨn | kukɨl | 'soap' |
| pat$^{h}$ | pat$^{h}$ɨn | pat$^{h}$ɨl | 'rice field' |
| kwaŋ | kwaŋɨn | kwaŋɨl | 'storeroom' |
| son | sonɨn | sonɨl | 'hand' |
| tari | tarin | taril | 'leg' |

### 5.1.2 Previous treatments of tensification

Tensification has previously been investigated mainly within rule-based approaches which are summarised as follows:

(i) Change of the feature [-son] to [+tense]
(Kim-Renaud 1974; S-C Ahn 1985)

(ii) Insertion of an x slot with the feature [+constricted glottis]
(H-S Sohn 1987)

(iii) Treating tensed obstruents as geminates
(Martin 1982; J. Yu 1989; J-I Han 1992)

The first approach is illustrated by the rule proposed in S-C Ahn (1985).

(6) **S-C Ahn** (1985)

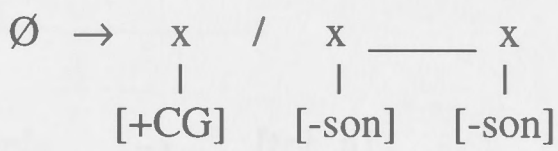
Post-lexical Tensing: [-son] → [+tense] / [-son] ____

The rule in (6) indicates that tensification is a kind of dissimilation by which a [-son] consonant becomes tensed by acquiring the [+tense] feature after another [-son] consonant. This rule correctly captures the case of obstruent-obstruent clusters, as it was meant to describe the fact that a neutral obstruent is not permitted to occur after another neutral obstruent in Korean. However, this rule fails to deal with the case where a verbal suffix-initial obstruent undergoes tensification even after a nasal-ending verb (and therefore ending in a [+son] consonant).

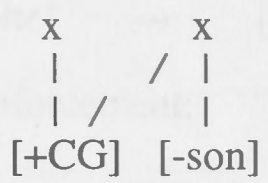
The rules (7) proposed by H-S Sohn (1987) illustrate the second approach. The Tensification Rule first inserts an x slot between two obstruents and then a [+CG] (constricted glottis) linked to this x slot is spread to the following obstruent. This inserted x slot, according to Sohn, is erased later, since Korean does not allow two consonants to occur in a single syllable.

(7) **H-S Sohn** (1987)

Tensification:




Spreading:




The basic idea of this approach is similar to the first approach in (6), except that it employs the [+CG] feature instead of [+tense]. Thus, again these rules cannot explain why a suffix-initial obstruent is tensified after a nasal in a verb-suffix, despite the fact that this context involves a sequence [+son]-[-son].

The second approach also encounters the difficulty of explaining the motivation for the x-slot insertion. As pointed out by Sohn herself, two consonants do not occur in a single syllable in Korean. Therefore, the question arises as to why an x slot and a segment should be inserted in spite of the fact that such an insertion obviously violates Korean syllable structure. Such an insertion appears to be merely an expedient to account for the phenomenon.

One of the most interesting aspects of tensification is how to account for the fact that a suffix-initial obstruent is tensified after a nasal in a verbal form (e.g. *sin-ca* → *sinc'a* 'wear shoes-let us'), but not in a nominal form (e.g. *sin-to* → *sinto* 'shoes-also'). Furthermore, tensification is not triggered in either verbal or nominal forms when a verb or noun ends with a liquid (e.g. *mil-ca* → *milca* 'push-let us', *pal-to* → *palto* 'foot-also'). The first and second approaches cover only the cases of obstruent-ending verbs/nouns, and cannot provide a comprehensive solution including the cases of sonorant-ending verbs/nouns.

With regard to the third approach, which claims that a tensed obstruent is a geminate, J-I Han (1992) proposes that surface tensed obstruents are derived from two sources: underlying neutral geminates and two adjacent [-son] consonants, as illustrated in (8a). Further, Han proposes a rule of Geminate Reinforcement through which neutral geminate consonants obtain [+constricted glottis], as shown in (8b).

(8) **J-I Han** (1992)

a. /tokki/ 'axe' → [tok':i]
   /tok + ki/ 'spite' → [tok':i]

b. Geminate Reinforcement:

```
   C  C          C  C
    \ /           \ /
[-son]   →    [+CG]
```

One serious problem in this approach is that the proposal does not work consistently with cases of vowel-ending verbs/nouns. Consider the following data where nouns are followed by a suffix meaning 'also'.

| (9) | Noun | 'also' | Gloss |
|---|---|---|---|
| | cip | cipt'o | 'house' |
| | sok | sokt'o | 'inside' |
| | aki | akito | 'baby' |

The suffix-initial consonant is realised as tensed *t'* when nouns end with a stop, but as shown in the third example, it is realised as neutral *t* after a vowel-ending noun. Under Han's proposal, the suffix should underlyingly be a geminate as in *cip-tto* → *ciptto*, and further, it would become *cipt'o* through the rule of Geminate Reinforcement.

This proposal, however, cannot explain why an underlying geminate surfaces as a neutral non-geminate after a vowel-ending noun as in *aki-tto* → *akito*. In order to account for this, it is necessary to assume a rule of degemination by which a geminate consonant becomes a single consonant, i.e. neutral, between vowels. But such a solution would lead to the wrong prediction that geminates do not occur in intervocalic positions.

| (10) | Noun | 'only' | 'even' | Gloss |
|---|---|---|---|---|
| | cip | cipp'un | cipk'aci | 'house' |
| | sok | sokp'un | sokk'aci | 'inside' |
| | som | somp'un | somk'aci | 'cotton' |
| | aki | akip'un | akik'aci | 'baby' |

In the examples in (10), the initial consonants of the suffixes are realised as tensed whether nouns end with a consonant or a vowel. According to Han's proposal, the underlying forms of the suffixes should be *ppun* and *kkaci*, respectively. If the degemination rule operated in intervocalic positions, such words as *akip'un* (← *aki-ppun*) and *akik'aci* (← *aki-kkaci*) should not exist on the surface. Nevertheless, such words are found, revealing the invalidity of the degemination rule. In conclusion, Han's proposal that treats tensed obstruents as being underlyingly geminates cannot provide a convincing solution for tensification.

### 5.1.3 Previous treatments of vowel alternation

Vowel alternation has previously been treated as (i) epenthesis of the vowel *ɨ* (C-W Kim 1973), or (ii) deletion of the vowel *ɨ* (B-G Lee 1977; Kim-Renaud 1982; S-C Ahn 1985; H-S Sohn 1986). The former assumes that the vowel *ɨ* is not present in the lexical representation and is inserted during a derivation, whilst the latter claims that the vowel is lexically present and is deleted during a derivation.

Let us first consider the epenthetic hypothesis. In this hypothesis vowel epenthesis is claimed to be invoked when some morphological operation creates a medial tri-consonantal cluster or a final bi-consonantal cluster, which are impermissible in Korean. An epenthetic vowel breaks up the first and second consonants of such clusters, as in *mək-ps'ita* → *mə**kps'**ita* –(insertion)→ *mək**ɨ**ps'ita*, *mək-m* → *mə**km*** –(insertion)→ *mək**ɨ**m*.

Notice, however, that when a suffix begins with a liquid or a nasal, the vowel is inserted, e.g. *sok-ro* → *sok**ɨ**ro*, *mək-ni* → *mək**ɨ**ni*, despite the fact that medial bi-consonantal clusters are permitted in Korean. If epenthesis is invoked solely to avoid impermissible clusters it should not apply to these cases.[1]

Let us now examine the second view that the alternation involves deletion of the vowel *ɨ*. H-S Sohn (1986), couched in the theory of Underspecification (Pulleyblank 1983; Archangeli 1984; Kiparsky 1985; Archangeli & Pulleyblank 1987), proposes that the vowel *ɨ* is underlyingly unspecified for the features [high], [back], [round] and [low]. She claims that, being the least marked vowel, *ɨ* is deleted when it is adjacent to another vowel, e.g. *cu-ɨm* → *cum* 'give (nominaliser)', *kʰɨ-ə* → *kʰə* 'big (infinitive)'. The scope of this proposal is limited to cases where the vowel is deleted before or after another vowel, and thus it fails to provide a convincing explanation for cases where the deletion takes place after a consonant. Observe the following.

---

1 Detailed discussion of the inadequateness of the epenthetic hypothesis will be given in Chapter Six.

| (11) | Verb | -ɨni(k'a) 'because' | -ɨma 'I will' | Gloss |
|---|---|---|---|---|
| a. | mək | məkɨni | məkɨma | 'eat' |
| | sin | sinɨni | sinɨma | 'wear shoes' |
| b. | ka | kani | kama | 'go' |
| | po | poni | poma | 'see' |

The underlying forms of these suffixes would be *-ɨni* and *-ɨma*, since Sohn treats the vowel *ɨ* as lexically belonging to the suffix. The vowel *ɨ* surfaces when preceded by a consonant as shown in (11a), and is deleted when preceded by a vowel as shown in (11b). These outcomes seem to favour the vowel-deletion approach.

However, this approach is not consistent with cases of obstruent-initial suffixes. As illustrated in (12), obstruent-initial suffixes that have the pattern -CV never involve *ɨ*~zero alternation after either vowel-ending or consonant-ending verbs.

| (12) | Verb | -ɨca 'let us' | -ɨko 'and' | Gloss |
|---|---|---|---|---|
| a. | mək | məkc'a | məkk'o | 'eat' |
| | sin | sinc'a | sink'o | 'wear shoes' |
| b. | ka | kaca | kako | 'go' |
| | po | poca | poko | 'see' |

In (12b), the vowel *ɨ* is deleted after a vowel-ending verb, as predicted by Sohn's proposal. However, as shown in (12a), the vowel is also deleted after a consonant-ending verb. Note that deletion of the vowel *ɨ* is invoked by its feature of least markedness.

> "Epenthesis is regarded as the most revealing process, though not the only means, in determining the least specified segment in a language since it characterizes the featural asymmetry with respect to the other vowels." (Archangeli 1984)

As Archangeli claims, a contrast is made between *i* and other vowels in terms of their specification. While deletion of the vowel *i* can be understood to take place when it is adjacent to another vowel, there is no reason why the vowel *i* should also be deleted after a consonant, a context which has nothing to do with the partial specification of *i*.

In conclusion, a fundamental problem in Korean *i*~zero alternation is how to account for the different distribution of the vowel *i* before obstruent-initial and sonorant-initial suffixes. Neither the epenthetic hypothesis nor the deletion hypothesis in the above proposals provide a satisfactory solution for *i*~zero alternation.

In section 5.1, we have observed tensification and *i*~zero alternation. The following facts appear to be important in these phenomena:

(i) Whether the suffix has a pattern -CV, -C## or -CCV.
(ii) Whether the suffix-initial consonant is an obstruent or a sonorant.
(iii) Whether the verb/noun ends with an obstruent or a sonorant.
(iv) Whether the given form is a verbal or a nominal.

The relevant phenomena are analysed in the remainder of this chapter and in Chapter Six, exploring the syllabic structure of consonantal clusters. In the course of the analysis it will be shown how the above facts are related to tensification and *i*~zero alternation.

## 5.2 Vowel Alternation in the Suffix Patterns -C##, -CCV

### 5.2.1 Lexical status of the vowel *i*

We begin the analysis by considering the lexical status of the vowel *i* in Korean. As described before, the vowel *i* alternates with zero. A number of languages have been reported to exhibit alternations of this kind between a vowel and zero.

(13) **Khalkha Mongolian** (ë~Ø):

| | | | |
|---|---|---|---|
| saxël | 'moustache' | saxlaː | 'one's own moustache' |

**French** (ɛ~Ø):

| | | | |
|---|---|---|---|
| apɛl | 'a call' | apl-*e* | 'to call' |

**Polish** (e~Ø):

| | | | |
|---|---|---|---|
| koper | 'drill' | kopr-o | 'to drill' |

**Palestinian Arabic** (i~Ø):

| | | | |
|---|---|---|---|
| ʔakil | 'food' | ʔakl-u | 'his food' |

**Moroccan Arabic** (i̵~Ø):

| | | | |
|---|---|---|---|
| kti̵b | 'he wrote' | ki̵tb-uː | 'they wrote' |

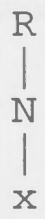
**Tangale** (u/o~Ø):

| | | | |
|---|---|---|---|
| targo | 'trap' | tarug-no | 'my trap' |

The alternating vowels in the above languages have been discussed as being underlyingly empty nuclei: Mongolian and French in Charette (1992), Polish in Gussmann & Kaye (1993), Palestinian Arabic in Yoshida (1993), Moroccan Arabic in Kaye (1990b) and Tangale in Nikiema (1989). These alternations involve neither the insertion nor the deletion of a vowel. They are viewed as a cross-linguistic phenomenon which involves the phonetic interpretation of an empty nucleus; namely, each syncopated vowel is represented as a nuclear position which has no phonetic content, and whether or not this empty position receives phonetic realisation is determined by a set of principles.

I assume that *i*~zero alternation in Korean is also not a language-specific phenomenon but a manifestation of certain universal properties of languages. That is, the Korean vowel *i* is a phonetic realisation of an empty nucleus.

(14) **Vowel *i***



Phonetic realisation/non-realisation of empty nuclei is controlled by the ECP (Empty Category Principle).

(15) **Empty Category Principle** (Kaye 1993: 94)

The Phonological ECP: A p-licensed (empty) category receives no phonetic interpretation.

P-licensing:
1. Domain-final (empty) categories are p-licensed (parameterised).
2. Properly governed (empty) nuclei are p-licensed.
3. A nucleus within an inter-onset domain is p-licensed.

Let us first consider final empty nuclei in Korean. The ECP states that whether or not final empty nuclei receive phonetic interpretation is determined by a parametric setting. As noted in 1.2, in a language which licenses final empty nuclei, a word may end with a consonant, while final nuclei must be phonetically realised in a language which does not license final empty nuclei. Korean belongs to the former. The representation of the consonant-ending word *cip* 'house' appears as in (16a).

(16) a. Final empty nucleus parameter [ON] ↓


*b.


The representation (16a) is well-formed as the final onset is licensed by a following nucleus. If the final consonant *p* were a coda as in (16b), the structure would violate the Coda Licensing Principle, which states:

(17) **Coda Licensing Principle** (Kaye 1990a: 311)

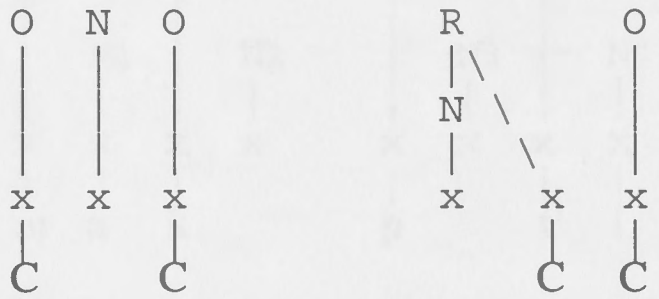
A post-nuclear rhymal position must be licensed by a following onset.

According to this principle, the coda *p* in the structure (16b) must be licensed by a following onset, but there is no governing onset available on its right.[2]

### 5.2.2 Suffix patterns -C##, -CCV

We now proceed to consider how the ECP operates for word-internal empty nuclei. We first note that internal empty nuclei allow a structure where two apparently contiguous consonants are two onsets separated by an empty nucleus, as in (18a).

(18) a. b.




[CC] [CC]

This onset-Ø-onset structure contrasts with a coda-onset structure as in (18b), which is widely accepted as the syllabic structure for consonantal clusters in Korean (H-S Sohn 1987; S-W Chung 1990; O-M Kang 1992). We discuss the inappropriateness of the coda-onset structure for Korean consonantal clusters in Chapter Six, where we deal with sonorant-ending verbs/nouns, and point out that a coda-onset view fails to handle clusters involving nasals. For the reminder of this thesis, we will analyse relevant phenomena on the assumption that consonantal clusters have an onset-Ø-

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2 See 1.2 for more details.

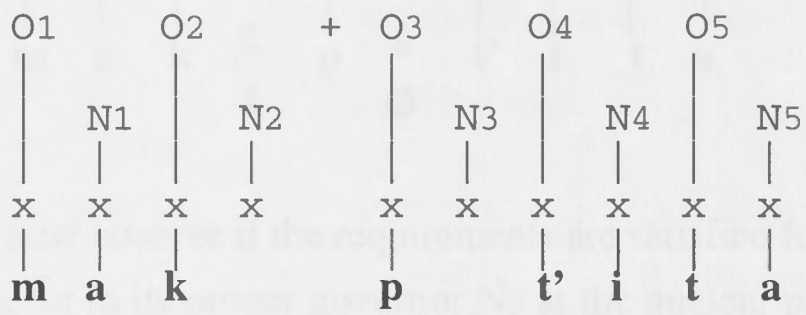
onset structure in Korean. The validity of this assumption will be verified during the course of the analysis.

Let us return to the discussion of internal empty nuclei. The effects of the ECP on internal empty nuclei will be demonstrated by an account of the derivation of words in which the suffix is composed of a single consonant (-C##), or begins with a bi-consonantal cluster (-CCV). (19) shows representative examples for words with the suffix pattern -CCV.

| | | | | |
|---|---|---|---|---|
| (19) | mak-pt'ita | → | makɨpt'ita | 'defend (polite. recollective)' |
| | sin-pt'ita | → | sinɨpt'ita | 'wear shoes (polite. recollective)' |
| | mit-ps'ita | → | mitɨps'ita | 'believe-let us (polite)' |
| | cap-ps'ita | → | capɨps'ita | 'catch-let us (polite)' |

As displayed above, this case involves epenthesis of the vowel *ɨ*. Taking the word *mak-pt'ita* as an example, (20) presents its underlying representation.[3]

(20)




In (20), the nuclei N2 and N3 are empty. They may not receive phonetic realisation, if the requirements defined by the ECP are satisfied. As both occur in word-internal position, Proper Government is responsible for their phonetic realisation/non-realisation.

---

3 I assume that the second consonant of the suffix (i.e. *t'* in *-pt'i-*) is underlyingly tensed. Although it is represented as neutral in the orthography, it never appears as neutral in actual utterances. One might claim that the suffix is a compound of *p-ti* (and becomes *pt'i*). However, there is no evidence that *ti* is an independent morpheme, i.e. *ti* is never found in words other than *-pt'i*.

(21) **Proper Government** (Kaye 1993: 94)

A nuclear position α properly governs a nuclear position β iff

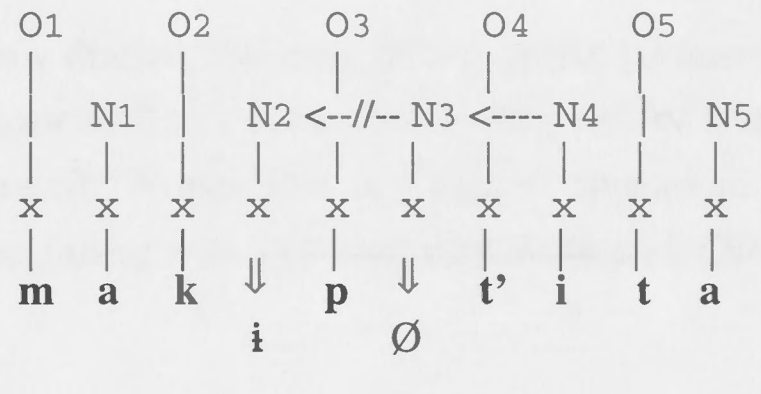
(i) α is adjacent to β on its projection

(ii) α is not itself licensed

(iii) No governing domain separates α from β

Taking N3 first, its proper governor is the following nucleus N4. Both are adjacent at the nuclear projection level, and no governing domain intervenes. Further, the governor N4 is filled with the vowel *i*, so that the nucleus is not itself licensed. The empty nucleus N3 is thus properly governed by N4, and licensed not to receive phonetic interpretation.

(22)

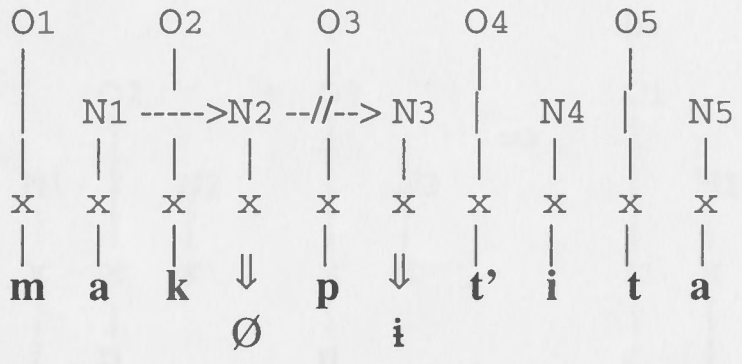



[makɨpt'ita]

Let us now observe if the requirements are satisfied for N2. The nucleus N2 is adjacent to its proper governor N3 at the nuclear projection level and no governing relation intervenes between the two. However, N2 is not properly governed because N3 is itself licensed. This unsuccessful application of the ECP leads N2 to be phonetically interpreted as the vowel *i*. As a result, we obtain [makɨpt'ita].

It should be noted that directionality of proper government is subject to parametric variation. For example, head-final proper government is attested in Moroccan Arabic (Kaye 1990b), French (Charette 1991), and head-initial proper government is found in Finnish (Gibb 1992). Above, proper government was shown to operate from right to left in Korean. To confirm if this directionality is correct, let us look at the representation (23), where the directionality of proper government is assumed to operate from left to right.

(23) *




*[makpɨt'ita]

As assumed here, the proper governor of the empty nucleus N2 is the preceding nucleus N1. N2 is properly governed since N1 contains the vowel *i*. In turn, N2 which is itself licensed cannot act as a proper governor for the another empty nucleus N3, so N3 is spelled out as *ɨ*. Consequently, we would obtain the wrong result *[makpɨt'ita] if the directionality was left to right.

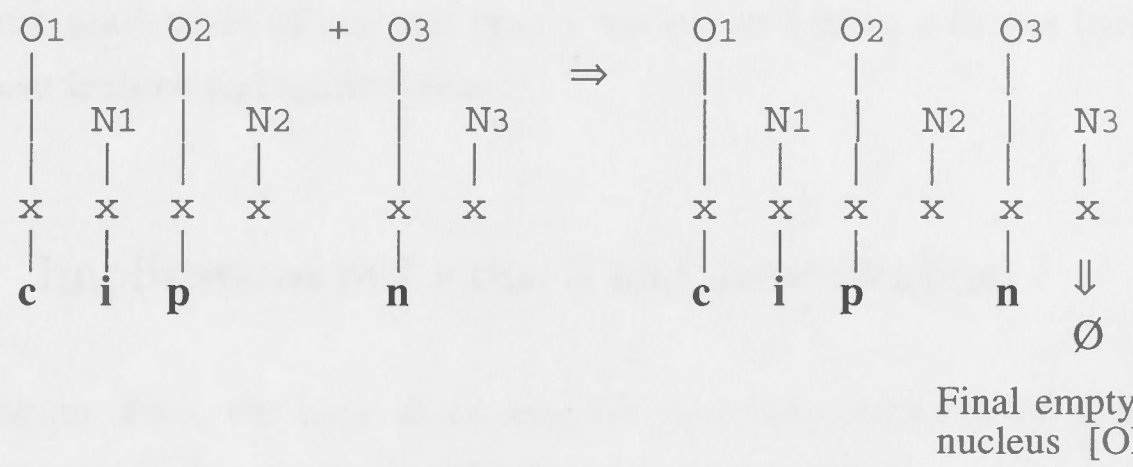
We now discuss the case of the suffix pattern -C##. When such a suffix is appended to a consonant-ending verb or noun, the sequence -CØ-CØ is created. Notice that this pattern appears as identical to cases of suffixes beginning with a bi-consonantal cluster (-CØ-CØCV).

(24)

| | | | | |
|---|---|---|---|---|
| a. | makØ-pØt'ita | → | makɨpt'ita | 'defend (polite. recollective)' |
| | mitØ-pØs'ita | → | mitɨps'ita | 'believe-let us (polite)' |
| b. | capØ-mØ | → | capɨm | 'catch (nominaliser)' |
| | kat$^{h}$Ø-nØ | → | kat$^{h}$ɨn | 'identical (noun-modifier)' |
| | somØ-lØ | → | somɨl | 'cotton (accusative)' |
| | cipØ-nØ | → | cipɨn | 'house (topicaliser)' |

In (24b), the suffixes end with an empty nucleus. Taking the word *cip-n* as an example, (25) shows its derivation.

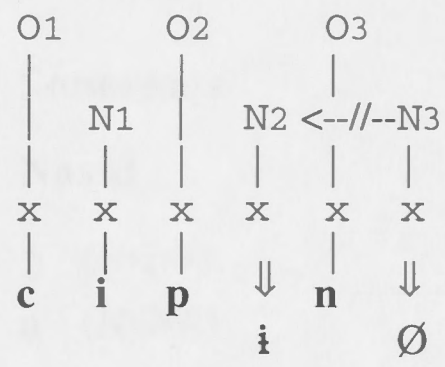
(25) a. b.




Final empty nucleus [ON]

In (25a), the nuclei N2 and N3 are empty. They may not receive phonetic realisation, if the requirements defined by the ECP are satisfied. First, N3 is in word-final position, so it is licensed by virtue of the fact that Korean licenses final empty nuclei. For the internal empty nucleus N2, its phonetic realisation/non-realisation is dependent on whether it is properly governed by a following nucleus N3. The proper government is not triggered, since N3 is itself licensed. N2 which fails to be properly governed manifests itself as *i*.

(26)




[cipɨn]

To summarise, proper government correctly predicts that the vowel *ɨ* appears if followed by a consonantal cluster or a word-final consonant. Further, it is also predicted that *ɨ* is not present before a sequence CV, since in this case an empty nucleus is properly governed by a following vowel. However, the vowel *ɨ* is found in such environment, if the following consonant is a sonorant, as in *capɨma*, *capɨrə*. By contrast, if the following consonant is an obstruent *ɨ* may not be present, but the obstruent is tensified instead, as in *capk'o*, *capc'a*. It is therefore obvious that the quality of the following consonant has a significant role in determining the phonetic

realisation of internal empty nuclei in Korean. In the next section, we explore how the quality of the following consonant is concerned in the phonetic realisation of internal empty nuclei, by taking a closer look at obstruent lenition and tensification.

## 5.3 Implications of Lenition and Tensification

In Chapter Two, we have discussed the internal structures of Korean consonants, which are reproduced below for convenience.

(27)

a. **Obstruents**

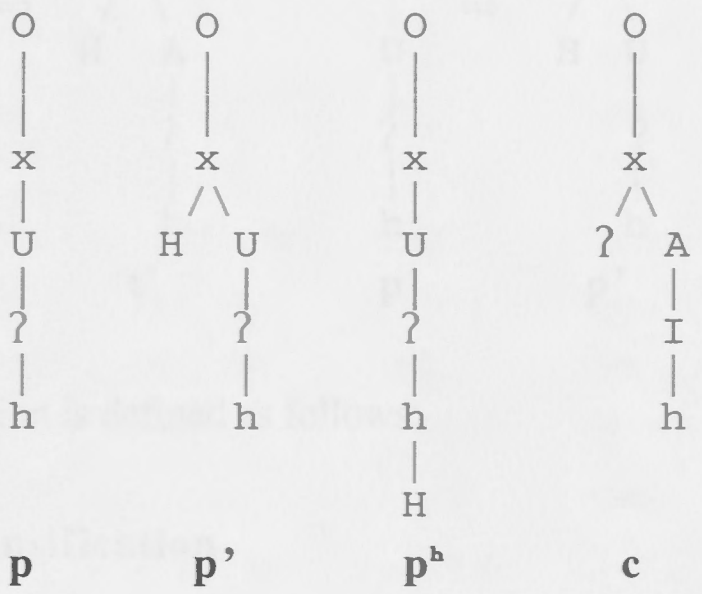
| **Neutral** | | **Tensed** | | **Aspirated** | |
|---|---|---|---|---|---|
| k | (h•ʔ•v) | k' | (H•h•ʔ•v) | $k^h$ | (H•h•ʔ•v) |
| t | (h•ʔ•A) | t' | (H•h•ʔ•A) | $t^h$ | (H•h•ʔ•A) |
| p | (h•ʔ•U) | p' | (H•h•ʔ•U) | $p^h$ | (H•h•ʔ•U) |
| c | (h•ʔ•I•A) | c' | (H•h•ʔ•I•A) | $c^h$ | (H•h•ʔ•I•A) |
| s | (A•h) | s' | (H•A•h) | | |

b. **Sonorants**

| **Nasal** | | **liquid** | |
|---|---|---|---|
| ŋ | (N•ʔ•v) | r | (A) |
| n | (N•ʔ•A) | | |
| m | (N•ʔ•U) | | |

Tensed obstruents are composed of elements identical to their aspirated counterparts, but have a contour structure while aspirates do not. Affricates also have a contour structure (cf. 2.3).

(28)




### 5.3.1 An element-based interpretation of obstruent lenition and tensification

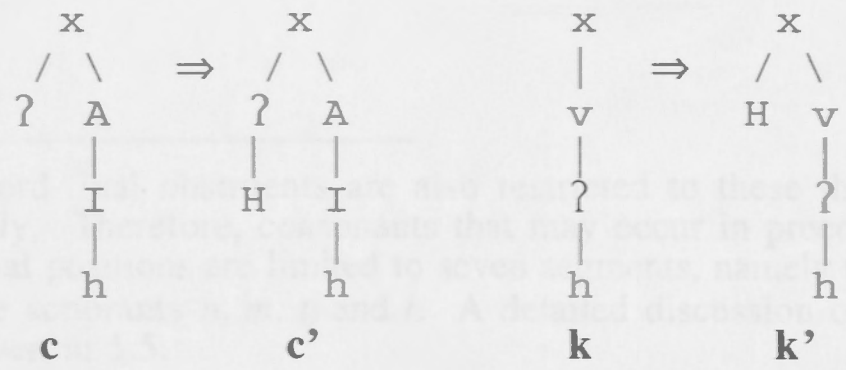
(29) shows examples of suffixation in which verb/noun-final and following suffix-initial segments are both obstruents.

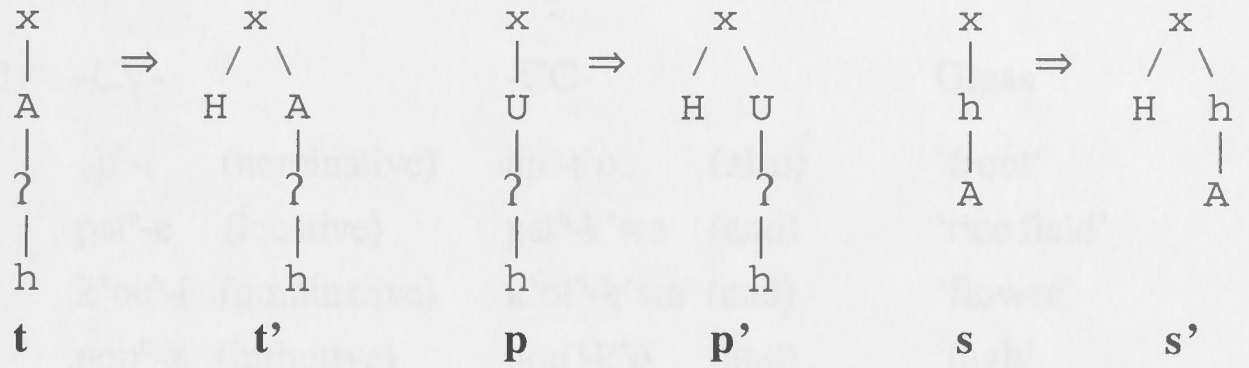
(29)

| | | | |
|---|---|---|---|
| mak-ca | → | makc'a | 'defend-let us' |
| cap-ko | → | capk'o | 'catch-and' |
| cip-to | → | cipt'o | 'house-also' |
| sok-pota | → | sokp'ota | 'inside-than' |

In (29), after a stem-final stop, neutral obstruents *c*, *k*, *t* and *p* in suffix-initial position become their tensed counterparts *c'*, *k'*, *t'* and *p'*, respectively. From the viewpoint of an element-based approach, this tensification is interpreted as obtaining of the element 'H', which represents tenseness.

(30)






Tensification is defined as follows:

(31) **Tensification**

Neutral obstruents are tensified by obtaining the element 'H'.

We next consider what happens to the first member of the clusters. In Korean, only the three unreleased stops *k*, *t* and *p* are allowed to occur in preconsonantal position, as far as obstruents are concerned.[4] Underlying tensed, aspirated, and released neutral velar and bilabial stops are converted to their homorganic unreleased counterparts, and all alveolar obstruents become *t*.

(32) k, k', $k^h \rightarrow k^\neg$ t, t', $t^h$, c, c', $c^h$, s, s' $\rightarrow t^\neg$

p, p', $p^h \rightarrow p^\neg$

($C^\neg$ indicates an unreleased stop)

Some examples are given below.

---

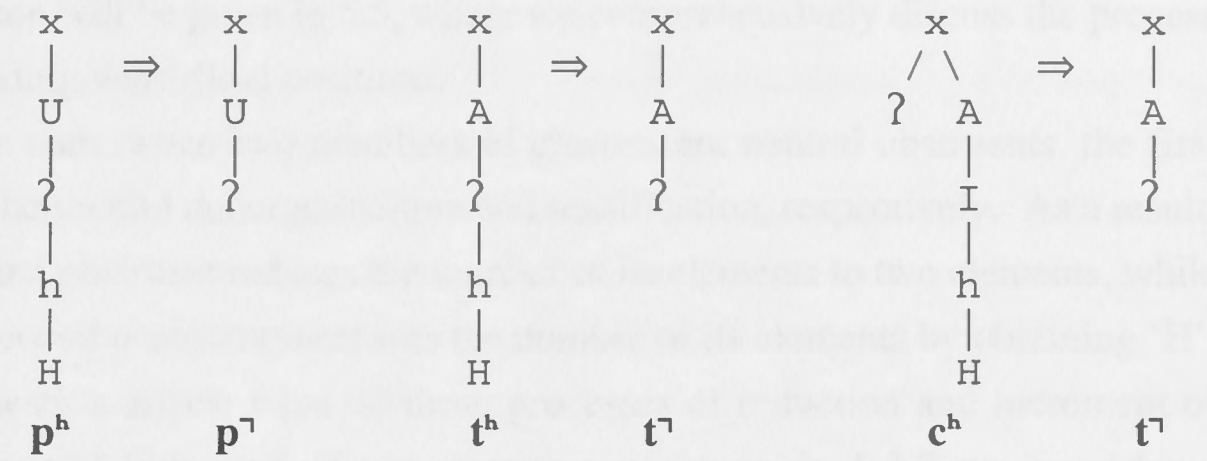
4 Word-final obstruents are also restricted to these three unreleased stops only. Therefore, consonants that may occur in preconsonantal and word-final positions are limited to seven segments, namely these three stops, and the sonorants *n*, *m*, *ŋ* and *l*. A detailed discussion on this matter will be given in 5.5.

| (33) | -CV- | | -CC- | | Gloss |
|---|---|---|---|---|---|
| | ap$^{h}$-i | (nominative) | ap$^{\urcorner}$-t'o | (also) | 'front' |
| | pat$^{h}$-e | (locative) | pat$^{\urcorner}$-k'wa | (and) | 'rice field' |
| | k'oc$^{h}$-i | (nominative) | k'ot$^{\urcorner}$-k'wa | (and) | 'flower' |
| | nop$^{h}$-a | (infinitive) | nop$^{\urcorner}$-k'o | (and) | 'high' |
| | nak'-a | (infinitive) | nak$^{\urcorner}$-c'a | (let us) | 'fish' |
| | mit-ə | (infinitive) | mit$^{\urcorner}$c'a | (let us) | 'believe' |
| | nac-a | (infinitive) | nat$^{\urcorner}$k'o | (and) | 'low' |
| | sok-i | (nominative) | sok$^{\urcorner}$t'o | (also) | 'inside' |
| | cip-i | (nominative) | cip$^{\urcorner}$t'o | (also) | 'house' |

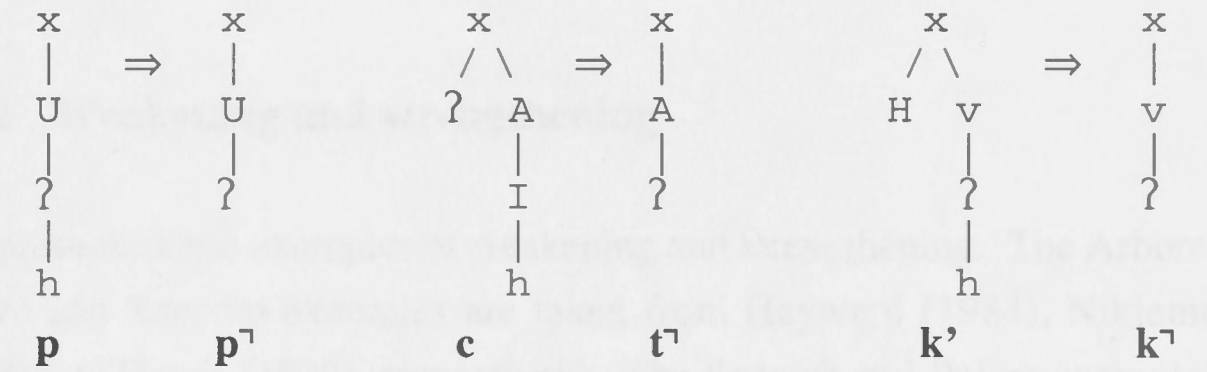
Released and unreleased neutral stops are in complementary distribution: the former is found before a vowel and the latter occurs elsewhere. Since the distribution of these two types is predictable, throughout this thesis I will use the identical transcript *C* for both types. *C*$^{\urcorner}$ will be used to represent unreleased stops only when it is necessary to distinguish from released neutral stops.

The examples in (33) illustrate that obstruents are lenited to unreleased stops *k*, *t* and *p* before another consonant, while they are realised as released neutral, aspirated, tensed stops or affricates before a vowel. To be more specific, obstruent lenition involves a loss of tenseness and aspiration as well as friction, and palato-alveolar affricates further lose their palatality and become alveolar stops. In terms of an element-based approach, this lenition process is captured as the loss of elements 'H', 'h' and 'I' from the internal structure of the segments involved.

(34) a. b. c.




d. e. f.




In (34a) and (34b), two elements 'H' and 'h' are lost; (34c) shows the loss of these two elements and 'I', as well as debranching; in (34d), the element 'h' is lost; (34e) and (34f) show the decomposition of the elements 'I' and 'h' in the former and 'H' and 'h' in the latter, in addition to debranching for both.

The generalisation which we can draw here is that obstruent lenition produces segments that contain only two elements, namely '?' and one of 'A', 'v' or 'U'. The three unreleased stops *k*, *t*, *p* are identified respectively by 'v', 'A' and 'U', which define the place of articulation of each segment. Hereafter, the term 'place-defining element' is used to refer to these elements. The effect of obstruent lenition is described as follows:

(35) **Obstruent Lenition (Tentative)**

Obstruents are reduced to bi-elementary segments, the '?' element and a place-defining element ('A', 'v' or 'U').

Obstruent lenition is also applicable to word-final consonants, e.g. $ap^h \rightarrow$ [ap¬] 'front', $pat^h \rightarrow$ [pat¬] 'rice field'. A revised version of obstruent lenition will be given in 5.5, where we comprehensively discuss the process including word-final positions.

In sum, when two members of clusters are neutral obstruents, the first and the second undergo lenition and tensification, respectively. As a result, the first obstruent reduces the number of its elements to two elements, while the second obstruent increases the number of its elements by obtaining 'H'. A question arises: what do these processes of reduction and increment of element(s) indicate? To answer this question, in 5.3.2 we consider a government-based approach to weakening and strengthening processes.

### 5.3.2 Weakening and strengthening

(36) presents some examples of weakening and strengthening. The Arbore, Mooré and Sesotho examples are taken from Hayward (1984), Nikiema (1988) and Harris (1990), respectively. The Spanish and Pulaar examples are from Harris (1992a).

(36)

a. **Weakening**

Arbore (č → y):

| | | |
|---|---|---|
| gerrač (basic form) | gerrayme (multiple reference) | 'thief' |
| sermač (basic form) | sermayme (multiple reference) | 'hyena' |

Spanish (s — h): después — de[h]pué[h] 'after'

b. **Strengthening**

| | | | | |
|---|---|---|---|---|
| Pulaar (r → d): | mbor-ri | → | mbordi | 'pus' |
| | wor-ru | → | wordu | 'male' |
| Mooré (r → d, l): | pen-re | → | pende | 'lower belly' |
| | bol-re | → | bolle | 'clay' |
| Sesotho (f → p): | N-fep'a | → | mpep'a | 'feed' |

(36a) shows weakening processes in preconsonantal position: *č*, *s*, *l* are lenited to *y*, *h*, *w*, respectively, before another consonant. (36b) shows strengthening of a consonant in postconsonantal position: *r* is converted to *d* or *l*, and *f* becomes *p* after another consonant.

Within the framework of GP, weakening and strengthening are viewed as the reduction and increment of element(s) in the internal structure of segments (Harris 1988, 1990; Harris & Kaye 1990). The weakening and strengthening processes in the languages displayed above are illustrated in (37) with the internal structure of each segment.

(37) a. **Weakening**

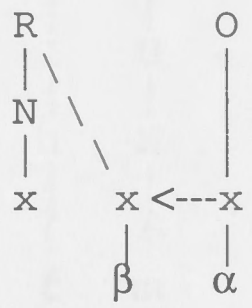
| | | | |
|---|---|---|---|
| Arbore (č → y): | č (h•ʔ•I) | → | y (I) |
| Spanish (s → [h]): | s (A•h) | → | h (h) |

b. **Strengthening**

| | | | |
|---|---|---|---|
| Pulaar (r → d): | r (A) | → | d (h•ʔ•A) |
| Mooré (r → d, l): | r (A) | → | d (h•ʔ•A) or l (A•ʔ) |
| Sesotho (f → p): | f (U•h) | → | p (h•ʔ•U) |

It is significant to note here that these processes take place in response to the governing relation in which they are involved. Consider the following interconstituent government holding between a coda and a following onset.

(38) a. **Interconstituent governing domain**




b. **Coda Licensing Principle** (Kaye 1990a: 311)

A post-nuclear rhymal position must be licensed by a following onset.

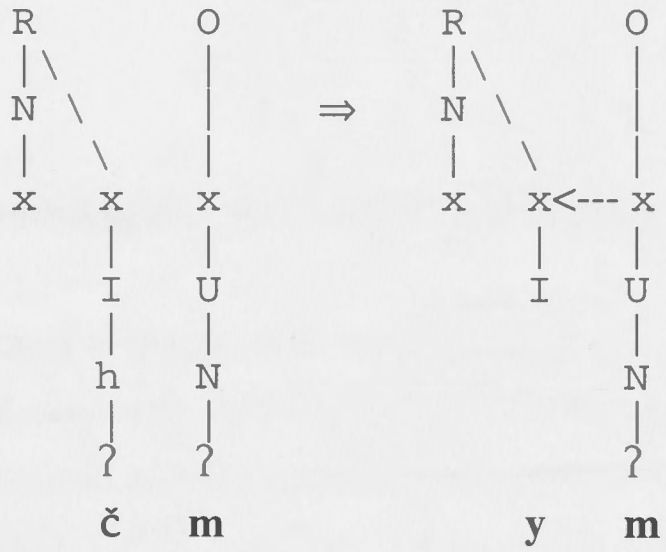
(38a) shows that a coda position is governed by the following onset position. We also note that this onset-to-coda government is obligatorily established, in conformity with the Coda Licensing Principle in (38b). Given that β and α occur in a governed coda and a governing onset respectively, these segments must satisfy the following condition:

(39) **Complexity Condition** (Harris 1990: 274)

> Let α and β be segments occupying the positions A and B respectively. Then, if A governs B, α must be no more complex than β.

The examples of weakening and strengthening noted above are viewed as processes in which the governor α increases its complexity and/or the governee β reduces its complexity, in order to enhance the slope complexity differential of the governor α and its governee β. To illustrate the reduction, let us take the weakening process in Arbore as an example. As noted already, in this language, the palatal affricate *č* is weakened to the palatal glide *y* when followed by the multiple reference suffix *-me* .

(40) **Arbore** (čm → ym)

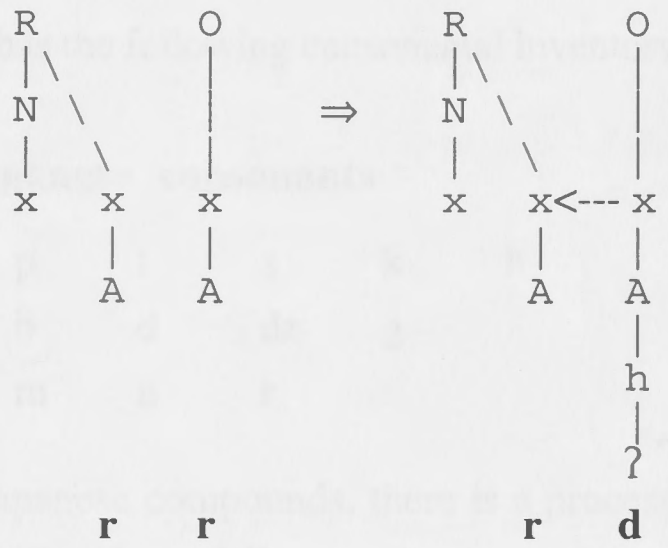



The first structure in (40) shows that the coda and onset positions are occupied by the palatal affricate *č* and the labial nasal *m*. In terms of interconstituent government, the coda must be licensed by the following

onset. The palatal affricate, which occurs in the governed position, undergoes the reduction process and is reduced to only one element 'I'.

While the Arbore example involves a reduction of segmental complexity in a governed position, the Pulaar example illustrates an increment process in a governing position. As reported before, this language has a process whereby *r* is strengthened to *d* after *r*.

(41) **Pulaar** (r → d)




In the first structure above, both the coda and onset positions are occupied by the element 'A'. In the situation where the governor and governee have the same degree of segmental complexity, the onset position increases its complexity by obtaining the elements 'h' and '?' in order to be a better governor.

### 5.3.3 Phonotactics involving the onset-onset structure

Consideration of the mechanism of weakening and strengthening suggests a likely explanation for Korean obstruent lenition and tensification occurring in governed and governing positions, respectively. However, it cannot be taken for granted that Korean consonantal clusters involve a governing relation, since consonantal clusters are two onsets in Korean. Note that two onsets, as being separated by a nucleus, are in principle free from a governing relation, as opposed to a coda-onset cluster which must obligatorily form a governing relation as per the Coda Licensing Principle.

It is therefore necessary to provide independent evidence for a governing relation between two onsets. Below, I will discuss *ɯ*~zero alternation in Japanese and syncope of schwa in German, to demonstrate that onset-Ø-onset may be a structure for clusters which have a head-final governing relation.

## *Japanese ɯ~zero alternation*

Japanese has the following consonantal inventory.

(42) **Japanese consonants**

| | | | | |
|---|---|---|---|---|
| p | t | s | k | h |
| b | d | dz | g | |
| m | n | r | | |

In Sino-Japanese compounds, there is a process by which *t* in a sequence *tɯ* is assimilated to a following consonant *k, t, p* or *s*.[5]

(43) **Japanese gemination**

| | | | | | | |
|---|---|---|---|---|---|---|
| zitɯ 'real' | + | ka 'home' | → | zikka | 'parents' home' |
| | + | tai 'body' | → | zittai | 'essence' |
| | + | sai 'existence' | → | zissai | 'reality' |
| | + | hi 'expenses' | → | zippi | 'actual expenses' |

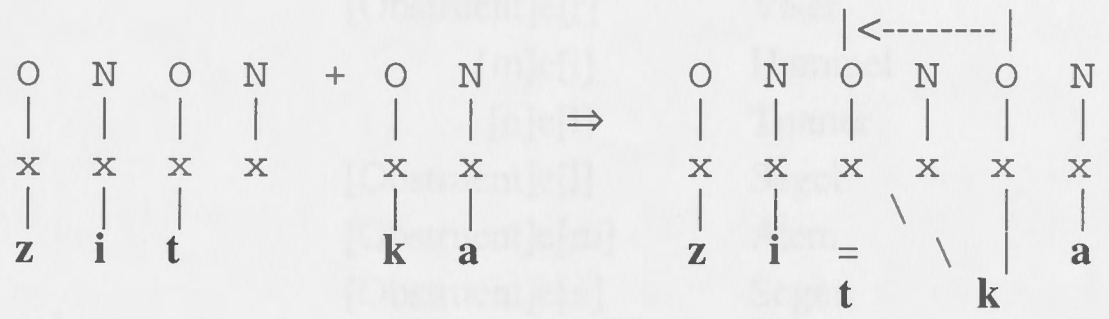
In the examples in (43), the vowel *ɯ* is syncopated and the preceding consonant *t* loses its identity by assimilating to a following consonant, resulting in a geminate. The alternation of *h* (h) with *p* (H•?•h•U) in the last example is subject to the status of the position in which *h/p* occurs (cf. Yoshida 1991); *p* appears in a governing position, while *h* appears elsewhere, e.g. *si* 'private' + *hi* 'expenses' → *sihi* 'one's own expenses'. Yoshida (ibid.) shows that the gemination in (43) is due to head-final

---

5 In Japanese, consonantal clusters are limited to geminates and homorganic nasal-obstruent sequences. See Yoshida (1991) for detailed discussion of the syllabic structure of consonantal clusters in Japanese.

government between *t* and the following consonant, which occur in two onsets.

(44)




Interestingly, the examples of the sequence '*t*-*ɯ*-sonorant' exhibit a different result from '*t*-*ɯ*-obstruent' with respect to the syncope of the vowel *ɯ*.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (45) | zitɯ 'real' | + | mee | 'name' | → | zitɯmee | 'real name' |
| | | + | ri | 'profit' | → | zitɯri | 'actual profit' |

In these examples, geminates are not formed and the vowel *ɯ* is present, indicating that *t* and the following nasal or liquid are not in a governing relation. The presence of the vowel *ɯ* reflects the inability of sonorant consonants to be governors in Japanese.

In short, the presence or absence of the vowel *ɯ* is determined by whether or not a governing relation holds between a preceding *t* and a following consonant. If the governing relation is formed the vowel is not present, and if not, the vowel appears. We will see that syncope of schwa in German parallels this *ɯ*~zero alternation in Japanese.

### *Syncope of schwa in German*

Lieber (1987) has summarised the distribution of the schwa in German native stems. According to Lieber, the schwa occurs (i) between any consonant and [r], (ii) between nasals or obstruents and [l], and (iii) between obstruents and nasals. The following examples, provided by Wurzel (1970) via Lieber (1987), illustrate this distribution.

(46) Schwa occurs between:

| | |
|---|---|
| [l]e[r] | Keller |
| [m]e[r] | Eimer |
| [n]e[r] | Donner |
| [Obstruent]e[r] | Vater |
| [m]e[l] | Hammel |
| [n]e[l] | Tunner |
| [Obstruent]e[l] | Segel |
| [Obstruent]e[m] | Atem |
| [Obstruent]e[n] | Segen |

This German case is a further example of head-final interonset government. Two consonants are intervened by an empty nucleus, i.e. *lØr*, *mØr*, whose phonetic realisation is subject to the governing relation between the two surrounding consonants. The presence of the schwa in the examples above indicates that surrounding consonants fail to form a governing relation. In turn, the failure of this government is attributed to the two consonants not being appropriate to form a governing relation, more particularly, to the first consonant in a governed position being stronger than a second consonant in a governing position.

The current account therefore predicts that a governing relation will be established if two consonants are a mirror image of those in (46) above, that is to say, if they are *rØl*, *rØm*, etc. Such a distribution indicates that the governed position is no longer occupied by a consonant stronger than that in its governed position. Look at the following data, which are also taken from Lieber (1987: 109).

(47) Schwa does not occur between:

| | |
|---|---|
| [r]_[l] | Kerl |
| [r]_[m] | Wurm |
| [r]_[n] | Horn |
| [r]_[Obstruent] | Ort |
| [l]_[m] | Halm |
| [l]_[n] | Köln |
| [l]_[Obstruent] | Zelt |
| [m]_[Obstruent] | Samt |
| [n]_[Obstruent] | Front |
| [Obstruent]_[Obstruent] | Kraft |

In these words, the schwa does not occur. The distribution of the two consonants are an exact mirror image of those shown in (46) above where the schwa occurs, suggesting that two consonants in these sequences also occur in two onsets having an intervening empty nucleus, i.e. *rØl*, *rØm*, and successfully enter into a governing relation.

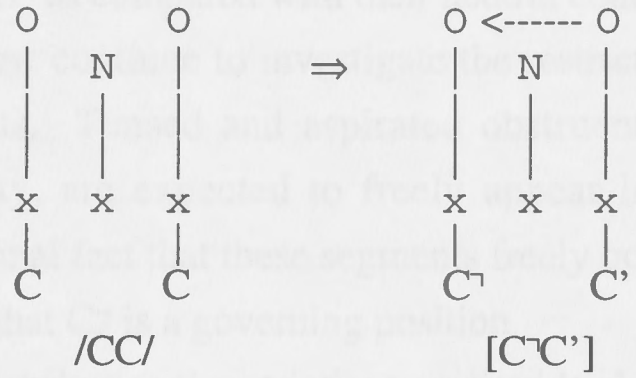
Another conceivable way of dealing with the sequences without the schwa is to assume that the two consonants are syllabified into a coda and an onset. That is, a sequence with the intervening schwa, e.g. [mər], has the structure onset-nucleus-onset, while a sequence without the schwa, e.g. [rm], has the structure coda-onset. Notice however that by assuming different structures for these two types of sequences, one has to treat the former sequence, i.e. [mər], as merely having an onset-nucleus-onset structure but not as involving a governing relation. Therefore, the two consonants in this structure should be free in terms of distributional restriction. If this was the case, the schwa would be able to occur between any consonants, and such sequences as [rəm], [rət] would be expected to exist in German. Yet such sequences are not found, and under this assumption one would have to treat the presence/absence of schwa as accidental. By contrast, the absence of such sequences as [rəm], [rət] is correctly captured under interonset government. Once again, the two consonants in *rØm*, *rØt* are in a governing relation, and accordingly the only surface forms derived from these sequences are [rm], [rt], where a trapped empty nucleus is inaudible, while the two consonants in *mØr*, *tØr* fail to form a governing relation and the empty nucleus is phonetically realised as the schwa as in [mər], [tər].

### 5.3.4 Distribution of the two members of consonantal clusters

The points we have made in 5.3.2 and 5.3.3 are that weakening and strengthening occur respectively in governed and governing positions, and that an onset-onset structure may have a governing relation. Returning to our discussion of Korean obstruent clusters, we can now identify obstruent lenition and tensification as occurring in governed onset and governing

onset positions, respectively. This head-final interonset government is illustrated below.

(48) **Interonset governing domain**




To see if we can deal generally with all Korean consonantal clusters as entering into a head-final governing relation, let us observe the table in (49), which summarises the distribution of the members of consonantal clusters, $C_1C_2$.

(49) **Distribution of two members of consonantal clusters**

| $C_1$ \ $C_2$ | t p k<br>c s | t' p' k'<br>c' s' | $t^h$ $p^h$<br>$k^h$ $c^h$ | m | n | l |
|---|---|---|---|---|---|---|
| t<br>p k | − | + | + | − | − | − |
| n<br>m ŋ | + | + | + | + | + | − |
| l | + | + | + | + | − | + |

(Neutral stops t, p, k in $C_1$ are unreleased.)

(49) shows that there are regular restrictions in the cooccurrence of members of clusters. As already discussed, the absence of clusters where two members are neutral obstruents is due to tensification of $C_2$, and the absence of tensed and aspirated obstruents in $C_1$ is due to obstruent lenition.

Recall that nasals have three elements, 'N', '?' and a place-defining element ('U', 'v' or 'A'), and the liquid *l* has two elements, '?' and 'A'.[6] A

---

6 In preconsonantal position and in a geminate, underlying *r* is converted to *l*. See 6.4 for details on the alternation of *r*~*l*.

neutral fricative has two elements 'A' and 'h'. Released neutral stops have three elements, 'h', '?' and a place-defining element, and affricates have these three elements and 'I'. Tensed and aspirated obstruents have the greatest complexity among Korean consonants; they have an additional element 'H' as compared with their neutral counterparts.

We now continue to investigate the restrictions on the cooccurrence of consonants. Tensed and aspirated obstruents, which have the greatest complexity, are expected to freely appear in governing position. The distributional fact that these segments freely occur in C2 thus provides clear evidence that C2 is a governing position.

The distributional restrictions on liquids also supply crucial evidence in favour of the head-final governing relation. Liquids are structurally simplest among Korean consonants, and therefore the Complexity Condition predicts that a liquid is a potential governee and cannot govern other segments. This prediction coincides with the distributional restrictions: a liquid cannot occur in a governing position C2, except in the case of a geminate, while it may freely occur in a governed position C1, except where C2 is the homorganic nasal *n*. The absence of the sequence *l-n* is due to the OCP by which these two segments surface as the geminate *ll*, e.g. *mul-nanri* → *mullalli* 'water-disaster', *tal-nara* → *tallara* 'moon-country'.

To conclude, the distribution of the two members of clusters suggests that phonotactic constraints on all consonantal clusters in Korean are manifestations of head-final interonset government. Obstruent lenition and tensification are indications that segments occur in a governed onset and a governing onset position, respectively.

Another significant fact drawn from tensification is that a head of this government must be occupied by a segment that contains 'H'. Notice that the neutral affricate *c* is composed of four elements (?•h•I•A); nevertheless, it never occurs in a governing position C2 even though the governed position C1 is occupied by an unreleased stop which has two elements ('?' and a place-defining element). It is still tensified by adding the element 'H' in this environment, e.g. *mak-ca* → *makc'a* 'defend-let us'. Accordingly, an attempt that treats segments without 'H' as governors must acknowledge tensification to be accidental.

The existence of clusters where a nasal or liquid is followed by a neutral obstruent appears to go against this claim, since the neutral obstruent in such clusters should govern the preceding consonant. However, it will be shown in Chapter Six that the two consonants in these clusters are in fact not in a governing relation, and hence these sequences are not counterexamples.

Having investigated the restrictions on the cooccurrence of consonants, we arrive at the following results:

(50) Consonantal clusters in Korean involve head-final interonset government.

a. A governed onset reduces its complexity to two elements, '?' and a place-defining element.

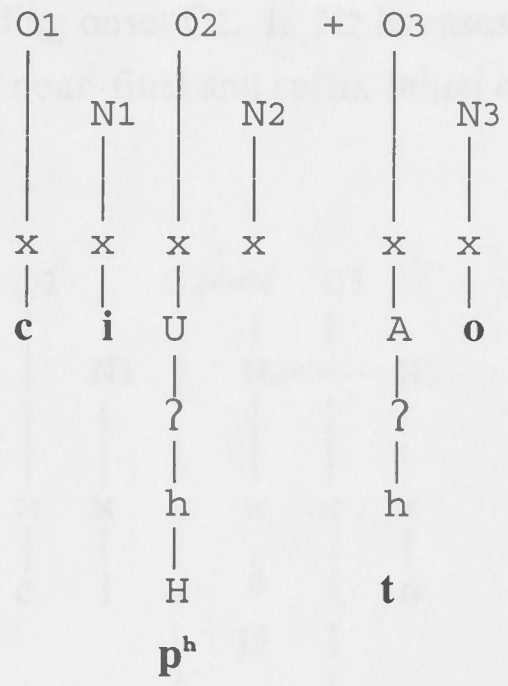
b. A governing onset increases its complexity by obtaining the element 'H'.

(50a) indicates lenition of released neutral, tensed and aspirated obstruents in preconsonantal position. (50b) excludes neutral obstruents as well as nasals and liquids from candidates for governor. Neutral obstruents and liquids have already been noted not to occur in a governing position. The inadequacy of nasals as governors will be discussed in Chapter Six, where we discuss clusters in which the first consonant is a sonorant.

## 5.4 Obstruent-ending Verbs/Nouns

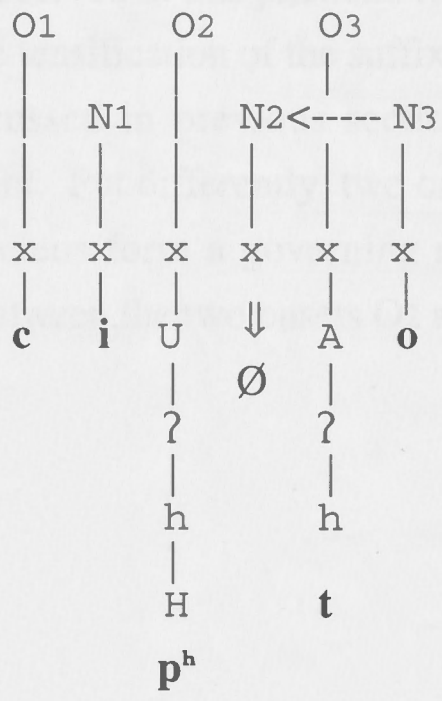
In this section, we deal with suffixation in which a verb/noun ends with an obstruent, and show how interonset government affects the derivation of the suffixation. Let us first examine cases of obstruent-initial suffixes. Taking the word *cip$^{h}$-to* 'straw-also' as an example, (51) shows its underlying representation.

(51)




In the structure above, N2 is empty. The preceding onset O2 and the following onset O3 are occupied by the aspirated stop $p^h$ and the neutral stop *t*, respectively. Concentrating first on the proper government for N2, the empty nucleus N2 is adjacent to its proper governor N3 at the nuclear projection level. N3 dominating the vowel *o* properly governs N2, so N2 surfaces without receiving phonetic interpretation.

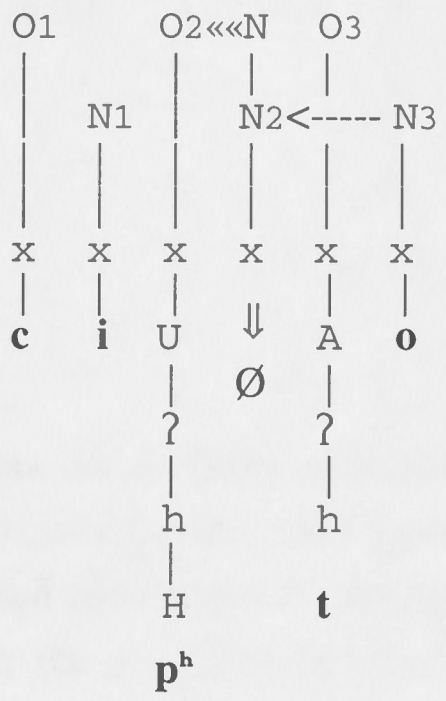
(52)




We note here that an onset is to be licensed by a following nucleus. This licensing property is known as onset licensing (KLV 1990; Charette 1991; Cyran 1994). For the representation in (52) above, our concern is whether

or not the properly governed nucleus N2 has the onset-licensing property for the preceding onset O2. If N2 licenses O2, the result would be *[cip$^{h}$to] in which the noun-final and suffix-initial consonants maintain their underlying forms.

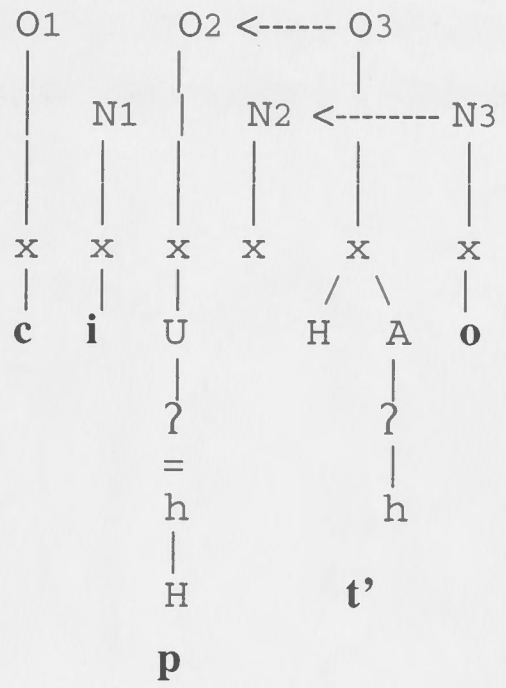
(53)




(<--- : proper government, «««« : onset licensing)

However, the correct phonetic form [cip$^{\urcorner}$t'o] reveals that this is not the case. What is observed in this phonetic form is the lenition of the noun-final $p^{h}$ to $p^{\urcorner}$ and the tensification of the suffix-initial *t* to *t'*. Lenition and tensification were discussed in previous sections to be manifestations of head-final government. Put differently, two onsets intervened by a properly governed empty nucleus form a governing relation. The effects of the governing relation between the two onsets O2 and O3 are illustrated in (54).

(54)




[cipt'o]

The element 'H' is added to the underlying neutral stop *t* in the governing position O3, making the onset a governor, so that the segment is converted to the tensed counterpart *t'*. At the same time, the underlyingly aspirated stop $p^h$ in the governed position O2 loses the elements 'h' and 'H', becoming the unreleased stop *p*.

As for the motivation of the interonset government, I propose that this governing relation is induced by properly governed empty nuclei not having the property to license preceding onset positions in Korean. It is important to recall that every phonological positions must be licensed except for the head of a domain, as stated in Licensing Principle (cf. 1.2.1).

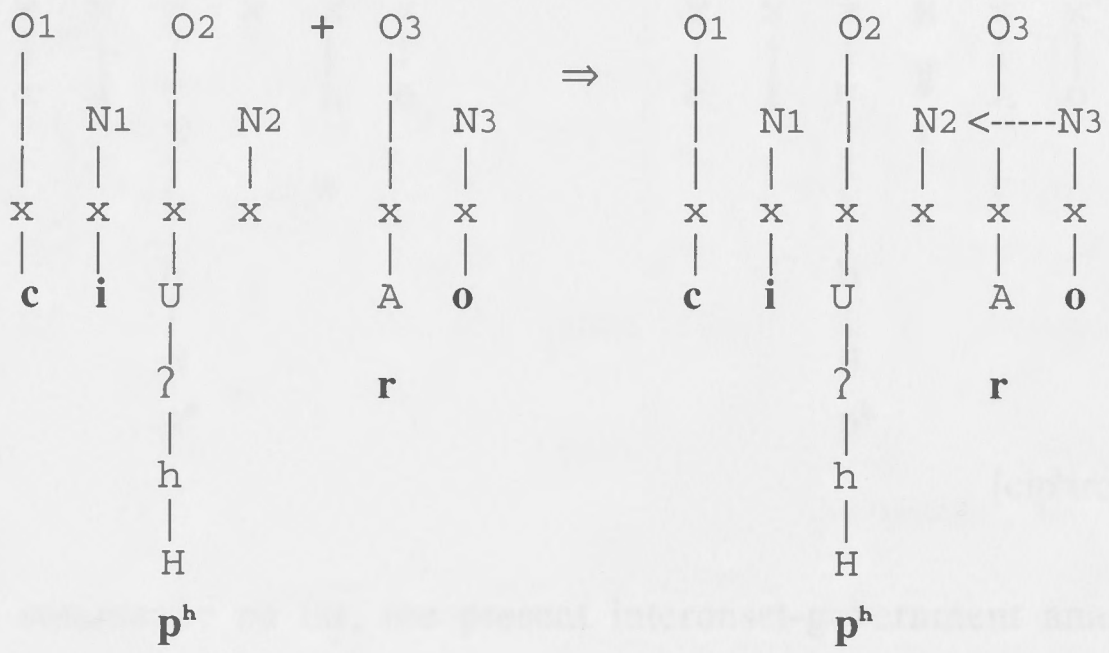
(55) **Licensing Principle** (Kaye 1990a: 306)

> All phonological positions save one must be licensed within a domain. The unlicensed position is the head of this domain.

For our present discussion, this principle has a significant implication that if a position exists in a representation, it must be licensed. Given that a properly governed empty nucleus lacks the onset-licensing property, the preceding onset position must be licensed by another position. Interonset government clearly shows that the following onset takes over this licensing responsibility for the preceding onset. (Detailed discussions of reduction in word-final position will be given in 5.5.3-5.5.5.)

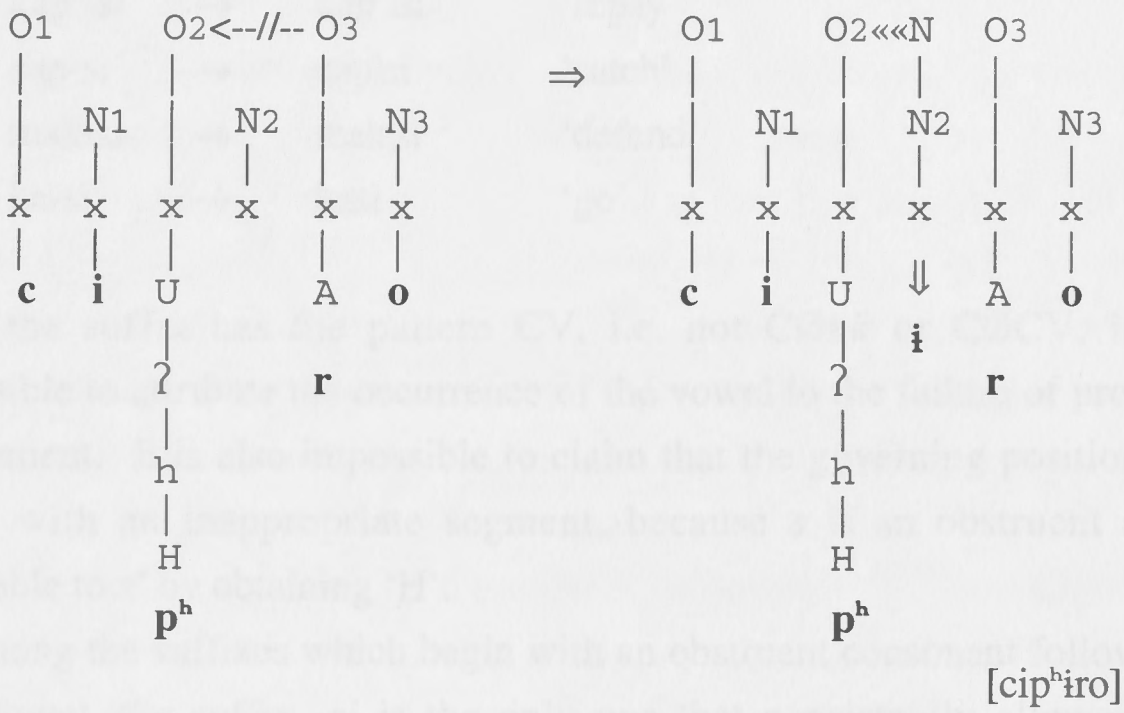
Let us move now to the case where a suffix begins with a sonorant. (56a) gives the underlying representation of the word *cip$^h$-ro* 'straw-with'.

(56) a. b.




In (56b), the empty nucleus N2 is properly governed by the following nucleus N3 which is linked with the vowel *o*. As noted above, since a properly governed nucleus lacks the property to license a preceding onset in Korean, N2 cannot license O2, and instead the following onset O3 is responsible for O2. However, unlike the case of obstruent-initial suffixes, the governing onset O3 is linked with the liquid *r* which is not tensifiable nor more complex than *p$^h$*. Consequently, a governing relation is not formed between the two onsets O2 and O3. In short, the trouble we face is that the properly governed empty nucleus N2 cannot license the preceding onset O2, nor is the onset head O3 linked to an appropriate segment. As evidenced by the phonetic form [cip$^h$iro] (← *cip$^h$Ø-ro*), the nucleus N2 is phonetically interpreted as the vowel *i* in order to support the onset O2.

(57) a. b.




[cipʰɨro]

To summarise so far, the present interonset-government analysis predicts that if the suffix-initial is a sonorant consonant, the vowel *ɨ* will be present between the two consonants, i.e. [CɨCV], and that if the suffix beings with an obstruent, the vowel will be absent and the obstruent tensified, i.e. [CC'V]. This prediction is borne out by the facts, as illustrated by representative examples below.

(58)

| | Suffix-initial consonant | | |
|---|---|---|---|
| | *Obstruent* | *Sonorant* | |
| cipʰ | cipt'o | cipʰɨro | 'straw' |
| pak' | pakt'o | pak'ɨro | 'outside' |
| kapʰ | kapc'a | katʰɨnik'a | 'repay' |
| mit | mitk'o | mitɨni | 'believe' |
| mak | makc'a | makɨrə | 'defend' |

There is, however, a case where this prediction turns out to be false. The verbal suffix *-si* '(honorific)' is the case. Under the interonset analysis, when this suffix is added to a consonant-ending verbal stem, the suffix-initial fricative *s* is expected to be tensified in response to the interonset government requirement. However, the outcome is epenthesis of the vowel *ɨ*, and not tensification.

(59)

| | | | | |
|---|---|---|---|---|
| | kap$^{h}$-si | → | kap$^{h}$ɨsi | 'repay' |
| | cap-si | → | capɨsi | 'catch' |
| | mak-si | → | makɨsi | 'defend' |
| | ka-si | → | kasi | 'go' |

Since the suffix has the pattern CV, i.e. not CØ## or CØCV, it is impossible to attribute the occurrence of the vowel to the failure of proper government. It is also impossible to claim that the governing position is linked with an inappropriate segment, because *s* is an obstruent and tensifiable to *s'* by obtaining 'H'.

Among the suffixes which begin with an obstruent consonant followed by a vowel, the suffix *-si* is the only one that consistently allows the epenthetic vowel to appear. A possible solution is to assume that the presence of the vowel is related to the somewhat different complexity of the fricative *s* from other obstruents. Recall that *s* is composed of the two elements 'A' and 'h', and is the simplest of the obstruents which have a tensed counterpart.

(60)

| **Neutral** | | **Tensed** | |
|---|---|---|---|
| k | (h•ʔ•v) | k' | (H•h•ʔ•v) |
| t | (h•ʔ•A) | t' | (H•h•ʔ•A) |
| p | (h•ʔ•U) | p' | (H•h•ʔ•U) |
| c | (h•ʔ•I•A) | c' | (H•h•ʔ•I•A) |
| s | (A•h) | s' | (H•A•h) |

Another fact to be considered is that a non-nuclear head inherits its governing property from another position, as stated in G(overnment)-licensing.

(61) **Government-licensing** (Charette 1990a: 241)

> For a governing relation to hold between a non-nuclear head A and its complement B, A must be licensed to govern by its nucleus at the licenser projection level.

According to G-licensing, it is a following nucleus that provides the governing property to an onset which governs a complement. For example, in the word *cipt'o* (← *cip$^{h}$Ø-to*), the interonset government between *p* and *t'* is supported by the rightmost vowel *o*. This means that for the case of *-si*, the vowel *i* is responsible for supporting the preceding consonant *s* to be a governor. Note that the vowel *i* (I) is simplex, and has less G-licensing capacity than complex segments. I claim that the phonetic realisation of the empty nucleus in the case of *-si* is due to the simple internal structure of *s* in addition to the weak G-licensing capacity of *i*.

This claim is supported by the other *s*-initial suffixes *-so* and *-se*. In these cases, the vowel *i* appears before the suffixes, reflecting the simple complexity of *s*. However, these cases further exhibit free variants where the consonant is tensified and the vowel *i* does not appear, demonstrating a better G-licensing capacity of the vowels *o*=(U•A) and *e*=(A•I), which have an internal structure more complex than *i* (I).

| | | | | |
|---|---|---|---|---|
| (62) | capØ-so | → | capiso ~ caps'o | 'catch-(interrogative)' |
| | makØ-so | → | makiso ~ maks'o | 'defend-(interrogative)' |
| | capØ-se | → | capise ~ caps'e | 'catch-(hortative)' |
| | makØ-se | → | makise ~ maks'e | 'defend-(hortative)' |
| | capØ-si | → | capisi ~ *caps'i | 'catch-(honorific)' |
| | makØ-si | → | makisi ~ *maks'i | 'defend-(honorific)' |

It thus appears that the suffix *-si* is not a counterexample, but rather constitutes evidence supporting the present analysis of interonset government.

## 5.5 Licensing Inheritance in Korean

### 5.5.1 The facts

As already noted in previous sections, Korean has a well-known process by which three series of obstruents, i.e. aspirated, tensed and released neutral obstruents, lose their opposition and are neutralised to unreleased homorganic stops before another obstruent. As a result, only seven consonants may occur in preconsonantal positions: three nasals {ŋ n m}, a liquid {l} and three unreleased stops {k t p}. This process, which is known as neutralisation, is also found in word-final position, and thus word-final consonants are also limited to these seven. (63) shows some examples.

(63)

| -CV- | | -CC- | | -C## | Gloss |
|---|---|---|---|---|---|
| apʰi | (nominative) | apˀt'o | (also) | apˀ | 'front' |
| cipi | (nominative) | cipˀt'o | (also) | cipˀ | 'house' |
| pak'e | (locative) | pakˀt'o | (also) | pakˀ | 'outside' |
| soki | (nominative) | sokˀt'o | (also) | sokˀ | 'inside' |
| ose | (locative) | otˀto | (also) | otˀ | 'cloth' |
| patʰe | (locative) | patˀk'wa | (and) | patˀ | 'rice field' |
| k'ocʰi | (nominative) | k'otˀk'wa | (and) | k'otˀ | 'flower' |
| naca | (infinitive) | natˀk'o | (and) | natˀ | 'be low' |
| sani | (nominative) | santo | (and) | san | 'mountain' |
| kami | (nominative) | kamto | (and) | kam | 'persimmon' |
| saŋi | (nominative) | saŋto | (and) | saŋ | 'table' |
| pari | (nominative) | palto | (and) | pal | 'foot' |

It was shown in 5.3.1 that neutralisation is interpreted as involving obstruent lenition by which the segments lose the elements 'H', 'h' and 'I', and leave only two elements, i.e. '?' and one of place-defining elements 'A', 'v' or 'U'.

Given the facts described above, the following two specific questions need to be answered:

(i) Why are the consonants lenited in such positions?
(ii) Why does the lenition result in conversion to the restricted segments?

With regard to the question (i), we have already discussed lenition in preconsonantal position and shown that weakening in this context is due to the fact that lenited consonants occur in a governed position within interonset government. In this section, we will deal with lenition processes including a word-final context, from the viewpoint of Licensing Inheritance (Harris 1992a).

### 5.5.2 Licensing Inheritance

To address the mechanisms of lenition, Hariss (1992a) proposes the principle of Licensing Inheritance.

(64) **Licensing Inheritance** (Harris 1992a: 401)

A licensed position inherits its licensing potential from its licenser.

As indicated in this principle, a licensed position acquires the capacity (a(utosegmental)-licensing potential) to license segmental materials from another position, namely its licenser. The inherited nature of the a-licensing potential enables us to explain lenition in terms of a prosodic hierarchy: that is, a licensed position inherits an a-licensing capacity weaker than that of its licenser (see 1.4 for details).

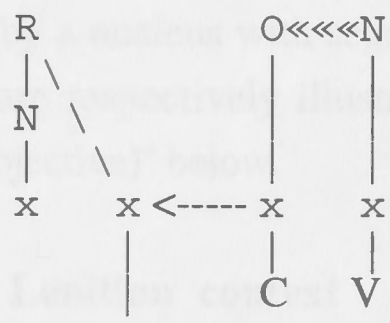
Look at the following Spanish data cited in Harris (ibid.).

(65) **Spanish**

a. costa — co[h]ta
b. algo — a[y]go
c. be[ʎ]o vs. be[l]dad
d. re[ñ]ir vs. re[n]cilla

The words in (65) exhibit lenition processes before another consonant: (a) shows *s*-spirantarisation (s → h), (b) shows liquid gliding (l → y), (c) and (d) show depalatalisation of a lateral (ʎ → l) and a nasal (ñ → n). These processes are captured in terms of Licensing Inheritance as follows. As shown in (66), lenited segments occur in a coda position within an interconstituent governing domain. Again, this interconstituent government is imposed by Coda Licensing Principle, which determines that a coda must be licensed by a following onset.

(66)




**s** → [h]
**l** → [y]
**ʎ** → [l]
**n** → [n]

(««««: G-licensing, <--- : interconstituent government)

According to Licensing Inheritance, the coda position inherits its a-licensing potential from the onset head, i.e. the following onset. What is crucial in these weakening processes is that the onset head is G(overnment)-licensed by another position, namely its nucleus (cf. 5.4). In other words, the onset head obtains its own a-licensing potential from the following nucleus. In this regard, the onset head is identified as a weak a-licenser, and cannot provide its governee, the preceding coda position, with a sufficient capacity to support whole segmental materials.[7]

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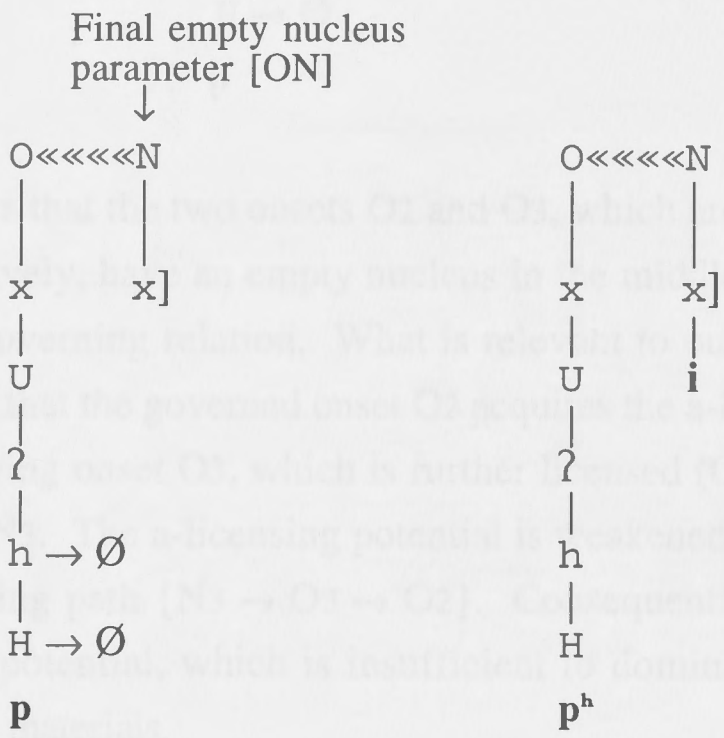
7 See Harris (1992) and also 1.4 in this thesis for details of lenition in intervocalic and word-final positions.

### 5.5.3 Obstruent lenition in Korean

Above, we have considered Licensing Inheritance as an explanation of the mechanisms of lenition. Licensing Inheritance provides a straightforward answer to our first question, i.e. why are the consonants lenited in preconsonantal and word-final positions in Korean? Let us first consider lenition in word-final position. Recall that final empty nuclei are licensed in Korean, and thus a word-final consonant is in fact followed by an empty nucleus. The environment of this word-final lenition context contrasts with a non-lenition context which is provided by a sequence of a consonant followed by a nucleus with segmental content. Lenition and non-lenition contexts are respectively illustrated by the words *apØ* 'front' and *ap$^{h}$-i* 'front (subjective)' below.

(67) a. **Lenition context** b. **Non-lenition context**

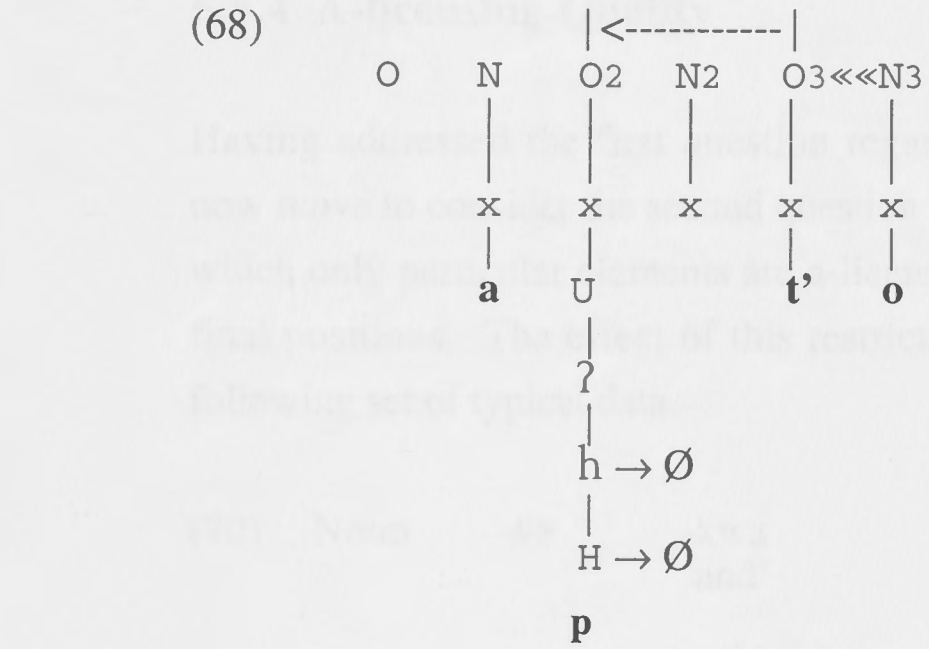



In the structures (67a) and (67b), we can see a difference in the capacity of the onsets to dominate their segmental materials. The onset licensed by the empty nucleus may contain up to only two elements as in (67a), whilst the onset licensed by the nucleus containing the vowel *i* supports whole elements that are underlyingly present as in (67b). Reduction in (67a) is induced by the fact that the empty nucleus, which is itself a weak a-licenser,

cannot confer sufficient a-licensing power on the preceding onset to dominate the whole underlying materials.

Next, for lenition in the preconsonantal position, we first recall that in Korean two successive obstruents are two onsets that are separated by an empty nucleus. The underlying representation of *apt'o* (← *ap$^{h}$-to* 'front-also') is as follows.

(68)




(68) shows that the two onsets O2 and O3, which are associated with *p* and *t'* respectively, have an empty nucleus in the middle, and that these onsets are in a governing relation. What is relevant to our present discussion of lenition is that the governed onset O2 acquires the a-licensing potential from the following onset O3, which is further licensed (G-licensing) by another position, N3. The a-licensing potential is weakened as it is inherited along the licensing path {N3 → O3 → O2}. Consequently, O2 inherits weak a-licensing potential, which is insufficient to dominate the full underlying segmental materials.

In short, obstruent lenition in Korean appears to be attributable to licensed onsets inheriting only a limited a-licensing capacity from their licensers which are identified as weak a-licensing positions. Notice that a licensed onset in both contexts, i.e. preconsonantal and word-final positions, occurs before a licensed empty nucleus, i.e. [C¬ØC'] and [-C¬Ø]. Obstruent lenition in Korean is summarised as below.

(69) **Obstruent Lenition (Revised)**

Obstruents are reduced to bi-elementary segments before licensed empty nuclei, the '?' element and a place-defining element ('A', 'v' or 'U').

### 5.5.4 A-licensing Quality

Having addressed the first question regarding Korean neutralisation, we now move to consider the second question which involves the restriction by which only particular elements are a-licensed in preconsonantal and word-final positions. The effect of this restriction can be demonstrated by the following set of typical data.

(70)

| Noun | -## | -kwa 'and' | Gloss |
|---|---|---|---|
| nac | nat | natk'wa | 'daytime' |
| nac$^{h}$ | nat | natk'wa | 'face' |
| nas | nat | natk'wa | 'sickle' |
| nat$^{h}$ | nat | natk'wa | 'single' |

As shown, the nouns are all phonetically realised in exactly the same form [nat] in preconsonantal and word-final positions. Among these examples, the conversion of the underlying *s* (A•h) to *t* (ʔ•A) is particularly interesting because it does not involve a loss of elements. This conversion is carried out simply by the substitution of the element 'ʔ' for 'h'. Similarly, the liquid *r* (A) surfaces as *l* (A•ʔ) in these positions in Korean.

(71)

| Noun | -i '(nominative)' | -## | -kwa 'and' | Gloss |
|---|---|---|---|---|
| par | pari | pal | palkwa | 'foot' |
| tor | tori | tol | tolkwa | 'stone' |
| kir | kiri | kil | kilkwa | 'road' |

This case likewise cannot be treated as lenition, since it rather involves the increment of the element '?'.

It should be stressed here that lenition in principle relates to quantity of segments (numbers of whole a-licensed elements) rather than quality of segments (kinds of a-licensed elements). The cases of $s \rightarrow t$ and $r \rightarrow l$ suggest that licensed onsets have a certain property by which only selected elements are a-licensed in Korean. To develop this idea, in what follows I will consider Finnish data and representations of geminates.

### *Word-final consonants in Finnish*

Finnish has the following consonantal phonemes. ((72) is taken from Yip 1991.)

(72)

| | | |
|---|---|---|
| p | t | k |
| | d | |
| v | s | |
| m | n | |
| | l | |
| | r | |

In Finnish, according to Gibb (1992), there is a highly restricted distribution in word-final consonants, namely only *t, s, r, l, n* may occur word-finally. (The following examples are from Gibb 1992.)

(73)

| | | |
|---|---|---|
| "t" | pidot | 'feast' |
| "s" | ulos | 'out' |
| "r" | auer | 'haze' |
| "l" | askel | 'step' |
| "n" | sievoinen | 'handsome' |

These consonants all contain the element 'A', which represents coronality. Remember that a word-final consonant is followed by a final empty nucleus, e.g. *pidotØ*, *ulosØ*, etc. This means that an onset occupied by a word-final consonant obtains an a-licensing capacity from a following final empty

nucleus. Thus, the above distributional restriction indicates that a word-final empty nucleus transmits to the preceding onset the a-licensing potential that allows it to dominate only segments containing the element 'A'.

Let us formalise the restriction involved in the above Finnish facts. Given that the restriction involves the 'quality' of element(s) to be a-licensed, I would like to use the term 'a(utosegmental)-licensing Quality' to indicate these restrictions. As far as a-licensing Quality is concerned, there are two types of elements to be thought of: (i) elements that must be a-licensed and (ii) elements that must not be a-licensed. I shall call the former 'obligatory elements' and the latter 'prohibited elements'. The distributional restriction of word-final consonants in Finnish can then be formally stated as follows.

(74) **A-licensing Quality in Finnish**

| | |
|---|---|
| Position: | Onset |
| Licenser: | Licensed word-final empty nucleus |
| Obligatory element: | 'A' |
| Prohibited element: | 'L' |

(74) above indicates that in Finnish an onset position which inherits its a-licensing potential from a licensed final empty nucleus must a-license the coronal element 'A'. The prohibited element 'L' captures the impossibility of the voiced stop *d* occurring in word-final positions in the language.

***Representation of geminates***

While further investigation is needed to clarify the relationship between a-licensing Quality and the individual contexts to which it applies, it is understood at the present level that a governed position does not a-license the element 'H' within governing domains the head of which is a non-nucleus, i.e. coda-onset, onset-onset and branching onset. This claim reflects the treatment of 'H' within charm theory (KLV 1985, 1990). According to charm theory, this element is defined as a negatively charmed element, with which segments are identified as potential governors. Thus,

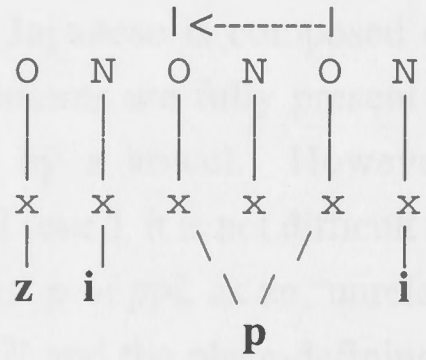
the 'H' element is viewed as unable to appear in governed positions. (75) presents the inability of a governed position in a-licensing this element 'H'.[8]

(75) **Non-nuclear positions licensed by non-nuclear heads**

| | |
|---|---|
| Position: | Non-nuclear position |
| Licenser: | Non-nuclear position |
| Prohibited element: | 'H' |

The claim that such a governed position cannot a-license the element 'H' raises a problem with respect to the structure of geminates. In the standard literature, geminates are treated as having a structure where a single segment is linked with two positions belonging to two separate syllables. Hence the Japanese word *zippi* 'actual expenses', for example, is represented as follows.

(76)

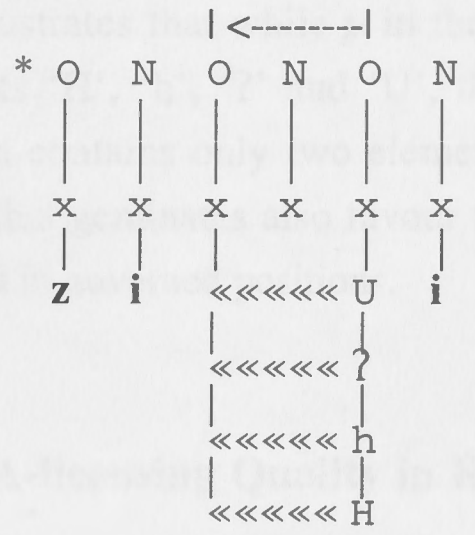



In (76) above, we can see that the labial stop *p* is associated with two separate onset positions. In terms of governing relationships, the first onset is licensed by the second onset (see 5.3.3, for details of interonset government in Japanese), which means that the first onset acquires a-licensing potential from the second onset. In terms of segment-internal structure, on the other hand, the two positions are regarded as sharing identical elements, i.e. 'H', 'h', 'ʔ' and 'U'.

---

8 'L' is another negatively charmed element. This element is viewed as being included in nasals (Yoshida 1991, Y. Heo 1994), which are a potential governee. I exclude this element from the present discussion, as further investigation is needed to clarify the treatment of this element within a theory that makes no use of charm.

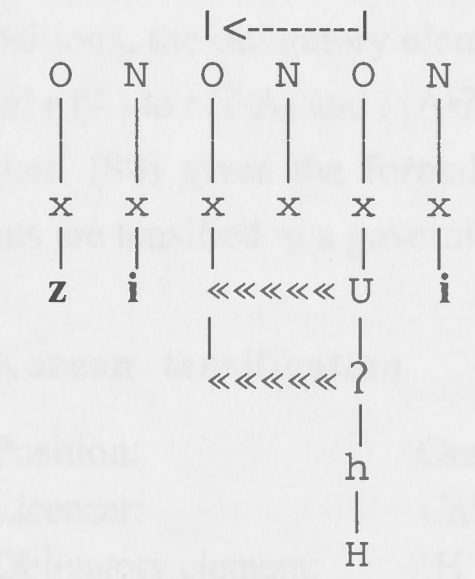
(77)




Thus, the structure (77) appears to negate our proposal that the element 'H' cannot occur in governed positions.

Nevertheless I claim that this proposal is valid even in the case of geminates. Let us take a closer look at the articulation of geminate sounds, to examine whether or not geminated consonants should really be treated as having an identical segmental structure. As noted above, the voiceless labial stop *p* in Japanese is composed of four elements, 'H', 'h', 'ʔ' and 'U'. These elements are fully present in *p* as in *pi* in which *p* is immediately followed by a vowel. However, from a careful observation of the geminated sound, it is not difficult to identify the first member of the cluster, i.e. the first *p* of *ppi*, as an 'unreleased' stop, which consists of the glottal element 'ʔ' and the place-defining element 'U'.[9] The revised structure of the word *zippi* is given below.

(78)




[zippi]

---

9 I owe this idea to Shohei Yoshida.

(78) illustrates that while *p* in the governing onset position has the full elements 'H', 'h', '?' and 'U', the unreleased *t* in the governed onset position contains only two elements '?' and 'U'. This structure clearly shows that geminates also favour the claim that the element 'H' is not a-licensed in governed positions.

### 5.5.5 A-licensing Quality in Korean

So far, I have demonstrated that licensed onset positions may be sensitive to the quality of a-licensed element(s). As already noted, in Korean obstruents are neutralised to unreleased homorganic stops before licensed empty nuclei. The neutralisation is formally expressed as follows.

(79) **Korean neutralisation**

| | |
|---|---|
| Position: | Onset |
| Licenser: | Final empty nucleus or Onset-head |
| Prohibited element: | 'H', 'h', 'I' |
| Obligatory element: | '?' |

(79) indicates that onset positions must a-license the element '?', but must not contain the elements 'H', 'h' and 'I' before licensed empty nuclei, namely in preconsonantal and word-final positions. While the prohibited elements 'H', 'h' and 'I' determine the unreleased nature of obstruents in these positions, the obligatory element '?' accounts for the conversion of *s* (A•h) and *r* (A) to *t* (?•A) and *l* (A•?), respectively.

Further, (80) gives the formalism of tensification by which neutral obstruents are tensified in a governing onset position.

(80) **Korean tensification**

| | |
|---|---|
| Position: | Onset head |
| Licenser: | Unlicensed nucleus |
| Obligatory element: | 'H' |

This formalism accounts for the fact that governing onsets must contain the element 'H'. In other words, the element 'H' is necessary for onsets to be governors, in addition to fulfilling the requirements defined by the Complexity Condition.

Having proposed that a-licensing Quality is significant with regard to Korean neutralisation and tensification, we need to address the following two issues:

(81) (i) The role of a-licensing Quality in lenition
(ii) Coda Condition (Itô 1986)

The first issue concerns the possibility that Korean lenition can be accounted for solely in terms of a-licensing Quality: that is, the lenition of $c^h$ (H•h•ʔ•I•A) to *t* (ʔ•A), for example, may be captured simply by positing that the elements 'H', 'h' and 'I' cannot be a-licensed before licensed empty nuclei. In this approach, Licensing Inheritance is not necessary, and hence we could obtain a simpler solution. However, it should be noted that without Licensing Inheritance we would be unable to provide a convincing explanation of why reduction of elements takes place only in such specific positions. Accordingly, the relation between lenition processes and their contexts would be treated as merely accidental. Moreover, such an approach would encounter difficulties in handling lenition processes in languages where lenited consonants do not show a tendency for only particular elements to be a-licensed — for instance Spanish, as illustrated in 5.5.2, is such a language.

It is also impossible to account for Korean lenition by invoking Licensing Inheritance alone (Licensing Inheritance, in this case, refers only to the quantitative aspects of a-licensed elements). As noted before, Licensing Inheritance involves quantitative aspects of elements, and not qualitative aspects. Therefore, if we discard a-licensing Quality, it would be difficult to explain why certain elements are eliminated from weak a-licensing positions while certain elements must be a-licensed.

In conclusion, both Licensing Inheritance and a-licensing Quality are necessary to deal with Korean lenition: the former explains the lenition

contexts, namely why lenition takes place in certain positions, and the latter accounts for the patterns of lenition, namely why segments are lenited in a certain way.

Let us now turn to consider the Coda Condition, which is proposed by Itô (1986) to account for distributional restrictions on the first member of consonantal clusters and on word-final consonants. In this approach, the restrictions are captured by a set of conditions that segments have to meet in order to appear in coda positions (in Itô's terms). Korean neutralisation would be expressed as in (82).

(82) **Korean Coda Condition**

$$* \quad C]_{\sigma}$$
$$\quad\quad |$$
$$\lceil +ten \rceil$$
$$| +asp |$$
$$\lfloor +cont \rfloor$$

This Korean Coda Condition indicates that segments which contain the features [+tense], [+aspiration] or [+continuant] are disallowed to occur in preconsonantal and word-final positions. It is therefore possible to exclude tensed, aspirated and neutral released obstruents from these positions, and subsequently we can reach the correct result.

However, the Coda Condition fails to provide an explanatory solution. Within a government-based approach, lenition is identified as taking place in weak a-licensing positions, whose weakness is captured in terms of governing relations. By contrast, the Coda Condition is merely a series of stipulated constraints, and thus cannot explain the mechanisms by which such constraints are imposed on these particular positions.

In fact, a-licensing Quality is also open to criticism of lacking explanatory power. The requirements for well-formedness at the segmental level are described in terms of the quantity of elements, as defined by the Complexity Condition. Therefore, a-licensing Quality is in principle irrelevant to these requirements.

A-licensing Quality, however, differs from the Coda Condition in that it operates in cooperation with generally defined constraints, namely government. In this connection, it is possible to predict:

(83) (i) The contexts of a-licensing Quality
(ii) The quantity and quality of outputs of a-licensing Quality

Regarding (83i), contexts to which a-licensing Quality applies are predictable in terms of Licensing Inheritance: more specifically, weak a-licensing positions which inherit a-licensing potential from other positions. As for (83ii), we note that a-licensing Quality operates in a way which satisfies the requirements for well-formed governing relations. Again, segments in a governing relation must meet the Complexity Condition. Therefore, for example, in Korean a-licensing Quality for the preconsonantal position, i.e. a governed onset, as expected cannot create segments which have greater complexity than their governing onsets. Further, a-licensing Quality is also predicted not to permit this preconsonantal position to a-license the element 'H', since as discussed above, this element does not occur in governed positions. By contrast, the Coda Condition is not connected with any devices to predict possible properties which are excluded from or included in such a position. Nor can the Coda Condition generalise distributional restrictions beyond preconsonantal and word-final positions, as it is meant to handle restrictions involved only in these positions.

In the following subsection 5.6, we discuss the paradigms of three types of irregular verbs as further evidence for the present analysis of interonset government and a-licensing Quality.

## 5.6 *p*-, *t*- and *s*-irregular Verbs

Korean has groups of verbs which are treated as irregular because their paradigms involve certain morphophonemic alternations that are

phonologically unpredictable (H-B Choy 1959; W Heo 1965). The following twelve types of irregular verbs are listed in H. Sohn (1977).

(84)

| | | |
|---|---|---|
| a. *p*-irregular | b. *t*-irregular | c. *s*-irregular |
| d. *rə*-irregular | e. *ri*-irregular | f. *r*-irregular |
| g. *yə*-irregular | h. *h*-irregular | i. *kəra*-irregular |
| j. *i*-irregular | k. *u*-irregular | l. *nəra*-irregular |

In this thesis, we deal with six types of irregular verbs (84a)-(84f), which involve consonantal clusters. An analysis of (84a)-(84c) is given in the present Chapter Five, and of (84d)-(84f) in Chapter Six.

### 5.6.1 The data

We first observe the data for *p*-, *t*- and *s*-irregular verbs. As illustrated in (85a) and (85b), *p*-irregular and *t*-irregular verbs exhibit *p~w* alternation and *t~r* alternation respectively; a stem-final segment is *p* or *t* when followed by a consonant-initial suffix, but is the glide *w* or the liquid *r* when followed by a vowel-initial suffix. The *p*-regular and *t*-regular verbs retain the stem-final consonant *p* and *t* with both vowel-initial and consonant-initial suffixes.

(85)

| | | -ə/a '(infinitive)' | -ko 'and' | Gloss |
|---|---|---|---|---|
| a. | ***p*-regular** | cap-a | cap-k'o | 'catch' |
| | ***p*-irregular** | kiw-ə | kip-k'o | 'sew' |
| b. | ***t*-regular** | mut-ə | mut-k'o | 'bury' |
| | ***t*-irregular** | mur-ə | mut-k'o | 'ask' |
| c. | ***s*-regular** | pis-ə | pit-k'o | 'comb' |
| | ***s*-irregular** | pw-ə | put-k'o | 'swell up' |

The *s*-regular verb in (85c) shows that the stem-final *s* is realised as *t* when followed by a consonant-initial suffix. The stem-final consonant of the *s*-irregular verb is *t*, identical to that of the *s*-regular verb before a consonant-

initial suffix, but this disappears before a vowel-initial suffix, and further a stem-final vowel and a suffix-initial vowel form a diphthong.[10]

In the remainder of this chapter, I will provide an account of the paradigms of these irregular verbs in conjunction with interonset government and a-licensing Quality. The paradigms of irregular verbs will turn out to be fully predictable under a government-based analysis.

### 5.6.2 Previous analyses

These three irregular verb paradigms are one of the most widely investigated issues in Korean phonology. Previous analyses may be grouped into the following two types:

(86) The different paradigms in regular and irregular verbs are due to:

a. different vowel length of the stem-final vowel
(H. Sohn 1977; Kim-Renaud 1986)

b. different underlying representation of the stem-final segment
(C-G Kim 1971; C-W Kim 1973; B-G Lee 1977)

Proposal (86a) claims that the stem-final vowel is short in regular verbs and long in irregular counterparts, e.g. /cəp-ə/ → *cəpə vs.* /ki:p-ə/ → *kiwə*.[11] Proposal (86b), on the other hand, attempts to account for the irregular alternation by postulating different underlying forms, e.g. /cəp-ə/ → *cəpə vs.* /kib-ə/ → *kiwə*.

I reject the first view (86a). In Chapter Four, I have already argued that long vowels do not exist in Korean. Supporting data included some

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[10] Despite the absence of the segment *s* in the conjugation, this verb is referred to as *s*-irregular on the grounds that *s* used to surface in Middle Korean and that *s* is still present in many dialects such as Kyengsang, Cenla, and Pyengan dialects (H. Sohn 1977), e.g. *pus-ə* 'swell up (infinitive)', *pus-əra* 'swell up (imperative)'. In addition, the stem-final segment is represented as 's' in the orthography.

[11] According to H. Sohn (1977), a long vowel is shortened before vowel-initial affixes in irregular verbs.

examples taken from *p*-irregular verbs. Here, I provide additional independent evidence to point out the shortcomings of the first view.

H. Sohn (1977), couched in the theory of sonority, claims that the alternations in these irregular verbs are due to an assimilation of the degree of aperture. The following rule is proposed by Sohn to account for the *p~w* alternation of the *p*-irregular verbs.

(87) **H. Sohn** (1977: 53)

p → w / V: ___ V

According to Sohn, the degree of aperture of *p* is 0, that of vowels is 5 to 7, and that of *w* is 4. In intervocalic position, *p* increases its sonority in assimilation to surrounding vowels which have more sonority, and as a result, it surfaces as *w*.

Look at the following data which provides counterexamples to this analysis.

| | | | | |
|---|---|---|---|---|
| (88) | kɛ: -pal | → | kɛ:pal | 'crab-leg' |
| | nɛ: -pota | → | nɛ:pota | 'stream-than' |

These words are conventionally regarded as having a long vowel.[12] In these words the consonant *p* is in exactly the same environment as that to which the rule (88) applies: *p* occurs in an intervocalic position and the preceding vowel is long. If *p~w* alternation in *p-irregular* verbs is truly triggered by assimilation in the degree of sonority, then the consonants *p* in these words would also have to undergo the same process and change to *w*. The fact that they maintain their underlying forms suggests that the sonority analysis is not appropriate to account for the phenomenon.

The inappropriateness of this analysis is also emphasised by the additional examples in (89).

---

12 The vowel length of examples in (88) and (89) is based on Hi-Seung Lee (1992) *Essence Kukeo Sajeon (The Essence Korean dictionary)*, Minjungseokwan, Seoul.

| (89) | -ko 'and' | -ə/a '(infinitive)' | Gloss |
|---|---|---|---|
| | mipk'o | miwə | 'ugly' |
| | $c^h$upk'o | $c^h$uwə | 'cold' |

The stem-final vowels of these words are short. Despite this, the following consonant *p* undergoes devocalisation before a vowel-initial suffix, as shown in the words of the second column.

I agree with the second view (86b), that the irregular verbs have a different underlying representation from their regular counterparts. However, the previous studies, which adopt a rule-based approach, must be criticised for a lack of explanatory support.

Let us take B-G Lee (1977) as an example. B-G Lee proposes the following rule for *p*-irregular verbs on the assumption that the underlying form of the stem-final segment of these verbs is the voiced *b*, whilst in *p*-regular verbs the stem-final consonant is the voiceless *p*.

(90) ***b*** $\rightarrow$ ***w*** **rule** (B-G Lee 1977)

$$\begin{bmatrix} +\text{ant} \\ -\text{cor} \\ -\text{nas} \\ +\text{voice} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{cons} \\ +\text{high} \\ +\text{back} \\ -\text{ant} \\ +\text{round} \\ +\text{cont} \end{bmatrix}$$

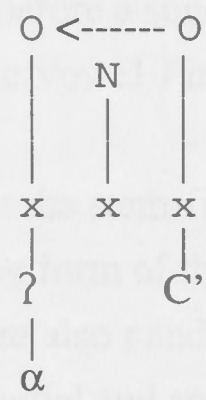
According to B-G Lee, this rule is part of the consonant gradation rules by which consonants are weakened in intervocalic position, for example, *p* being weakened to *b*, and *b* weakened to *w*. Thus, before a vowel-initial suffix, the irregular verb *kib-* surfaces as *kiw-* (e.g. *kiwə* $\leftarrow$ *kib-ə*), while the regular verb *cəp-* is realised as *cəb-* (e.g. *cəbə* $\leftarrow$ *cəp-ə*). Further, the underlying form *b* of irregular verbs is claimed to become *p* before a consonant-initial suffix, e.g. *kipk'o* ($\leftarrow$ *kib-ko*), due to the fact that among obstruents, only *k*, *t*, *p* may occur in preconsonantal position in Korean. Although rule (90) can derive the phonetic form which we desire, it does not provide the reason why *b* is weakened to *w* before a vowel-initial suffix.

The additional point that needs to be made is that weakening in intervocalic position is not productive in Korean. If the weakening of *b* to *w*, as well as of *p* to *b*, were truly productive, we would expect that aspirated $p^h$ and tensed *p'* would also be affected. Remember that obstruent lenition in pre-obstruent position is productive in Korean. Thus, aspirated and tensed obstruents, as well as neutral ones, are converted to their unreleased counterparts in such a position. In an intervocalic position, however, aspirated and tensed consonants always retain their underlying forms, e.g. *kip*$^h$*ə* (← *kip*$^h$-*ə*) 'deep-(infinitive)', *kip'ə* (← *kip'*-*ə*) 'happy-(infinitive)'. Consequently, we reach the conclusion that lenition does not operate in intervocalic positions in Korean, and hence the voiced *b* cannot be the underlying form of the stem-final segment of *p*-irregular verbs.

### 5.6.3 *p*- and *t*-irregular verbs

We first analyse paradigms of *p*- and *t*-irregular verbs in this subsection, and deal with *s*-irregular verbs in 5.6.4. Before presenting an analysis, let us first repeat the requirements involved in interonset government in Korean, as these are important for the analysis.

(91) a.




(α = 'A', 'U' or 'v')

b. (i) A governed onset dominates only two elements, 'ʔ' and a place-defining element.

(ii) A governing onset increases its complexity by obtaining the element 'H'.

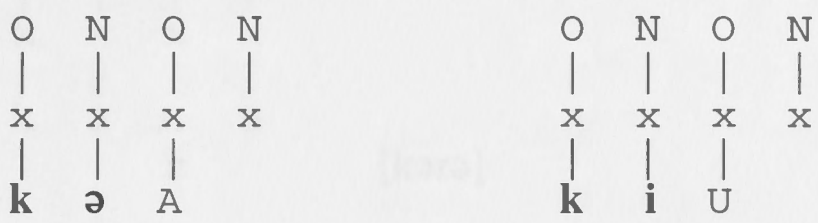
The relevant data was partially presented in 5.6.1, and (92a) and (92b) below exhibit the expanded data of *t*-irregular and *p*-irregular verbs, respectively. Their regular counterparts are given in (92c) and (92d).

| (92) | -ko 'and' | -ə/a '(infinitive)' | -ma 'I will' | Gloss |
|---|---|---|---|---|
| a. | kətk'o | kərə | kərɨma | 'walk' |
| | mutk'o | murə | murɨma | 'ask' |
| | k'ɛtatk'o | k'ɛtara | k'ɛtarɨma | 'perceive' |
| b. | kipk'o | kiwə | kiuma | 'sew' |
| | nupk'o | nuwə | nuuma | 'lay' |
| | topk'o | towa | touma | 'help' |
| c. | kətk'o | kətə | kətɨma | 'fold up' |
| | mutk'o | mutə | mutɨma | 'bury' |
| d. | capk'o | capa | capɨma | 'catch' |
| | ipk'o | ipə | ipɨma | 'wear' |

While the stem-final segment is *t* or *p* throughout all forms in regular verbs, irregular verbs show certain alternations. A stem-final segment appears as *t* or *p* before an obstruent-initial suffix but as *r* or *w* before a vowel-initial suffix. Further, before a sonorant-initial suffix, a stem ends with *r* followed by the epenthetic vowel *ɨ* in *t*-irregular verbs, but with the vowel *u* in *p*-irregular verbs.

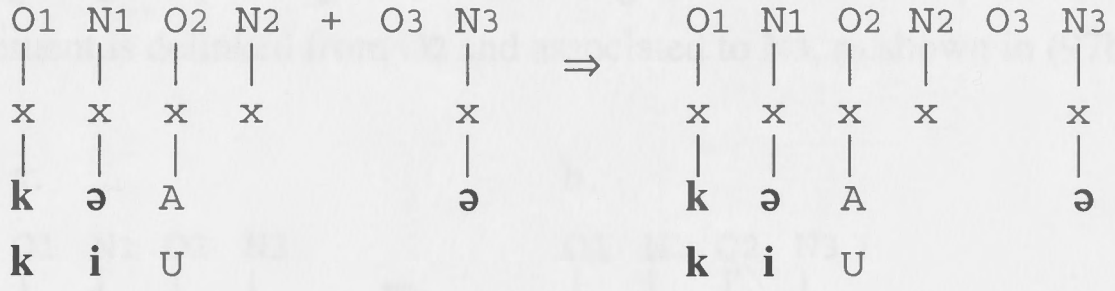
It is clear that the stem-final segment is *t* and *p* in the regular verbs. As for the underlying form of the irregular verbs, if we assume that their stem-final segments are also *t* and *p*, it would be impossible to explain the forms with the vowel-initial and sonorant-initial suffixes. I propose that the stem-final segment is solely the element 'A' for *t*-irregular verbs, and the element 'U' for *p*-irregular verbs.

(93) ***t*-irregular verbs** ***p*-irregular verbs**




To begin examining these underlying forms, we first consider the derivations of the infinitive forms *kəAØ-ə* and *kiUØ-ə*. (94a) shows their underlying represenations.

(94) a. b.



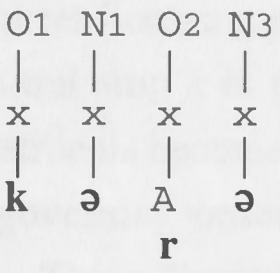

In (94b) above, the stem-final onset, O2, is linked with the element 'A/U'. We can also see that the following nucleus N2 is empty. This empty nucleus N2 is further followed by the onset O3 that dominates no skeletal point. Gussmann & Kaye (1993) claim that such a sequence of an empty nucleus followed by an onset that has no skeletal point is deleted from a representation.

(95) **Reduction** (Gussmann & Kaye 1993: 433)

> An empty nucleus followed by a pointless onset is removed from any phonological representation in which it occurs.

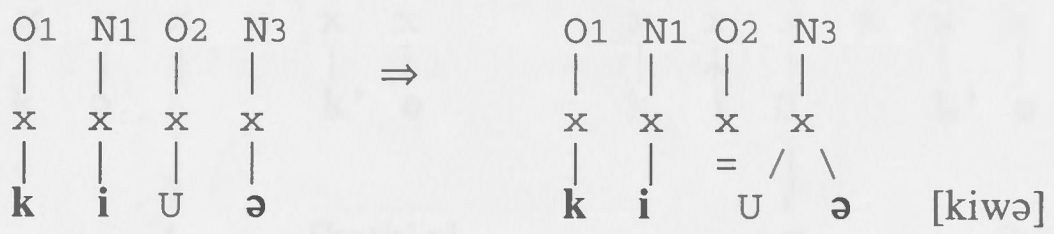
Following their further claim that this reduction is a part of UG, I assume that N2 and O3 in the structure (94b) above are erased from the structure. This completes the derivation for the *t*-irregular verb, yielding the following form which is pronounced as *kərə*.

(96)



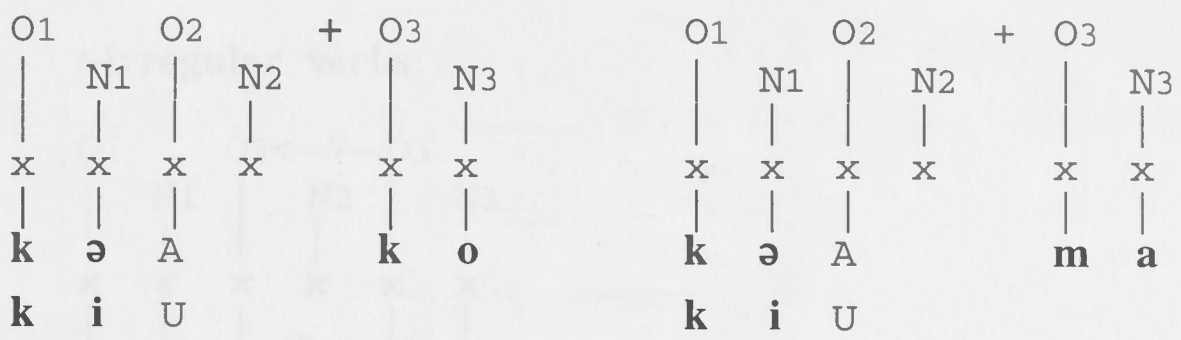

As for the *p*-irregular verbal form *kiUØ-ə*, the Principle of Reduction produces the structure (97a), where the element 'U' is followed by a nucleus containing the vowel ə. Since the 'U' element occurs in an onset, it is interpreted as the glide *w*, yielding a correct phonetic form [kiwə]. However, it should be recalled that glides are syllabified into a nucleus forming a light diphthong with a following vowel in Korean (cf. 2.4). The 'U' element is delinked from O2 and associated to N3, as shown in (97b).

(97) a. b.




Next, let us analyse cases where a consonant-initial suffix is attached to these irregular verbal stems. (98) shows the underlying representations of verbal forms with the obstruent-initial suffix *-ko* 'and' in (98a), and with the sonorant-initial suffix *-ma* 'I will' in (98b).

(98) a. b.

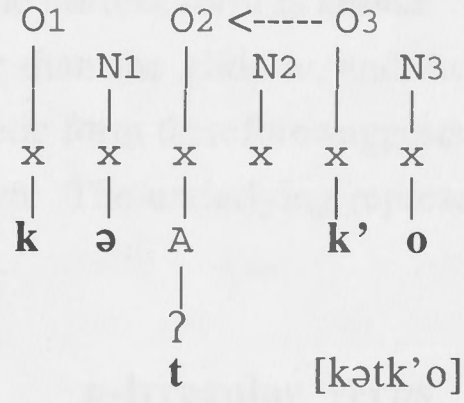


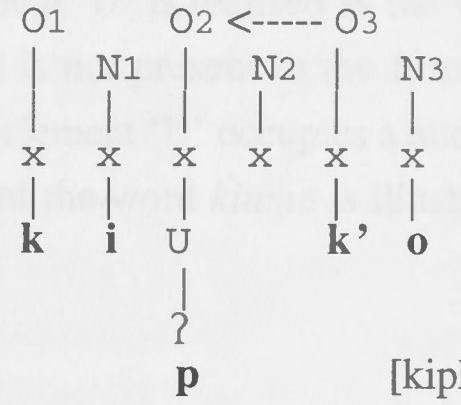

In both structures, two onsets O2 and O3 surround the empty nucleus N2. This empty nucleus N2 is properly governed by the following nucleus N3, and O3 now has to license the preceding onset O2 on the behalf of N2 which

lacks the onset-licensing property. The governing position O3 is occupied by the neutral stop *k* in (98a) and by the nasal *m* in (98b). Recall that neutral obstruents become their tensed counterparts by adding the element 'H' in a governing onset position, however sonorants cannot serve as governors. These diverse capacities of obstruents and sonorants directly reflect oncoming derivations.

In the case of the obstruent-initial suffix, *k* in the governing position O3 is tensified to *k'*, and at the same time the element '?' is added to the governed position O2 to satisfy the requirement that a governed onset must dominate '?' in Korean. The phonetic forms are *kətk'o* and *kipk'o*.

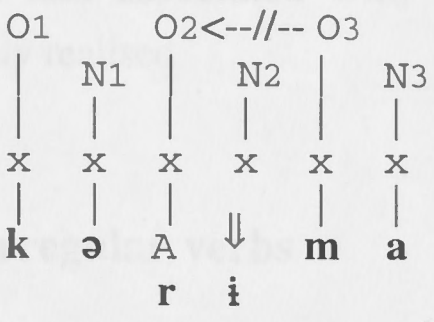
(99) ***t*-irregular verbs** ***p*-irregular verbs**




By contrast, in the representation with the sonorant-initial suffix *-ma*, a governing relation between O2 and O3 is not established because of the inability of a nasal to act as a governor. In the *t*-irregular verbal form *kəAØ-ma*, the failure of interonset government results in the phonetic form *kərɨma*, in which the nucleus N2 is interpreted as the vowel *ɨ*.

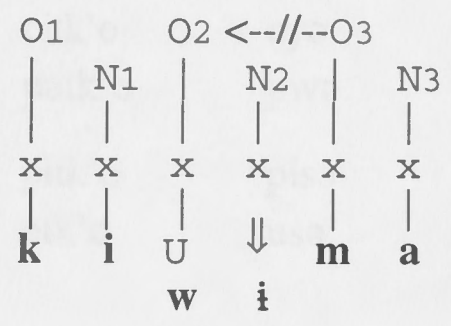
(100) ***t*-irregular verbs**




For the *p*-irregular verbal form *kiUØ-ma*, if the option of the epenthetic vowel *ɨ* is chosen, the phonetic form will be *kiwɨma*, in which 'U' in the

onset O2 is interpreted as the glide *w*, and the unlicensed empty nucleus N2 is spelled out as *i*.

(101) *

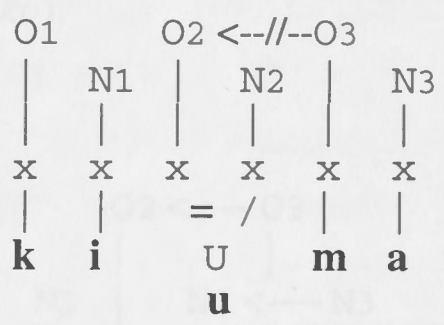



*[kiwima]

This form is, in fact, ill-formed, since again the structure violates Korean syllable structure with respect to the glide *w*. As noted before, glides occur in a nucleus, and not in an onset.

The correct form is *kiuma*. The element 'U' is realised as the vowel *u* rather than the glide *w*, and the vowel *i* is not present in the form. This phonetic form therefore suggests that the element 'U' occupies a nucleus on its own. The underlying representation of the word *kiuma* is illustrated in (102).

(102) ***p*-irregular verbs**




[kiuma]

The 'U' element, which is originally associated with O2, is delinked from the onset and associated with the nucleus N2, which needs to be phonetically realised.

### 5.6.4 *s*-irregular verbs

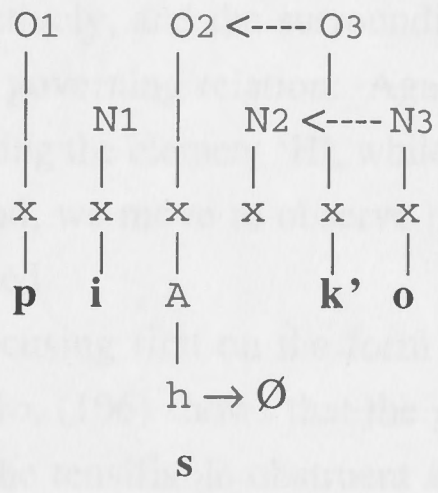
The data in (103a) shows the paradigm for *s*-irregular verbs. The conjugation of *s*-regular verbs is also given in (103b) for comparison.

| (103) | -ko 'and' | -ə/a '(infinitive)' | -ma 'I will' | Gloss |
|---|---|---|---|---|
| a. | citk'o | cyə | cima | 'build' |
| | putk'o | pwə | puma | 'pour' |
| b. | pitk'o | pisə | pisɨma | 'comb' |
| | utk'o | usə | usɨma | 'laugh' |

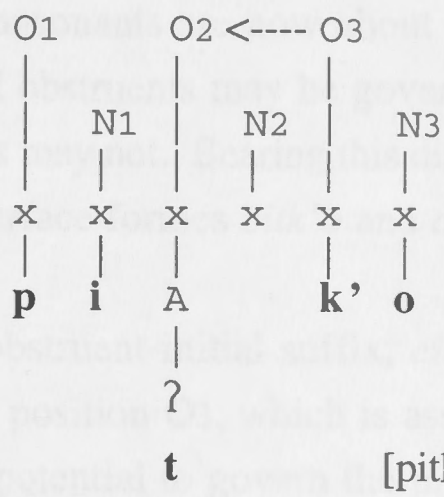
The words in the first column show that the stem-final segment is *t* when followed by an obstruent-initial suffix, in both regular and irregular verbs. In the second column, where a suffix begins with a vowel, a stem-final consonant disappears, and the preceding vowel and the suffix-initial vowel form a diphthong in the irregular verbs, while the stem-final *s* is retained in the regular verbs. When a suffix begins with a sonorant consonant as in the third column, the stem-final *s* is also not present in the irregular, but it remains in the regular.[13]

Let us first take a look at *s*-regular verbs. The conversion of the stem-final *s* to *t* in forms with an obstruent-initial suffix is a result of *s* occurring in a governed onset. (104) shows the derivation of the regular word *pitk'o* (← *pisØ-ko*).

(104) a.




⇒ b.




[pitk'o]

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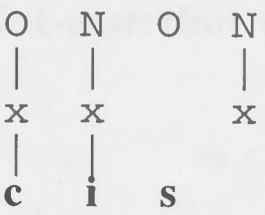
13 In the orthography, the vowel *ɨ* is present before a sonorant-initial suffix, e.g. *ciɨma, puɨma*. However, this vowel is deleted either before or after another vowel in actual pronunciation. For details of the deletion of the vowel, see W. Heo 1965, B-G Lee 1979, H-S Sohn 1986, etc.

In (104a), O2 and O3 surround the empty nucleus N2 that is properly governed by the following nucleus N3. These onsets fall into a governing relation. In the governed onset O2, the segment *s* loses 'h', and further the element '?' is obtained to this position, since a governed onset cannot a-license 'h', but must dominate '?'.

In like manner, the irregular verbal form *citk'o* (← *cisØ-ko*) is derived. However, the stem-final segment *s* behaves differently here from that of the regular verbs; namely *s* disappears when the suffix-initial segment is a sonorant consonant or a vowel. The underlying representation of the stem of *s*-irregular verbs is presented in (105), where the onset, which precedes the stem-final empty nucleus, does not dominate a skeletal point.

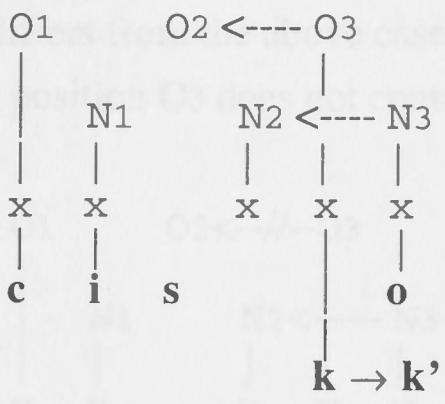
(105) ***s*-irregular verbs**




To test this underlying representation, let us first consider derivations of the forms *citk'o* (← *cisØ-ko*) and *cima* (← *cisØ-ma*), where suffixes begin with a consonant. In the both forms, the stem-final empty nucleus is properly governed by the rightmost nucleus containing the vowels *o* and *a*, respectively, and the surrounding two consonants are now about to enter into a governing relation. Again, neutral obstruents may be governors by acquiring the element 'H', while sonorants may not. Bearing this difference in mind, we move to observe how the surface formes *citk'o* and *cima* are obtained.

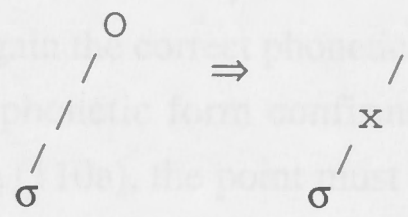
Focusing first on the form with an obstruent-initial suffix, *citk'o* (← *cisØ-ko*, (106) shows that the governing position O3, which is associated with the tensifiable obstruent *k*, has the potential to govern the preceding onset O2.

(106)



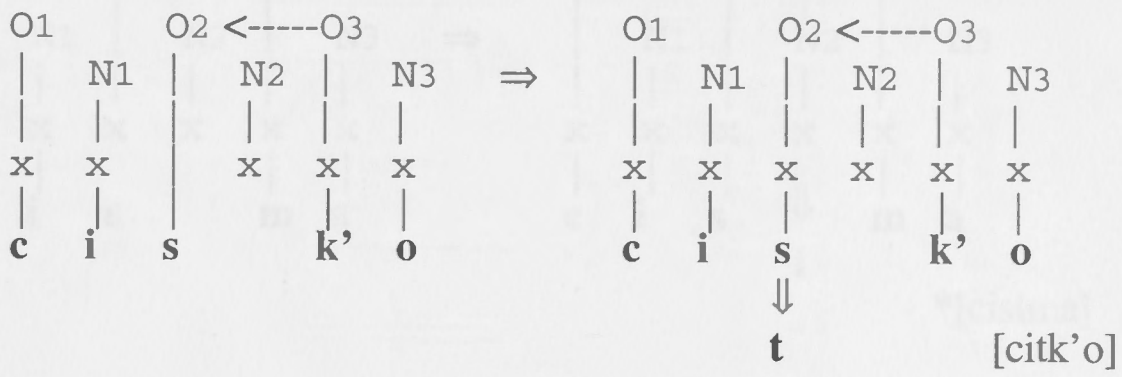

In the representation (106), there are a floating segment and an onset that does not dominate a skeletal point. It is claimed in Kaye (1992a) that when a constituent is available to access a floating segment, the segment may be linked with the constituent and a skeletal point be created.

(107) **Point-insertion convention** (Kaye 1992a)




For the Korean word *cisØ-ko*, I will follow Kaye and assume that the governed onset O2 is linked to the segment *s* and a skeletal point is provided between the two.

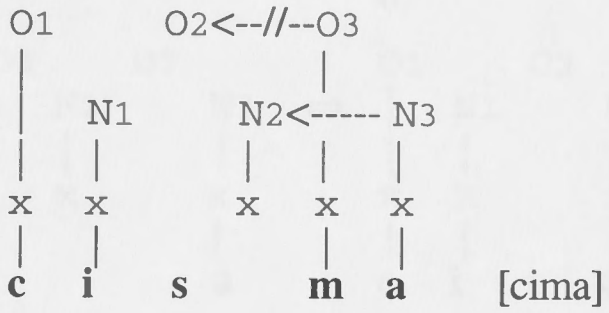
(108)




The fricative *s* surface as the unreleased stop *t* in the governed onset, and the neutral obstruent *k* becomes *k'* in the governing onset. This completes the derivation for *citk'o*.

For the form with a sonorant-initial suffix, *cima* (← *cisØ-ma*), the situation differs from the above case of the obstruent-initial suffix in that the governing position O3 does not contain an appropriate segment.

(109)

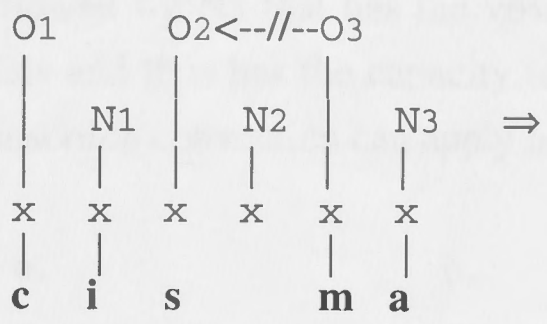



[cima]

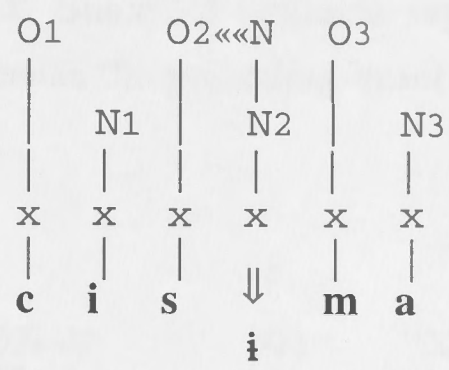
The governing relation is not constructed between O2 and O3. The onset O2, which fails to be licensed, cannot access the floating segment *s*. Nor does N2 receive phonetic interpretation, because no governing duty is imposed on this nucleus as the preceding onset O2 does not have a point to be governed. The unsyllabified segment *s* is not present on the surface, and thus we gain the correct phonetic form *cima* from the above representation.

This phonetic form confirms that O2 is pointless. If it had a point as shown in (110a), the point must be licensed and in turn, this licensing duty would lead the following empty nucleus N2 to be phonetically interpreted as in (110b). The result would then be the wrong form **cisima*.

(110) a.




b.

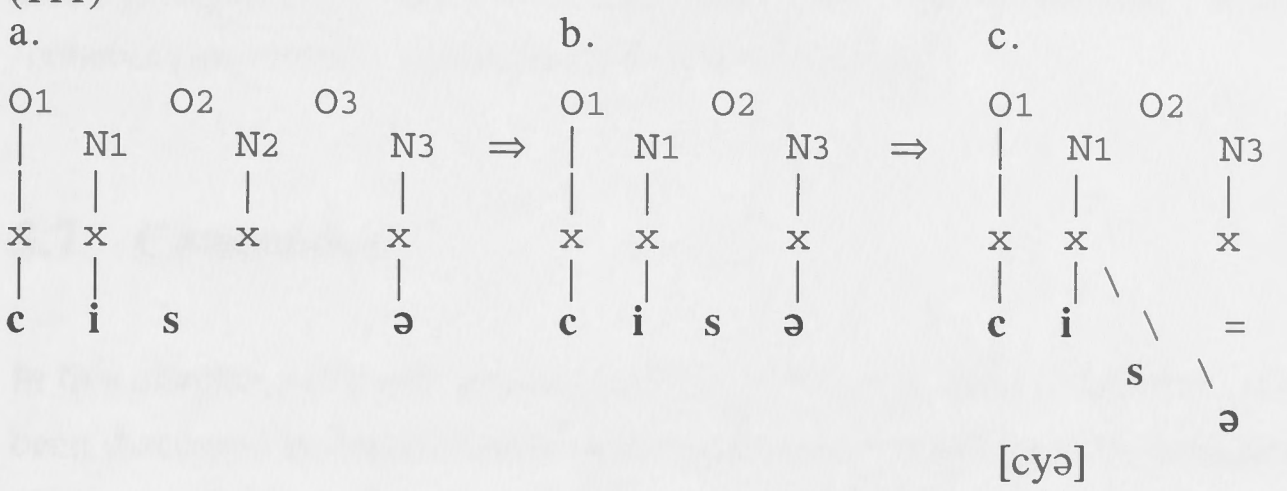



*[cisima]

Let us now turn to the infinitive form *cyə* (← *cisØ-ə*), where *s* disappears and the stem vowel *i* surfaces as the glide *y*. The underlying representation (111a) shows that the empty nucleus N2 is followed by the pointless onset O3. The sequence of N2-O3 is removed as per the Principle

of Reduction. Consequently, the structure (111b) is derived, in which the rightmost nucleus N3 is now preceded by the onset O2.

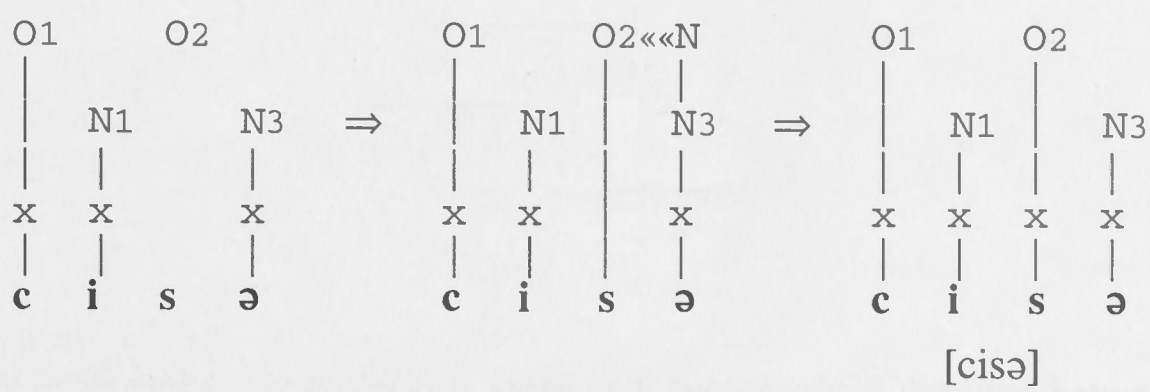
(111)




Without being intervened by an onset point, two nuclear positions N1 and N3 are next each other, which are linked with the high vowel *i* and the non-high vowel ə, respectively. As discussed in Chapter Four, two vowels undergo diphthongisation in such an environment. The second vowel ə is associated with N1 producing a light diphthong, and at the same time is delinked from N3 in the pronunciation of the younger generation, as in (111c). This diphthongisation correctly results in the phonetic form *cyə*,

The structure (111b) above, in fact, could be derived in another way, namely by the segment *s* being directly associated with the onset O2. Look at (112a), which is a reproduction of (111b). O2 and the floating segment *s* are followed by N3 that has the vowel ə. Since N3 contains segmental materials and thus has the capacity to license the preceding onset O2, the point-insertion convention can apply here.

(112)



As illustrated in (112b) and (112c), O2 and *s* are associated and a point is given. Therefore, if the point-insertion convention is adopted, the result would be *cisə*. This form is found in dialects such as Kyeongsang, Cenla, and Pyeongan (H. Sohn 1977), e.g. *pus-ə* 'swell up (infinitive)', *is-əra* 'connect (imperative)' (cf. footnote 6 of this chapter).[14]

## 5.7 Conclusion

In this chapter, obstruent lenition, tensification and *i*~zero alternation have been discussed in connection with the onset-onset structure of consonantal clusters. I have shown that obstruent lenition and tensification are indications that the two consonants involved are in a governing relation. In contrast, the so-called epenthesis of the vowel *i* appears to be a result of interonset government not being formed.

I have proposed a-licensing Quality to deal with distributional restrictions by which only particular consonants are a-licensed in preconsonantal and word-final positions in Korean. This a-licensing Quality, together with interonset government, accounts for the paradigms of *p*-, *t*- and *s*-irregular verbs. The paradigms of these verbs appear to be fully predictable from the perspective of a government-based approach without any additional stipulation.

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14 This observation indicates that there is a parametric difference between Seoul dialect and these dialects with respect to point-insertion convention. That is, the convention is adopted for these irregular forms in these dialects, but not in Seoul dialect.

# 6

# Sonorant Spreading

## 6.0 Introduction

In this chapter, we continue investigating phenomena which are involved in consonantal clusters in Korean. The focus will be on cases where the first member of clusters is a sonorant. Throughout the investigation, I attempt to show that these cases are also favourable to an onset-Ø-onset structure.

In sections 6.1~6.3, I first deal with nasal-ending verbs/nouns. After surveying the relevant data in 6.1, I consider a coda-onset structure for Korean consonantal clusters in 6.2, which is widely accepted in Korean phonology (H-S Sohn 1987; S-W Chung 1990; O-M Kang 1992, among others), and point out that this structure fails to deal with cases involving nasals. We then present an analysis of the relevant processes based on interonset government in 6.3. Section 6.4 will be devoted to discussion of cases of liquid-ending verbs/nouns.

## 6.1 The data

In (1), an obstruent-initial suffix is attached to a nasal-ending verb/noun. It has already been shown that a suffix-initial obstruent is tensified in both verbal and nominal forms, if the verb/noun ends with an obstruent. However, when the verb/noun ends with a nasal, different results obtain: a suffix-initial obstruent is tensified in verbal forms, but remains neutral in nominal forms.

(1)

a. **Verb-suffix**

| Verb | -ca<br>'let us' | -ko<br>'and' | -təra<br>'(recollective)' | Gloss |
|---|---|---|---|---|
| nam | namc'a | namk'o | namt'əra | 'remain' |
| sin | sinc'a | sink'o | sint'əra | 'wear shoes' |

b. **Noun-suffix**

| Noun | -coc$^{h}$a<br>'even' | -to<br>'also' | -put$^{h}$ə<br>'from' | Gloss |
|---|---|---|---|---|
| som | somcoc$^{h}$a | somto | somput$^{h}$ə | 'cotton' |
| t'aŋ | t'aŋcoc$^{h}$a | t'aŋto | t'aŋput$^{h}$ə | 'ground' |
| sin | sincoc$^{h}$a | sinto | sinput$^{h}$ə | 'shoes' |

Another fact that should be mentioned in relation to the behaviour of nasals is that there are two types of nasal-initial suffixes in Korean. The first type entails epenthesis of the vowel *i*, as discussed in Chapter Five.

(2)

| Verb | -ma<br>'I will' | -ni<br>'because' | Gloss |
|---|---|---|---|
| cap | capima | capini | 'catch' |
| mit | mitima | mitini | 'believe' |
| kap$^{h}$ | kap$^{h}$ima | kap$^{h}$ini | 'repay' |
| nak' | nak'ima | nak'ini | 'fish' |
| sum | sumima | sumini | 'hide' |
| sin | sinima | sinini | 'wear shoes' |
| po | poma | poni | 'see' |

The other type nasalises a preceding stop.

| (3) | Verb | -na '(male. interrogative)' | -ni '(female. interrogative)' | Gloss |
|---|---|---|---|---|
| | cap | camna | camni | 'catch' |
| | mit | minna | minni | 'believe' |
| | kap$^{h}$ | kamna | kamni | 'repay' |
| | nak' | naŋna | nakŋni | 'fish' |
| | sum | sumna | sumni | 'hide' |
| | sin | sinna | sinni | 'wear shoes' |
| | po | pona | poni | 'see' |

The examples in (3) illustrate that the verb-final stops *p, k, t* are realised as their homorganic nasals *m, ŋ, n* when followed by the nasal-initial suffixes *na* or *ni*.

Let us take a closer look at these two types of nasal-initial suffixes, to inspect what makes them behave differently. One possible reason is a morphological difference. As noted above, such a difference is clearly observed with regard to tensification, when a verb/noun ends with a nasal and the following suffix-initial consonant is an obstruent: a suffix-initial obstruent is tensified only in verbal forms, and not in nominal forms. However, the two types of nasal-initial suffixes in question are both verbal suffixes, and thus such a difference is ruled out here.

Another conceivable reason is that the two types of nasal-initial suffixes may be in a different phonological environment. In Chapter Five, it was shown that when suffixes have the pattern -C## or -CCV, suffixation always involves vowel epenthesis, whether the suffix-initial consonant is an obstruent or a sonorant. Observing the first type suffixes *ni* and *ma*, which yield vowel epenthesis, and the second type suffixes *ni* and *na*, which yield nasalisation, it is clear that their patterns are irrelevant to these different outcomes, as they are all composed of a consonant followed by a vowel (-CV). The quality and quantity of the vowel following the suffix-initial nasal cannot be a reason for the difference, either, since both types of suffixes contain the identical short vowels, *i* and *a*.

To sum up, the environment of the two types of nasal-initial suffixes are not distinguishable morphologically nor phonologically. Bearing this in

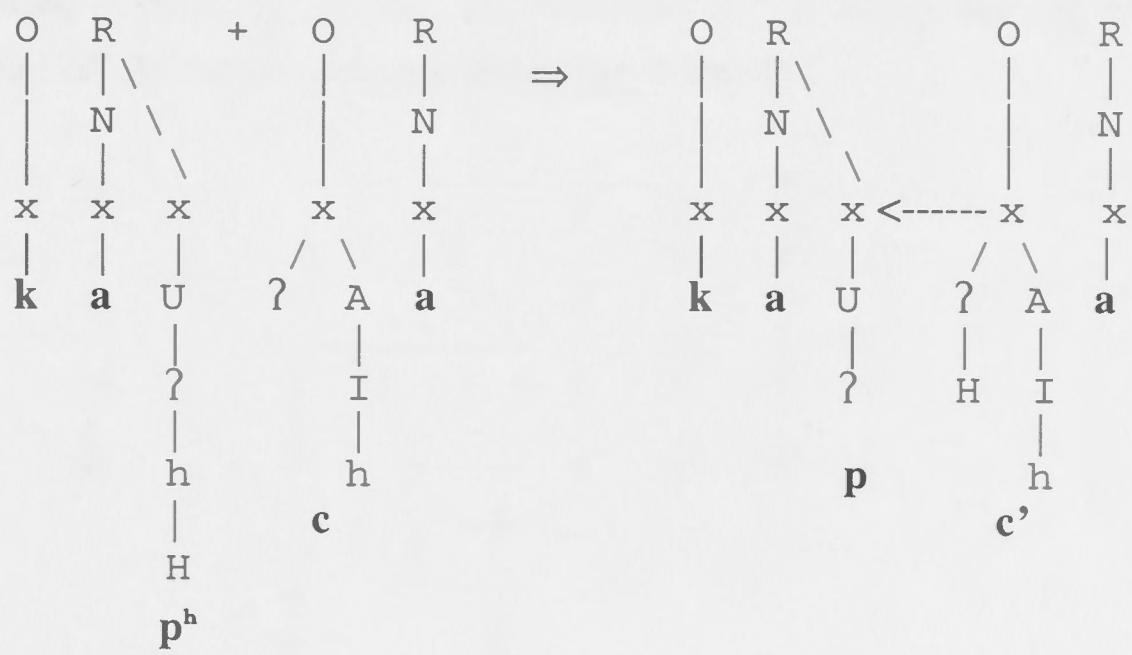
mind, we proceed to consider the possibility that consonantal clusters in Korean could constitute a coda-onset structure.

## 6.2 Problems in Coda-Onset Analysis

In Chapter Five, obstruent lenition and tensification were discussed under interonset government. I argued that lenition and tensification are an indication that two obstruents are in a governing relation. The lenited first member is a governed onset and the tensified second member is a governing onset.

In fact, lenition and tensification in obstruent clusters can also be accounted for within a coda-onset analysis. Let us first consider the derivation of the verbal form *kapc'a* (← *kap*$^{h}$*-ca* 'repay-let us').

(4) a. b.



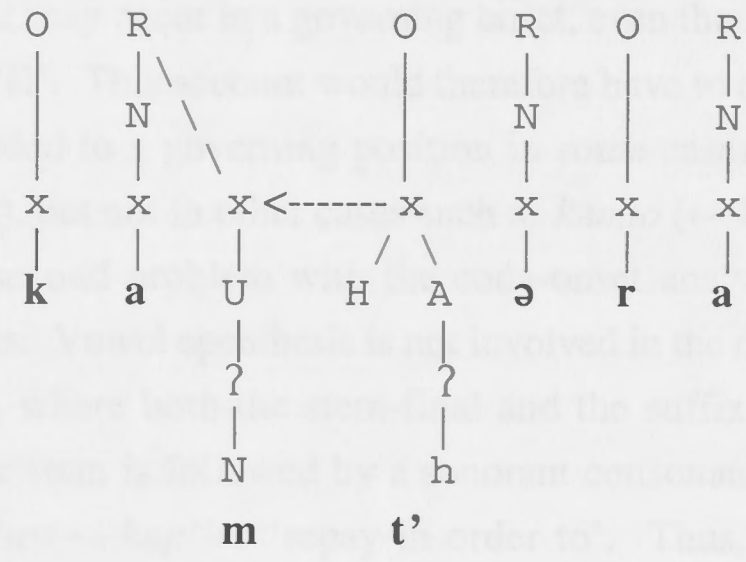

In (4a), the aspirated stop *p*$^{h}$ in the stem-final position occupies a coda, and *c* in the suffix-initial position occurs in a following onset. Recall that a coda must be governed by a following onset as defined in the Coda Licensing Principle (cf. 1.2.2 and 5.3.2). In this structure, the coda and the following onset enter into a governing relation. As shown in (4b), *p*$^{h}$ in the governed coda loses the elements 'H' and 'h', and becomes the unreleased *p*, whilst *c* in the governing onset is tensified to *c'* by obtaining 'H'.

The identical operations also apply in the context of noun-suffixes. Taking *sup$^h$-to* 'forest-also' as an example, the noun-final *p$^h$* and the suffix-initial *t* would occur in a coda and a following onset, under a coda-onset analysis. The aspirated *p$^h$* (H•ʔ•h•U) is reduced to the two elements 'ʔ' and 'U' in a governed coda, and *t* (ʔ•h•A) obtains the 'H' element in a governing onset, yielding a desirable result *supt'o*.

As illustrated, the coda-onset analysis correctly accounts for lenition as well as tensification in obstruent clusters. Thus, it seems to be reasonable to propose the coda-onset as the syllabic structure of Korean consonantal clusters. Nevertheless, I reject this analysis for the following two reasons.

First, the coda-onset analysis faces difficulty in explaining why a neutral obstruent in a suffix-initial position behaves differently in verbal forms and nominal forms, when the verb/noun-final consonant is a nasal. Consider the following underlying representation of the verb-suffix *kam-təra* 'wind (recollective)'. The suffixation produces the cluster *m-t*, where the first and second segments occur in the coda and following onset, respectively. A governing relation is formed, and the neutral *t* in the governing onset acquires 'H' for the reasons noted for *kapc'a* above.

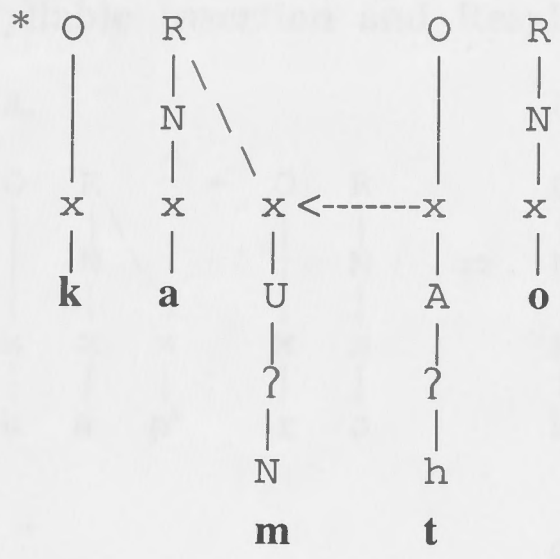
(5)




[kamt'əra]

Let us now compare this with the case of noun-suffixes. Taking *kam-to* 'persimmon-also', for example, this form also involves the cluster *m-t*. Thus, it would be natural to expect the same result with respect to the tensification of the neutral stop *t* in the governing onset. However, in the noun-suffix, the coronal stop *t* remains neutral.

(6)



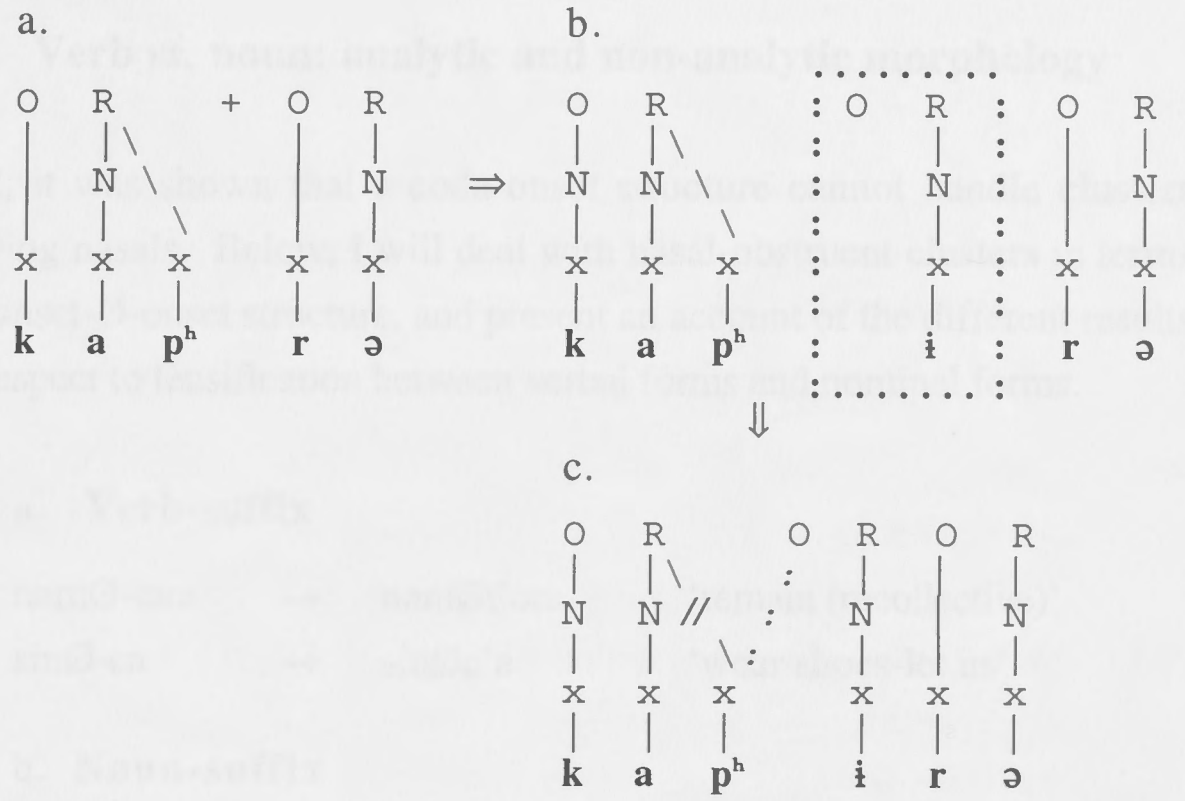

[kamto]

The trouble with this structure is that the governing onset position is occupied by the neutral stop *t*, which lacks the element 'H'.

One might claim that this governing relation qualifies since *m* and *t* are equivalent in degree of segmental complexity and therefore satisfy the Complexity Condition, which states that a governee must be no more complex than its governor — that is, a governor and a governee may have identical complexity. However, if one regards *m-t* as a well-formed coda-onset structure for a Korean consonantal cluster, one must treat the occurrence of tensification as arbitrary. Notice that this account implies that a segment may occur in a governing onset, even though it does not have the element 'H'. This account would therefore have to arbitrarily stipulate that 'H' is added to a governing position in some cases such as *kamt'əra* (← *kam-təra*), but not in other cases such as *kamto* (← *kam-to*).

The second problem with the coda-onset analysis arises from vowel epenthesis. Vowel epenthesis is not involved in the derivation of *kapc'a* (← *kap$^h$-ca*), where both the stem-final and the suffix-initial are obstruents. When the stem is followed by a sonorant consonant, the vowel *i* appears, e.g. *kap$^h$-rə* → *kap$^h$irə* 'repay-in order to'. Thus, under the coda-onset analysis, one must allow a different syllabic status for the stem-final consonant. In *kapc'a*, the stem-final *p* is a coda (kap.c'a), but in *kap$^h$irə*, the final coda is suddenly syllabified into an onset (kap$^h$.rə → ka.p$^h$i.rə).

(7) **Syllable Insertion and Resyllabification**




In (7b), a syllable with the vowel *ɨ* is inserted between the coda and the onset. (7c) indicates the resyllabification by which $p^h$ is delinked from the coda and relinked to the following onset.

Advocates of the coda-onset analysis need to show the environments in which syllable insertion applies. Couched in a rule-based approach, one could propose a 'syllable insertion rule' applying only before a sonorant and not before an obstruent. However, this proposal is immediately rejected when we consider suffixes beginning with a bi-consonantal cluster whose first member is an obstruent, e.g. *kap$^h$-pt'ita* → *kap$^h$ɨpt'ita* 'repay (recollective)'. Moreover, this rule encounters a serious problem with the case of nasal-initial suffixes. As noted in 6.1, there are two types of nasal-initial suffixes, one of which involves vowel epenthesis, e.g. *kap$^h$-ni* → *kap$^h$ɨni* 'repay-because', and one of which nasalises a preceding stop, e.g. *kap$^h$-ni* → *kamni* 'repay (interrogative)'. It should be recalled that the environment of these two types of nasal-initial suffixes are not distinguishable morphologically nor phonologically. Accordingly, if the two nasals are treated in the same way as occurring in an onset that governs a preceding coda, there will be no means to differentiate these two types of nasal-initial suffixes in structural terms.

## 6.3 Nasal-ending Verbs/Nouns

### 6.3.1 Verb *vs.* noun: analytic and non-analytic morphology

In 6.2, it was shown that a coda-onset structure cannot handle clusters involving nasals. Below, I will deal with nasal-obstruent clusters in terms of an onset-Ø-onset structure, and present an account of the different results with respect to tensification between verbal forms and nominal forms.

(8) a. **Verb-suffix**

| | | | |
|---|---|---|---|
| namØ-təra | → | namØt'əra | 'remain (recollective)' |
| sinØ-ca | → | sinØc'a | 'wear shoes-let us' |

b. **Noun-suffix**

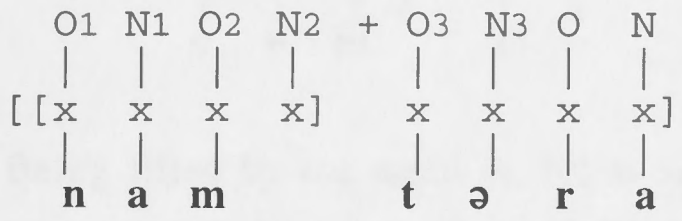
| | | | |
|---|---|---|---|
| somØ-to | → | somto | 'cotton-also' |
| t'aŋØ-putʰə | → | t'aŋputʰə | 'ground-from' |

The present analysis of interonset government makes the strong prediction that an obstruent undergoing tensification is always preceded by a nucleus that does not receive phonetic interpretation, and the absence of tensification indicates that a preceding nucleus is phonetically realised. Given that a suffix-initial obstruent is tensified in verbal forms but is not in nominal forms, our prediction suggests that a verb-final empty nucleus is sustained intact without receiving phonetic realisation through a derivation, whereas a noun-final empty nucleus is phonetically realised in some way.

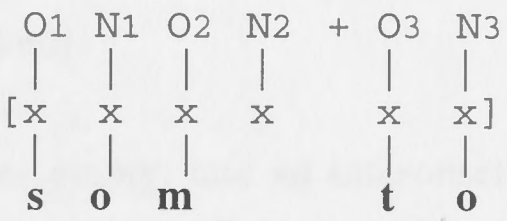
I propose that a verb-suffix has an internal cycle, whilst a noun-suffix does not, and that this different cyclic status yields the contrastive behaviour of suffix-initial obstruents in verb-suffixes and noun-suffixes. Compare the morphological structures of the verbal form *namt'əra* (← [[namØ]+təra]) and the nominal form *somto* (← [somØ+to]).

(9)

a. **Verb** (cyclic)




b. **Noun** (non-cyclic)



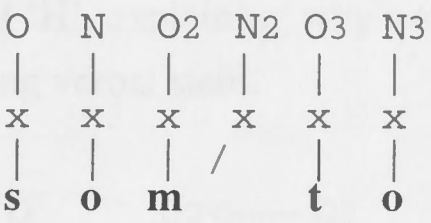

Both the verb-stem *nam* and the noun *som* end with an empty nucleus in their representations. What distinguishes the verb-final empty nucleus from the noun-final empty nucleus is that the former is domain-final within the innermost cycle, while the latter is domain-internal.

Remember that Korean parametrically licenses domain-final empty nuclei (cf. 5.2). The empty nucleus N2 in (9a) is itself licensed by virtue of this parametric setting. Unlike N2 in (9a), however, N2 in (9b) is domain-internal, and thus cannot be licensed in the same way as the verb-final empty nucleus. N2 will be properly governed by N3 in (9b), and O3 will be responsible for licensing O2 since, as discussed in Chapter Five, properly governed nuclei lack the licensing property for preceding onsets in Korean. The interonset government between O2 and O3 predicts that there will be two possible results as for phonetic realisation of this internal empty nucleus: either the empty nucleus will be inaudible if the governing relation is established, or it will be audible if the governing relation is not established. The former and the latter result in tensification and epenthesis of the vowel *ɨ*, respectively.

However, the surface form *somto* appears to be problematic as it denies both possibilities: it displays neither tensification nor epenthesis of the vowel *ɨ*. Again, the absence of tensification indicates that the noun-final empty nucleus receives phonetic interpretation, but contrary to all expectations the empty nucleus is not spelled out as the vowel *ɨ*.

There is, however, another option that can be adopted. This is to give segmental material to an empty nucleus in a direct manner. For the case at hand, I claim that a nasal in a preceding onset spreads into an internal empty nucleus. The underlying representation of the nominal form *somto* appears as follows.

(10)

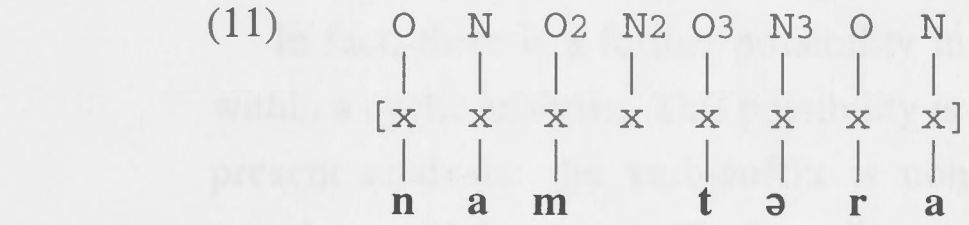



[somto]

Being filled by the nasal *m*, N2 is no longer empty, and so interonset government between O2 and O3 is not triggered. This provides a straightforward explanation as to why the suffix-initial obstruent *t* is not tensified after a nasal-ending noun, and why epenthesis of the vowel *ɨ* is not involved, either, in this case.

Let us now turn our attention to the verbal form [[namØ]+təra]. As noted above, within the innermost cycle, a verb-final empty nucleus is licensed by itself. (11) shows the structure of the next cycle.

(11)



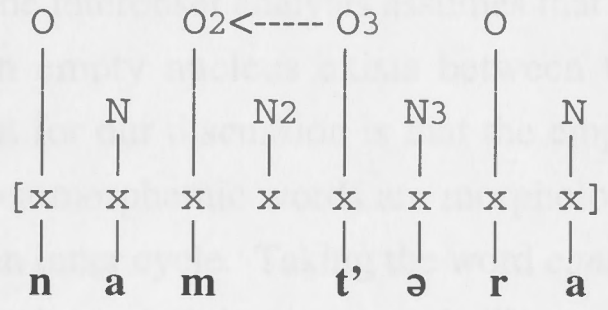

The empty nucleus N2 is preceded by O2 that contains the nasal *m*. In this regard, the structure coincides with that of the nominal form *somØto*. The structure (11), however, crucially differs from *somØto* in that the nucleus N2 has filtered out the nasal spreading strategy within the innermost cycle and, once failed, spreading strategy does not apply in the second cycle. Regarding the inapplicability of nasal spreading to this empty nuclear position N2, the reader is referred to the Principle of Strict Cyclicity, which states:

> "... on any cycle A no cycle rule may apply to material within a previous cycle B without making crucial use of material uniquely in A"
>
> (Kean 1974:179)

Accordingly, N2 remains without receiving phonetic interpretation in the second cycle, and the surrounding two onsets O2 and O3 hold a governing relation. The neutral stop *t* in the governing position O3 is tensified by

addition of 'H', explaining why a suffix-initial obstruent is tensified after a nasal-ending verbal stem.

(12)




[namt'əra]

In sum, I have discussed cases of nasal-ending verbs/nouns, in connection with morphological structures which are different in verbal and nominal forms. A suffix-initial obstruent is not tensified in the noun-suffix, because a noun-final empty nucleus is domain-internal and is filled with a nasal that is spread from a preceding onset.

In fact, there is a further possibility in accounting for this difference within a cyclic analysis. This possibility is to take the opposite view to the present analysis: the verb-suffix is non-cyclic, e.g. [namØ+təra] → *namt'əra*, and the noun-suffix is cyclic, e.g. [[somØ]+to] → *somto*. Under this view, the nasal-spreading strategy would not be necessary. In the former case, *m* and *t* would immediately fall into a governing relation since the verb-final empty nucleus is internal, and so *t* becomes the tensed *t'*. In the latter case, on the other hand, the noun-final empty nucleus is domain-final, and is licensed by itself, thus no governing relation is required between *m* and *t*, which leaves *t* as neutral. However, it will be shown shortly that this view is untenable, and that our cyclic analysis, i.e. of verbal forms as cyclic and nominal forms as non-cyclic, is supported by further data.

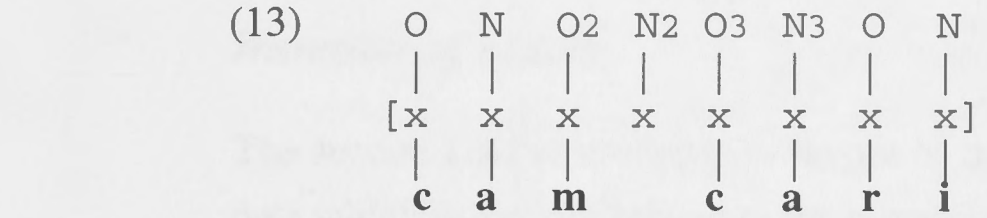
### 6.3.2 Empirical support

The purpose of this subsection is to provide evidence that support our analysis, which is based on nasal spreading and different cyclic status of noun-suffixes and verb-suffixes.

### *Morpheme-internal nasal-obstruent clusters*

Let us first consider a nasal-obstruent sequence within a monomorphemic word. The interonset analysis assumes that the cluster has a representation where an empty nucleus exists between the two consonants. What is important for our discussion is that the empty nucleus is domain-internal, since monomorphemic words are morphologically simple, and thus do not contain an inner cycle. Taking the word *camcari* 'dragonfly' as an example, its non-cyclic underlying structure is illustrated in (13).

(13)



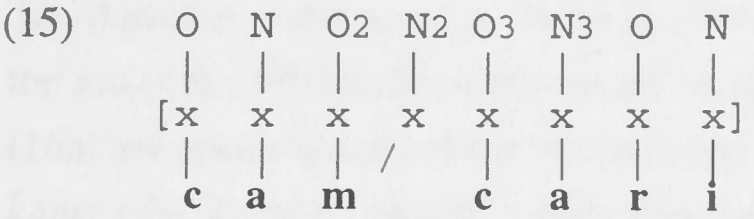

Given the *m-Ø-c* sequence, if our analysis is correct, the obstruent *c* should not be tensified, as the intervening nucleus will be filled with a nasal. On the other hand, if our analysis is wrong, then the obstruent *c* should be tensified, as the two onsets O2 and O3 enter into a governing relation and the internal-empty nucleus is not phonetically realised. Keeping this, observe the following data.

(14) **Morpheme internal**

| | | | |
|---|---|---|---|
| camcari | 'dragonfly' | səmki- | 'take care of' |
| kunte | 'spot' | kyənti- | 'bear' |
| caŋsa | 'trade' | muŋki- | 'squash' |

Crucially, the obstruents are neutral after a nasal, indicating that these two consonants are not in a governing relation. The absence of a governing relation in these words is also due to the nasal spreading by which an intervening nucleus becomes no longer empty. (15) shows the representation of the word *camcari*.

(15)

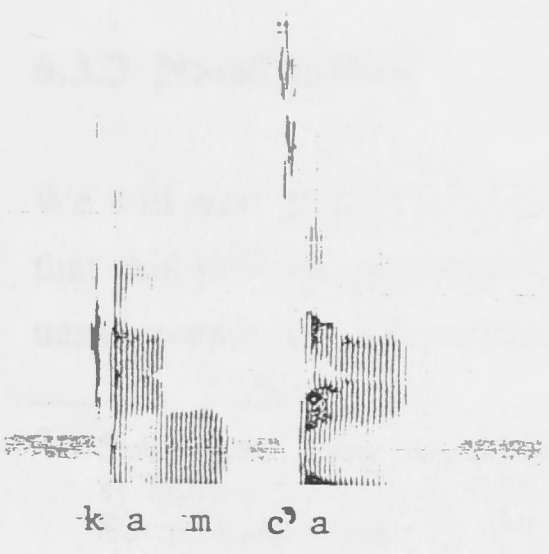


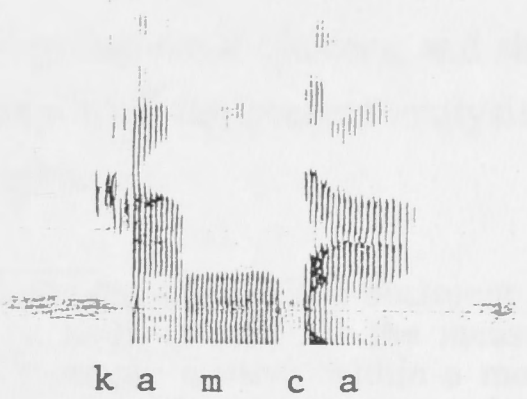

In short, it should be stressed here that monomorphemic words do not contain an inner cycle. Non-tensification of a neutral obstruent after a nasal in morpheme-internal positions appears to support our analysis that noun-suffixes are also non-cyclic.

### *Duration of nasals*

The second kind of evidence in favour of the present proposal comes from data which is directly related to the representation of nasals. A nasal that is doubly linked with two skeletons, namely an onset and a following nucleus, is expected to have a relatively longer duration than a nasal segment linked with a single onset. To verify this expectation, I have measured eight pairs of words, which are distinctive in terms of tenseness of the obstruent in the post-nasal position.[1] The following spectrograms of one such pair are representative.

(16) a. **kamc'a** b. **kamca**

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1 I am indebted to Young-Joon Lee, Seok-Ho Moon, and Hung-Soo Jun who served as informants, and especially grateful to Phil Rose for his invaluable help with these experiments.

The duration of the nasal is 70 ms in (16a) and 126 ms in (16b), showing the nasal in (16b) to be nearly twice as long as that in (16a). (16a) and (16b) are spectrograms of the words *kamc'a* (← *kam-ca* 'wind-let us') and *kamca* (← *kamca* 'potato'), respectively.[2] Significant for our present concern is the fact that *kamc'a* is verb-suffix and therefore its lexical representation is cyclic, i.e. [[kamØ]+ca], while *kamca* is a noun and hence does not contain an inner cycle, i.e. [kamØca], and further the internal empty nucleus is filled with a nasal, i.e. *kam:ca*. The spectrograms therefore match our expectation.

Our expectation regarding nasal duration is also satisfied by language-external evidence. Sato (1993) has investigated the comparative duration of nasals in Japanese, English and Korean. Note that the syllable-final nasal in Japanese is the so-called moraic nasal. According to Sato, unsurprisingly, the Japanese syllable-final nasal has a longer duration than that of English. For example, the duration of *n* before the voiced *d* is 121.56 ms in Japanese and 100.31 ms in English. In Korean, nasals before a neutral obstruent are assumed to be doubly linked with an onset and the following nucleus, so that if this assumption is correct they should have a longer duration than in English. Sato shows that the duration of the Korean nasal *n* before neutral *t* is 121.88 ms, which is as long as that of Japanese. Further, Sato provides similar results for the duration of the nasal *m* before neutral *p* and before tensed *p'*: this is 126.88 ms before *p*, and 91.25 ms before *p'*.[3]

### 6.3.3 Nasalisation

We will now discuss nasalisation involving stop-nasal clusters, and show that this provides further evidence in support of the present analysis of nasal-spreading. (17) presents some examples.

---

2 Since there is no verbal suffix which shares the same initial obstruent and syllabic structure as nominal suffixes, a noun is used for the measure. Since a nasal also spreads onto the next empty nucleus within a monomorphemic noun, duration of nasals in verb-suffix and monomorphemic noun would be sufficient to show the two different types of nasals.

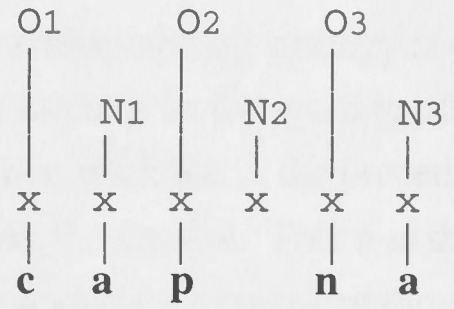
3 Sato (1993) also includes the duration of nasals before aspirated obstruents. For example, the duration of *m* before $p^h$ is 90.00 ms, which is similar to that before *p'*.

(17)

| | | | | |
|---|---|---|---|---|
| | cap-na | → | camna | 'catch-(male. interrogative)' |
| | mit-ni | → | minni | 'believe-(female. interrogative)' |
| | cip-macə | → | cimmacə | 'house-even' |
| | kuk-man | → | kuŋman | 'soup-only' |

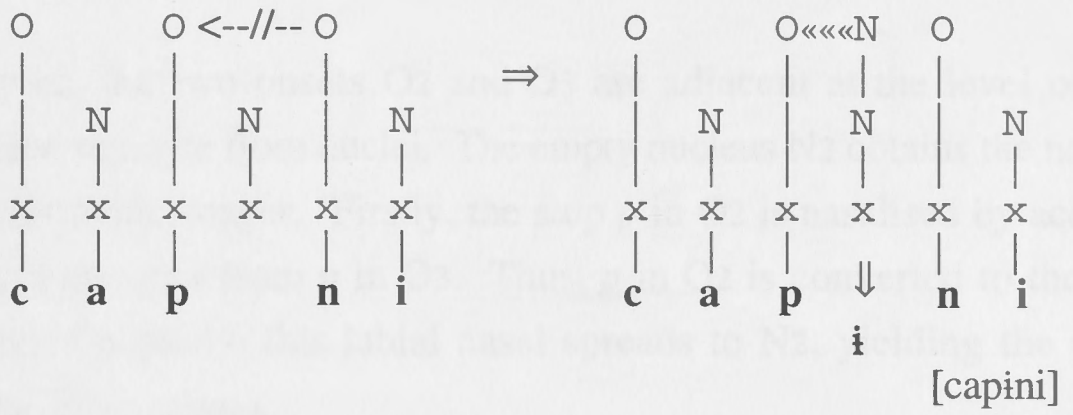
The underlying representation of the word *capØ-na*, for example, is as follows.

(18)




In this structure, the nucleus N2 is empty, and cannot license the preceding onset O2. O3 takes over this licensing responsibility. The onset O3, however, contains the nasal *n*, which is not tensifiable and thus cannot serve as a governor. This inability of O3 to be a governor leads the stem-final empty nucleus N2 to be phonetically realised. In Chapter Five, it was shown that a stem-final empty nucleus is spelled out as the epenthetic vowel *i* when followed by a nasal in response to onset-licensing responsibility, in the case of the suffix *ni* 'because'.

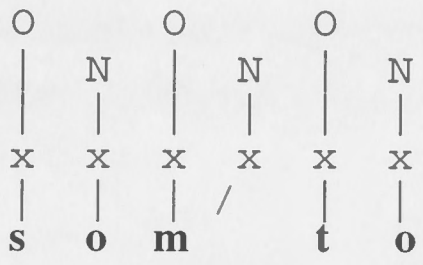
(19) **The suffix *-ni* 'because'**




In the present case of *capØ-na* '(male. interrogative)', however, the phonetic form *camna* indicates that epenthesis is not invoked. Recall that

nasal spreading is another option by which an empty nucleus may be phonetically realised, as illustrated by the word *somto* (← [somØ+to] 'cotton-also').

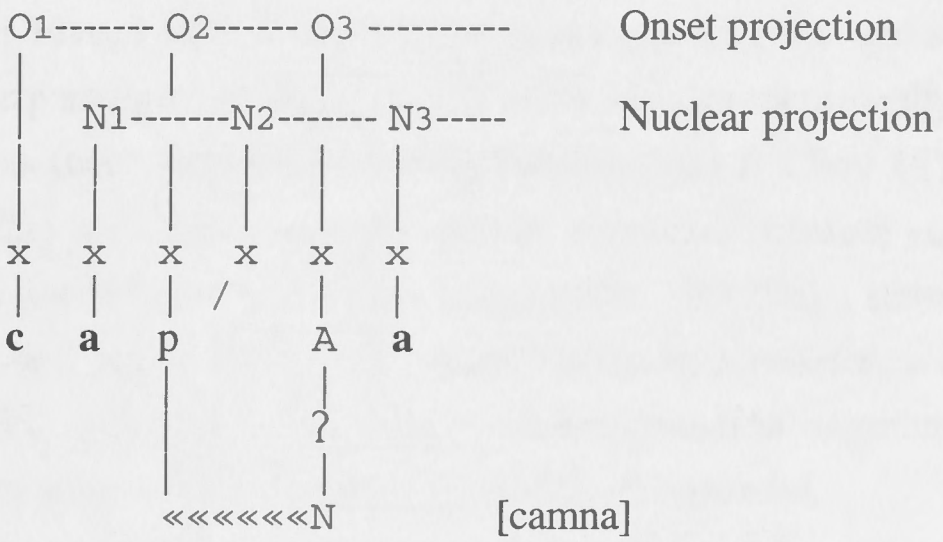
(20)




[somto]

This nasal-spreading strategy is employed for the phonetic realisation of the empty nucleus in the word *capØ-na*. Notice, however, that in this case a nasal is not available in the preceding onset. Instead, the empty nucleus is followed by the nasal *n*. This *n* is the source of the spreading nasality. (21) shows the underlying representation of the word *camna*.

(21) **The suffix *-na* '(male. interrogative)'




[camna]

As shown, the two onsets O2 and O3 are adjacent at the level of onset projection separate from nuclei. The empty nucleus N2 obtains the nasal via two derivational stages. Firstly, the stop *p* in O2 is nasalised by acquiring the nasal element from *n* in O3. Thus, *p* in O2 is converted to the labial nasal *m*. Secondly, this labial nasal spreads to N2, yielding the correct phonetic form *camna*.

## 6.4 Liquid-ending Verbs/Nouns

So far, we have dealt with nasal-ending verbs and nouns. In this section we consider phenomena involved in liquid-ending verbs and nouns. First, I discuss the paradigms of liquid-ending verbs. In fact, there are three types of verbal stems which end with a liquid.

| (22) | -ə/a (infinitive) | -ko 'and' | -myən 'if' | Gloss |
|---|---|---|---|---|
| a. ***rə*-irregular** | pʰuɾɨrə | pʰuɾɨko | pʰuɾɨmyən | 'be green' |
| | iɾɨrə | iɾɨko | iɾɨmyən | 'reach' |
| b. ***rɨ*-irregular** | nalla | naɾɨko | naɾɨmyən | 'bring' |
| | talla | taɾɨko | taɾɨmyən | 'be different' |
| c. ***r*-irregular** | mirə | milko | milmyən | 'push' |
| | urə | ulko | ulmyən | 'cry' |

In Chapter Five, I have discussed the paradigms of *t-*, *p-* and *s-* irregular verbs. The paradigms of liquid-ending verbs are also traditionally treated as irregular, as their alternations are unpredictable (H-B Choy 1959; W Heo 1965). (22a) involves *r*~zero alternation: *r* appears before a vowel-initial suffix, but not before a consonant-initial suffix. In (22b) a stem ends with the geminate *ll* before a vowel-initial suffix, but with *rɨ* before a consonant-initial suffix. (22c) shows *r-l* alternation: the stem-final segment is *r* when followed by a vowel, but *l* when followed by a consonant.

In previous studies, the alternating forms of the *rə*-irregular verbs have sometimes been treated as being lexically conditioned (C-W Kim 1973; H. Sohn 1977). However, we shall see that the paradigms of the *rə*-irregular verbs, as well as of the other verbs cited above, are fully predictable from the perspective of a government-based approach.

### 6.4.1 The distribution of *r* and *l*

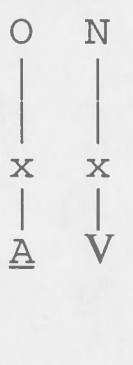
We first consider the distribution of *r* and *l* in Korean. They are in a complementary distribution: *r* appears before a vowel, and *l* appears elsewhere.

| | | | | | | |
|---|---|---|---|---|---|---|
| (23) | **r**: | before a vowel: | saram | 'people' | kori | 'ring' |
| | **l**: | word final: | mul | 'water' | sil | 'string' |
| | | pre-consonantal: | solkɛ | 'hawk' | milca | 'let us push' |
| | | in a geminate: | mollɛ | 'without a notice' | | |
| | | | mullo | 'with water' | | |

I assume that the lexical form of a liquid is *r* (A), and that it surfaces as *l* (A•ʔ) in the following two cases: (i) when it occurs in a governing position, and (ii) when it inherits a-licensing potential from a word-final empty nucleus. (24) illustrates each cases. In (24a), the lexical form is maintained before a vowel. The structures (24b) and (24c) show that *r* is converted to *l* when it occurs in a geminate and in pre-consonantal position, respectively. Note that *l* (A•ʔ) can be seen as a strong version of r (A) in the sense that *l* has a more complex internal structure. As a geminate universally involves head-final government (Yoshida 1991), the second onset must govern the preceding onset in (24b). In the governing position, *r* becomes its strong form *l*.

(24)

a.




**rV**

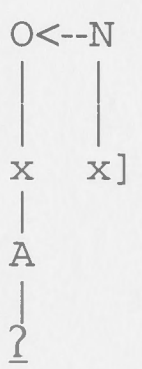
b.


**ll**

c.


**lC**

d.




**l##**

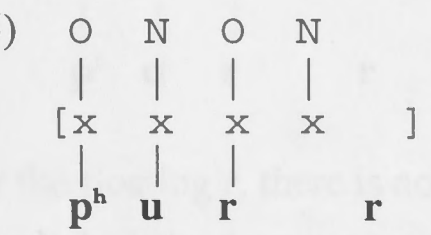
(24c) shows that the liquid is doubly linked with an onset and a following nucleus. By occupying a nucleus, the liquid has to support the nucleus to license the preceding onset, and this nucleus-to-onset licensing requires the liquid to be the strong form *l*. A detailed discussion of this liquid spreading will be given later in this chapter. Regarding (24d), it is worth recalling that a-licensing Quality in Korean requires onsets to dominate the element '?' (and a place-defining element) when licensed by word-final empty nuclei. The conversion of the lexical form *r* to *l* in word-final positions is due to this requirement.

### 6.4.2 *rə*-irregular verbs

Our analysis begins with *rə*-irregular verbs. The stem ends with *ri* when a suffix begins with a consonant, but *r* is added to *ri* in a vowel-initial suffixal form, e.g. *pʰuri-ko*, *pʰuri-myən* but, *pʰurir-ə*. The unexpected presence of *r* before -*ə* in the infinitive form is the reason why these verbs are called *rə*-irregular. Crucially, the stem always contains the sequence *ri*. Recall that *i* is the phonetic manifestation of an empty nucleus. The consistent presence of the vowel *i* (in *ri*) indicates that the nucleus is not licensed in any cases. It is therefore suggested that the nucleus is not domain-final within the innermost cycle. If this nucleus was domain-final, i.e. [pʰurØ], the nucleus would not be present when followed by an obstruent-initial suffix, and instead the obstruent would be tensified, e.g. **pʰulk'o* ← [[pʰurØ]+ko].

I claim that the stem has the following underlying representation where the empty nucleus is not final but followed by the segment *r* which is not associated with a skeletal point.

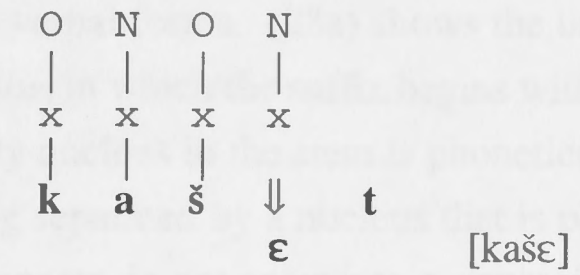
(25)




If this stem is pronounced in isolation, it will be *pʰuri*.

To explain this phonetic form, I would like to refer to the representation of the French word *kašɛ* 'seal', which is cited in Charette (1991). According to Charette, its underlying form is *kašØt*, where the final *t* is floating.

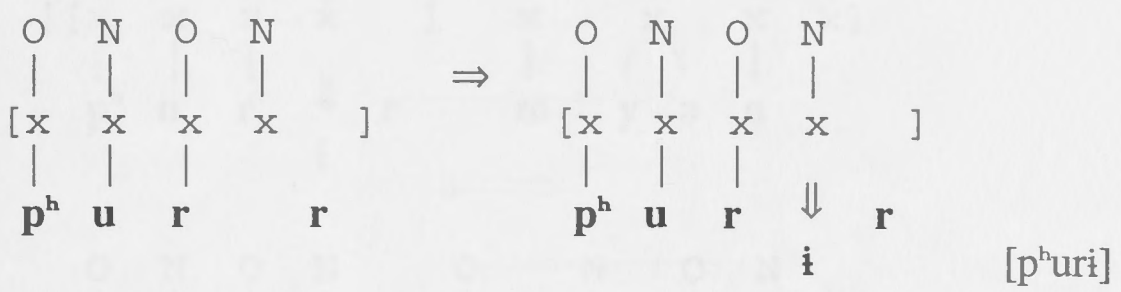
(26)




If the rightmost nucleus was final in this domain, the phonetic form should have been *kaš*, since French licenses final-empty nuclei, e.g. *forte* [fɔrtØ] 'strong', *lève* [lɛvØ] 'stand up!'. Charette claims that the final consonant *t* prevents the preceding empty nucleus from being final, and the phonetic interpretation of the empty nucleus is subject to proper government. There is, however, no proper governor available to its right (proper government is head-final in French), and the empty nucleus therefore manifests itself as the vowel ɛ.[4] The empty nucleus is licensed and the final *t* surfaces when this form is followed by the infinitive suffix *-e*, i.e. *kašte* (← *kašØt-e*).

The Korean word *pʰuri*, (← [pʰurØr]) is derived in a like manner. In the structure (25) above, which is reproduced here as (27a), the rightmost nucleus does not occur in the final position of this domain, since it is followed by the floating segment *r*. As a result, the nucleus is realised as *i* as in (27b).

(27)




For the floating *r*, there is no accessible constituent available in the structure. Unsyllabified *r* does not receive phonetic interpretation.

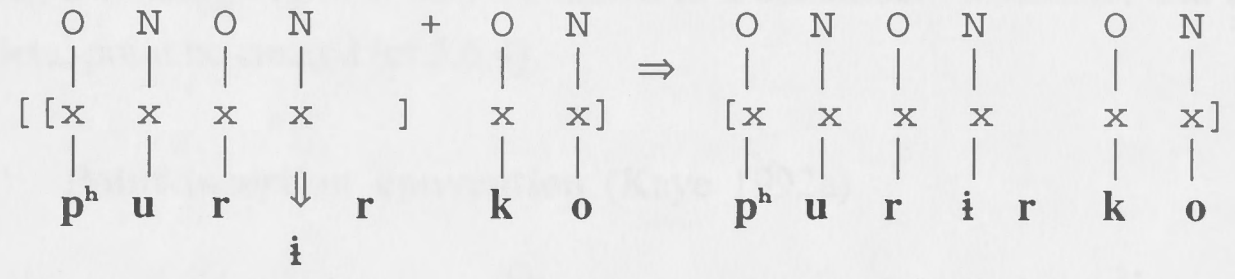
---

4 In French, empty nuclei are realised as ɛ in accented nuclei, otherwise as a schwa ə (Charette 1991).

Another point that need to be noted is that in (27a) two *r*s are adjacent, and may be affected by the OCP.[5] The phonetically interpreted rightmost nucleus has the effect of separating the two *r*s, so that the structure is no longer under the influence of the OCP.

Let us now observe how this floating segment *r* affects the derivation of each verbal forms. (28a) shows the underlying representation of the word *pʰuriko*, in which the suffix begins with an obstruent. On the first cycle, the empty nucleus in the stem is phonetically realised, as demonstrated above. Being separated by a nucleus that is phonetically realised, the surrounding two onsets do not enter into a governing relation on the second cycle, and the suffix-initial *k* remains neutral, as shown in (28b).

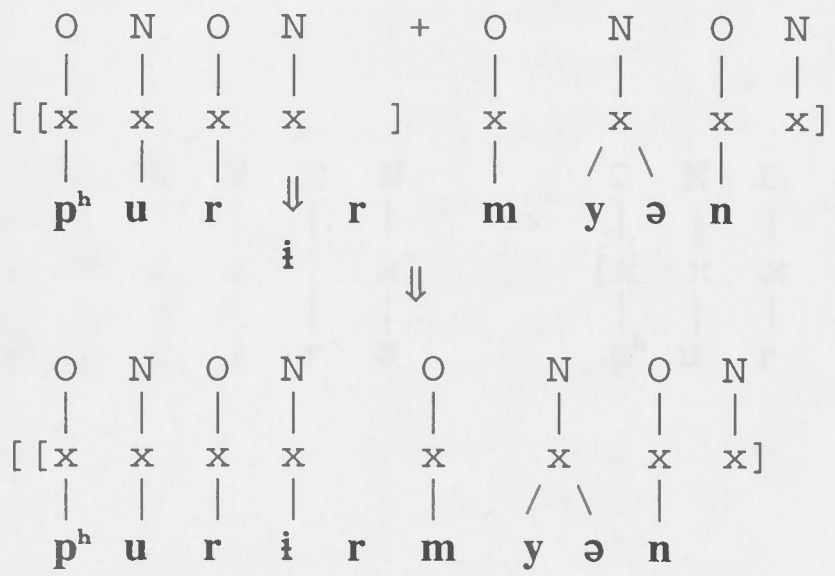
(28) a. b.




[pʰuriko]

The fact that interonset government is not triggered renders the difference between obstruent and sonorant in suffix-initial position meaningless. The verbal form of a sonorant-initial suffix is derived through the identical process, e.g. [[pʰurØr]+ myən] → [pʰuri + myən] → *pʰurimyn*.

(29)



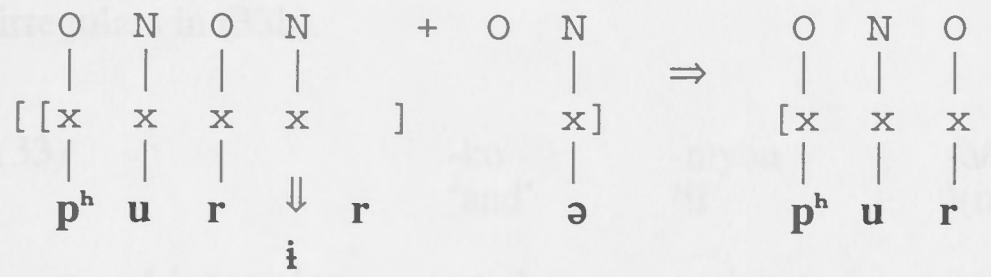

[pʰurimyn]

---

5 See 1.5 for detailed discussion of OCP.

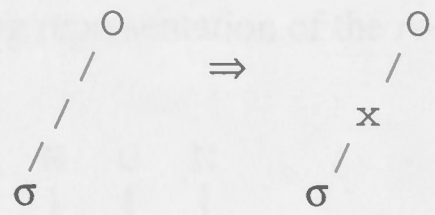
(30) below is the derivation of the infinitive form. Unlike consonant-initial suffixes, this suffix provides an onset to which the floating *r* may associate.

(30)



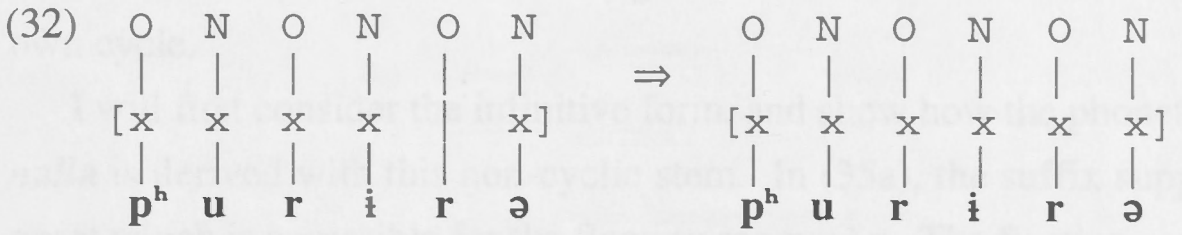

In the previous chapter, we considered the point-insertion convention by which a floating segment may be linked to a constituent available, and a skeletal point be created (cf.5.6.4).

(31) **Point-insertion convention** (Kaye 1992a)




Point-insertion convention applies in the context at hand. The segment *r* is linked with the onset supplied by the suffix, and a skeletal point is given. This point-insertion convention completes the derivation of the word *pʰurɨrə*.

(32)




[pʰurɨrə]

### 6.4.3 *rɨ*-irregular verbs

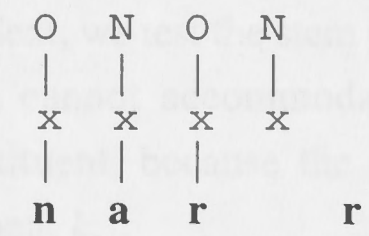
Let us now proceed to *rɨ*-irregular verbs. When a suffix begins with a consonant, the stem ends with the sequence *rɨ*, as in the first and the second examples in (33a). Notice that these stem-ending *rɨ* is identical to that of *rə*-irregulars in (33b).

(33)

| | -ko 'and' | -myən 'if' | -a/ə '(infinitive)' |
|---|---|---|---|
| a. ***rɨ*-irregular** | narɨko | narɨmyən | nalla |
| b. ***rə*-irregular** | pʰurɨko | pʰurɨmyən | pʰurɨrə |

The difference between these two irregular types is exhibited when a following suffix begins with a vowel. As shown in the third examples in (33a) and (33b), in this case the stem ends with *rɨr* in the *rə*-irregular, but the stem-final *rɨ* is replaced by the geminate *ll* in the *rɨ*-irregular. The underlying representation of the *rɨ*-irregular verbal stem appears as follows.

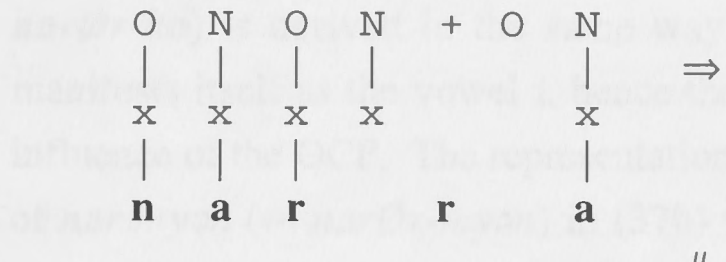
(34)



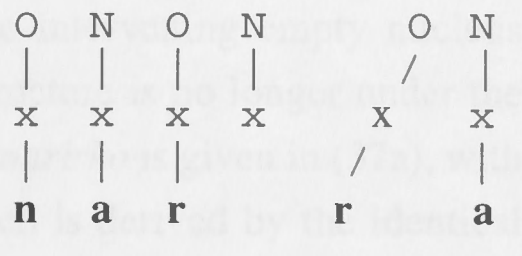

This representation is identical to *rə*-irregular verbal stems in that the stem-final empty nucleus is followed by a floating segment *r*. The structure, however, contrasts with the *rə*-irregular verbs in that it does not have its own cycle.

I will first consider the infinitive form, and show how the phonetic form *nalla* is derived with this non-cyclic stem. In (35a), the suffix supplies an onset which is accessible for the floating segment *r*. The floating segment *r* is associated with the onset, and a skeletal point is inserted, as shown in (35b).

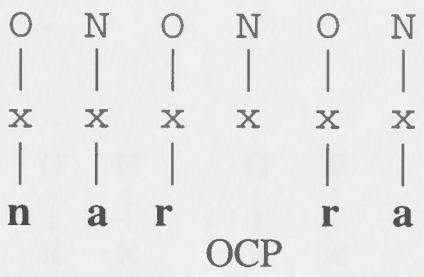
(35) a.



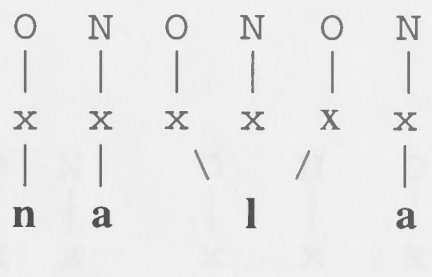

b.




c.




d.

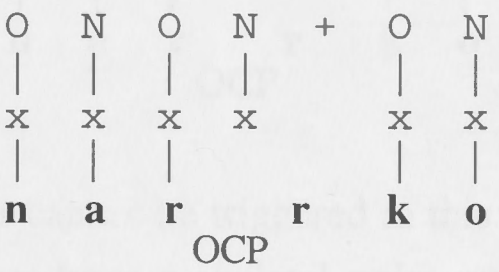



[nalla]

We now have the representation (35c) where two identical segment *r*s are next to each other. These two *r*s are merged under the influence of the OCP, resulting in a geminate. It was noted in 6.4.1 that *r* is converted to *l*, its strong version, by obtaining the element '?' in a geminate. As shown in (35d), the liquid surfaces as *l*.

Next, we test the stem with the consonant-initial suffix *-ko*. This verbal form cannot accommodate the floating segment *r* with an accessible constituent, because the onset of the suffix is occupied by the lexical segment *k*.

(36)

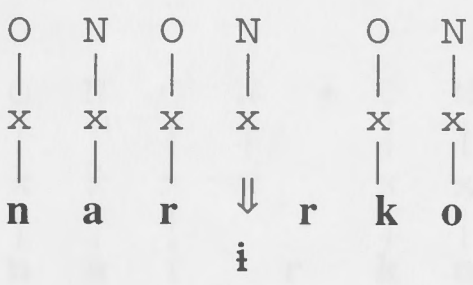



In the structure above, we can see that the two identical segment *r*s are adjacent, and may be influenced by the OCP. The OCP effect on two *r*s was merger in the case of *narØr-a* above. However, it will be shown shortly that merger effect cannot be invoked in this case, *narØr-ko*. We have already seen a similar situation in the case of *rə*-irregular verbs, where

the vowel *i* appears between two adjacent *r*s, e.g. *pʰurØr* → *pʰurir*, and as a result, the structure avoids violation of the OCP. The word *nariko* (← *narØr-ko*) is derived in the same way: the intervening empty nucleus manifests itself as the vowel *i*, hence the structure is no longer under the influence of the OCP. The representation of *narirko* is given in (37a), with of *narimyən* (← *narØr-myən*) in (37b) which is derived by the identical process.

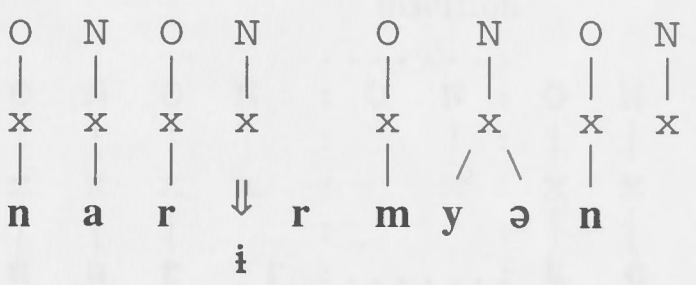
(37)

a.




[nariko]

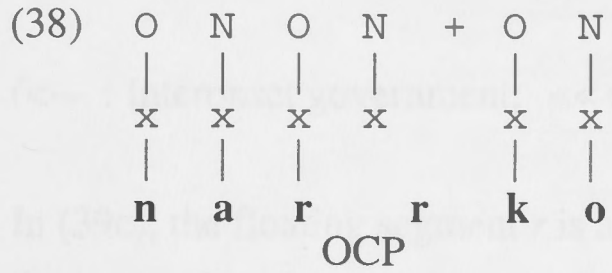
b.




[narimyən]

Comparing this with the case *narØr-a*, in which the merger effect on the two *r*s yields *nalla*, one might wonder why the two *r*s do not undergo merger in the case of *narØr-ko* (and *narØr-myən*). Look at the underlying representation of *narØr-ko*, which is repeated below as (38).

(38)

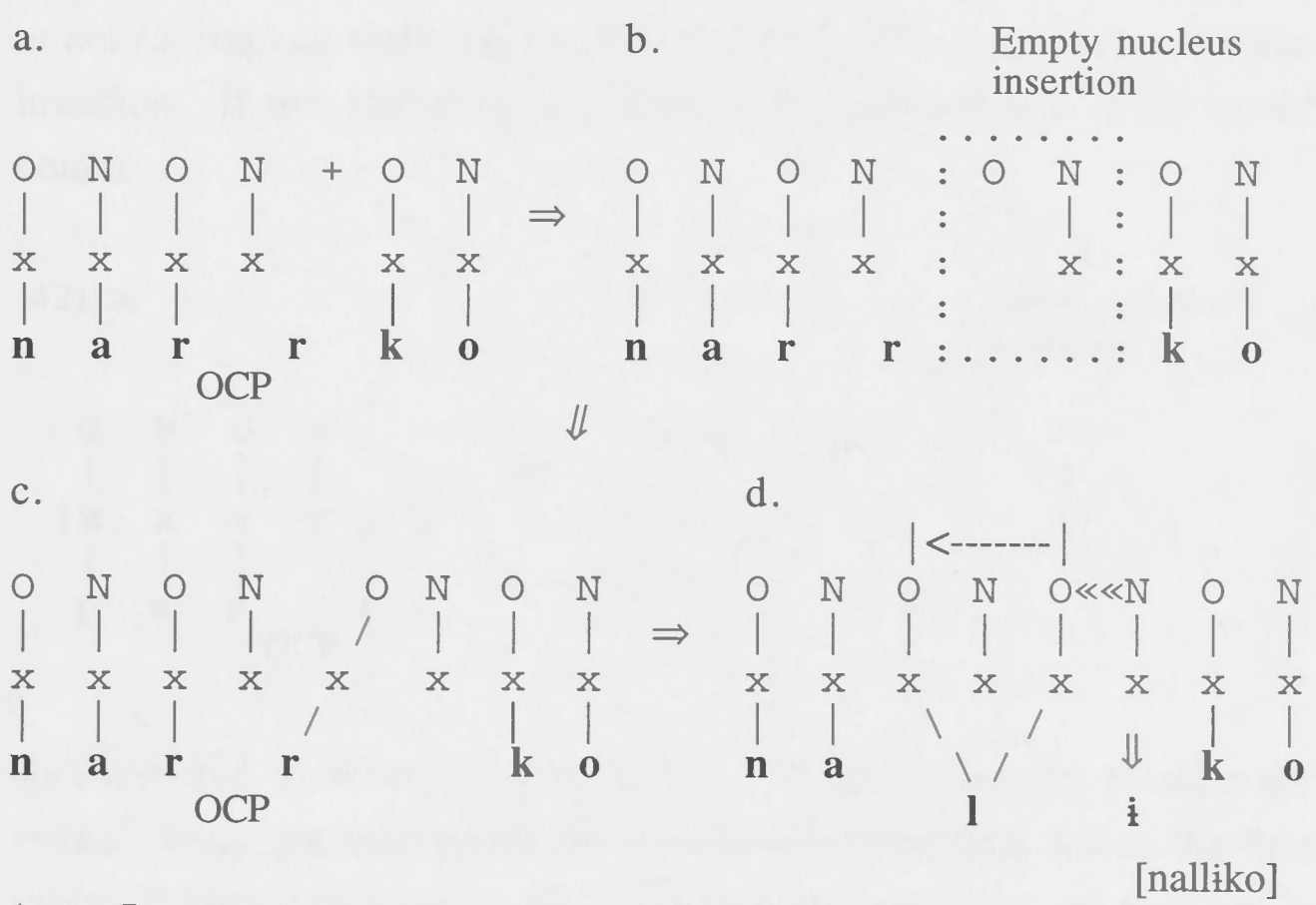



Merger cannot be triggered in this particular structure, since the second *r* does not have a skeletal point which is necessary to form a geminate. Moreover, these two *r*s are not followed by a vowel required to support their merger. Remember that a geminate universally involves head-final government (Yoshida 1991). Therefore, if two *r*s are merged yielding a geminate, then the geminate structure would need to form a governing domain, where an onset head appears on the right of its governee. It should be noted that a non-nuclear head must be G(overnment)-licensed by its

nucleus, in order to possess a governing property (Charette 1990a, 1992).[6] In the case of *nalla* discussed above, it was the rightmost vowel *a* which supports the preceding geminate.

Bearing the above requirements for a geminate in mind, let us consider the structure (39a). Given that the two *r*s violate the OCP, the geminate *ll* will be produced, if a vowel is given for the second *r*. (39b) shows that an empty nucleus is inserted to fix the violation of the OCP.

(39)




(<--- : Interonset government; «« : G-licensing)

In (39c), the floating segment *r* is associated with the onset accompanied by the inserted nucleus, and a point is created. (39d) shows that the two *r*s are merged, and at the same time the following nucleus receives phonetic realisation to G-license the geminated structure, resulting in *nallɨko*. This structure (39d) is well-formed, as the second liquid is now linked to a skeletal point, and this onset head is G-licensed by the following nucleus that is phonetically realised as the vowel *ɨ*. Our concern is whether or not such a form exists in reality.

---

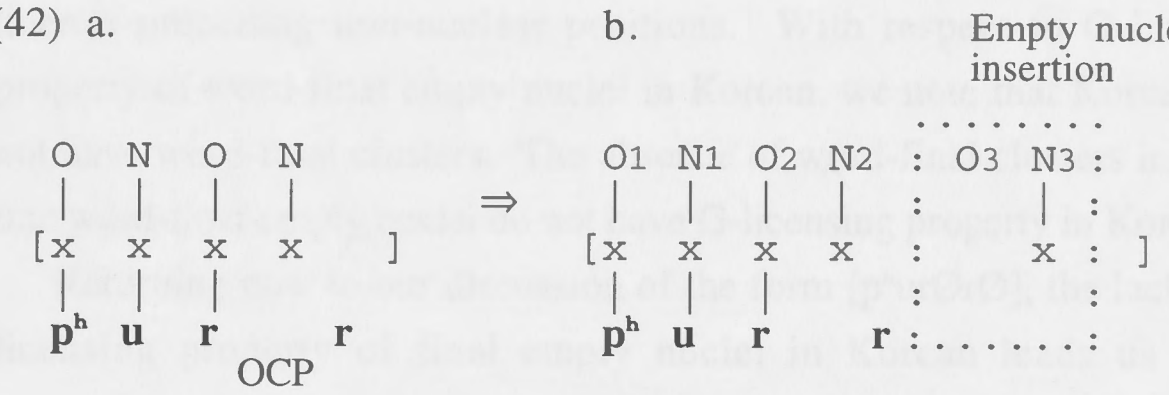
6 See 5.4, for details on Government-licensing.

| | | | | | | |
|---|---|---|---|---|---|---|
| (40) | narØr-ko | → | nariko | ~ | nalliko | 'bring-and' |
| | narØr-myən | → | narimyən | ~ | nallimyən | 'bring-if' |
| | tarØr-ko | → | tariko | ~ | talliko | 'different-and' |
| | tarØr-myən | → | tarimyən | ~ | tallimyən | 'different-if |

(40) illustrates the fact that forms containing the geminate *-ll-* are possible in addition to the forms with *-ri-* for *ri*-irregular verbs.

Having reached the point that the geminate *-ll-* is drawn from insertion of an empty nucleus in *ri*-irregular verbs, it should be made explicit whether or not *rə*-irregular verbs, such as *p$^h$urØr*, would also adopt empty nucleus insertion. If this operation is adopted, the representation (42b) would obtain.

(42) a. b.

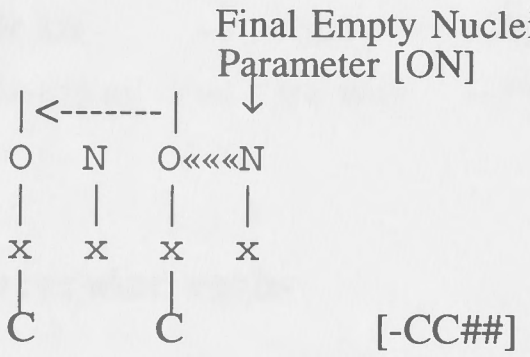



As illustrated, unlike *ri*-irregular verbs, *rə*-irregular verbs in question are cyclic. Thus, the inserted empty nucleus would be final within the first cycle. It should be recalled here that domain-final nuclei are licensed in Korean. This parametric setting disallows N3 in (42b) to be spelled out as *i*. Given the situation where N3 does not receive phonetic interpretation, the possibility for O2 and O3 to form a governing relation (and therefore a geminate is obtained) is then dependent on whether or not the licensed final empty nucleus N3 G-licenses the preceding onset O3.

According to Charette (1992), whether or not licensed word-final empty nuclei possess G-licensing property is subject to parametric variation. An indication that a language allow final empty nuclei to have this property is that word-final consonantal clusters exist in that language. As illustrated by an interonset governing domain below, word final clusters are possible

when a second member of clusters is G-licensed by a word-final empty nucleus to govern its complement, i.e. a first member of clusters.

(43)

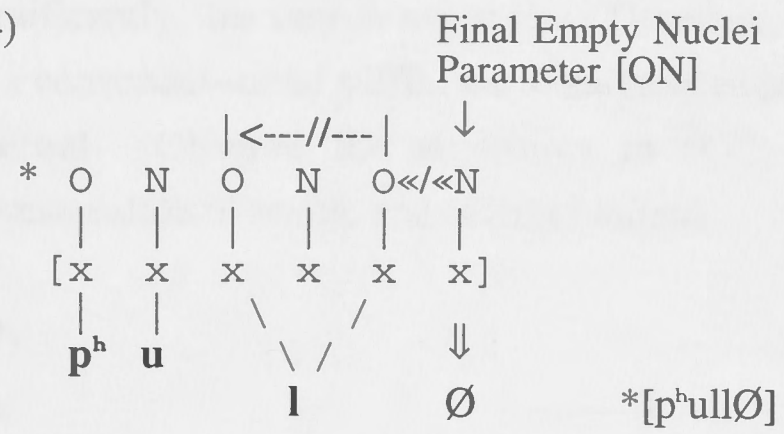



(«««« : G-licensing, <--- : interonset government)

If a language disallows final empty nuclei to have G-licensing property, word-final clusters do not exist, for word-final empty nuclei cannot G-license preceding non-nuclear positions. With respect to G-licensing property of word-final empty nuclei in Korean, we note that Korean does not have word-final clusters. The absence of word-final clusters indicates that word-final empty nuclei do not have G-licensing property in Korean.

Returning now to our discussion of the form [pʰurØrØ], the lack of G-licensing property of final empty nuclei in Korean leads us to the consequence that a geminate cannot be obtained in the given situation.

(44)




As shown in (44), the parametrically licensed final empty nucleus is disallowed from receiving phonetic realisation, and nor does this nucleus possess G-licensing property. Accordingly, the preceding two onsets cannot form a geminate structure. This accounts for the impossibility of the merger effect for *rə*-irregular verbs.

(45)

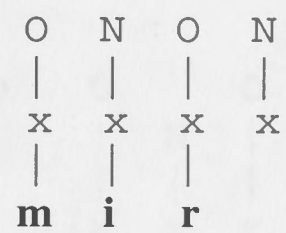
| | | | | |
|---|---|---|---|---|
| pʰurØr-ko | → | pʰuriko | ~ *pʰulliko | 'green-and' |
| pʰurØr-myən | → | pʰurimyən | ~ *pʰullimyən | 'green-if' |
| irØr-ko | → | iriko | ~ *illiko | 'reach-and' |
| irØr-myən | → | irimyən | ~ *illimyən | 'reach-if' |

### 6.4.4 *r*-irregular verbs

*r*-irregular verbs have a conjugation in which the stem-final liquid is realised as *l* with a consonant-initial suffix, e.g. *mil-ko*, *mil-myən*, but as *r* with a vowel-initial suffix, e.g. *mir-ə*. Neither tensification nor epenthesis is observed in these verbal forms. With these phonetic forms in mind, let us investigate the paradigm.

(46) shows the underlying representation of the *r*-irregular verbal stem.

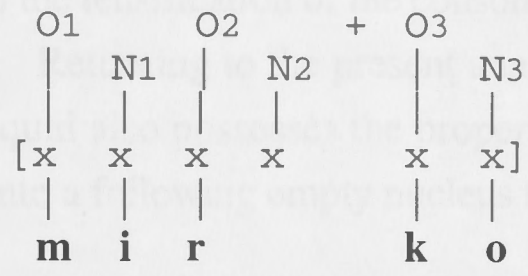
(46)



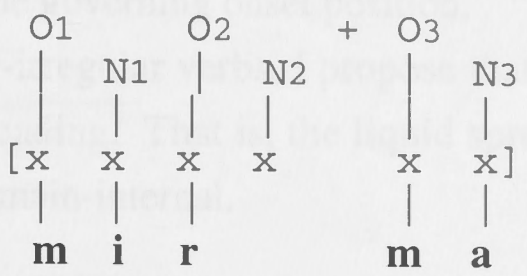

Significantly, this stem is not cyclic. Therefore, when the stem is followed by a consonant-initial suffix, the stem-final empty nucleus will be domain-internal. Observe the structures in (47): (47a) is an underlying representation of *milko*, and (47b) of *milma*.

(47)

a.



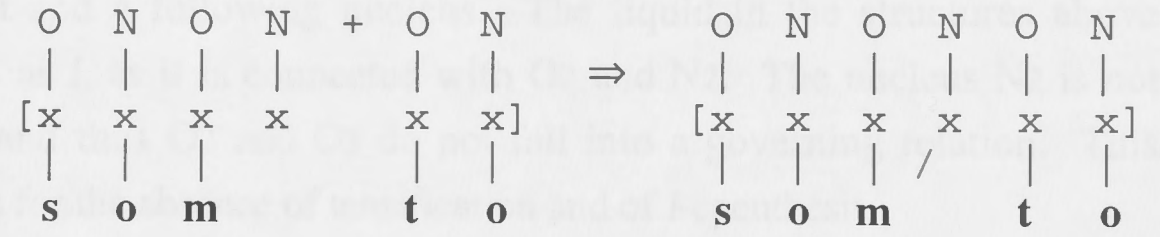

b.



The absence of tensification and *i*-epenthesis in the phonetic forms *milko* and *milma* suggests that O2 and O3 do not enter into a governing relation, nor is N2 phonetically interpreted as *i*.

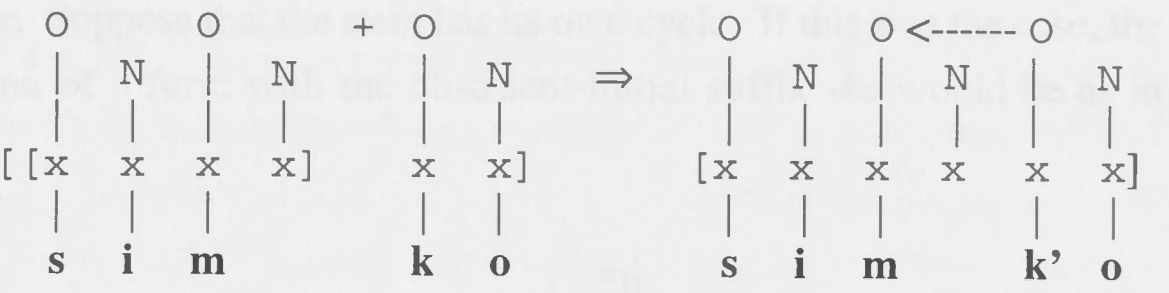
A similar situation has been discussed in previous sections. Look at the following representations of the words *somto* (← [somØ+to]) 'cotton-also' and *simk'o* (← [[simØ]+ko]) 'plant-and'. The suffixation of [somØ+to] in (48a) does not involve tensification. The absence of tensification is captured by nasal spreading, whereby a noun-final empty nucleus is filled with segmental material spread from a preceding nasal. Needless to say, epenthesis of *i* also does not take place in this case.

(48) a.




[somto]

b.

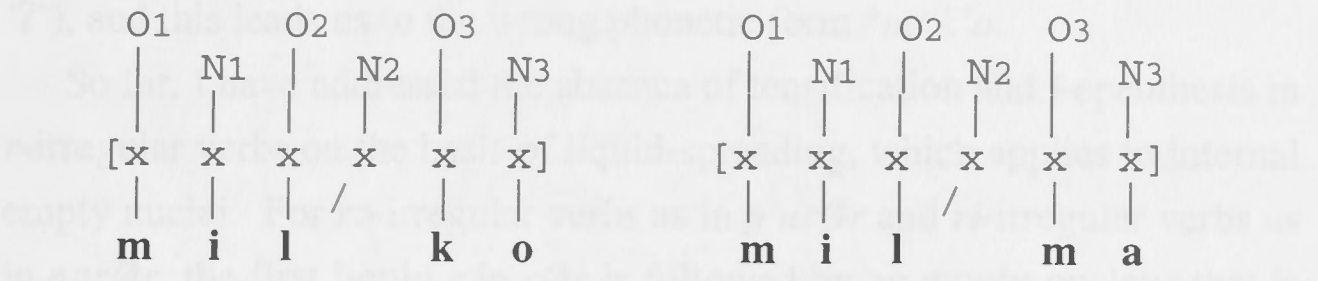



[simk'o]

By contrast, [[simØ]+ko] in (48b) is cyclic. On the first cycle, nasal spreading does not apply to the final-empty nucleus, since domain-final empty nuclei are parametrically licensed in Korean. On the second cycle, interonset government is formed between two surrounding onsets, resulting in the tensification of the consonant *t* in the governing onset position.

Returning to the present analysis of *r*-irregular verbs, I propose that the liquid also possesses the property of spreading. That is, the liquid spreads onto a following empty nucleus that is domain-internal.

(49) a. b.

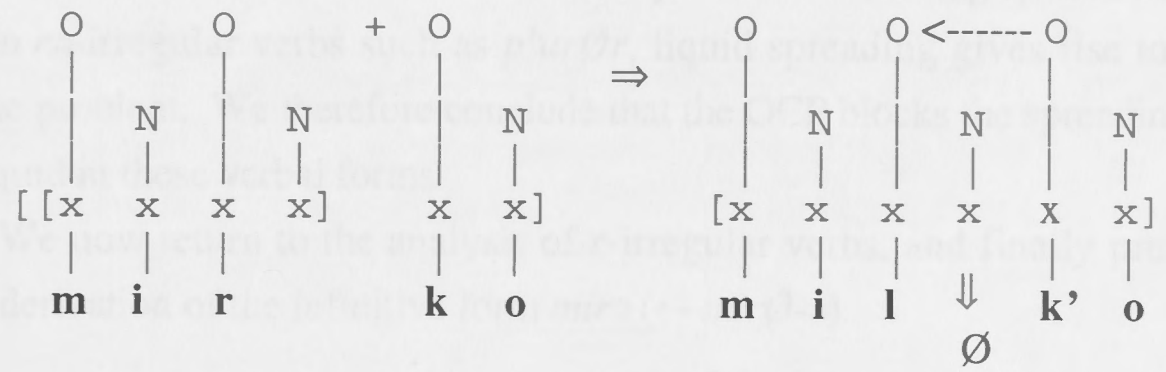



[milko] [milma]

In both (49a) and (49b), the domain-internal empty nucleus N2 is filled with a liquid. As discussed in 6.3.1, *r* is converted to *l* when doubly linked with an onset and a following nucleus. The liquid in the structures above surfaces as *l*, as it is connected with O2 and N2. The nucleus N2 is not empty, and thus O2 and O3 do not fall into a governing relation. This accounts for the absence of tensification and of *i*-epenthesis.

Having proposed a non-cyclic structure for *r*-irregular verbs, we need to demonstrate the inappropriateness of another possibility, i.e. a cyclic structure. Suppose that the stem has its own cycle. If this was the case, the derivation of a form with the obstruent-initial suffix *-ko* would be as in (50).

(50) a. *b.



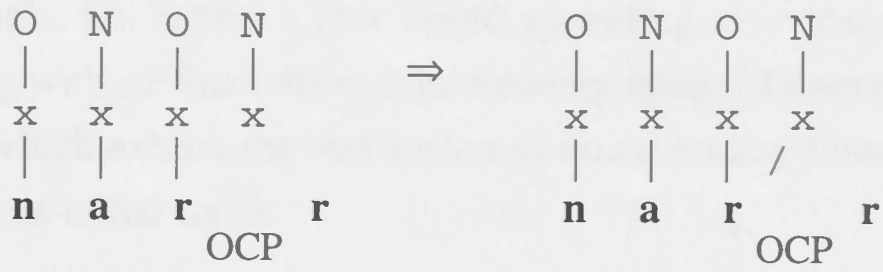

*[milk'o]

The structure (50a) shows that the stem-final empty nucleus is domain-final in the first cycle, and thus is licensed by a parametric setting. The liquid does not spread onto this parametrically licensed nucleus. In (50b), liquid-spreading is not triggered, as per the Principle of Strict Cyclicity (cf. 6.2). The surrounding two onsets constitute a governing domain. The neutral

stop *k* in the governing position would be tensified to *k'*, and *r* in the governed position would become *l* (since governed onsets must dominate '?'), and this leads us to the wrong phonetic form **milk'o*.

So far, I have addressed the absence of tensification and *i*-epenthesis in *r*-irregular verbs on the basis of liquid-spreading, which applies to internal empty nuclei. For *rə*-irregular verbs as in *pʰurØr* and *ri*-irregular verbs as in *narØr*, the first liquid *r* in *rØr* is followed by an empty nucleus that is domain-internal. Therefore, one could claim that liquid spreading is also applicable to these cases. Consider (51), which shows that the intervening empty nucleus is filled with a liquid for the case of *narØr*.

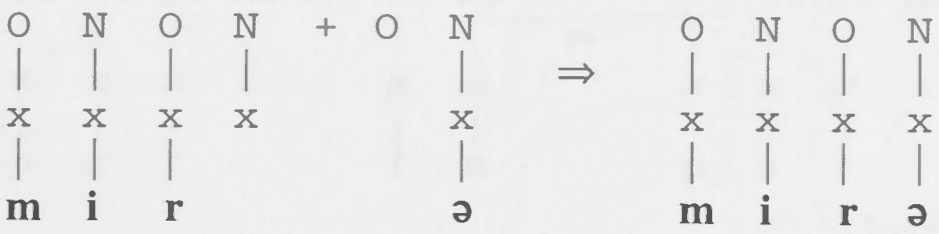
(51) a. *b.




In (51a), the structure violates the OCP. As illustrated in (51b), the liquid spreading yields a situation where the empty nucleus is now occupied by a liquid. A serious problem in (51b) is that the violation of the OCP is still not remedied. Rather, by adopting the liquid spreading, we would lose the means to avoid the OCP violation, namely the nucleus being spelled out as *i*. In *rə*-irregular verbs such as *pʰurØr*, liquid spreading gives rise to the same problem. We therefore conclude that the OCP blocks the spreading of a liquid in these verbal forms.

We now return to the analysis of *r*-irregular verbs, and finally present the derivation of the infinitive form *mirə* (← *mirØ*-*ə*).

(52) a. b.



In (52a), the stem-final empty nucleus is followed by an onset which does not dominate a skeletal point. There is also no floating segment which may link to this onset. The empty nucleus and the pointless onset are deleted from the representation as defined in the Principle of Reduction (cf. 5.4.3). This leaves the configuration in (52b), which is the correct structure for *mirə*.

### 6.4.5 Liquid-ending nouns

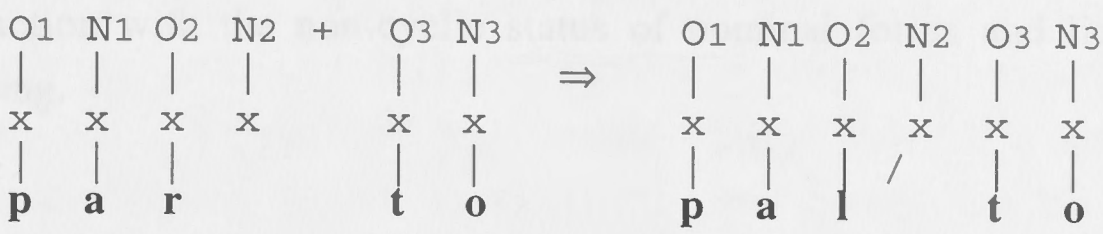
In the previous section, a liquid was shown to have the spreading property by which a following internal empty nucleus is filled with segmental materials, i.e. liquid. This liquid spreading also plays a major role in dealing with suffixations of liquid-ending nouns. Observe the examples in (53), which exhibit the suffixation of liquid-ending nouns followed by an obstruent-initial suffix.

(53)

| Noun | -coc$^{h}$a 'even' | -to 'also' | -put$^{h}$ə 'from' | Gloss |
|---|---|---|---|---|
| par | palcoc$^{h}$a | palto | palput$^{h}$ə | 'foot' |
| mur | mulcoc$^{h}$a | multo | mulput$^{h}$ə | 'water' |
| sikor | sikolcoc$^{h}$a | sikolto | sikolput$^{h}$ə | 'the country' |

In the above examples, a suffix-initial obstruent is not tensified. To explain this non-tensification, it is significant to recall that nominal forms are non-cyclic (cf. 6.3.1), as exemplified by the underlying representation of the word *palto* (← *parØ-to*) in (54a).

(54) a. b.




[palto]

In the structure (54a), the internal empty nucleus N2 is preceded by O2 which dominates a liquid. Parallel to liquid spreading in *r*-irregular verbs, the liquid in O2 spreads onto the empty nucleus N2 as shown in (54b). This spreading renders the governing relation between O2 and O3 unnecessary. As a result, *r* surfaces as *l* in this context where it doubly links to O2 and N2, and *t* in O3 remains as neutral.

If the nominal form was cyclic, i.e. [[parØ]-to], the noun-final empty nucleus would be final, which is licensed by a parametric setting, so that the empty nucleus resists liquid spreading on the second cycle, i.e. [parØto]. The surrounding two consonants *r* and *t* fall into a governing relation, and *r* becomes *l* and *t* undergoes tensification. The surface form would thus be *palt'o*, which is incorrect.

Liquid spreading further predicts that the epenthesis of the vowel *i* is also not triggered when sonorant-initial suffixes are attached to liquid-ending nouns, since a noun-final empty nucleus will be filled by a liquid, e.g. *parØ-man* → *palman* 'foot-only'. This prediction is verified by the forms in (55).

(55)

| Noun | -man 'only' | -ro 'with' | Gloss |
|---|---|---|---|
| par | palman | pallo | 'foot' |
| mur | mulman | mullo | 'water' |
| sikor | sikolman | sikollo | 'the country' |

The geminate *-ll-* in the third column is a result of the OCP effect (merger) on the noun-final and suffix-initial *r*s, e.g. *parØ-ro* → *pallo* (see 6.4.3, for details of the merger effect on two adjacent *r*s).

In short, liquid-ending nouns involve neither *i*-epenthesis nor tensification. The absence of these phenomena has been accounted for in conjunction with the non-cyclic status of nominal forms and liquid-spreading.

## 6.5 Conclusion

In this chapter, I have investigated phonological processes observed in consonantal clusters involving sonorants. The investigation has made it clear that sonorant consonants have a special property in Korean, which can be characterised as follows:

(56) **Sonorant spreading**

A sonorant consonant spreads onto a following empty nucleus which is domain-internal.

This property explains the absence of tensification of an obstruent after a sonorant consonant. Tensification of a suffix-initial obstruent after a nasal-ending verb is due to the fact that (regular) verbal forms are morphologically complex.

I have also presented an analysis of the paradigms of liquid-ending irregular verbs, and shown that the conjugational forms involved are fully predictable in terms of a principle-based approach.

Yet, the analysis of the paradigm of *r*-irregular verbs can be subject to controversy with respect to their non-cyclicity. Recall that regular verbal forms are cyclic. The fact that *r*-irregular verbs are non-cyclic indicates that there is no cyclic verb (and therefore no regular verb) in which the stem ends with a liquid followed by a domain-final empty nucleus, i.e. -*rØ*. One might claim that it is unnatural that a verb with the stem-final -*rØ* does not have a regular counter part, while all other irregular verbs do.

Despite this unnaturalness, I would like to claim that the non-cyclicity of *r*-irregular verbs cannot be rejected for this reason. There is great consistency in the analysis of sonorant-obstruent clusters. That is, a suffix-initial obstruent is not tensified when preceded by a domain-internal empty nucleus (therefore non-cyclic), but tensified when preceded by a domain-final empty nucleus (therefore cyclic). Needless to say, the non-cyclic structure of *r*-irregular verbs also conforms to this consistency. With

respect to the reason for the absence of *r*-regular verbs, i.e. cyclic verbs with stem-final *-rØ*, I do not have a solution to it, as yet.

# Conclusion

The primary aim of this thesis has been to present an analysis of major issues in Korean phonology from the perspective of Government Phonology. The foundations of Government Phonology are outlined in Chapter One, where I introduced some central concepts of the theory. In Chapter Two, in representing segments in Korean, I adopted recent developments of element theory: elimination of charm and the ATR element (Charette & Göksel 1994, Cobb 1993, Harris & Lindsey 1994) and the adoption of 'A' for coronality in non-nuclear positions (Brockhaus 1994, Cyran 1994). It was also shown that Korean has an eight-vowel system (rather than a nine- or a ten-vowel system), and that glides in Korean syllabify into a nucleus forming a light diphthong with a following vowel.

In Chapter Three, where vowel harmony was discussed, I proposed A-head alignment and showed that all vowel harmonic patterns are explained without exception in terms of A-head alignment. Our observations further demonstrated that vowel harmony is also found in monomorphemic words (rather than sound symbolic words), in addition to sound symbolic words and infinitive verbal forms, which have been previously treated as limited vowel harmonic contexts in the standard view. Licensing Constraints in Korean were also verified in conjunction with vowel harmony in this chapter.

Chapter Four discussed vowel coalescence and glide formation. There are three types of vowel sequences: sequences which undergo (i) vowel coalescence, (ii) glide formation, and (iii) neither process. I addressed the different outcomes between types (i) and (ii) in terms of Nuclear Fusion (Yoshida 1991) by which only sequences that may form a branching nucleus undergo vowel coalescence. For the vowel sequences (iii), where

the second member is *u*, I claimed that the element 'U' lacks leftward spreading and this is the reason for the absence of vowel coalescence and glide formation in these sequences.

In Chapter Five and Six, I presented an analysis of phonological phenomena involved in consonantal clusters in conjunction with the syllabic structure of the clusters. I argued that consonantal clusters are two onsets that are separated by an empty nucleus. Head-final interonset government was also proposed as operating between the two surrounding onsets, and an intervening empty nucleus is phonetically inaudible if this interonset government is formed. Obstruent lenition and tensification, which take place respectively in the first and second members of consonantal clusters, are indications that interonset government is established. Epenthesis of the vowel *i* and nasalisation are the results of the two onsets not forming a governing relation and an empty nucleus in the middle thus being phonetically realised. I also proposed that sonorant consonants in Korean have the property of spreading onto a following nucleus that is domain-internal. The absence of tensification after a sonorant is due to this property. Regarding neutralisation, I proposed the a-licensing Quality by which licensed onset positions obligatorily dominate the element '?', but are prohibited from a-licensing the elements 'I', 'H' and 'h'. These chapters further investigated the paradigms of irregular verbs involving consonantal clusters, and demonstrated that the paradigms are fully predictable in terms of a government-based approach.

A further important point that needs to be added is involvement of the diachronic aspects of Korean. Although this thesis ultimately aims to explore phonological phenomena from the synchronic point of view, I have taken the position that consideration of historical changes is necessary to gain deeper understanding of phonology in modern Korean. It seems that contemporary Korean is historically at a significant stage in the sense that some historical changes involving vowels have recently attained completion, for example, vowel harmony operating across morpheme boundaries and vowel length distinctions.

The overall discussion of this thesis suggests that the adoption of empirically supported phonological government, together with the acceptance of phonological elements, allow us to deal with the above

phonological events in terms of an approach which explores explanatory solutions (rather than simply descriptive accounts). In particular, in contrast to previous analyses which are mainly based on rules and distinctive features, the analyses revealed that principle-based solutions are capable of replacing these analyses, with a lesser degree of arbitrariness.

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