# Empty Nuclei in Korean

**For My Family**
Eun Young, Young Hee,
So Youn, So Jung

# Table of Contents

**Acknowledgements**

# Acknowledgements

great perseverance and love after all these difficult years. To my family, I dedicate this thesis.

20 April, 2002, Leiden
Sang Jik Rhee

# Chapter 1
# The vowel [ɨ] in Korean

Unlike other vowels in Korean, the vowel [ɨ] is unique in that it is subject to ɨ/zero alternation in suffixation, and to insertion in loanwords. Within rule-based frameworks, these two processes are characterised as ɨ-deletion rule and as ɨ-insertion, respectively (e.g. S.-C. Ahn 1985, 1998; Kim-Renaud 1982, among others). Consequently, Underspecificaton Theory (Archangeli 1984) treats the vowel [ɨ] as completely unspecified in lexical representations (e.g. H.-S. Sohn 1986). What these previous analyses have not dealt with, however, is the distribution of [ɨ] in mono-morphemic words, partly because morpheme-internal [ɨ] is static, in the sense that it is not subject to deletion or insertion. But, there is positive evidence that this vowel must be also treated differently from other vowels, because the occurrence of [ɨ] is highly constrained morpheme-internally, in suffixation and in loanwords, as we will see throughout the thesis

In this chapter, I present a general background to the vowel [ɨ] in Korean. In 1.1, the segmental inventory of Korean is introduced. In 1.2, I briefly review how previous analyses have dealt with the processes regarding [ɨ] in suffixation. In 1.3 and 1.4, I examine the distribution of [ɨ] in mono-morphemic words and in suffixation where the occurrence of the vowel [ɨ] is not random: the context in which [ɨ] occurs is strictly regular. In 1.5, I consider the occurrence of the vowel [ɨ] in loanwords. Finally, in 1.6, I put forward the proposal that the ɨ-deletion and the ɨ-insertion rules can be unified if we assume that [ɨ] is construed as the phonetic interpretation of an empty nucleus.

## 1.1. The segmental inventory of Korean

I assume that Korean has 8 vowels and 19 consonants underlyingly.

(1)　(a) Vowels
　　　 /i/, /e/, /ɛ/, /ɨ/, /a/, /u/, /o/, /ə/
　　　 (b) Consonants
　　　 (i) Lenis obstruent: /p/, /t/, /k/, /s/, /c/[1], /h/
　　　 (ii) Aspirated obstruent: /pʰ/, /tʰ/, /kʰ/, /cʰ/
　　　 (iii) Tensed obstruent: /p'/, /t'/, /k'/, /s'/, /c'/

---

[1] The symbols /c, c', cʰ/ represent palato-alveolar affricates. According to the IPA, they are symbolised by /tʃ, tʃ', tʃʰ/ respectively. However, in this thesis, the symbols /c, c', cʰ/ are used for notational convenience.

(iv) Nasal: /m/, /n/, /ŋ/
(v) Liquid: [r] or [l]

Regarding the phonetic quality of the eight vowels, /i/, /e/ and /ɛ/ are front; /ɨ/ and /a/ are mid; /u/, /o/ and /ə/ are back. Note that the phonetic value of /ə/ is an unrounded back vowel which is transcribed as [ʌ] in the IPA.[2] Obstruents are classified according to three manner types, referred to as lenis, aspirated and tensed, as in (1). However, there is a gap for the coronal fricatives /s/ and /s'/: an aspirated /s$^h$/ is not present. /s/ has special properties. Phonetically it is aspirated (Kagaya 1974), but phonologically it behaves like other lenis obstruents (Kim-Renaud 1974, Iverson 1983, among others. For a detailed discussion on this matter, see Chapter 3). Regarding the liquids, [r] and [l] are complementarily distributed: [r] occurs intervocalically and [l] elsewhere. A number of phonologists have proposed that the underlying segment of liquids in Korean is /l/. However, Y. Heo (1995) and S.J. Rhee & Heo (1998) argue that /r/ is the underlying segment. The debate concerning underlying segments will be discussed in Chapter 2.

## 1.2. Previous treatments of the vowel [ɨ] in suffixation

ɨ/zero alternation in suffixation has been a highly controversial topic. The debate has focused on the issue as to whether or not the vowel [ɨ] is a part of the suffixes in question. Those who claim that [ɨ] belongs to a set of suffixes with ɨ/zero alternations, argue that it is deleted in appropriate contexts (e.g. S.-C. Ahn, 1985, 1991, Kim-Renaud, 1982, B.-G. Lee 1976, and H.-S. Sohn, 1986 among others). Those who propose that [ɨ] is unspecified in the underlying representation argue that it is inserted in particular contexts (e.g. H.-P. Choi 1937, C.-W. Kim 1968, S.-H. Kim 1992, and Y.-S. Kim 1985 among others). These contexts are shown below.

| (2) | Stem | Connective | Effective | |
|-----|------|------------|-----------|---|
| (a) | /ka/ | [kamjə] | [kani] | 'to go' |
|     | /nar/[3] | [nalmjə] | [nani][4] | 'to fly' |
| (b) | /əp/ | [əpɨmjə] | [əpɨni] | 'to carry on the back' |
|     | /tat/ | [tatɨmjə] | [tatɨni] | 'to close' |
|     | /mək/ | [məkɨmjə] | [məkɨni] | 'to eat' |
|     | /s'is/ | [s'isɨmjə] | [s'isɨni] | 'to wash' |
|     | /nop$^h$/ | [nop$^h$ɨmjə] | [nop$^h$ɨni] | 'to be high' |
|     | /kat$^h$/ | [kat$^h$ɨmjə] | [kat$^h$ɨni] | 'to be the same' |

---

[2] In the relevant literature on Korean phonology, the back unrounded vowel is conventionally represented by the schwa symbol /ə/, which I follow in this thesis. Bearing this in mind, the vowel /ə/ in Korean behaves differently from that of English, Dutch, French etc., in which this vowel occurs in metrically weak position.

[3] The underlying representations in (2) are based on the 'standard' syllabification, i.e. stem-final consonants are syllabified as 'coda'.

[4] Note that the stem-final liquid is deleted. For an analysis of the phenomenon, see Chapter 4.

| /an/ | [anɨmjə] | [anɨni] | 'to hug' |
|------|----------|---------|----------|
| /kam/ | [kamɨmjə] | [kamɨni] | 'to wind' |

In (2a), we observe that [ɨ] does not occur when the stem-final segment is either a vowel or a liquid; otherwise, it does occur, as in (2b). For the proponents of ɨ-deletion, the underlying representations of the connective and the effective suffix are /ɨmjə/ and /ɨni/, respectively. They propose rules in which the vowel [ɨ] is deleted between a vowel and a nasal, or a liquid. According to the proponents of ɨ-insertion, the underlying representations of these suffixes are /mjə/ and /ni/, respectively. They utilise a rule in which the vowel [ɨ] is inserted between a consonant other than a liquid and a nasal.

Each approach has different empirical consequences. For vowel-final stems, as in (2a), the deletion analysis treats the phenomenon as a vowel-hiatus effect; the suffix-initial [ɨ] is deleted when it follows another vowel. In liquid-final stems, the suffix-initial [ɨ] is deleted before a labial nasal. In this case, the implicit motivation for the deletion of [ɨ] would be to form a well-formed 'coda'-onset sequence: [lm]. In other contexts, the suffix-initial [ɨ] is retained. On the other hand, the insertion approach assumes that the insertion of [ɨ] is attributed to *euphonic* purposes, in the sense that the epenthetic [ɨ] between a consonant and a sonorant may contribute to ease of pronunciation, by avoiding two contiguous consonants (H.-P. Choi 1937: 167). The implication is that the epenthetic vowel functions as a *boundary marker* between a stem and a suffix (S.-H. Kim 1992: 95).

I will now point out some empirical problems for both approaches. First, one major problem with the deletion approach is that it is difficult to handle the asymmetrical distribution of nasal-nasal (henceforth NN) sequences morpheme-internally and in suffixation. Morpheme-internal NN sequences have no [ɨ] separating them.

| (3) N1 / N2 | Labial | Coronal | Velar |
|-------------|--------|---------|-------|
| Labial | /simmani/ 'ginseng digger' | /kənman/ 'even though' | /paŋmaŋi/ 'club' |
| Coronal | /kumnil/ 'to do a stretch' | /kənnə/ 'to cross' | /maŋnani/ 'wretch' |
| Velar | ----- | ----- | ----- |

In (3), we observe that morpheme-internal NN sequences contain (partial) nasal geminates, e.g. coronal-coronal, labial-labial, coronal-labial, labial-coronal, velar-labial and velar-coronal NN sequences, except velar-velar, labial-velar and coronal-velar.[5] Unlike the process in suffixation (cf. (2b)), [ɨ] does not occur between two nasals morpheme-internally. But, if [ɨ]-deletion following a liquid creates a well-

---

[5] The distributional restriction is imposed on the velar nasal, i.e. this segment cannot occur in an onset position.

formed 'coda'-onset cluster, then the deletion approach is unable to account for why the vowel [ɨ] is not deleted before a nasal in the connective and the effective suffixation, as in (3). Namely, morpheme-internal NN sequences are completely acceptable.

The insertion approach also has a major empirical problem. There are exceptions in interrogative /ni/ and indicative /ne/ suffixation. Unlike the other nasal-initial suffixes in (2), they are exceptional in that ɨ-insertion does not occur, e.g. [anni] and [anne] 'to hug', [kamni] and [kamne] 'to wind'. To treat them as exceptions to ɨ-insertion, however, would be counter-intuitive, because these are productive verbal inflectional processes. Another problem is that the ɨ-insertion analysis nonetheless requires the ɨ-deletion rule to account for the deletion of the stem-final [ɨ] in the stative forms (the stative suffix is /a/ or /ə/[6]). Some examples of verbs ending in [ɨ] are /s'ɨ/ 'to write', /k'ɨ/ 'to extinguish', /t'ɨ/ 'to float'; the stative form of each verb is [s'ə:], [k'ə:] and [t'ə:], respectively. Therefore, two conflicting processes are listed in the grammar within the ɨ-insertion approach.

To summarise, both the insertion and the deletion approaches to ɨ/zero alternation lead to empirical problems. The deletion analysis cannot handle the asymmetrical behaviour of [ɨ] with respect to morpheme-internal NN sequences and those in suffixation. The ɨ-insertion analysis has both conceptual and empirical problems in that it still requires the ɨ-deletion rule to account for stative suffixation, where the stem-final [ɨ] is deleted. Furthermore, it treats highly productive interrogative and indicative suffixation as exceptional.

## 1.3. The distribution of [ɨ] in native mono-morphemic words[7]

In this section, I consider the distribution of [ɨ] in native mono-morphemic words in order to show that its occurrence is not random. Consider morpheme-initial and -final [ɨ].

## 1.3.1. Morpheme-final [ɨ]

In Korean, mono-morphemic words may end in either a consonant or a vowel. Apart from verb stems which cannot occur in isolation,[8] the occurrence of [ɨ] is quite rare in morpheme-final position.[9] It indicates that [ɨ] shows a different behaviour

---

[6] The shape of the stative suffix is determined by the stem-final vowel. If it is either /a/ or /o/, the suffix is /a/; otherwise, it is /ə/: e.g. /mak/ 'to block', [maka]; /nok/ 'to melt', [noka]; /mək/ 'to eat', /məkə/; /cuk/ 'to die', [cukə] and so on.

[7] This section owes much to Y. Heo (1995).

[8] It is interesting to note that mono-syllabic verb stems ending in the vowel [ɨ] begin with either a tensed or an aspirated consonant, e.g. [s'ɨ] 'to write', [k'ɨ] 'to extinguish', [tʰɨ] 'to sprout' and so on. On the realisation of the vowel [ɨ] in these stems in suffixation, see Y. Heo (1995).

[9] According to Y. Heo (1995: 25), there are only three examples, all of which are pronouns, e.g. [kɨ] 'he', [jənɨ] 'other (person)' and [ənɨ] 'which'.

from other vowels in that the latter occur freely in this position.   The first generalisation regarding morpheme-final position, then, is as follows.

(4) The vowel [ɨ] may not occur finally: *(C)ɨ#

## 1.3.2. The vowel [ɨ] in the initial nuclear position

The vowel [ɨ] may occur morpheme-initially, as in (5a), or as the initial nucleus, as in (5b).

| (5) | (a) | Morpheme-initial | | | |
|-----|-----|-----|-----|-----|-----|
| | | [ɨt'ɨm] | 'top' | [ɨsɨk] | 'dim' |
| | | [ɨmcʰuŋ] | 'guileful' | [ɨŋtal] | 'shady side' |
| | | [ɨŋəri] | 'stiff muscle' | [ɨsɨmpʰure] | 'misty' |
| | (b) | Initial nucleus | | | |
| | | [kɨrɛto] | 'even if' | [k'ɨtʰɨrəki] | 'slip' |
| | | [tɨlc'uk] | 'blueberry' | [tʰɨcip] | 'hitch' |
| | | [sɨrasoni] | 'lynx' | [s'ɨreki] | 'rubbish' |
| | | [nɨkɨl] | 'sickening' | [nɨtʰari] | 'agaric ' |
| | | [ɨk'ɛ] | 'to crunch' | [ɨt'ɨm] | 'top' |
| | | [cɨlkəp] | 'to be delightful' | [hɨmɨt] | 'to be pleased' |

The following generalisation is made.

(6) The vowel [ɨ] may occur as the first nucleus: #(C)ɨ.

## 1.3.3. Morpheme-internal [ɨ]

Although [ɨ] does not occur morpheme-finally, it may nevertheless occur before a *morpheme-final* consonant, as shown in (7).

| (7) | [sasɨm] | 'deer' | [ərɨn] | 'adult' |
|-----|---------|--------|--------|---------|
| | [c'acɨŋ] | 'irritation' | [onɨl] | 'today' |
| | [mɛtɨp] | 'knot' | [katɨk] | 'full' |
| | [tikɨt] | 'name of Korean Alphabet' | | |

(7) illustrates that [ɨ] occurs before a single final consonant.  Interestingly, note that [ɨ] may not occur before a single consonant followed by another vowel, although other vowels may occur freely.  Consider the following examples.

| (8) | [ak<u>a</u>s'i] | 'young lady' | [k'ur<u>ə</u>mi] | 'parcel' |
|-----|---------|--------------|----------|----------|
| | [anɨ<u>k</u>'op] | 'to be disgusted' | [ari<u>t</u>'ap] | 'to be lovely' |
| | [tarɛ<u>k</u>'i] | 'sty' | [sirɛki] | 'dried leaves' |

In (8), notice that the underlined vowels may alternate with another vowel, but not with the vowel [ɨ]: (due to lack of minimal pairs, consider only the underlined sequences) [a<u>kas'i</u>] vs. [a<u>kɨs'i</u>] 'young lady',[10] [k'u<u>rə</u>mi] vs. [kwit'u<u>rami</u>] 'cricket'; [ta<u>rɛk'i</u>] vs. [kə<u>rik'i</u>] 'to be restrained'; [si<u>rɛki</u>] vs. [to<u>riki</u>] 'Dutch treat'. In other words, forms like *[akɨs'i], *[k'urɨmi], *[anɨk'op] etc., are not possible words in Korean. The implication is that the vowel [ɨ] may not occur before a consonant followed by another vowel. This is not consistent with (5), because [ɨ] may occur in the initial nucleus when it is followed by a consonant and another vowel. However, note that there is a significant difference between the data: [ɨ] occurs in the initial nucleus in (5) and in the non-initial nucleus in (8). At this stage, we can make the preliminary generalisation that [ɨ] has a different distribution in the initial and the non-initial nuclear positions, i.e. the vowel [ɨ] in the initial nucleus position cannot be absent (see Chapter 3).

However, [ɨ] does occur before two consonants followed by a vowel as shown in (9).

(9)    (a) Nasal-obstruent
       [kəsɨmcʰire]        'sleepy'              [sikɨmcʰi]        'spinach'
       [sikʰɨnduŋ]         'to be impudent'      [utɨmdʒi]         'treetop'
       (b) Liquid-nasal and liquid-obstruent
       [tasɨlki]           'gastropod'           [kətɨlmək]        'to be arrogant'
       [mindɨlle]          'dandylion'           [kotɨlkɛ]         'horsebell'

It appears that the two consonants in (9) after [ɨ] can constitute 'coda'-onset clusters within 'standard' syllabification (S.-C. Ahn 1985, H.-S. Sohn 1986). Also, as in (8), if the underlined vowels are not taken into consideration, the two neighbouring consonants would have formed 'coda'-onset clusters. That is, [aks'i], [k'ulmi], [ank'op], [alt'ap], [talk'i] and [silki] are possible words in Korean.[11] This indicates that [ɨ] may not occur between two consonants in 'coda'-onset clusters. It implies that the occurrence of [ɨ] is sensitive to the distribution of surrounding consonants. Before we investigate the occurrence of [ɨ] with respect to the distribution of surrounding consonants any further, the observations made thus far can be summarised as follows.

(10)   (a)    [ɨ] may not occur morpheme-finally.
       (b)    [ɨ] in the first nuclear position may occur before a single consonant
              followed by another vowel, but not in other positions.
       (c)    Morpheme-internal [ɨ] may occur before two consonants followed by
              another vowel.

---

[10] These two forms are synonyms.
[11] Note that [l] rather than [ɾ] occurs in 'coda' position. This is due to the allophonic relation between the two consonants, as discussed in 1.1.

Given the generalisations in (10), it is fair to say that [ɨ] has a rather limited distribution compared to other vowels in Korean.

## 1.3.4. The vowel [ɨ] and its surrounding consonants

The generalisation in (10b) requires further refinement with respect to the occurrence of morpheme-internal [ɨ], because this vowel occurs before a consonant followed by another vowel, as shown in (11).

(11)  (a)    Between a nasal or a lenis obstruent, and a liquid
             [cinɨrəmi]         'fin'             [hətɨre]            'trash'
             [pusɨrəm]          'ulcer'
      (b)    Between a lenis obstruent and a nasal
             [nakɨne]           'stranger'        [kocɨnək]           'silent'
             [sɨlkɨməni]        'sectretely'
      (c)    Between two lenis obstruents
             [pantɨsi]          'certainly'       [potɨki]            'dwarf tree'
      (d)    Between a tensed or an aspirated obstruent, and a lenis obstruent
             [kɛk'ɨsi]          'tidily'          [təlkʰɨtək]         'click'

In contrast to (8) and (9), if the underlined [ɨ] were absent, its surrounding consonants would not form 'coda'-onset clusters: e.g. *[cinrəmi], *[hətre] and *[pusrəm]. These forms are not possible in Korean. Thus, the occurrence of [ɨ] is sensitive to the distribution of its surrounding consonants depending on whether or not they may serve as 'coda'-onset clusters. The revised generalisation regarding (10b) is as follows.

(12) [ɨ] may not occur between 'coda'-onset clusters morpheme-internally.

The condition in (12) regulates the absence of [ɨ] in (9) and its presence in (11).
In summary, the following table shows the combinatorial possibilities of two consonants with respect to the intervening vowel [ɨ] (Y. Heo 1995: 32).

(13) The occurrence of morpheme-internal [ɨ] between two consonants (C1 and C2)

| C2 \\ C1 | Liquid | Nasal | Lenis obstruent | Tensed or aspirated |
|---|---|---|---|---|
| Liquid | Ø | Ø | Ø | Ø |
| Nasal | ɨ | Ø | Ø | Ø |
| Lenis obstruent | ɨ | ɨ | ɨ | Ø |
| Tensed or aspirated | ɨ | ɨ | ɨ | ɨ |

(Ø: absence; ɨ: presence)

Two examples do not conform to (13). The vowel [ɨ] invariably occurs after a lenis fricative /s/, even though a tensed obstruent follows [ɨ]. According to 'standard' syllabification, these two types of consonants would have formed 'coda'-onset clusters without the intervening [ɨ]. Two examples of words of this type are shown in (14).

(14)   [usɨk'waŋ]          'funny'                [mesɨk'əp]          'to feel sick'

The presence of [ɨ] between a lenis fricative /s/ and a tensed obstruent in native Korean is limited to only two words, which may be treated as exceptions. However, as we will see later in section 1.5, the vowel [ɨ] in the same context occurs frequently in loanword adaptation. In particular, complex 'coda' clusters involving /s/ from English such as *wasp*, *test* and *disk* are phonetically realised as [wasɨpʰɨ], [tʰesitʰɨ] and [tisɨkʰɨ], respectively. Note that [ɨ] intervenes between a lenis fricative and an aspirated stop, which shows approximately the same distribution as the data in (14). Thus, the presence of [ɨ] in this context requires attention in native Korean. Therefore, we must seek a proper account of the occurrence of [ɨ] related to the special nature of fricatives.

Thus far, we have described the presence and the absence of the vowel [ɨ] in mono-morphemic words. In the next section, I will consider verbal suffixation where ɨ/zero alternations occur.

## 1.4. The vowel [ɨ] in verbal suffixation

As mentioned earlier, verbal stems in Korean cannot occur in isolation. They require at least one suffix. In general, we can distinguish two types of verbal suffixes depending on whether or not ɨ/zero alternations take place. In this section, the discussion focuses on the set of suffixes involved in ɨ/zero alternations. The remaining set of suffixes is dealt with in Chapter 4. Consider the following verbal suffixes with ɨ/zero alternation, as shown in (15), e.g. the intentive suffix alternates [rə] with [ɨrə], the connective [mjə] with [ɨmjə], and the honorific [si] with [ɨsi].

(15)   (a) Obstruent-final stem

| stem | intentive | connective | honorific | |
|---|---|---|---|---|
| /kapʰ/ | [kapʰɨrə] | [kapʰɨmjə] | [kapʰɨsi] | 'to pay back' |
| /pɛtʰ/ | [pɛtʰɨrə] | [pɛtʰɨmjə] | [pɛtʰɨsi] | 'to spit out' |
| /c'ocʰ/ | [c'ocʰɨrə] | [c'ocʰɨmjə] | [c'ocʰɨsi] | 'to chase' |
| /tak'/ | [tak'ɨrə] | [tak'ɨmjə] | [tak'ɨsi] | 'to clean' |
| /mak/ | [makɨrə] | [makɨmjə] | [makɨsi] | 'to block' |
| /tat/ | [tatɨrə] | [tatɨmjə] | [tatɨsi] | 'to close' |
| /pəs/ | [pəsɨrə] | [pəsɨmjə] | [pəsɨsi] | 'to take off' |
| /c'ic/ | [c'icɨrə] | [c'icɨmjə] | [c'icɨsi] | 'to tear' |

(b) Nasal-final stem

| /kam/ | [kamɨrə] | [kamɨmjə] | [kamɨsi] | 'to wind' |
| /an/ | [anɨrə] | [anɨmjə] | [anɨsi] | 'to hug' |

(c) Liquid-final stem[12]

| /kər/ | [kəllə] | [kəlmjə] | [kəsi] | 'to hang' |

(d) Vowel-final stem

| /ka/ | [karə] | [kamjə] | [kasi] | 'to go' |

In (15), we observe that [ɨ] occurs if the stems end in either an obstruent or a nasal. It does not occur if the stems end in either a vowel or a liquid. As seen above in (13), the occurrence of [ɨ] in suffixation contexts is roughly similar to in mono-morphemic contexts.

However, there are cases where ɨ-realisation is inconsistent with (13). As discussed in section 1.2, the nasal-final stems behave in a rather different way. Morpheme-internally, we do not encounter [ɨ] between two nasals. The relevant data are repeated from (3) in (16). However, in suffixation contexts, [ɨ] occurs between two nasals, as in (15b).

(16)  [simmani]     'ginseng digger'    [kumnil]     'to do a stretch'
      [kənman]      'even though'       [kənnə]      'to cross'
      [paŋmaŋi]     'club'              [maŋnani]    'wretch'

So far, we have investigated the occurrence of [ɨ] in both mono-morphemic and suffixation contexts. What we have observed is that [ɨ] does not behave arbitrarily. Its distribution is controlled by the presence or the absence of following vowels and the quality of the surrounding consonants. One exception would seem to involve the morpheme-initial position, where the occurrence of [ɨ] does not seem to be affected by the presence of a following vowel. In addition, the distribution of [ɨ] in mono-morphemic words is identical to that in verbal suffixation but slightly different, with respect to nasal-final stems. In the next section, I discuss the occurrence of [ɨ] in loanword adaptation from English.

## 1.5. The vowel [ɨ] in loanwords

When a foreign word is adopted in another language, its phonetic shape usually undergoes phonological changes in conformity with the segmental and the syllabic system of the host language. The segmental system deals with the transformation of segments of the source language which are lacking in the segmental inventory of the host language. The syllabic system deals with the (re-)adjustment of segments or the repair strategy which may violate language-specific syllabic conditions (Paradis 1988, Paradis & Lacharité 1997 and Yip 1993 among others). Typical instances of

---

[12] In liquid-final stems, alternative phonetic forms are possible in child speech: [kərirə] in the intentive; [kərimjə] in the connective; [kərisi] in the honorific.

syllabic readjustments involve deletion of consonants and insertion of vowels. In this section, I briefly investigate these two aspects of loanword adaptation, focusing on the occurrence of [ɨ].

Apart from Sino-Korean words, most loanwords in Korean come from English. In terms of 'standard' syllabification, English has a rather more complex syllable structure than Korean. English has branching onsets and codas, while Korean does not (S.-C. Ahn 1991). Thus, when English words with complex consonant clusters are adopted in Korean, it is reasonable to assume that various repair strategies are required to readjust segmental sequences into the syllable structure of Korean. One prominent strategy is to insert [ɨ] to break up consonant sequences in order to preserve maximal segmental identity in comparison to the source language. Thus, we expect multiple ɨ-insertion in various positions in English loanwords. However, as we will see below, like in native Korean, the occurrence of [ɨ] is highly regulated in that it is not inserted in every consonant cluster. We do not see any insertion in certain types of consonant clusters. In this section, I describe the contexts in which [ɨ] does and does not occur in English loanword adaptation, and compare them with those of native Korean.

## 1.5.1 The consonant transformation

Before we investigate the occurrence of [ɨ] in loanwords, I sketch how English consonants are adopted into the consonant system of the borrowing language. First, consider the following consonants in non-final, pre-vowel position. English voiceless stops are realised as aspirated stops, and voiced ones are converted into lenis stops in Korean.

(17)   English        Korean         English        Korean
       *pie*          [pʰai]         *bye*          [pai]
       *tie*          [tʰai]         *day*          [tei]
       *key*          [kʰi]          *gay*          [kei]

With respect to other obstruents, inter-dental fricatives /θ/ and /ð/ are realised as [s] and [t], respectively. The coronal fricatives /s/ and /z/ are realised as [s] and [c]. The labial fricatives /f/ and /v/ are realised as [pʰ] and [p]. The palato-alveolar fricative /ʃ/ and /ʒ/ are realised as [sj] and [c]. The affricates, /tʃ/ and /dʒ/ are as [cʰ] and [c]. Thus, [c] in Korean corresponds to /z/, /ʒ/ and /dʒ/ of English. The relevant examples are shown in (18).

(18)   *thinner*       [sinə]         *This*[13]      [tis]
       *sofa*          [sopʰa]        *zoom*          [cum]
       *fashion*       [pʰɛsjən]      *veto*          [pitʰo]
       *show*          [sjo]          *version*       [pəcən]
       *chain*         [cʰein]        *gin*           [cin]

---

[13] *This* is a brand of cigarette in Korea.

The three nasals of English are realised in Korean without modification, as shown below.

(19)  *main*          [mein]           *neon*            [neon]
      *ping-pong*     [pʰiŋpʰoŋ]

The English liquids /l/ and /r/ are adopted in rather complex ways in Korean. First, initial /l/ and /r/ in English are realised as [l] in Korean. Thus, there is no segmental distinction between these two consonants in initial position in Korean due to the allophonic relation between [l] and [r], as mentioned in section 1.1. In internal position, however, they are realised as [ll] and [r], respectively. Consider the following examples.

(20)  *lemon*          [lemon]          *radio*           [latio]
      *cola*           [kʰolla]         *vanilla*         [panilla]
      *aurora*         [orora]

Regarding the initial position, as in *lemon* and *radio*, there is a distributional constraint on liquids in native Korean: liquids cannot occur in initial position.[14] If this constraint were active in loanword adaptation, then serious confusion would arise between liquid-initial and vowel-initial words; both types of words would begin with a vowel. The constraint on liquids is suspended in loanword adaptation, probably to minimise lexical confusion.

With respect to the internal position, internal /l/ in English is represented as [ll] in Korean, while /r/ is realised as [r]. It seems that the English orthography, irrespective of the number of *l*'s being spelled, does not affect the realisation of internal /l/ as [ll] in English loanword adaptation, as in *cola* and *vanilla.*[15] One important observation is that a vowel always follows [ll]. This observation is supported by the word *film* where [ɨ] occurs between /l/ and /m/, i.e. [pʰillɨm]. Unlike /l/ and /r/ in initial position, the segmental identity of English internal /l/ and /r/ is more or less preserved.

To summarise, the following schema illustrates how English consonants are converted into Korean in initial and internal position.

---

[14] In fact, the pronunciation of my surname is [li], but the actual pronunciation is [i] due to the fact that surnames in Korean occur initially rather than finally as in western names, i.e. [l] is dropped in initial position. Interestingly, note that North Korean does not have this constraint. Therefore, the same surname is realised as [li] without l-dropping.

[15] As we see later in Chapter 3, the sequence [ll] is possible morpheme-internally in native Korean: [kəlle] 'dustclothes', [pəlle] 'insect', [tallɛ] 'to soothe', [nalljəp] 'quick' etc. However, note that a single [l] occurs only in final position.

(21)    English                           Korean
        /p/, /t/, /k/ ─────────⟶          [pʰ], [tʰ], [kʰ]
        /b/, /g/ ─────────⟶               [p], [k]
        /d/ ─────────────⟶                [t]
        /ð/ ──────╱
        /f/, /v/─────────────⟶            [pʰ], [p]
        /m/, /n/, /ŋ/ ─────────⟶          [m], [n], [ŋ]
        /ʃ/, /tʃ/ ─────────⟶              [sj], [cʰ]
        /s/ ─────────────⟶                [s]
        /θ/ ──────╱
        /z/ ─────────────⟶                [c]
        /ʒ/ ──────╱
        /dʒ/ ─────╱
        initial /l/────────⟶              [l]
              /r/──────╱
        internal /l/ ─────────⟶           [ll]
        internal /r/ ─────────⟶           [r]

   In the next section, I deal with final consonants as well as complex consonant clusters where we observe multiple ɨ-insertion.

## 1.5.2. The distribution of [ɨ] in loanwords

In terms of 'standard' syllabification, Korean does not allow complex onsets and codas. Accordingly, when a language which has complex consonant clusters, like a word is borrowed from English, [ɨ] is inserted in various positions in order to conform to Korean syllable structure. Thus, the prime sites of the occurrence of [ɨ] are branching onsets and codas where [ɨ] appears between two consonants in the former case, and after two consonants in the latter. Some relevant examples of each case are shown in (22) and (24), respectively.

(22)    (a) Branching onset: Cr cluster
        _printer_       [pʰɨrintʰə]        _brazier_       [pɨreicə]
        _training_      [tʰɨreiniŋ]        _drama_         [tɨrama]
        _crew_          [kʰɨru]            _gravy_         [kɨrɛpi]
        _fry_-pan       [pʰɨraipʰɛn]
        (b) Branching onset: Cl cluster
        _plan_          [pʰɨllɛn]          _blender_       [pɨllentə]
        _clay_          [kʰɨllei]          _glycerine_     [kɨlliserin]
        _fly_           [pʰɨllai]

In (22a), we observe that all underlined Cr clusters, i.e. /pr/, /tr/, /kr/, /fr/, /br/, /dr/, /gr/ are resolved by the vowel [ɨ], as in (22a). With respect to the Cl clusters in (22b), the vowel [ɨ] occurs between an obstruent and /l/; /l/ is also realised as [ll] in

Korean, as discussed in (20). The occurrence of [ɨ] in this position is intended to maximally preserve the segmental identity of the source language. Note that the context in which [ɨ] occurs in (22a) coincides with the native Korean words in (11a) in section 1.3.3, where [ɨ] occurs between an obstruent and a liquid: [hətɨre] 'trash'; [sinapɨro] 'gradually'; [sikɨrəci] 'to vanish'. The examples in (22) also illustrate that [ɨ] appears in the first syllable as for native Korean in (5) in section 1.3.1, e.g. [kɨrɛto] 'even if'; [s'ɨreki] 'rubbish'; [sɨrasoni] 'lynx'. This strongly indicates that even in loanwords the behaviour of [ɨ] is not random at all. In addition, consider loanwords in which [ɨ] occurs between two aspirated stops. The source of these examples is usually related to natural science terminology or to German. As noted in (13) above, these cases are absent among native words.

(23)    [aksʼeropʰɨtʰol]       *axerophthol*       [kecelsjapʰɨtʰɨ]       *Gesellschaft*
        [kikantopʰɨtʰerisɨ]    *Gigantopteris*     [napʰɨtʰallen]         *naphthalene*

Consider complex 'coda' clusters in final position.

(24)    *pulp*      [pʰəlpʰɨ]        *belt*      [peltʰɨ]
        *bulk*      [pəlkʰɨ]
        *camp*      [kʰɛmpʰɨ]        *tent*      [tʰentʰɨ]
        *bank*      [pɛŋkʰɨ]

In (24), we observe that [ɨ] does not appear between two consonants, but it does occur finally. Recall that in native Korean this vowel does not occur in final position. The occurrence of [ɨ] in final position seems obligatory when consonant clusters precede it, i.e. *[pʰəlɨp] or *[pʰəlɨpʰɨ]. As discussed in section 1.3.3, [ɨ] does not occur between 'coda'-onset clusters. As we see in (25) below, the presence of final [ɨ] in loanwords is also affected by the quality of the preceding consonant, i.e. it does not occur after certain types of segments.

In order to see how the quality of consonants determines the presence of [ɨ] in final position, consider the following English loanwords that end in a single consonant.

(25)    (a)  Nasal-final words
             *dam*     [tɛm]                 *pen*     [pʰen]
             *king*    [kʰiŋ]
        (b)  Liquid-final words
             *HIL*     [hil]                 *car*     [kʰa]
        (c)  Stop-final words
             *soup*    [sup] or [supʰɨ]      *cut*     [kʰət] or [kətʰɨ]
             *cake*    [kʰeik] or [kʰeikʰɨ]
             *cube*    [kʰjupɨ]              *bed*     [petɨ]
             *tag*     [tʰakɨ]

    (d)    Fricative or affricate-final words

| *(bay) leaf* | [lip$^h$ɨ] | *live* | [laipɨ] |
| *bus* | [pəsɨ] | *jazz* | [cɛcɨ] |

The vowel [ɨ] does not appear after nasal- or liquid-final words, as in (25a) and (25b). The r-final English words are of interest. Note that the segment /r/ is not realised on the surface, as in the word *car* in Korean. The same phenomenon is observed in internal position where /r/ occupies 'coda' position followed by an onset, e.g. *carpet* [k$^h$ap$^h$et] or [k$^h$ap$^h$et$^h$ɨ], *target* [t$^h$aket] or [t$^h$aket$^h$ɨ], and so on. This implies that Korean adopts a non-rhotic (or British) accent in English loanword adaptation.[16] In other words, the treatment of coda-/r/ of English loanwords is the same as that of the British accent: coda-/r/ is deleted before a consonant or in final position. This is surprising in the sense that the influence of the American accent prevails in Korea. For instance, English education is based upon American English and Korean adopts the American accent with respect to vowel-quality, e.g. *dot-(com)* [tat(k$^h$əm)] and *hip hop* [hip hap]. Non-rhoticity in English loanwords would be due to the nature of /r/ in Korean, i.e. /r/ does not occur in 'coda' position. I will discuss the matter regarding to the segment /r/ in more detail in Chapter 3 and 5.

Regarding the stop-final words in (25c), at first glance, the generalisation seem to be that [ɨ] occurs irrespective of whether final stops are voiceless or voiced in the source language. In fact, the presence of [ɨ] in final position may be a significant indicator to distinguish native from loan words in Korean. It is reasonable to assume that Koreans perceive some degree of foreignness with [ɨ] in final position, since there are almost no words ending in this vowel. With respect to the voiceless stop-final words, however, we observe that there are alternations between an aspirated and a lenis stop: aspirated stops occur with the following [ɨ], lenis ones without it. What these alternations suggest is that the occurrence of [ɨ] is sensitive to the quality of a preceding consonant. Parallel cases arise in English words ending in complex codas where /s/ is involved.

(26)   *wasp*    [wasɨp$^h$ɨ] *[wasp$^h$ɨ]    *test*    [t$^h$esɨt$^h$ɨ] *[t$^h$est$^h$ɨ]
       *desk*    [tesɨk$^h$ɨ] *[tesk$^h$ɨ]

Unlike (24), where [ɨ] does not occur in 'coda'-onset clusters in English, the examples in (26) show that it is not the case. The vowel [ɨ] mediates between /s/ and a following aspirated stop, despite the fact that these consonant sequences are a well-formed 'coda'-onset ones in English. Once again, this strongly suggests that the quality of surrounding consonants affects the occurrence of [ɨ] in loanwords as well as native words, as discussed in section 1.3.3, e.g. [usɨk'waŋ] 'funny' and [mesɨk'əp] 'to feel sick', as in (14). The relevant generalisation is that the vowel [ɨ]

---

[16] For a general description of the difference between the British and the American accent, see Wells (1982). Another instance of non-rhoticity in English loanword adaptation is found in Cantonese which has been influenced by British English historically and socially (Silverman 1992, Yip 1993). However, S.J. Rhee (2000) argues that non-rhoticity of both languages in English loanword adaptation is mainly due to phonotactic constraints on /r/ rather than social and historical factors.

must occur after the fricative /s/ followed by aspirated or tensed obstruents in both native and loan words.

Consider (25d) where the English examples end in fricatives or affricates. Like the stop-final words in (25c), final voiceless and voiced labial fricatives in English are realised as [pʰɨ] and [pɨ] respectively. Regarding coronal fricative-final words, we observe that [ɨ] occurs finally after a fricative and an affricate, as in [pəsɨ] and [cɛcɨ]. Recall from (21) that /z/ in English is realised as a lenis affricate [c] in Korean. Thus, the example *jazz* provides another context in which [ɨ] occurs after an affricate.

Thus far, we have seen that [ɨ] occurs between consonant clusters, and, in final position in English loanword adaptation. However, we note that there are other cases where the vowel [i] occurs in final position instead of [ɨ], as shown in (27).

(27)  *sash*        [sɛsi]           *beige*         [peici]
      *coach*       [kʰoucʰi]        *college*       [kʰallici]

All these examples end in a palatal fricative or a palatal affricate in the source language. These consonants are converted into [si] for /ʃ/ as in *sash*, [ci] for /ʒ/ and /dʒ/ as in *beige* and *college*, respectively, and [cʰi] for /tʃ/ as in *coach*. It is plausible to assume that the realisation of [i] in this position is influenced by the preceding palatal consonant. In particular, the distinction between /ʒ/ and /dʒ/ in English is merged into [ci] in Korean. Recall that the segment [c] is also used to represent English /z/, as in (25d). In this case, the vowel [ɨ] rather than [i] occurs in final position. Hence, the segmental distinction between /ʒ/ and /dʒ/, and /z/ in English is made on the basis of which vowel occurs in final position.

Until now, I have considered English loanwords ending in a single consonant. We observe that the occurrence of [ɨ] depends on the quality of preceding consonants, i.e. if they are a nasal or [l], then it does not occur; if they are fricatives or affricates, it does occur, while the vowel [i] occurs after English palatal consonants. Comparing (25) with (24), an important difference is noted in that the occurrence of [ɨ] is obligatory when it follows complex coda sequences in (24), but its occurrence depends on the quality of preceding consonants in (25). Thus, in loanwords, we do not have forms such as *[pəlpʰ], *[peltʰ], *[pəlkʰ], among others.

To sum up, the contexts in which [ɨ] occurs among loanwords are as follows.

(28)  (a)   Words ending in a single consonant
            (i) The vowel [ɨ] does not occur after nasals and liquids.
            (ii) The vowel [i] occurs after palatal affricates and fricatives.
            (iii) The vowel [ɨ] occurs after non-palatal fricatives.
            (iv) The vowel [ɨ] occurs after stops; but it alternates with zero after words ending in voiceless stops; if zero alternants occur, the preceding stops must be lenis.

(b)   Words ending in complex clusters
      (i) The vowel [ɨ] occurs finally when complex clusters precede it.
      (ii) The vowel [ɨ] does not occur between these two consonants if the
      first member is a sonorant (e.g. nasal or liquid); it does occur between
      the two if the first member is a fricative
(c)   Words containing branching onsets
      The vowel [ɨ] breaks up onset clusters.
(d)   Words containing two contiguous aspirated segments
      The vowel [ɨ] intervenes between these two segments.

## 1.6 An alternative view of the vowel [ɨ] in Korean

Up to now, I have investigated the occurrence of [ɨ] in native Korean and loanwords.
I have tried to show that the distribution of the vowel [ɨ] is not arbitrary in native
Korean, i.e. it is highly regular in mono-morphemic as well as in suffixation
contexts. The quality of neighbouring consonant(s) affects the presence or absence
of [ɨ]. Similarly, the occurrence of [ɨ] in loanwords is also systematically
constrained, i.e. its distribution depends on the quality of adjacent consonants. This
section reviews an ɨ-insertion approach to loanwords. Then, I put forward an
alternative view on the vowel [ɨ] by rejecting the previous approaches to it.

   As I pointed out in section 1.2, both ɨ-deletion and ɨ-insertion analyses face
empirical problems. The deletion analysis is not able to handle the asymmetrical
distribution of NN sequences in mono-morphemic and in suffixation contexts. The
result of ɨ-insertion is to treat productive suffixation in the interrogative and the
indicative as exceptional. With respect to loanwords, the main motivation of ɨ-
epenthesis is to conform to Korean syllable structure which bars branching onsets
and final complex codas. For instance, S.-C. Ahn (1998: 211-212), proposes the
following four rules to account for ɨ-epenthesis.

(29) Vowel epentheses in loanwords
   (a) Epenthesis in onset
                     N$^{17}$
                     |
       Ø →   [ ]  /  $_\sigma$[C ___ C]$_\sigma$
   (N: an empty slot for a vowel; σ: syllable; C: consonant)
    |
   [ ]

---

[17] The N with an empty slot refers to an unspecified nucleus that will get phonetic content. According to
Ahn's proposal, the phonetic content is provided by redundancy rules of vowel specification. I do not
discuss this matter in this chapter; see Chapter 5 for a detailed discussion on this issue.

(b) Epenthesis in coda (I)

$$\varnothing \rightarrow \underset{|}{\overset{N}{[\ ]}} \ / \ \left\{ \begin{bmatrix} \text{+cont} \\ \begin{bmatrix} \text{+plosive} \\ \text{+voice} \end{bmatrix} \end{bmatrix} \right\} \ \underline{\quad} \ ]_\sigma$$

(c) Epenthesis in coda (II)

$$\varnothing \rightarrow \underset{|}{\overset{N}{[\ ]}} \ / \ \text{C} \underset{\underset{[\text{-son}]}{|}}{\text{C}} \underline{\quad\quad} ]_\sigma$$

(d) Epenthesis in coda (III): default case

$$\varnothing \rightarrow ɨ \ / \ \text{C} \underline{\quad\quad} \text{C}]_\sigma$$

Putting aside rule (29b) for the time being, let us consider the empirical effects of these three rules. Rule (29a) is designed to break up a consonant cluster by ɨ-insertion since Korean allows only a single consonant in onsets. The rules in (29c) and (29d) treat complex coda sequences in final position. The former deals with lC and NC (N: nasal, C: obstruent) clusters such as *lp*, *lt*, *mp*, *nt* etc. The latter concerns sC clusters such as *sp*, *st* and *sk*. Interestingly, the insertion sites of these three rules are exactly the same as those for the vowel [ɨ] in native mono-morphemic words as discussed in 1.3. Some relevant native examples are repeated in comparison with loanword ones. (The sequences under comparison are underlined.)

(30)    (a) Rule (29a)

| loanword | | Korean | |
|---|---|---|---|
| [pip<u>ɨ</u>rap<sup>h</sup>on] | *vibraphone* | [sinap<u>ɨ</u>ro] | 'gradually' |
| [ət<u>ɨ</u>resiŋ] | *addressing* | [kot<u>ɨ</u>rim] | 'icicle' |
| [piak<u>ɨ</u>ra] | *viagra* | [ciŋk<u>ɨr</u>əp] | 'creepy' |

(b) Rule (29c)

| [si<u>lk</u><sup>h</sup>ɨ] | *silk* | [tə<u>lk</u><sup>h</sup>itək] | 'click |
| [pɛ<u>ŋk</u><sup>h</sup>ɨ] | *bank* | [sə<u>ŋk</u><sup>h</sup>ɨm] | 'with big strides' |

(c) Rule (29d)

| [t<sup>h</sup>e<u>st</u><sup>h</sup>ɨ] | *test* | [u<u>sɨk</u>'waŋ] | 'funny' |
| [te<u>sk</u><sup>h</sup>ɨ] | *desk* | [me<u>sɨk</u>'əp] | 'to feel sick' |

(30) indicates that the contexts in which [ɨ] occurs in the formulations of ɨ-insertion rules of (29) are exactly the same as the distribution of [ɨ] in native words. This illustrates that a rule-based approach to loanwords runs into the *duplication problem* (Kenstowicz & Kisseberth 1977: 136), i.e. rules are added to the grammar which duplicates the morpheme structure constraints.

Finally consider rule (29b). This rule is designed to account for the occurrence of [ɨ] in final position, when loanwords in the source language end in a voiced stop,

as in *cube* [kʰjupɨ], *bed* [petɨ] and *tag* [tʰɛkɨ].[18]  In fact, these examples constitute a set of words which is totally unique to loanwords, precisely because almost no native words end in the vowel [ɨ].  This rule, however, does not take into account alternations between aspirated and lenis stops, as illustrated in (25c), e.g. *soup* [sup] or [supʰɨ], *cut* [kʰət] or [kətʰɨ] and *cake* [kʰeik] or [kʰeikʰɨ].  What these examples show is that there is an intrinsic relation between the laryngeal nature of the stops and the occurrence of [ɨ]: the presence of aspirated stops requires a following [ɨ], but the presence of lenis stops does not.  Within Ahn's rule-based formulation, several additional rules are required in order to capture such alternations between aspirated and lenis stops and between [ɨ] and zero.  For instance, since English voiceless stops are converted into aspirated stops in Korean, a process in which aspirated stops become lenis in final position is needed, e.g. [sup], or another process, in which the vowel [ɨ] is inserted when it follows aspirated stops, is required, e.g. [supʰɨ].  Such rules, however, do not seem to establish a non-arbitrary relation between the phonological processes in question and the contexts in which they take place.  Concretely, these rules do not reveal the reason why lenis stops without [ɨ] occur in final position, and why aspirated stops require a following [ɨ] when they occur in final position.

Thus far, I have examined the ɨ-insertion approach to loanwords.  Apart from final [ɨ] in loanwords, the vowel [ɨ] in internal position shows that there is no phonotactic difference between native and loanwords.  This implies that we can treat the internal [ɨ] in loanwords in the same grammar as native words.  The previous ɨ-deletion and the ɨ-insertion analysis, however, appear not to capture the same distribution of [ɨ] in a unified way, precisely because these approaches assume that the native morpheme-internal [ɨ] is lexically specified.

However, there is an alternative way to achieve a unified treatment of the vowel [ɨ].  This is to recognise an *empty nucleus* in the lexical representation with the assumption that the phonetic interpretation of an empty nucleus is the vowel [ɨ] when certain conditions are satisfied, and that it is not audible otherwise.  For instance, consider the words [pipɨrapʰon] 'vibraphone' and [sinapɨro] 'gradually'.  Under this approach, the lexical representations are as follows.

(31) (a) [pipɨrapʰon] *vibraphone*[19]

```
   O   N1   O   N2   O   N3   O   N4
   |   |    |   |    |   |    |   |
   x   x    x   x    x   x    x   x
   |   |    |        |   |    |   |
   p   i    p        r   a    pʰ  o    n
```

---

[18] According to Ahn's transcription, the phonetic forms are *cube* [kʰjubɨ], *bed* [pedɨ] and *tag* [tʰɛgɨ] where intervocalic voicing takes place.  As we will see in Chapter 3, I argue that intervocalic voicing is not present in the phonology of Korean.  Thus, throughout the thesis, all intervocalic obstruents are represented by lenis ones.  In addition, close inspection of rule (29b) reveals that this rule comprises two processes: ɨ-epenthesis and intervocalic voicing.  That is, after ɨ-epenthesis, intervocalic voicing occurs.

[19] In particular, note that the final /n/ in (31a) is not syllabified.  Full syllabification of given segmental strings will be discussed in Chapter 2 and onwards.

(b) [sinapɨro] 'gradually'

```
O    N1   O    N2   O    N3   O    N4
|    |    |    |    |    |    |    |
x    x    x    x    x    x    x    x
|    |    |    |    |         |    |
s    i    n    a    p         r    o
```

(31) gives partial lexical representations in which N2 and N3, in (31a) and (31b), respectively, are empty.  The task is, then, to develop an algorithm of how to interpret these empty nuclei.  If an adequate algorithm is available, the obvious advantage of this approach is that the grammar becomes simpler, because no ɨ-insertion and ɨ-deletion rules of the type in (29) are necessary in Korean phonology.

Regarding the algorithm for the interpretation of empty nuclei, I adopt Government Phonology (GP), which provides a principles-and-parameters-based account, i.e. the Empty Category Principle.  In the remaining chapters, I will investigate how this principle together with language-specific conditions determines the phonetic interpretation of empty nuclei in Korean.

# Chapter 2
# The syllable structure of Korean

In this chapter, I present a government-based analysis of the syllable structure of Korean. Most phonologists agree that Korean allows branching rhymes and nuclei (Kim & Shibatani 1976, B.-G. Lee 1982, S.-C. Ahn 1985, J.-M. Kim 1986 and H.-S. Sohn 1986, among others). However, there is disagreement with regard to onsets. Lee argues that Korean has branching onsets, while Kim and Sohn claim that it does not. I will propose a very different view of Korean syllables structure, arguing that Korean has no branching constituents of any type on the basis of Y. Heo (1995) and Rhee & Heo (1998), i.e. no branching onsets, no branching nuclei and no branching rhymes. In other words, Korean can be informally classified as a CV language, as opposed to a CVC language as most Korean phonologists have assumed.

This chapter is organised as follows. In the first two sections, I show how syllabification and segmental structure are treated in Government Phonology (GP). In the remaining sections, I present a government-based analysis of the syllable structure of Korean. In 2.1, I present basic notions of GP which are relevant to syllabification. In 2.2, I briefly introduce element theory, which specifies subsegmental structures in GP, and present the representations of Korean vowels and consonants. In 2.3, I consider the syllabification of consonant + glide + vowel (henceforth CGV) sequences in order to determine whether or not Korean has branching onsets. In 2.4, I argue that the vowel-length distinction is not present lexically in Korean and present supporting evidence for my argument. In 2.5, I examine morpheme-internal consonant sequences in order to determine whether or not they constitute coda-onset sequences. In 2.6, I conclude that Korean has no branching constituents.

## 2.1. Basic notions for syllabification in GP[1]

## 2.1.1 Phonological government

The core notion in GP is *government*. One of the key roles of government is to determine a non-ambiguous syllabification for a given phonological string consisting of a sequence of skeletal points with which segments are associated. Syllabification is based on governing relations, established at the level of lexical

---

[1] The framework was developed by Kaye, Lowenstamm & Vergnaud (henceforth KLV) (1985, 1990). For further developments in GP, see Kaye (1990, 1992, 1995), Charette (1988, 1991, 1992), Charette & Göksel (1994), Harris (1990, 1992, 1994), Brockhaus (1995a,b), Harris & Lindsey (1995), Lindsey & Harris (1990), Cyran (1998) and Ploch (1999), among others.

representation.[2]  Needless to say, we cannot adequately account for phonological phenomena in without considering syllabification; it is therefore clear that government plays a major role in phonological processes.

Both *constituent* and *inter-constituent government* are defined as binary, asymmetric relations holding between two skeletal points.  In order for a governing relation to be established between two skeletal points, the following conditions must be satisfied:

(1) The Strict[3] Adjacency Condition:
Two positions in a governing relation must be strictly adjacent.

(2) The Strict Directionality Condition:
In a given governing domain at the skeletal level, the direction of government is universally invariable.
(i) Constituent government: head-initial
(ii) Inter-constituent government: head-final

Given the Strict Adjacency Condition and the Strict Directionality Condition, it follows that each constituent is maximally binary.[4]  N-ary (n > 2) constituent are ruled out in GP.  Consider a ternary constituent like the following:

(3)        *A
         /   |   \
        /    |    \
      α      β      γ
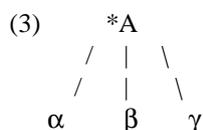
If α is taken to be the head (governor) of the constituent A, then a governing relation can be established between α and β, because the complement (governee) β is adjacent to its governor α.  A governing relation cannot hold between α and γ, however, because the governor α is not immediately adjacent to its governee γ, violating the Strict Adjacency Condition.  The same applies in the case that γ is the head of the constituent A.  Finally, let us consider the case in which β is the head of A.  Notice that β can govern α and γ without violating the Strict Adjacency Condition, since α and γ are both adjacent to β.  However, if a governing relation is to hold between β and α, and between β and γ, government must apply in two

---

[2] The level of lexical representation is defined as "the level at which the stem is attached to accompanying affixes, if any" (KLV 1990: endnote 34).  Informally, in GP literature, the lexical representation is referred to as an input to phonological processes after syllabification is done through government and licensing.

[3] The term *strict* means that the governor must be adjacent to the governee at the P0 projection, i.e. the projection containing every skeletal point.

[4] This is characterised by the *Binarity Theorem* in KLV (1990: 199).  Exceptions to the Binarity Theorem would be so-called super-heavy syllables.  However, V:C sequences in final position can be syllabified as branching nucleus (or two contiguous nuclei)-onset-empty nucleus (cf. the Coda Licensing Principle, see (8) below).  Genuine exceptions are found in English: words like *bind*, *child*, *paste* etc.  For a treatment of these exceptions, see Harris (1994).

directions simultaneously: right-to-left and left-to-right, in violation of the Strict Directionality Condition. Thus, the conditions of Strict Adjacency and Strict Directionality ensure that constituents are maximally binary.

GP recognises three syllabic constituents: O (onset), N (nucleus) and R (rhyme).[5] Constituents and segments are linked to one another via skeletal points, as illustrated in (4).

(4)　　O　　R[6]　　(constituent level)
　　　　|　　|
　　　　|　　N
　　　　|　　|
　　　　x　　x　　(skeletal level)
　　　　|　　|
　　　　σ　　σ　　(segmental level)　　(σ: segment)
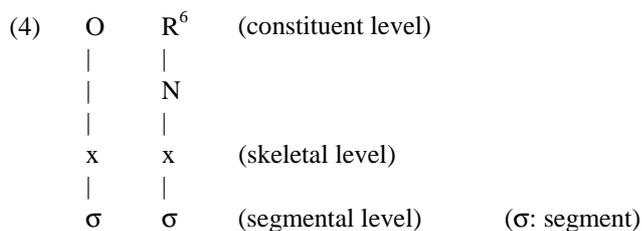
Given the Strict Adjacency and the Strict Directionality requirements, only the following structures are predicted to be available.

(5)　(a)　O　　(b)　O　　(c)　O
　　　　　　　　　　|　　　　　|　\
　　　　　　　　　　x　　　　　x → x

　　(d)　R　　(e)　R　　(f)　R
　　　　　|　　　　|　　　　　|　\
　　　　　N　　　　N　　　　　N　\
　　　　　|　　　　|　\　　　 |　　\
　　　　　x　　　　x → x　　　x → x
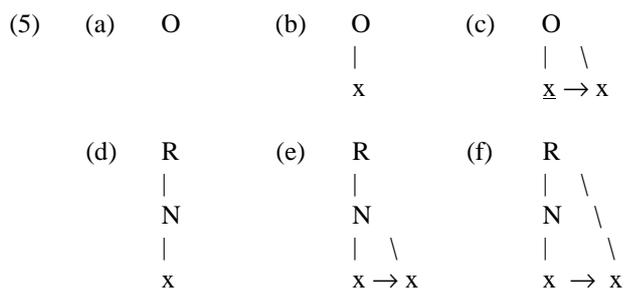
( The head of each constituent is underlined, and the arrows indicate the direction of government.)

Let us consider in more detail the three branching constituents: (5c), (5e) and (5f) showing a branching onset, a branching nucleus and a branching rhyme respectively. Within each of these constituents, a governing relation is established between the skeletal points, i.e. one skeletal point governs the other. This type of government is called *constituent government*: its government direction is universally head-initial.

---

[5] Notice that there are no constituents 'coda' and 'syllable'. See KLV (1990) and Brockhaus (1999) for discussions regarding the lack of evidence for these constituents. A syllable, as we will see in (5) below, can be interpreted as a sequence of onset-rhyme (OR). Similar proposals are put forward in *Strict CV Phonology* and *Head-Driven Phonology*; see Lowenstamm (1996) and Rowicka (1999) for Strict CV Phonology, and see Hulst van der & Ritter (1998, 1999b) for Head-Driven Phonology. Despite the absence of the constituent 'syllable' in GP, however, terms such as *syllabic structure*, *syllabification* and so on will be used throughout the thesis for ease of reference.

[6] KLV (1990) stipulates that the left branch of every rhyme is the nuclear constituent. In other words, the rhyme is a projection of the nucleus.

The second type of governing relation is established between two skeletal points dominated by different constituents. This is known as *inter-constituent government*. Like constituent government, inter-constituent government is subject to the Strict Adjacency and the Strict Directionality Conditions. However, the direction of government is head-final. Inter-constituent governing domains are illustrated in (6).

(6) (a) Government between contiguous nuclei

```
    R       O       R
    |               |
    N               N
    |               |
    x  <————————  x
```
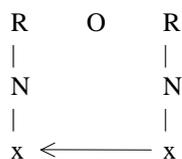
(b) Government between an onset and the preceding rhymal complement

```
    R               O
    |  \            |
    N   \           |
    |    \          |
    x     x  <——  x
```
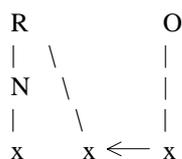
(6a) and (6b) illustrate an inter-constituent governing relation between two contiguous nuclei, and between a rhymal complement ('coda'[7]) and a following onset, respectively. In (6a), since the intervening onset is empty and does not dominate a skeletal point, the nuclei are adjacent at both skeletal and segmental levels.

Governing relations are, in fact, an instance of a more general principle, the *Licensing Principle*, stated below.[8]

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

The Licensing Principle regulates the projection of positions, ranging from the skeletal level through successively higher levels such as the constituent level, the nuclear projection etc. In more concrete terms, the onset constituent must be licensed by a following nucleus, or, an onset must be followed by a nucleus.[9] Each

---

[7] Since there is no constituent coda in GP, the term *rhymal complement* or *post-nuclear rhymal position* is used to refer to coda in the 'standard' syllabification framework. Throughout the thesis, I will use these two terms and 'coda' interchangeably.
[8] For a more detailed discussion of the Licensing Principle, see Brockhaus (1995b).
[9] This is formally stated as a separate principle by Harris (1992, 1994).
       The Onset Licensing Principle
       An onset head position must be licensed by a nuclear position.

nucleus apart from the head of a domain is, in turn, licensed through government by another nucleus at a higher level of projection.[10]

Another important principle is the *Coda Licensing Principle*. Consider (6b), in which there is a rhymal complement position governed by a following onset. Whenever a rhyme branches, its complement requires a following onset. Kaye (1990) calls this requirement the Coda Licensing Principle.

(8) The Coda Licensing Principle
    A post-nuclear rhymal position must be licensed by a following onset.

One significant effect of the Coda Licensing Principle is that a word-final consonant cannot be syllabified in a rhymal complement position. Rather, it occupies an onset position which is licensed by an empty nucleus due to the effect of the Onset Licensing Principle. The Licensing Principle and the Coda Licensing Principle effectively guarantee that all syllabic structures end in a nucleus.

## 2.1.2 Governing properties

For any governing domain, the governing position must possess the appropriate governing properties. These governing properties are determined by the internal structures of the segments associated with the skeletal points. In GP, a segment is assumed to consist of one or more elements. A segment can either contain a single element (*simplex segment*) or a combination of elements (*complex segment*[11]). The notion of *charm* is used to relate to the combinatorial possibilities of elements (KLV 1985, 1990). Recently, however, the notions of *headedness* and *headlessness* (or empty-headedness) have replaced charm in the revised theory of elements (Charette & Göksel 1994, Ploch 1999, among others). Informally speaking, positively or negatively charmed segments refer to headed segments and neutral or charmless segments to headless ones. In terms of governing roles, both headed and headless segments may be governors, while only headless segments may be governees. The distributional relationships between headed and headless segments are illustrated in (9).

(9)  (a)  O        (b)  O        (c)  N        (d)  N
          |             | \           | \           | \
          x             x → x         x → x         x → x
          |             |   |         |   |         |  /
          σ⁻/°          σ⁻  σ°        σ⁻/° σ°        σ⁻/°

---

[10] Instances of such domains are those of stress, vowel harmony and vowel/zero alternation.

[11] The term *complex segment* also refers to affricates or pre-nasalised segments in the literature (e.g. Clements 1985, Sagey 1986 and van de Weijer 1996, among others). In order to avoid terminological confusion, I will use the term *contour segment* to refer to these segments in the thesis.

```
(e)    N        (f)    R        O
       |               | \      |
       x               N  \     |
       |               |   \    |
       σ⁻/°            x    x ← x
                       |    |
                       σ°   σ⁻/°
```

(σ⁻: headed segment, σ°: headless segment)
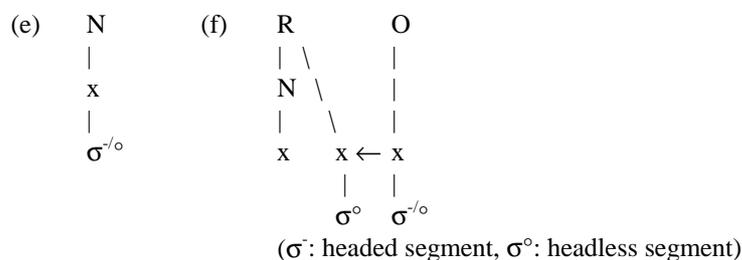
(9b) illustrates a branching onset. The governing position is linked to a headed segment, while the governed position is occupied by a headless segment. Roughly speaking, headed segments include plosives and non-sibilant fricatives while the set of headless segments comprises nasals, glides, liquids and certain types of obstruents. For instance, in terms of this rough classification, the sequences /br/, /dr/, /gr/, /pl/, /kl/ etc., found in Indo-European languages, are syllabified as branching onsets in which an obstruent and a liquid are associated with the governing and the governed positions, respectively.

(9c) and (9d) represent branching nuclei: a heavy diphthong and a long vowel respectively. They differ from (9a) in that either a headed or a headless segment may occupy the governing position. Examples of headed vowels might be the low vowel /a/ and tense (ATR) vowels, while headless vowels might be lax (non-ATR) vowels. When a headless segment occupies a governing position, its segmental structure will be more complex than that of its governee due to the *Complexity Condition*.[12] Heavy diphthongs as in (9c) are manifested by, for instance, English /aɪ/, /eɪ/ and /aʊ/, in which the headed segment /a/ governs the headless segments /ɪ/ and /ʊ/, and the segment /e/, which has greater complexity than the segment /ɪ/, occupies the governing position.[13]

Finally, (9f) illustrates a rhymal complement position governed by a following onset. The governing position associates with a headed or a headless segment, and a headless segment occupies the governed position. In sequences such as /lp/, /lt/ and /lk/, for instance, a headed segment occurs in governing position, while in a sequence /lm/, a headless segment /m/ occupies a governing position onset position to govern /l/ in a rhymal complement position, since the segmental structure of /m/ is more complex than that of /l/.[14]

---

[12] The Complexity Condition is formalised in KLV (1990) and Harris (1990). The complexity of a given segment is calculated in terms of the number of elements it is composed of. For a detailed discussion of the Complexity Condition with respect to segments in Korean, see Chapter 3.

[13] See section 2.2 for an account of how the segmental representations of vowels are composed of an element or elements.

[14] See section 2.2 for segmental representations of consonants of Korean.

## 2.1.3 Empty constituents and the ECP

GP recognises empty onsets and empty nuclei. There are two types of empty onsets. One type has no skeletal point, and therefore no segmental point, as in (10a), and another type does have a point but still lacks content, as in (10b).

(10)  (a)  O    N           (b)  O    N
           |                     |    |
           x                     x    x
           |                     |
           σ                     σ

It seems reasonable to assume that the phonological behaviour of these two empty onsets is quite different. Such cases arise when an empty onset intervenes between two contiguous nuclei. If the empty onset has no skeletal point, then these two nuclei can form a governing domain (see (6a)), i.e. various types of vowel-hiatus occur such as glide formation, vowel deletion and vowel coalescence. However, if it has a skeletal point between two nuclei, vowel-hiatus could not occur, since the presence of a skeletal point of the empty nucleus blocks the establishing of a governing domain. A typical case that motivates the distinction between these two onsets is the h-aspiré phenomenon in French (Charette 1988).

We came across the notion *empty nucleus* when discussing the Onset Licensing and the Coda Licensing Principles, which require that all phonological domains end with a nucleus. When words end in a single consonant, we have what is called a *domain-final empty nucleus*. Empty nuclei can also be found in domain-internal positions. Evidence for this comes from vowel/zero alterations in languages such as Polish (Gussmann & Kaye 1993 and Rowicka 1999, among others), Moroccan Arabic (Kaye 1987), and Korean (Y. Heo 1995).

The interpretation of (both internal and final) empty nuclei is determined by the *Empty Category Principle* (ECP), which is understood to be a part of Universal Grammar (UG):

(11) The Empty Category Principle[15]
I. A licensed (empty) category receives no phonetic interpretation licensing under the following circumstances:
(a) Domain-final (empty) categories are licensed (parameterised)
(b) Properly governed (empty) nuclei are licensed
(c) A nucleus within an inter-onset domain

---

[15] The ECP in (11) differs in its formulation from that of Kaye (1995). One missing licensing condition in the ECP is *magic-licensing* which is designed to account for sC clusters in Indo-European languages (Kaye 1992). Apart from this, the difference has no bearing on matters discussed in this thesis.

II. Proper government
α properly governs β if:
(a) α and β are adjacent on the relevant projection
(b) α is not itself licensed, and
(c) No governing domain separates α from β

The ECP basically dictates that an empty nucleus is not phonetically interpreted if it is licensed. The licensing conditions for empty nuclei vary, depending on the position of the nucleus. The condition (I.a) is a parameter, i.e. some, but not all, languages license domain-final empty nuclei. Informally speaking, a language which has consonant-final words (such as English, Dutch, German, Arabic and Korean), licences a domain-final empty nucleus that is not phonetically realised. However, in languages without consonant-final words (such as Japanese and Italian), final empty nuclei are not licensed and so must be interpreted, i.e. words in these languages must end in a vowel.

The interpretation of domain-internal empty nuclei is determined by the relation of proper government. A domain-internal empty nucleus is licensed, and therefore has no phonetic interpretation, if it is properly governed by another nucleus, but it is interpreted if proper government does not hold. However, some languages such as Polish and Mongolian (Gussmann & Kaye 1993 and Cyran & Gussmann 1999 for Polish, and Charette 1992 for Mongolian) show that the notions of domain-final licensing and proper government are insufficient to license empty nuclei; an additional mechanism is required: inter-onset government. In Chapter 3, I consider how these three conditions, i.e., the domain-final licensing parameter, proper government and inter-onset government provide an adequate account of the distribution of the vowel [ɨ] in Korean.

## 2.1.4 The morphology-phonology interface in GP

Regarding the interplay between morphology and phonology, GP recognises two types of structures: *analytic* and *non-analytic*.[16] In an analytic construction, morphology is visible to phonology, while in a non-analytic structure the phonology is insensitive to morphology. More concretely, in suffixation or compounding, an analytic structure involves internal domains being either of the type [[A] [B]] or [[A] B], whereas a non-analytic structure does not contain such internal domains, being simply [AB]. For the structure [[A] [B]], phonological processes apply to A and B separately. The results are concatenated to form a single domain (i.e. [AB]), and then phonological processes apply to that domain. With respect to [[A] B], relevant phonological processes apply to A and concatenate the result with B, with phonological processes then applying to the result of the concatenation (i.e. [AB]). In the non-analytic structure [AB], phonological processes simply apply to the result of concatenation. The implication is that non-analytic structures are treated in the same way as mono-morphemic words.

---

[16] For a detailed discussion of this matter, see Kaye (1995).

In stress-assignment in English, for instance, a suffix like adjectival /əl/ -al is treated as non-analytic, since it triggers a primary stress shift away from the initial syllable in a denominal adjective such as [paréntal]. By contrast, analytic suffixes such as nominal /nɪs/ -ness and /hʊd/ -hood are usually stress-neutral, hence [[ábstract]ness] and [[párent]hood]. Another type of analytic structure [[A] [B]] is instantiated by compounds, e.g. [[bláck][bòard]], in which a full vowel and some degree of stress are expected for each domain. Based upon the notions of analytic and non-analytic structures, I will classify suffixes of Korean into these two types in Chapter 4 and discuss whether or not these notions can properly capture phonological phenomena under suffixation in Korean.

## 2.2 The representations of Korean segments

Unlike some other generative phonology frameworks such as Underspecification and Feature Geometry, GP takes the ultimate unit of the segment to be the monovalent element. [17] In KLV (1985) and Harris (1990), the following ten elements are used: A, I, U, R, L, H, N, h, ʔ, and v. The revised version of element theory, however, recognises the following five or six elements: A, I, U, L, H, ʔ[18] (Ploch 1999). As mentioned in 2.1.2, a segment contains a single element or a combination of elements through *fusion* in which case two elements are involved, namely, a head and an operator. The result of fusion is a complex segment which contains all the properties of the head together with the salient property of the operator.[19] By convention in GP, segments are represented by parentheses in which heads are underlined.[20] For example, (U) and (U̱) are simplex segments containing the element U. (U) is headless (or empty-headed) and its typical phonetic realisation is [ʊ], while (U̱) is U-headed and its typical phonetic realisation is [u]. Furthermore, (A.I̱) and (A̱.I) are complex segments containing A and I; the phonetic realisations of the two are [e] and [ɛ] or [æ], respectively.

---

[17] GP is not the only framework that regards elements as the ultimate unit of the segment. Other versions of element theory are couched in frameworks such as Particle Phonology and Dependency Phonology. See Harris & Lindsey (1995) for a discussion of how these frameworks deal with segmental structure, and the relevant references therein.

[18] According to Ploch's proposal, R and A merge into A, H and h into H, and L and N into L, and there is no 'cold vowel' element v (KLV 1985) or @ (Harris 1994).

[19] The salient properties of each element are as follows:

| A | non-high | I | palatal | U | labial | R | coronal |
|---|---|---|---|---|---|---|---|
| N | nasal | h | narrowed | ʔ | occluded | v | none |
| L | slack vocal folds | | | H | stiff vocal folds | | |

The head-operator relations among elements in the revised theory are regulated by *licensing constraints*: the head of a segment can license elements in question or not. The licensing constraint is designed for implementing language-specific sets of segments. For the licensing constraints for individual languages, see Charette & Göksel (1994) on Turkish, Cobb (1995) on Zulu and Basque, and S.-J. Kim (1996) on Korean, among others.

[20] In the revised theory of elements, the term *phonological expression* is used to refer to segments of which elements are composed. However, I use the term *segment* throughout the thesis, noting that it is a cover term and has no bearing on theoretical differences.

In this thesis, the segmental representations of Korean are based on the revised theory of elements with retention of the element R. The reason why I retain the element R is that there is an asymmetry between the (new) element A and the elements I and U. In loanword adaptation (see Chapter 5), the phonetic content of unlicensed empty nuclei is occasionally identified by the spreading of the element U or I which a preceding consonant contains, e.g., [hip$^h$ɨ] or [hip$^h$u] *hip* and *[k$^h$ouc$^h$ɨ] but [k$^h$ouc$^h$i] *coach*. In these examples, the plosive /p$^h$/ contains the element U and the affricates /c$^h$/ the element I. If the element A represents coronality, then we expect the word *tzar* to be realised as [c'ara] rather than [c'arɨ], or both forms are possible. The correct form is [tarɨ], which indicates that A does not spread to identify a following unlicensed empty nucleus.

I assume that the vowel inventory of Korean comprises eight vowels: /i, e, ɛ, a, u, o, ə, ɨ/. The vowel [ɨ] is the interpretation of an unlicensed empty nucleus. Korean has 19 consonants. In terms of headedness, tensed and aspirated obstruents are headed, and the remainder are headless. The segmental representations of vowels and consonants are given below (The head is underlined).

(12)  (a) Vowels

| /i/ | (I̲) | /e/ | (A.I̲) |
|-----|-----|-----|--------|
| /ɛ/ | (I.A) | /a/ | (A̲) |
| /u/ | (U̲) | /o/ | (U.A̲) |
| /ə/ | (A) | /ɨ/ | |

(b) Consonants
(i) Liquids[21]

| /r/ | (R) | [l] | (R.ʔ) |
|-----|-----|-----|-------|

(ii) Nasals

| /n/ | (R.ʔ.L) | /m/ | (U.ʔ.L) |
|-----|---------|-----|---------|
| /ŋ/ | (ʔ.L)[22] | | |

(iii) Lenis stops

| /p/ | (U.ʔ.H) | /t/ | (R.ʔ.H) |
|-----|---------|-----|---------|
| /k/ | (ʔ.H) | | |

(iv) Tensed stops

| /p'/ | (U.ʔ.H̲) | /t'/ | (R.ʔ.H̲) |
|------|----------|------|----------|
| /k'/ | (ʔ.H̲) | | |

---

[21] These two segments are in complementary distribution. [r] occurs only before a vowel, and [l] before a consonant or in final position. A discussion of the underlying representation of liquids is found in section 2.5.

[22] Note that velar segments do not contain place elements. In KLV (1985) and Harris (1990), velar consonants are v-headed which contributes to velarity. In the revised theory, the element v is dropped, therefore, place is not specified.

(v) Aspirated stops[23]
/pʰ/            (U.ʔ.H) (H̲)          /tʰ/            (R.ʔ.H) (H̲)
/kʰ/            (ʔ.H) (H̲)
(vi) Affricates
/c/             (R.ʔ.I) (H)          /c'/            (R.ʔ.I) (H̲)
/cʰ/            (R.ʔ.I.H) (H̲)
(vii) Fricatives
/s'/            (R.H̲)                /s/             (R.H)
/h/             (H)

## 2.3 The structure of onsets: the syllabification of CGV sequences

### 2.3.1 Introduction

The syllabification of consonant + glide + vowel (CGV) sequences in Korean has been a controversial issue which phonologists have approached in a number of ways. For example, B.-G. Lee (1982) claims that glides are a part of the onset; specifically, that a glide following a consonant forms a branching onset (the branching onset analysis), as illustrated in (13a). S.-C. Ahn (1985) agrees with Lee's proposal in that a glide belongs to the onset, but argues that a consonant and a following glide associate with a single C-slot to form a contour segment, i.e. a glide contributes to the secondary articulation effect such as labialisation or palatalisation (the contour segment analysis), as illustrated in (13b).[24] Others, such as H.-S. Sohn (1986), J.-M. Kim (1986) and Kim & Kim (1991), claim that a glide and a following vowel form a branching nucleus (the heavy diphthong analysis), as in (13c).

---

[23] Motivation for assuming that aspirated segments consonants are contour segments, in which the element H is doubly-linked, is found in the following aspiration process. This process occurs when a lenis-stop final verbal stem is followed by the passive suffix /hi/, as shown below.

e.g.    /mək/ + /hi/        [məkʰi]        'to eat'         /tat/ + /hi/        [tacʰi]        'to close'
        /əp/ + /hi/         [əpʰi]         'to carry somebody or something on the back'

In this process, we note that stem-final lenis stops contain the element H and also the glottal fricative /h/ contain this element. Thus, the aspiration process involves two H elements and so aspirated segments are represented by a contour segment in which a doubly-linked H is present. In this way, we can make a distinction between aspirated and tensed obstruents, in terms of elements, i.e. the latter contains a single H element. As we will see in Chapter 4, the context of tensification is different from that of aspiration, in that the element H is not involved in the former.

[24] O. Kang (1999a, b), based on the OT framework, claims that glides belong to an onset rather than a nucleus. But it is not clear whether CG clusters form a branching onset or a contour segment, since detailed syllabification of CG clusters is not specified in an optimal form.

(13)        (a) Branching onset analysis          (b) Contour segment analysis
                 O          N                          O          N
               /   \        |                          |          |
              x    x     x                         x          x
              |     |      |                       /   \        |
              C    G     V                        C    G     V
                 (c) Heavy diphthong analysis        (d) Light diphthong analysis
                 O          N                          O          N
                 |        /   \                        |          |
              x    x     x                         x          x
              |     |      |                          |        /   \
              C    G     V                        C    G     V

However, I will argue that these analyses are incorrect, and propose an alternative, more adequate account of the syllabification of CGV sequences, i.e. the light diphthong analysis on the basis of the cooccurrence restrictions on GV rather than on CG, as illustrated in (13d).

## 2.3.2 The analysis

On examining the distribution of consonants in morpheme-initial position, we find that consonant sequences are not permitted. Only a single consonant may occur, as shown in (14).[25]

(14)    [paci]                  'trousers'        [p'i]                  'to sprain'
        [pʰato]                 'wave'
        [totuk]                 'thief'           [t'i]                  'belt'
        [tʰa]                   'to get on'
        [kim]                   'steam'           [k'ini]                'meal'
        [kʰo]                   'nose'
        [sal]                   'flesh'           [s'i]                  'seed'
        [cikɨm]                 'now'             [c'a]                  'salty'
        [cʰim]                  'needle'
        [na]                    'I'               [met'uki]              'locust'
        [him]                   'strength'

A single consonant may occur in the onset position. But what about CGV sequences? The relevant data is given in (15).

(15)    [pjapi]       'rub'                  [pəpwən]       'court'
        [titjə]       'to step on'           [twɛci]        'pig'
        [kjənti]      'to subsist'           [kwail]        'fruits'

---

[25] Generally, the liquids, [l, r], and the velar nasal [ŋ] do not occur in initial position in Korean. However, in loanwords, [l] may occur in this position (e.g. [latio] 'radio', [lamjɔn], 'instant noodle' etc.).

| | | | |
|---|---|---|---|
| [cjə] | 'to set' | [cwi] | 'to grab' |
| [sjə] | 'sour' | [swalswal] | 'with a great flow' |
| [mjənɨri] | 'daughter-in-law' | [mwə] | 'what' |
| [nja] | 'interrogative suf.' | [nwə] | 'to lie' |
| [hjaŋ] | 'perfume' | [hwal] | 'bow' |
| [orju] | 'mistake' | [irwə] | 'to fulfill' |
| [t'wi] | 'to run' | [tʰjunə] | 'tuner' |
| [kʰjəlle] | 'a pair of shoes' | [k'wəŋ] | 'peasant' |
| [p'jə] | 'bone' | [pʰwə] | 'to dig out' |
| [c'jə] | 'to steam' | [cʰwal] | 'to film' |

There are no restrictions on what consonant can precede the glide. This indicates that CG sequences do not form a branching onset precisely because we might expect some cooccurrence restrictions on possible CG clusters if they were to form a branching onset. Theory-internally, due to the presence of words like [hjaŋ], [hwal], [orju] and [irwə], the branching onset analysis would allow headless segments to occupy the governing position, i.e. the occurrence of /h/ and /r/ in governing position would violate the requirement that only headed segments occur in a governing position in the branching onset, as in (9b). In other words, only tensed or aspirated obstruents can occupy a governing position within a branching onset, if at all. Thus, we exclude the branching onset analysis.

In a similar fashion, the heavy diphthong analysis is ruled out, because it violates the governing requirements of a branching nucleus. Concretely, in a well-formed heavy diphthong, either a headed segment or a complex segment is required for a governing position and only a simplex segment occurs in a governed position, as in (9c). Thus, [ju] or [wa], where a simplex headless segment occupies the governing position, cannot be well-formed heavy diphthongs.

The remaining candidates for CGV syllabification are the contour segment analysis, as in (13b), and the light diphthong analysis, as in (13d). In order to determine whether CG sequences are contour segments and GV sequences are light diphthongs, I adopt the following criterion proposed by Da Silva (1992).

(16) Complex [contour: SJR] segments present restrictions with respect to the segmental material which may occupy their skeletal position.

Consider whether or not there are cooccurrence restrictions on (C)GV sequences.

(17) (a)    [w] cannot be followed by [o] or [u]

| | | | | | | |
|---|---|---|---|---|---|---|
| /wa/ | [kwail] | 'fruit' | [cwa] | 'left' | [hwal] | 'bow' |
| /wə/ | [mwəl] | 'what' | [hwəls'in] | 'very' | [pəpwən] | 'court' |
| /wi/ | [twi] | 'back' | [cwi] | 'mouse' | [nwi] | 'sister' |
| /wɛ/ | [twɛci] | 'pig' | [s'wɛki] | 'wedge' | | |
| /we/ | [k'wemɛ] | 'to sew' | [kwe] | 'box' | | |

(b)      [j] cannot be followed by [i], or [e], or [ɛ]

/ja/     [p'jam]     'cheek'        [kjarɨm]     'oval'
/jə/     [hjə]       'tongue'       [pjə]        'rice plant'
/ju/     [kurju]     'detention'    [kjul]       'orange'      [hjuka]      'leisure'
/jo/     [mjo]       'grave'        [pʰjo]       'ticket'

In (17), there are systematic constraints between the glide and the following vowel. In terms of elements, (17a) is characterised by the restriction on the presence of two contiguous U elements, since the labial glide and the following vowel both contain the element U. Likewise, (17b) is characterised as the restriction on the presence of two contiguous I elements, because the palatal glide and the following vowel both contain the element I (see (12a) for the vowel representations). As pointed out above, as in (15), however, both glides follow any consonant. These constraints suggest that a glide is part of a nuclear position rather than part of an onset.

Independent evidence that glides are part of the nucleus comes from the alternation between [r] and [l] (Kim & Kim 1991). In Korean, [r] occurs between two filled nuclei and [l] occurs elsewhere, as shown in (18).

(18)    [kul]         'cave          [kuri]        'nominative'
        [kulto]       'emphatic'     [kure]        'locative'

Consider compounds, where the first member ends in a liquid and the second begins with a glide.

(19)    [ir-joil]       *[iljoil]        'Sunday'
        [ser-ja]        *[selja]         'snow-night'
        [pʰar-wəl]      *[pʰarwel]       'August'
        [cʰir-wi]       *[cʰilwi]        '7ᵗʰ grade'

The fact that [r] occurs when the second member begining with a glide follows a liquid indicates that glides belong to the nucleus rather than to the onset.

In summary, we have examined four possible structures for the syllabification of CGV sequences in Korean. It was noted that the branching onset and nucleus analyses are ruled out because they violate distributional constraints on branching constituents. Furthermore, glide formation facts enable us to rule out the contour segment analysis in that it does not have any distributional constraints on the contour segment, which strongly suggests that the light diphthong analysis is correct. We will therefore adopt this in our analysis.

## 2.4. The structure of nuclei: the vowel length distinction

Traditionally, in 'standard' pronunciation of Korean, vowel length has been regarded as contrastive on the basis of minimal pairs such as the following:

(20)   Short vowel                    Long vowel
       [mal]        'horse'           [ma:l]        'speech'
       [nun]        'eye'             [nu:n]        'snow'
       [son]        'hand'            [so:n]        'offspring'
       [il]         'one'             [i:l]         'work'

At present, however, the vowel-length distinction is not perceived, among under 50s generation, including myself. For this generation, these minimal pairs are homophonous, i.e. all vowels are realised as short. Interestingly, the inconsistency is observed in vowel-length specifications, among Korean dictionaries (J.-W. Park 1994). This would imply that the vowel-length distinction is gradually disappearing in Modern Korean. In this thesis, I assume that the vowel-length distinction is not relevant and so only short vowels are lexically recognised.

Regarding the absence of the vowel-length distinction, I briefly discuss the treatment of irregular verbal conjugation. In the literature on irregular verbal conjugation (S.-C. Ahn 1985, K.-H. Kim 1987, H.-S. Sohn 1986, among others), it is assumed that the underlying length of stem-final vowels provides a criterion for distinguishing the regular from the irregular verbs, as shown below.

(21)

(a) p-regular verbs

| indicative /ta/ | conjunctive /ko/ | stative /a or ə/ | connective /mjə/ | |
|---|---|---|---|---|
| [ipt'a] | [ipk'o] | [ipə] | [ipɨmjə] | 'to wear' |
| [copt'a] | [copk'o] | [copa] | [copɨmjə] | 'narrow' |

(b) p-irregular verbs

| [to:pt'a] | [to:pk'o] | [towa] | [toumjə] | 'to help' |
|---|---|---|---|---|
| [tə:pt'a] | [tə:pk'o] | [təwə] | [təumjə] | 'hot' |

(c) t-regular verbs

| [tatt'a] | [tatk'o] | [tata] | [tatɨmjə] | 'to close' |
|---|---|---|---|---|
| [mutt'a] | [mutk'o] | [mutə] | [mutɨmjə] | 'to bury' |

(d) t-irregular verbs

| [kə:tt'a] | [kə:tk'o] | [kərə] | [kərɨmjə] | 'to walk' |
|---|---|---|---|---|
| [mu:tt'a] | [mu:tk'o] | [murə] | [murɨmjə] | 'to ask' |

Looking at the examples in (21), it is clear that the stem-final consonant of p- and t-regular verbs remain constant throughout the derivation. In contrast, p- and t-irregular verbs show consonant alternations between [p] and [w], and [t] and [r], respectively and the stem-final vowels are shortened.

However, as pointed by S.-G. Kim (1977), the occurrence of these consonant alternations is also observed when the stem-final vowel is short, e.g. [musəpta] and

[musəwə] 'fearful'; [puk'ɨrəpt'a] and [puk'ɨrəwə] 'shy'; [tɨtt'a] and [tɨrə] 'to hear'. The presence of these exceptions undermines the distinction between regular and irregular verbs on the basis of vowel-length.

Without the lexical vowel-length distinction, I argue that the stative and the connective forms of the irregular verbs are treated as lexicalised, in the sense that these forms are independently listed in the lexicon. The absence of the vowel-length distinction indicates that there are no branching nuclei in the syllable inventory of Korean.

## 2.5 Consonant Sequences in Korean

In this section, I consider morpheme-internal consonant sequences in Korean. My main purpose is to address the question of whether or not these sequences form genuine inter-constituent clusters. To put it another way, the discussion focuses on whether or not Korean has branching rhymes. Section 2.5.1 is devoted to an examination of sequences which are alleged as 'coda'-onset sequences and conclude that they are not genuine inter-constituent sequences, but rather 'fake' ones in which an empty nucleus intervenes between the two consonants in question. In 2.5.2, I discuss the distribution of liquids in Korean as additional evidence for this claim.

## 2.5.1 Does Korean have branching Rhymes?

The majority of phonologists (S.-C. Ahn 1985, H.-S. Sohn 1986, K.-H. Kim 1987, among others) would syllabify the word /pak'/ 'outside' as in (22).

```
(22)   O      R
       |      | \
       |      N  Co
       |      |   \
       x      x    x
       |      |    |
       p      a    k'           (Co: coda)
```

Analysed in this way, /pak'/ forms a 'closed syllable' with the final consonant /k'/ syllabified in the coda. The assumption that Korean is a so-called CVC-type language has been made on the basis not only of syllabic structure such as (22), but also because of the presence of morpheme-internal consonant clusters. The implication is that Korean has branching rhymes both morpheme-internally and morpheme-finally. In GP, however, the syllabification in (22) is untenable owing to the Coda Licensing Principle which dictates that a single domain-final consonant cannot occur in the 'coda'. Given the Coda Licensing and the Onset Licensing Principles, (23) is the only permissible syllabification of /pak'Ø/ (Ø: empty nucleus).

(23)    O    N    O    N
        |    |    |    |
        x    x    x    x
        |    |    |
        p    a    k'

The Coda Licensing Principle predicts that a morpheme-internal rhymal complement and a morpheme-final consonant will behave differently, precisely because they do not belong to the same constituent.[26] Kaye (1990) points out that the parameter regulating the presence of branching rhyme is unrelated to the occurrence of final consonants. In syllable typological terms, whether or not a language has internal branching rhymes is entirely independent of whether a language licenses final consonants (cf. the ECP in (11)). The two autonomous parameters give rise to the following possible combinations:

| (24)[27] | Licensing a final consonant NO | Licensing a final consonant YES |
|---|---|---|
| Internal branching rhymes NO | *CVCCV   *CVC# Vata, Desano, Zulu | *CVCCV    CVC# Krenak, Luo |
| Internal branching rhymes YES | CVCCV    *CVC# Italian | CVCCV    CVC# English, French, Dutch |

Which type does Korean belong to? Since it allows domain-final consonants, Korean must belong to the set of languages which licenses final empty nuclei. What about domain-internal branching rhymes? At first glance, it would appear that these exist in Korean. (25) sets out some relevant examples.

(25)    Liquid + C⁻  (C⁻: headed segment)

| | | | |
|---|---|---|---|
| [olp'ɛmi] | 'owl' | [k'alt'ɛki] | 'funnel' |
| [palk'ɨn] | 'with a burst' | [nals'in] | 'slender' |
| [kolc'aki] | 'valley' | [poltʰoŋ] | 'bumpy' |
| [talpʰɛŋi] | 'snail' | [kolcʰi] | 'headache' |
| [nalkʰarop] | 'sharp' | | |

These sequences do indeed satisfy the government requirements of an inter-constituent sequence and may therefore be like 'coda'-onset sequences, i.e. the

---

[26] The status of final consonants as codas has attracted the attention of many phonologists. According to Itô (1986), among others, a final consonant has 'extraprosodic' status, i.e. the syllabification of final consonants is postponed temporarily during the early stages of the derivation. At the post-lexical level, it receives syllabic interpretation. Furthermore, Harris (1992) notes three respects in which the behaviour of a final consonant differs from that of an internal rhymal complement:
(a)  extrametrical status in stress assignment
(b)  failure to trigger 'closed-syllable' shortening
(c)  contravention of general sonority sequencing constraints in the final consonant cluster
[27] The examples in (24) are provided by Kaye (p.c.) and Harris (1992 and p.c.).

headless [l] occupies the governed position followed' by the onset which contains the headed segment.  The presence of liquid + C⁻ sequences seems sufficient proof that Korean allows branching rhymes.

On the other hand, nasal + lenis obstruent (NC) sequences provide evidence that Korean does not have branching rhymes.  Generally speaking, languages which allow branching rhymes have constraints on nasals with following lenis obstruents: nasals in the 'coda' do not contain a place specification (Goldsmith 1990, among others).  In English, for instance, it is usually the case that such sequences are homorganic if the two consonants form a genuine cluster: e.g. ca[mp], fi[ŋger], te[nt].[28]  In the light of this, let us examine the distribution of NC sequences in Korean.  Here we find morpheme-internal heterorganic sequences, illustrated in (26).

(26)    Heterorganic sequences
        [tangol][29]       'customer'              [pənge]      'lightening'
        [nanboŋ]           'dissipation'           [anban]      'dough board'
        [simdɨrən]         'slowly moving'         [əmdu]       'daring'
        [kəmdʒən]          'black'                 [k'ɨmdʒik]   'awful'
        [əmsal]            'exaggeration of pain'  [kəmsil]     'moving indistinctly'
        [səmgi]            'to serve'              [imgɨm]      'king'
        [əŋdəɲi]           'hip'                   [təŋdal]     'following suit'
        [əŋsəŋ]            'loose'                 [caŋsɨŋ]     'totem pole'
        [toɲdʒa]           'cooking the rice'      [paŋdʒa]     'cursing'
        [caŋbu]            'shovel'                [toŋbɛ]      'dividing   duties   on
                                                                hunt'

The presence of these heterorganic sequences undermines the claim that Korean has branching rhymes.  They would need to be analysed as 'fake' sequences. For instance, the lexical representation of the word [pəngɛ] is depicted in (27).

(27)    O     N     O     N     O     N[30]
        |     |     |     |     |     |
        x     x     x     x     x     x
        |     |     |           |     |
        p     ə     n           k     ɛ

---

In the next section, I will examine the distribution of liquids and provide another piece of evidence that Korean has no branching rhymes.

## 2.5.2 The distribution of liquids in Korean

The distribution of liquids is entirely predictable in that [r] occurs between two filled nuclei and [l] occurs elsewhere. The complementary distribution of [l] and [r] indicates that we should take one of them to be the underlying segment. The relevant data are in (28). We can observe that the distribution of liquids is the same within a morpheme and under suffixation, as shown in (28a) and (28b) respectively.

(28)    (a) Within a morpheme
        (i) Between two filled nuclei
        [saram]        'human'        [siru]         'steamer'
        [sori]         'sound'        [suri]         'eagle'
        (ii) Before a consonant or final position
        [mals'əŋ]      'trouble'      [nals'in]      'slender'
        [silkɨməni]    'furtively'    [kolmu]        'thimble'
        [sal]          'flesh'        [mal]          'speech'
        [mil]          'wheat'        [tol]          'stone'
        (b) Under suffixation
                        conjunctive    stative        rational
        [pilta]        [pilko]        [pirə]         [pirəsə]       'to ask'
        [multa]        [mulko]        [murə]         [murəsə]       'to bite'

Let us firstly suppose that /l/ is the underlying segment. If so, we will need some process which changes /l/ to [r] in intervocalic position morpheme-internally and under suffixation. This would be a type of lenition where the element ʔ is delinked or uninterpreted. [31] However, whether or not this process is well-motivated is questionable. In terms of headship of elements, the question arises as to why this particular headless segment undergoes lenition in intervocalic position while other headless segments such as lenis obstruents and nasals do not. Alternatively, like the treatment of irregular verbal conjugation, all occurrences of the intervocalic [r] are

---

[31] There is a technical difference between delinking and non-interpretation. Delinking means that the element in question is completely deleted in lexical representations. The term *non-interpretation*, however, indicates that elements do not receive phonetic interpretation but they are present in lexical representations. In GP (Brockhaus 1995a), parentheses are used to represent uninterpreted elements, as shown below.
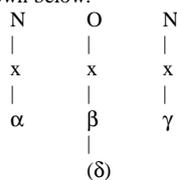
```
N       O       N
|       |       |
x       x       x
|       |       |
α       β       γ
        |
       (δ)                          (α, β, γ, δ: element)
```
See Chapter 3 for an analysis of neutralisation on this matter.

listed in the lexicon.  But, this alternative seems implausible, since the occurrence of [r] in this position is predictable.

Let us consider taking /r/ to be the underlying segment.  In this case, some process transforming /r/ to [l] is required.  Under the assumption that Korean has branching rhymes morpheme-internally, the process of /r/ to [l] before a consonant occurs in the rhymal complement position: e.g. /nars'inØ/ 'slender' [nals'in].  In this case, /r/ has to acquire the element ʔ in order to become [l] in the rhymal complement position.  However, the context in which this process would occur does not seem to warrant such a process, because the acquisition of the element ʔ would indicate that it is a process of fortition; yet the rhymal complement is traditionally assumed to be a position where lenition takes place.[32]  Thus, any attempt to analyse the process /r/-to-[l] as fortition in the rhymal complement position must be regarded with some scepticism.  All in all, the claim that Korean has branching rhymes seems undesirable.  An alternative view would be to treat internal consonant sequences as onset-onset, meditated by an empty nucleus, as in (29).

(29)   O     N     O     N     O     N     O     N
       |     |     |     |     |     |     |     |
       x     x     x     x     x     x     x     x
       |     |     |           |     |     |
       n     a     r           s'    i     n
                   ↓
                  [l]

This non-branching rhyme analysis results in an internal empty nucleus.  In (29), /r/ to [l] takes place before an empty nucleus, more specifically, a licensed empty nucleus.  As we will see Chapter 3, the constraint imposed on licensed empty nuclei can provide an adequate account of why /r/ becomes [l], i.e. licensed empty nuclei license only non-contour headless segments which contain the element ʔ.[33]  In other words, this process is subsumed under a more general licensing constraint on licensed empty nuclei in Korean.  The empirical consequence of this analysis is that the /l/-to-[r] process in intervocalic position is no longer present in Korean phonology.  Therefore, in terms of economy, this analysis is less costly than the proposal that /l/ is the underlying segment, because the latter analysis requires an independent process /l/-to-[r] in the grammar.

---

[32] Arbore and Spanish illustrate this point (cf. Harris, 1990, 1992).  In Arbore, the palatal stop becomes a palatal glide in the rhymal complement position, and in Spanish, the alveolar fricative becomes a glottal fricative in the same position.  In terms of elements, the former is characterised by the loss of H and ʔ, and the latter by the loss of R.

[33] Specifically, a licensed empty nucleus can license the following seven segments: [p, t, k, m, n, ŋ, l].  Segments other than these seven segments undergo 'neutralisation' to become one of these seven segments.

## 2.6. Summary and conclusion

In this chapter, I introduced some basic notions of GP, i.e. the notions of government and licensing and the segmental representations in terms of elements, and discussed the syllable structure of Korean. Due to the assumption that the vowel-length distinction is no longer lexical, there are no branching nuclei for long vowels. In 2.3 and 2.5, I argued that Korean has neither branching onsets nor branching rhymes. The existence of heterorganic nasal + obstruent sequences undermines the claim that Korean has branching rhymes. Furthermore, the distribution of liquids also indicates that the branching rhyme analysis is not plausible. I propose instead that such sequences should be analysed as two onsets with an intervening empty nucleus. In conclusion, I claim that Korean has only non-branching constituents, as in (30).

```
(30) ----  O    R    O    R    O    R   ---
           |    |    |    |    |    |
           |    N    |    N    |    N
           |    |    |    |    |    |
           x    x    x    x    x    x
```

In the remaining chapters, I will explore how empty nuclei are licensed in various circumstances, i.e. morpheme-internally, in suffixation and loanwords, in terms of the ECP and language-specific constraints. This government-based approach provides new perspectives in Korean phonology.

# Chapter 3

## Licensing empty nuclei:
## native mono-morphemic words[1]

In Chapter 2, I claimed that Korean syllable structure does not allow branching onsets, nuclei and rhymes. The consequence is that all surface internal consonant sequences are meditated by an empty nucleus. Also, it was noted that a single final consonant is syllabified as an onset followed by an empty nucleus, due to the effects of the Coda Licensing Principle and the Onset Licensing Principle. In this chapter, I explore how these empty nuclei are licensed in terms of the ECP. As briefly discussed in Chapter 2, the major mechanisms for licensing empty nuclei are domain-final licensing, proper government and inter-onset government. Domain-final licensing concerns domain-final empty nuclei (henceforth final empty nuclei). Proper and inter-onset government are involved in the licensing of domain-internal empty nuclei (henceforth internal empty nuclei). In this chapter, I will show that these three notions can interact to account for the phonetic realisation of the empty nuclei in question. In 3.1, I present an analysis of neutralisation which allows certain types of segments to occur before a final empty nucleus. Neutralisation is viewed as a licensing constraint imposed on a final empty nucleus. Section 3.2 concerns the licensing of internal empty nuclei with respect to proper and inter-onset government. Section 3.3 presents a discussion of licensing conditions on final and internal empty nuclei and attempts to unify these two into a single condition.

## 3.1. Licensing final empty nuclei: neutralisation

## 3.1.1. Data

There are three types of obstruents in Korean: lenis, tensed and aspirated. A look at the distribution of these obstruents reveals that all three types can occur in morpheme-initial and morpheme-internal, more precisely, inter-nuclear positions.

(1)  (a) Initial position

| [pal] | 'foot' | [p'allɛ] | 'laundry' | [pʰal] | 'arm' |
|-------|--------|----------|-----------|--------|-------|
| [tal] | 'moon' | [t'al] | 'daughter' | [tʰal] | 'mask' |
| [kɨn] | 'root' | [k'ɨn] | 'string' | [kʰɨn] | 'big' |

---

[1] Some aspects of the analysis in this chapter will be refined in the next chapter 4, by the postulation of *stem domains*. The scope of a stem-domain comprises a final consonant, excluding a final empty nucleus. As we will see later, the notion of stem domains does not invoke any inconsistency, in comparison with the analysis of the present chapter.

| [ca] | 'ruler' | [c'a] | 'salty' | [cʰa] | 'cold' |
|------|---------|-------|---------|-------|--------|
| [sal] | 'flesh' | [s'al] | [rice] | | |

(b) Internal position

| [təpurə] | 'together' | [ap'a] | 'daddy' | [kəpʰum] | 'bubble' |
|----------|-----------|--------|---------|----------|----------|
| [mati] | 'node' | [kat'ɨk] | 'full' | [pətʰi] | 'to resist' |
| [maku] | 'carelessly' | [kak'ap] | 'near' | [sikʰɨm] | 'sour' |
| [paci] | 'trousers' | [kac'a] | 'fake' | [k'acʰi] | 'magpie' |
| [iṣɨl] | 'dew' | [akas'i] | 'lady' | | |

In (1), all three types of obstruents may occur initially and intervocalically. However, only lenis stops can occur in final position or before another consonant, as shown in (2). (The symbol ˺ indicates an unreleased stop.)

(2)   (a)   Stem                    (b)   Stem + suffix (nominative)

|  | cip | [cip˺] | cip + i | [cipi] | 'house' |
|--|-----|--------|---------|--------|---------|
|  | mat | [mat˺] | mat + i | [maci] | 'eldest' |
|  | cucək | [cucək˺] | cucək + i | [cucəki] | 'ladle' |
|  | cipʰ | [cip˺] | cipʰ + i | [cipʰi] | 'straw' |
|  | mitʰ | [mit˺] | mitʰ + i | [micʰi] | 'bottom side' |
|  | puəkʰ | [puək˺] | puəkʰ + i | [puəkʰi] | 'kitchen' |
|  | picʰ | [pit˺] | picʰ + i | [picʰi] | 'light' |
|  | nac | [nat˺] | nac + i | [naci] | 'daytime' |
|  | pəs | [pət˺] | pəc + i | [pəsi] | 'friend' |

(c)   Stem + suffix (emphatic)

| cip + to | [cip˺t'o] |
|----------|-----------|
| cucək + to | [cucək˺t'o] |
| cipʰ + to | [cip˺t'o] |
| mitʰ + to | [mit˺t'o] |
| puəkʰ + to | [puək˺t'o] |
| picʰ + to | [pit˺t'o] |
| nac + to | [nat˺t'o] |
| pəs + to | [pət˺t'o] |

The data in (2b) demonstrate that the phonological distinction between the three types of obstruents is maintained when they are followed by the vowel-initial nominative suffix /i/. However, the distinction is not maintained in final position, as in (2a), nor in the context of the following consonant-initial suffix /to/, as in (2c). That is to say, the phonological opposition among obstruents is neutralised in final position or before another consonant, i.e. only a certain type of obstruent can occur, namely the lenis unreleased stop segments [p˺, t˺, k˺]. The segmental changes can be summarised as follows.

(3)    (a)    /p, p', p$^h$/              →        [p$^˺$]
       (b)    /t, t', t$^h$, s, s', c, c$^h$/    →        [t$^˺$]
       (c)    /k, k', k$^h$/             →        [k$^˺$]

The tensed and aspirated stops change into their lenis unreleased counterparts, while all of the non-stop obstruents are realised as the coronal stop [t$^˺$]. Traditionally, this phenomenon is called *obstruent neutralisation* or simply, *neutralisation* (Kim-Renaud 1974). I will use the term *neutralisation* throughout this thesis.

## 3.1.2 The analysis

In this section, I present a government-based analysis of neutralisation. Consider the following examples with tensed or aspirated obstruents.

(4)    Stem                                    Nominative /i/
       cip$^h$           [cip$^˺$]              [cip$^h$i]              'straw'
       mit$^h$           [mit$^˺$]              [mic$^h$i]             'bottom'
       puək$^h$          [puək]                [puək$^h$i]            'kitchen'
       pic$^h$           [pit]                 [pic$^h$i]             'light'
       pak'            [pak]                 [pak'i]               'outside'

In GP terms, neutralisation takes place before a final empty nucleus, as in (5).

(5) /cip$^h$Ø/   [cip$^˺$]

```
O     N1    O     N2
|     |     |     |
x     x     x     x
|     |     |
c     i     p$^h$
            ↓
            [p$^˺$]
```

Note that the stem final consonant /p$^h$/ is syllabified as an onset followed by an empty nucleus N2. In 'standard' syllabification, this segment would be syllabified as a coda. However, this syllabification is not possible in GP due to the Coda Licensing Principle and the Onset Licensing Principle, as discussed in Chapter 2. These two principles are repeated in (6).

(6)    (a)    Coda Licensing Principle
              A post-nuclear rhymal position must be licensed by a following onset.
       (b)    Onset Licensing Principle
              An onset head position must be licensed by a nuclear position.

These two principles determine the syllabification of a final consonant in an onset followed by a final empty nucleus. Regarding the interpretation of empty nuclei, the Empty Category Principle (ECP) is relevant (repeated in (7) from Chapter 2).

(7)          Empty Category Principle
     (a)     A licensed (empty) category receives no phonetic interpretation under the following circumstances:
     (i)     Domain-final (empty) categories are licensed (parameterised).
     (ii)    Properly governed (empty) nuclei are licensed.
     (iii)   A nucleus within an inter-onset domain
     (b)     Proper government
             $\alpha$ properly governs $\beta$ if:
     (i)     $\alpha$ and $\beta$ are adjacent on the relevant projection,
     (ii)    $\alpha$ is not itself licensed, and
     (iii)   No governing domain separates $\alpha$ from $\beta$.

As discussed in Chapter 2, with regard to (7ai), Korean chooses the parameter in which final empty nuclei are licensed: they are not phonetically realised. From the data in (4) and (5), we conclude that the context in which neutralisation occurs is before a final empty nucleus: tensed or aspirated obstruents do not occur in this position. In contrast, these segments can occur before an internal empty nucleus with phonetic content (i.e. unlicensed), as shown below.

(8)    [k'ak'ɨraki]          'bits of rice'          [təlkʰɨtək]          'click'
       [swet'ɨki]            'horse tail'            [kjac'ɨmak]          'slender'

In terms of licensing, neutralisation is analysed as a constraint imposed on a final empty nucleus which cannot license segments of a certain type. From the examples in (4), we observe that any tensed or aspirated obstruent undergoes neutralisation when they are followed by a final empty nucleus. Recall from Chapter 2 that all these segments are headed segments in terms of their element structure. This suggests that the following constraint governs neutralisation:

(9) Constraint on final empty nuclei (CFE)
    A final empty nucleus cannot license headed segments.

(9) amounts to a constraint barring segments before a final empty nucleus in Korean. If a final empty nucleus cannot license segments, one option is that the segments in question must become ones that it can license.[2] The question arises as to why there should be such a constraint on final empty nuclei at all. Incidently, Korean is not the only language to exhibit this phenomenon. For example, Turkish (Kaisse 1986), Mongolian (Hangin 1968), Dutch (Booij 1995), Polish (Rubach &

---

[2] The other option would be that final empty nuclei receive phonetic interpretation in order to license preceding onsets. This option is adopted in loanwords, as will see in 3.1.3 and Chapter 5.

Booij 1990), Georgian (Butskhrikidze 2002) and German (Brockhaus 1995a) are languages in which similar phenomena are observed before a final empty nucleus: voiced obstruents cannot occur in this position. In addition, non-coronals in Lardil (Kenstowicz & Kisseberth 1979) and non-nasals in Japanese (Yoshida 1991) are barred from occurring in the same position. The existence of CFEs in various languages indicates that there is a difference between unlicensed and licensed empty nuclei with respect to their ability to license the preceding onset. While any segment may occur before an unlicensed (empty) nucleus, only a limited set of segments may occur before a licensed one. As Harris (1992) and Brockhaus (1995a) put it, unlicensed nuclei have a much greater licensing ability. The weaker licensing ability of licensed empty nuclei affects the degree of segmental complexity of preceding onsets and may trigger segmental changes of the segments in question. That is to say, the presence of the CFEs is a reflection of their weakened or depleted licensing power.

With respect to segmental changes, neutralisation is the process by which headed segments become headless before a final empty nucleus. (10) represents the relevant segmental changes in terms of elements.

(10)    (a) aspirated obstruent

```
        pʰ  →     [pˀ]          tʰ  →     [tˀ]          kʰ  →     [kˀ]
        x         x             x         x             x         x
        | \       |             | \       |             | \       |
        U |       U             R |       R             ʔ |       ʔ
        | |       |             | |       |             | |       |
        ʔ |       ʔ             ʔ |       ʔ             H̲ /       (H)
        | |       |             | |       |
        H̲ /       (H)           H̲ /       (H)
        cʰ  →     [tˀ]
        x         x
        | \       |
        R I       R
        | |       |
        ʔ |       ʔ
        | |       |
        H̲ /       (I)
                  |
                  (H)
```

(b) tensed obstruent

    k' → [k˺]

    x      x

    |      |

    ʔ     ʔ

    |      |

    <u>H</u>    (H)

Thus, neutralisation is generally characterised as the loss of headship for headed segments, i.e. they become headless. In particular, contour segments such as aspirated consonants and affricates are realised as non-contour lenis stops. This indicates that final empty nuclei also cannot license contour segments.[3] Note that the outcomes contain the parenthesised element H. This notation is intended for representing an element which does not receive phonetic interpretation, but is still present in the segmental structure. In other words, the parenthesised elements are not totally delinked from the segmental structures.

The motivation of non-interpretation of the elements in question derives from the fact that the delinking analysis of the element H faces a serious technical problem. S.-J. Kim (1996) proposes that neutralisation is analysed as the delinking of the element H. The resulting segments contain place elements such as U and A,[4] and the element ʔ: the element H is absent from the segmental structures. As we will see below, however, the /r/ → [l] process is required before a final empty nucleus. In terms of elements within my proposal of segmental representations, this process is the addition of the element ʔ, i.e. /r/ contains the element R, and [l] contains the elements R and ʔ. As depicted in (10), after the application of neutralisation, the delinking analysis produces the same segmental structures of [l] and [t˺]: R and ʔ. However, in my analysis, this problem can be avoided because the representations of [t˺] and [l] are different: the former has three elements (R.ʔ.(H)) and the latter has two (R.ʔ).

The phonetic properties of the element H are determined by whether or not it contributes headship to a given segment. When it does, the phonetic interpretation is [stiff vocal cords] for tensed obstruents. If it is doubly-linked, the phonetic interpretation is [spread glottis] for aspirated obstruents. If not, i.e. for headless segments, it represents [noise burst] (John Harris p.c.). The non-interpretation of the element H after the application of neutralisation suggests that the resulting headless segments are realised without [noise burst], i.e. they become unreleased lenis stops: [p˺], [t˺] and [k˺].[5] The empirical consequence of the CFE in (9) is that a final licensed empty nucleus cannot license the element H together with headedness, with respect to stops.

---

[3] Also, note that one of the place elements, i.e. the element I, of the aspirated affricate is not interpreted. I will discuss the matter of the non-interpretation of the element I in the next section.

[4] Her segmental representations are based on Revised Theory of Element (RTE) in which the coronal element R is not present. For the motivation for retaining the element R, see Chapter 2.

[5] This phenomenon is analysed in terms of the feature [release] within rule-based frameworks, see C.-W. Kim (1970), Kim-Renaud (1974), K. Chung (1980), among others.

## 3.1.3 The headless segments

In the following examples, the stem-final consonant is a headless affricate /c/.

(11)   stem                nominative   accusative   emphatic
     /nacØ/ [natˀ]    [naci]       [nacɨl]      [natˀtʼo]      'daytime'
     /picØ/ [pitˀ]     [paci]       [picɨl]      [pitˀtʼo]      'debt'
     /cəcØ/ [cətˀ]     [cəci]       [cəcɨl]      [cətˀtʼo]      'breast'

Notice that /c/ becomes [tˀ] in isolation and in the emphatic forms[6], while stem-final /c/ is realised as it is in the nominative and accusative forms. Unlike the other headless segments listed in (4), stem-final /c/ is not licensed by the final empty nucleus: it is realised as [tˀ]. One piece of evidence for this is found in loanwords. Consider, for example, loanwords ending in a nasal:

(12)   [tɛm]                *dam*            [pʰen]                *pen*
     [kʰiŋ]               *king*

e.g.  [kʰiŋ] *king*
   O     N     O     N
   |     |     |     |
   x     x     x     x
   |     |     |
   kʰ    i     ŋ

The final empty nucleus in these examples remains uninterpreted, because nasals can be licensed by final empty nuclei, as happens in native Korean words, such as /pamØ/ [pam] 'night', /sinØ/ [sin] 'shoes', /kuməŋØ/ [kuməŋ] 'hole'.

What about loanwords which end in a plosive? Some of them have two possible phonetic forms, as shown in (13).

(13)   [hipˀ] or [hipʰɨ]        *hip*           [tʰeipˀ] or [tʰeipʰɨ]       *tape*
     [pɛtˀ] or [pɛtʰɨ]        *bat*           [netˀ] or [netʰɨ]          *net*
     [paikˀ] or [paikʰɨ]      *bike*          [kʰeikˀ] or [kʰeikʰɨ]      *cake*

---

[6] The emphatic suffix /to/ is an analytic suffix. Thus, when this suffix is added to a stem, as we will see in Chapter 4, the lexical representation is [[<stem> Ø] to]. Since the stem itself forms an internal domain, the stem-final consonant occurs before a final empty nucleus; the context in which neutralisation occurs. See Chapter 4 for a further analysis of the licensing of empty nuclei in suffixation.

e.g. [hip] or [hip$^h$ɨ]

```
O1   N1   O2   N2          O1   N1   O2   N2
 |    |    |    |           |    |    |    |
 x    x    x    x           x    x    x    x
 |    |    |    ↓           |    |    |    ↓
 h    i    p   [ø]          h    i   pʰ   [ɨ]
```

Notice that the final empty nucleus N2 is licensed when a plosive is realised as a lenis stop, but it is unlicensed when the plosive is manifested as an aspirated stop. In the latter case, the vowel [ɨ] emerges in final position. The interpretation of the final empty nucleus here is partially conditioned by constraint (9)[7]: final empty nuclei receive phonetic interpretation when they cannot license preceding onsets such as aspirated stops.

With this in mind, let us now consider English loanwords ending in a voiced coronal fricative /z/.

(14)   [cʰicɨ] *[cʰic]       *cheese*        [pʰɨricɨ] *[pʰɨric]      *freeze*
       [pʰjucɨ] *[pʰjuc]     *fuse*          [pʰoucɨ] *[pʰouc]       *pose*
       [kʰwicɨ] * [kʰwic]    *quiz*          [saicɨ] *[saic]         *size*

Recall from Chapter 1 that the voiced coronal fricative is transformed to [c] in Korean: e.g. [cum] *zoom*, [cero] *zero*. We see here that all final empty nuclei are interpreted when preceded by a lenis affricate [c], behaving in the same way as the final empty nuclei in (13) when preceded by a headed (i.e. aspirated) segment. The fact that the final empty nuclei in (14) are unlicensed indicates that the segment /c/ cannot be licensed by a final empty nucleus. What happens when this segment occurs before a final empty nucleus in native words? Precisely because Korean turns 'on' the domain-final licensing parameter, what is required is a change in the segmental structure of the preceding onset in order to be licensed by a final empty nucleus. Thus, /c/ becomes [t], as in (15).

```
(15)   /c/    →    [t]
        x           x
       / \          |
      ʔ   R         ʔ
          |         |
          I         R
          |         |
          H        (H)
                    |
                   (I)
```

---

This process can be characterised by non-interpretation of the elements H and I. The non-interpretation of H contributes unreleasedness in final position, and the non-interpretation of I contributes the loss of contour. The non-interpretation of the element I implies that final empty nuclei may not license two place elements simultaneously. The reason why the element I rather than R is not interpreted would be that the former is a secondary place element whereas the latter is not. The motivation for assuming that affricates contain the element I involves palatalisation under suffixation, as shown below.

(16)   /kut/ 'to solidify'          + /i/ 'adverbial suffix'     [kuci]
       /kat$^h$/ 'to be the same'    + /i/                       [kac$^h$i]

The palatalisation from /t/ to /c/ involves the spreading of I from the suffixal vowel /i/ to the preceding coronal plosive. It indicates that the element I is not a primary place element. The analysis of affricates with regard to neutralisation illustrates that the CFE in (9) requires revision to the extent that final empty nuclei can license neither headed nor contour segments.

However, there is another headless segment which final empty nuclei cannot license: the segment /s/. This segment becomes [t] before a final empty nucleus and occurs as it is in the nominative forms, as shown in (17).

(17)   /pəsØ/        [pət$^˺$]        /pəs/ + /i/     [pəsi]     'friend'
       /osØ/         [ot$^˺$]         /os/ + /i/      [osi]      'clothes'

As with the segment /c/, loanwords provide evidence that the final empty nucleus cannot license /s/.

(18)   [pəsɨ] *[pəs]     *bus*        [kasɨ] *[kas]       *gas*
       [cjusɨ] *[cjus]   *juice*      [masɨ] *[mas]       *mass*

In these examples, the final empty nuclei are interpreted. Now recall (12) and (13), which showed that final empty nuclei are licensed when preceded by headless segments like /m, n, ŋ, p, t, k/. Since the final empty nuclei in (18) receive interpretation, it is clear that /s/ cannot be licensed by final empty nuclei in native Korean words.

In terms of elements, this process can be expressed as the acquisition of the element ʔ, as in (19).

(19)    /s/          [tˀ]
        x            x
        |            |
        R            R
        |            |
        H           (H)
                     |
                     ʔ

Unlike other segments which undergo neutralisation, the question arises as to why /s/ should acquire the element ʔ before a final empty nucleus. Let us consider the structures of the six segments - /p, t, k, m, n, ŋ/ - that can be licensed by final empty nuclei.

(20)    p         t         k         m         n         ŋ
        x         x         x         x         x         x
        |         |         |         |         |         |
        U         R         ʔ         U         R         ʔ
        |         |         |         |         |         |
        ʔ         ʔ        (H)        ʔ         ʔ         L
        |         |                   |         |
       (H)       (H)                  L         L

   Notice that all of these segments contain the element ʔ, suggesting that final empty nuclei in Korean can only license headless segments which contain this element. To meet this constraint, /s/ will have to undergo a change in its segmental make-up, which consists of just R and H: in particular, /s/ acquires the element ʔ in order to become [tˀ], which can be licensed by a final empty nucleus.

   Finally, let us consider liquid-final words. As discussed in Chapter 2, the underlying segment of liquids is /r/. Since the segment /r/ contains the element R only, the final empty nucleus cannot license it, as in the case of /s/. In order for licensing to be possible, /r/ must acquire the element ʔ, and so is consequently realised as [l], as exemplified in (21).

(21)    /kirØ/        [kil]              /kir/ + /i/    [kiri]       'road'
        /torØ/        [tol]              /tor/ + /i/    [tori]       'stone'

     /r/          [l]
     x            x
     |            |
     R            R
                  |
                  ʔ

In summary, I have considered the headless segments which are not licensed by a final empty nucleus. Firstly, I claimed that in loanwords the segment /c/ cannot be licensed by a final empty nucleus since it is interpreted. In native words a segmental change to [t] is required so that the final empty nucleus can license it. Of the four elements which constitute /c/, the elements I and H do not receive phonetic interpretation due to the fact that the place element I is secondary and because unreleased segments are allowed before the final empty nucleus. Furthermore, I have considered two processes in which the element ʔ is acquired for the segments /r/ and /s/ to become [l] and [t], respectively. Motivation for these processes comes from the fact that final empty nuclei can only license headless segments containing the element ʔ.

## 3.1.4 The CFE in Korean and its implications

According to the analysis proposed in 3.1.3, final empty nuclei in Korean license neither the headless segments /c/ nor /s/ or /r/. This necessitates a revision of the constraint proposed in (9) in which final empty nuclei cannot license headed segments. This replaces (9) with (22).

(22)    Constraint on final empty nuclei in Korean (CFE)
        A final empty nucleus in Korean can only license non-contour headless unreleased segments which contain the element ʔ.

The term *non-contour segment*, effectively excludes /c/ from the list of the segments that a final empty nucleus can license and the term *unreleased* indicates the non-interpretation of the element H. Likewise, the phrase *segment which contain the element ʔ* excludes /s/ and /r/. This constraint induces a process of lenition for headed and contour segments where certain elements are not interpreted, and a process of fortition for the segments /s/ and /r/ to become [tʾ] and [l], respectively, by the acquisition of the element ʔ. As discussed in 3.1.2, the motivation for neutralisation is the weaker licensing capacity of final empty nuclei in comparison with unlicensed (empty) nuclei. The limited licensing ability of empty nuclei affects the degree of segmental complexity or headship of preceding onsets.

Regarding (22), neutralisation in Korean differs, in many respects, from *Final Obstruent Devoicing* (FOD) in languages such as German, Dutch, Mongolian etc. In terms of elements, FOD is characterised purely as lenition in which the voicing element L is either delinked or not interpreted phonetically. In contrast to FOD, however, neutralisation in Korean is viewed not as a single process, but as two: *decomposition* (loss of elements or lenition) and *composition* (addition of elements or fortition).[8] Decomposition occurs when a headed or contour segment precedes a

---

final empty nucleus, i.e. the change of headship for headed segments together with non-interpretation of certain elements of contour segments and the release element H. Composition takes place when a segment lacking ʔ precedes a final empty nucleus, i.e. /s/ and /r/ become [t] and [l], respectively. In other words, the CFE in (22) requires that any segment before final empty nuclei must contain at least a manner element such as ʔ. The fact that neutralisation is characterised by two opposite processes undermines an analysis in which neutralisation is related to the weaker licensing ability of final empty nuclei.

Other languages exhibit similar licensing constraints to the CFE in (22), e.g. some types of fricatives and/or affricates are disallowed before final empty nuclei. Certain South-East Asian languages, such as Cantonese (Silverman 1992), Thai (Moore & Rodchue 1994) and Sedang (Smith 1975), among others,[9] show that fricatives and/or affricates do not occur in final position. In Thai and Cantonese, only /p, t, k, n, m, ŋ, w, j/ can occur in this position. Fricatives (/s, f, h/), affricates (/c, cʰ/) and aspirated (/pʰ, tʰ, kʰ/) segments are not allowed to occur in Cantonese, and, the same types of segments are disallowed in Thai. In terms of elements, the CFEs in these languages also show that not only those segments lacking the element ʔ but also contour segments are not licensed by a final empty nucleus.

The fact that various segmental types may not occur in final position cross-linguistically suggests that there is no absolute measure of how complex onsets must be licensed by a final empty nucleus. Final empty nuclei in languages having FOD cannot license voiced obstruents; non-coronals in Lardil; non-velar nasals in Japanese. Thus, the degree of licensing ability of final empty nuclei has a language-specific basis.

Finally, I consider some previous approaches to neutralisation in Korean. Most analyses focus on the segmental changes of obstruents. In the SPE-type rule-based framework, Kim-Renaud (1974) proposes the feature [release] to capture neutralisation in terms of unreleasedness in final position. In the Feature Geometry framework (K.-H. Kim 1987 and H.-S. Sohn 1986, among others), the laryngeal features of aspirated and tensed stops, i.e. [constricted glottis] and [spread glottis] (Halle & Stevens 1971), are delinked to become a lenis stop. For non-stop obstruents, the feature [+continuant] in the manner node is delinked to become a coronal stop. S.-C. Rhee (1995) introduces the aperture feature (Steriade 1993) to account for the non-occurrence of aspirated and tensed stops, fricatives and affricates in the coda position. One advantage of his analysis is that unreleased stops and nasals are treated in the same way, i.e. both types contain Ao (Aperture Zero). However, what these analyses did not take into consideration is a liquid in this position. Generally, the liquid [l] has the feature [+continuant].[10] The delinking

---

we can achieve a coherent definition of lenition (weakening) and fortition (strengthening). For a detailed discussion, see Harris (1990).

[9] Also, some languages in India such as Thadou and Garo have a similar constraint on final consonants. See S.-C. Rhee (1995) for relevant data and references.

[10] van der Hulst & Ewen (2001: 12) point out that the lateral liquid can be treated as [-continuant] in some languages, due to the fact that this segment displays complete *central* closure, although there is a stricture of open approximation at the sides of the tongue. On this view, the lateral liquid can contain Ao in

analyses in Feature Geometry and the analysis in Aperture Geometry do not seem to express neutralisation, in terms of feature specifications, in a unified way.  The outcomes of neutralisation require two types of segments: one for [-continuant] for obstruents and the other for [+continuant] for liquids.

## 3.2. Licensing internal empty nuclei

As discussed in Chapter 1, a government-based analysis differs from mainstream analyses (S.-C. Ahn 1985, H.-S. Sohn 1986, among others) in that the occurrence of the vowel [ɨ] is treated as the phonetic interpretation of an empty nucleus when certain conditions are met.  In this section, I deal with the licensing conditions on internal empty nuclei in mono-morphemic words.  According to the ECP, there are three mechanisms for licensing empty nuclei: domain-final licensing, proper government and inter-onset government.  Korean uses all of these, if we are to account for the occurrence of the vowel [ɨ] in internal position.  In 3.2.1, drawing largely on Y. Heo's (1995) analysis, I briefly outline how proper and inter-onset government apply to the licensing of internal empty nuclei.  In 3.2.2, I discuss some problems of his analysis, in particular regarding empty nuclei intervening between two nasals (NN) and between a nasal and a lenis obstruent (NC).  I propose an alternative analysis invoking the Nasal Condition which applies to NN and NC clusters to account for the licensed status of empty nuclei.

### 3.2.1 Proper government and inter-onset government

In this section, I introduce Y. Heo's (1995) analysis of the licensing of internal empty nuclei.  Let us begin by considering how domain-final licensing and proper government account for the occurrence of the vowel [ɨ] in the following examples.

(23)    [katɨk]          'full'              [mɛtɨp]          'knot'
        [turɨp]          'aralia shoots'     [mosɨp]          'figure'
        [kjarɨm]         'oval'              [jərɨm]          'summer'
        [c'ac'ɨŋ]        'anger'             [kasɨm]          'breast'
        [onɨl]           'today'             [mantɨl]         'to make'
        [isɨl]           'dew'               [sik'ɨl]         'noisy'

Notice that the penultimate empty nuclei in (23) are interpreted as [ɨ] in every case.  This is due to the fact that final empty nuclei are licensed: they cannot act as proper governors for preceding empty nuclei.  Since the penultimate empty nuclei are not

---

Aperture Geometry, which can provide an adequate account to form a natural class with the nasals and unreleased stops in Korean.  However, with respect to tensification as we will see later, the nasals and the lenis obstruents forms a natural class in that they triggers tensification of a following suffix-initial obstruent, but the lateral liquid does not.  Hence the feature Ao itself does not appears to be appropriate to account for these two processes in a unified way.

properly governed, they must receive phonetic interpretation.  This is illustrated by
the word /katØkØ/ in (24).

(24) /katØkØ/  [katɨk]

```
                        ‖
                  ↓   ┌─────┐  ↑ proper government
         O    N    O    N    O    N
         |    |    |    |    |    |
         x    x    x    x    x    x
         |    |    |    ↓    |
         k    a    t   [ɨ]   k
```
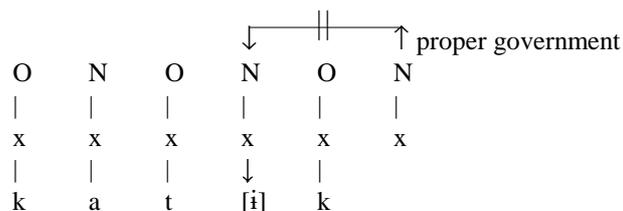
The notion of proper government also explains why internal empty nuclei do not
receive phonetic interpretation in other contexts.  Consider the following examples
in which the potential proper governor is unlicensed.

(25)   (a)   [mjəlcʰi]        ‘anchovy’        [əmpʰo]        ‘threat’
             [nakc’i]         ‘octopus’        [təlmi]        ‘nape’
       (b)   [pɛkc’əŋ]        ‘butcher’        [kompʰaŋ]      ‘must’
             [kult’uk]        ‘chimney’        [mals’əŋ]      ‘trouble’

The examples in (25) show that internal empty nuclei are not interpreted when they
are properly governed by a following nucleus.  In (25a), domain-final unlicensed
nuclei act as proper governors, while in (25b) antepenultimate empty nuclei are
licensed by the following unlicensed nucleus.  These two cases are illustrated in (26).

(26) (a) /nakØc’i/  [nakc’i]

```
                  ↓   ┌─────┐  ↑ proper government
         O    N    O    N    O    N
         |    |    |    |    |    |
         x    x    x    x    x    x
         |    |    |    ↓    |    |
         n    a    k   [ø]   c’   i
```

   (b) /pɛkØc’əŋØ/  [pɛkc’əŋ]

```
                  ↓   ┌─────┐  ↑            proper government
         O    N    O    N    O    N    O    N
         |    |    |    |    |    |    |    |
         x    x    x    x    x    x    x    x
         |    |    |    ↓    |    |    |
         p    ɛ    k   [ø]   c’   ə    ŋ
```
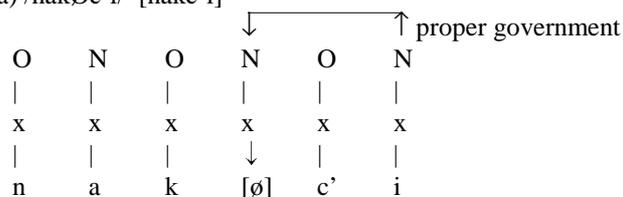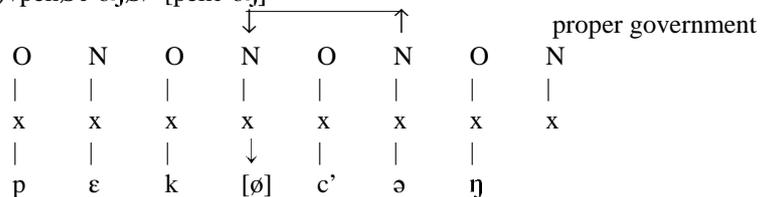
Let us consider some examples in which internal empty nuclei are properly
governed but also interpreted.

(27)  (a)   Headed segment + Ø + liquid + V
            /k'ak'Øraki/            [k'ak'ɨraki]            'bits of rice'
            /puk'Ø̲rəpØ/             [puk'ɨrəp]              'shy'
            /mik'Ø̲rəpØ/             [mik'ɨrəp]              'slick'
            /k'ØtʰØ̲rəki/            [k'ɨtʰɨrəki]            'piece'
      (b)   Nasal + Ø + liquid + V
            /omØri/                 [omɨri]                 'to shut'
            /kØrəmØro/              [kɨrəmɨro]              'therefore'
            /kənØri/                [kənɨri]                'to lead'
            /cinØrəmi/              [cinɨrəmi]              'fin'
      (c)   Lenis obstruent + Ø + liquid + V
            /kotØrØmØ/              [kotɨrɨm]               'icicle'
            /sikØrəci/              [sikɨrəci]              'to vanish'
            /tutØrəki/              [tutɨrəki]              'rash'
            /sinapØro/              [sinapɨro]              'gradually'

Notice that the underlined empty nuclei in these examples have a potential proper governor to their right.  Even though they may be properly governable, they are phonetically manifested.  Consider the word /kotØrØmØ/.

(28)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | ↓ | | ↑↓ ‖ ↑ | | : proper government |
| O1 | N1 | O2 | N2 | O3 | N3 | O4 | N4 |
| \| | \| | \| | \| | \| | \| | \| | \| |
| x | x | x | x | x | x | x | x |
| \| | \| | \| | ↓ | \| | ↓ | \| | |
| k | o | t | [ɨ] | r | [ɨ] | m | |

Here, we have three empty nuclei in succession.  Let us see how proper government applies in this structure.  The final empty nucleus N4 is licensed due to the effect of domain-final licensing.  It cannot be a proper governor for the penultimate empty nucleus N3, which therefore gets interpreted as the vowel [ɨ]. Since N3 is unlicensed, it can be a proper governor for the antepenultimate empty nucleus N2.  Because it is properly governed, we expect N2 to be licensed. However, the phonetic form [kotɨrɨm] (*[kotrɨm]) shows that it is interpreted.

   If we examine the distribution of the consonants which surround an N2-type nucleus in (28), we find that they involve sequences of obstruent/nasal + empty nucleus + liquid.  When the order of these sequences is reversed, i.e. liquid + empty nucleus + obstruent/nasal, the intervening empty nucleus is not interpreted.  This is shown by the following examples.

(29)   (a)   Liquid + Ø + headed segment + V

/kurØt'ukØ/              [kult'uk][11]            'chimney'
/ka'rØtɛ'k'i/            [k'alt'ɛki]             'funnel'
/marØs'əŋØ/             [mals'əŋ]               'trouble'
/sərØcʰi/               [səlcʰi]                'to run wild'
/karØkʰwi/              [kalkʰwi]               'rake'

(b)   Liquid + Ø + nasal + V

/s'ərØmɛ/               [s'əlmɛ]                'sledge'
/korØmokØ/              [kolmok]                'alleyway'
/tØrØməki/              [tɨlməki]               'to shake'
/karØmi/                [kalmi]                 'sea cucumber'

(c)   Liquid + Ø + lenis obstruent + V

/sarØkØnØ/              [salkɨn]                'with a rustle'
/t'ərØsɛ/               [t'əlsɛ]                'ornament'
/karØpi/                [kalpi]                 'rib'
/t'arØki/               [t'alki]                'strawberry'

In each of the cases in (29), an internal empty nucleus is properly governed by a following unlicensed nucleus, and is not interpreted. Aside from proper government, the main difference between (27) and (29) concerns the distribution of the consonants surrounding the internal empty nucleus. If an empty nucleus intervenes between a liquid and an obstruent or nasal, it is licensed by proper government. But if the order is reversed, an intervening empty nucleus is interpreted in spite of being properly governed, as shown below.

(30)   (a) Obstruent or nasal  + Ø + liquid + V

```
        ┌────────────┐ proper government
        ↓            ↑
   O1   N1   O2   N2
   |    |    |    |
   x    x    x    x
   |    ↓    |    |
   C   [ɨ]   L    V
```

(b) Liquid + Ø + obstruent or nasal + V

```
        ┌────────────┐ proper government
        ↓            ↑
   O1   N1   O2   N2
   |    |    |    |
   x    x    x    x
   |    ↓    |    |
   L   [ø]   C    V     (C: obstruent or nasal, L: liquid)
```

This suggests that not only proper government but also the distribution of the surrounding consonants affect licensing conditions and hence the interpretation of internal empty nuclei in Korean.

---

[11] I will deal with the process of /r/ changing to [l] in section 3.3.

On the basis of (30), Y. Heo (1995) proposed an additional notion for the licensing of internal empty nuclei, i.e. inter-onset government.   Inter-onset government requires a governing relation between two onsets in order to determine the phonetic interpretation of an intervening empty nuclei.  Recall from Chapter 2 that governing properties of consonants are determined by the internal structure of segments associated to the skeletal points.  It is assumed that headed segments are superior to headless segments in a governing relation.  Among headless segments, the governor must be at least equally complex in comparison with its governee. This is expressed by the Complexity Condition (Harris 1990).

(31) Complexity Condition
    Let $\alpha$ and $\beta$ be segments occupying the positions A and B respectively.  Then, if A governs B, $\beta$ must be no more complex than $\alpha$.

The complexity of a segment is calculated in terms of the number of elements of which a segment is composed.  Therefore, the liquid /r/, containing a single element R, is likely to be a governee, whereas nasals and obstruents are likely to be governors since they contain more than one element.

    Bearing this in mind, consider (30) again.  If we establish a governing relation between two onsets, i.e. O1 and O2, and its direction is head-final, then we can account for the phonetic interpretation of the intervening empty nucleus N1.  That is, when O2 governs O1 and the intervening empty nucleus N1 is properly governed, then N1 is licensed.  If not, it receives phonetic interpretation.  Y. Heo (1995: 125) formulated the following licensing conditions and the segmental governing hierarchy.

(32) (a) Licensing Condition for Internal Empty Nuclei

```
              ↓_____↑         proper government
  X     O1    N1    O2    N2    Y
        |     |     |     |
        x     x     x     x
        |           |     |
        α           β     V
        ↑_____↓          inter-onset government
```
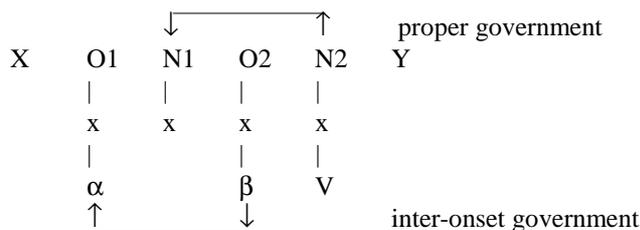
    N1 is licensed iff
    (i) it is properly governed
    (ii) O2 governs O1

    (b) Governing Hierarchy
    liquid < lenis obstruent < nasal < aspirated or tensed obstruent[12]

---

[12] This governing hierarchy is based upon Charm Theory (KLV 1985).  According to Y. Heo (1995), nasals are composed of 4 elements and lenis obstruents are composed of 2 to 4 elements.  His formulation

(32) states that an internal empty nuclei is licensed iff it is properly governed by a following nucleus, and inter-onset government is established between two consonants which surround it. If either of the two requirements is not satisfied, the internal empty nuclei are interpreted. Regarding the relation of proper and inter-onset government, inter-onset government applies only to a properly governable empty nucleus. That is, inter-onset government need not apply to an empty nucleus which fails to be properly governed. However, a properly governable empty nucleus receives phonetic interpretation when inter-onset government is not established, i.e. "the failure of inter-onset government blocks proper government" (Y. Heo 1995: 125). This indicates that proper government is no more than a necessary condition. Inter-onset government is required to license an empty nucleus in a given context.

Let us now consider how a combination of proper government and inter-onset government accounts for intervening empty nuclei in other sequences. Consider empty nuclei before a headed segment.

(33)  (a)  Lenis stop + Ø + headed segment + V

| | | |
|---|---|---|
| /sɛkØs'i/ | [sɛks'i] | 'lady' |
| /akØcʰakØ/ | [akcʰak] | 'toughness' |
| /kapØc'aki/ | [kapc'aki] | 'suddenly' |
| /nØkt'ɛ/ | [nikt'ɛ] | 'wolf' |
| /kakØt'ki/ | [kakt'uki] | 'pickled radish' |

　　(b)  Nasal + Ø + headed segment + V

| | | |
|---|---|---|
| /toŋØcʰimi/ | [toŋcʰimi] | 'pickled cabbage' |
| /maŋØk'oŋi/ | [mɛŋk'oŋi] | 'fool' |
| /pənØcʰəkØ/ | [pəncʰək] | 'sparkling' |
| /onØtʰoŋØ/ | [ontʰoŋ] | 'whole' |
| /əmØpʰo/ | [əmpʰo] | 'threatening' |
| /kəmØcʰi/ | [kɛmcʰi] | 'to attach' |

These examples confirm that a properly governable empty nucleus does not receive phonetic interpretation if the consonants surrounding it form an inter-onset governing domain: a headed segment governs a headless segment.

Next, consider an internal empty nucleus before a nasal.

(34)  (a)  Nasal + Ø + nasal + V

| | | |
|---|---|---|
| /kənØnə/ | [kənnə] | 'to cross' |
| /ənØni/ | [ənni] | 'sister' |
| /simØmani/ | [simmani] | 'ginseng-digger' |
| /amØmanØ/ | [amman] | 'a certain amount' |
| /kumØnirØ/ | [kumnil] | 'to stretch up' |
| /k'amØnaŋØ/ | [k'amnaŋ] | 'ability' |

is due to a literal interpretation of the Complexity Condition, and hence nasals are higher ranked than lenis obstruents.

|  |  |  |
|---|---|---|
| /paŋØmaɲi/ | [paŋmaɲi] | 'club' |
| /əŋØmaŋØ/ | [əŋmaŋ] | 'mess' |
| /maŋØnani/ | [maŋnani] | 'wretch' |
| /səŋØnjaŋØ/ | [səŋnjaŋ] | 'match' |

(b)   Lenis stop + Ø + nasal + V

|  |  |  |
|---|---|---|
| /nakØne/ | [nakɨne] | 'stranger' |
| /sikØmØcʰi/ | [sikɨmcʰi] | 'spinach' |
| /sØrØkØməni/ | [sɨlkɨməni] | 'secretly' |
| /totØmi/ | [totɨmi] | 'sieve' |

An intervening empty nucleus is licensed between two nasals in (34a), but it is unlicensed between a lenis stop and a nasal in (34b).  By adopting the Complexity Condition in (31) and proposing the governing hierarchy in (32b), Heo claimed that the empty nucleus intervening between two nasals is licensed due to the fact that the Complexity Condition allows a segment to govern another one when both contain the same number of elements.  However, the examples in (34b) are problematic in Heo's account, because nasals can govern lenis obstruents and so the intervening empty nuclei are expected to be licensed, as shown below.

(35) /nakØne/  [nakɨne]  *[nakne]

```
                              ↑proper government
                 ↓
   O1   N1   O2   N2   O3   N3
   |    |    |    |    |    |
   x    x    x    x    x    x
   |    |    |    ↓    |    |
   n    a    k   [ɨ]   n    e
                 ↑_____↓ inter-onset government
```
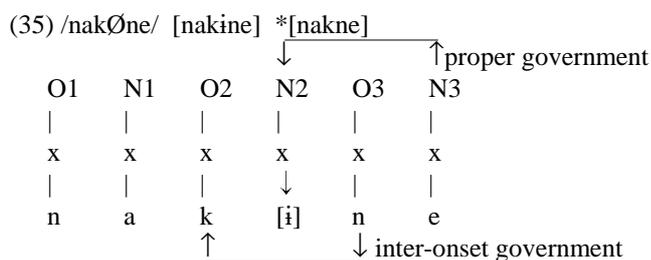
For this problem, Y. Heo (1995: 140-141) proposes the following distributional constraint on lenis obstruents.

Note that Korean cannot have C°C° clusters [C°: headless segment, SJR], where C° is a neutral [headless, SJR] segment.  It appears that neutral stops cannot have just any neutral governor but require a governor to be negatively charmed [headed, SJR].

This distributional constraint may account for the phonetic interpretation of the empty nucleus N2 in (35), i.e. no inter-onset governing relation can be established between O2 and O3.  However, the governing hierarchy and the adoption of the Complexity Condition are unable to avoid further problems in cases where empty nuclei occur before a lenis obstruent, as shown below.

(36)   (a)   Nasal + Ø + lenis obstruent + V

|  |  |  |
|---|---|---|
| /soŋØkosØ/ | [soŋgot] | 'gimlet' |
| /toŋØpɛ/ | [toŋbɛ] | 'dividing' |

|           | /caŋØtori/       | [caŋdori]    | 'hammer'       |
|-----------|------------------|--------------|----------------|
|           | /simØpurØmØ/     | [simburɨm]   | 'errand'       |
|           | /namØcisØ/       | [namdʒit]    | 'a bit over'   |
|           | /kəmØtɛŋØ/       | [kəmdɛŋ]     | 'soot'         |
|           | /muntØkØ/        | [mundɨk]     | 'suddenly'     |
|           | /tanØkorØ/       | [tangol]     | 'customer'     |
|           | /manØpo/         | [manbo]      | 'job chit'     |
| (b)       | Lenis stop + Ø + lenis obstruent + V |       |                |
|           | /cikØsi/         | [cikɨsi]     | 'patiently'    |
|           | /potØki/         | [potɨki]     | 'dwarfed tree' |
|           | /panØtØsi/       | [pandɨsi]    | 'certainly'    |
|           | /muŋØkØcəkØ/     | [muŋgɨcək]   | 'linger'       |

The intervening empty nucleus is licensed between a nasal and a lenis obstruent in (36a), but not between two lenis obstruents in (36b). The distributional constraint on lenis obstruents is responsible for phonetic interpretation of the intervening empty nuclei in (36b), because lenis obstruents require headed segments for a governor.

However, the examples in (36a) are problematic in Heo's analysis. According to the governing hierarchy in (32b), lenis obstruents cannot govern nasals. Therefore, the intervening empty nucleus should receive phonetic interpretation, as shown below.

(37) /munØtØkØ/ [mundɨk] *[munɨtɨk]
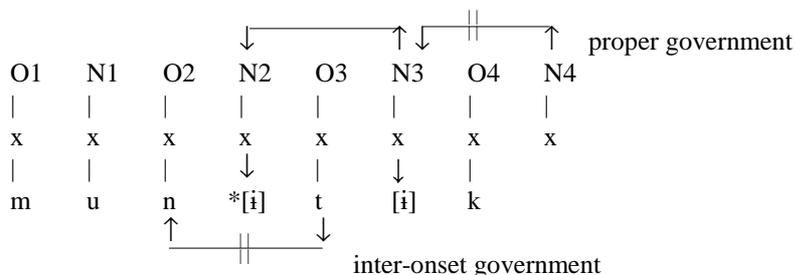


To account for fact that the empty nucleus N2 in (37) is not phonetically interpreted, Heo proposes that the lenis obstruent /t/ undergoes post-nasal voicing to fulfil the requirements of inter-onset government, instead of phonetic interpretation of N2. The result of post-nasal voicing is [d], which acquires the voicing element L from the neighbouring nasal in O2.[13] Since voiced obstruents are headed, they can govern

---

[13] In Heo's analysis, the segmental representations of nasals are as follows.

/n/ (R.L.ʔ.N); /m/ (U.L.ʔ.N); /ŋ/ (v°.L.ʔ.N)

(N: nasal, v°: cold element (KLV 1985, Harris 1990)).

headless nasals. [14]    Accordingly, the requirements of proper and inter-onset government are satisfied and so the empty nucleus N2 is licensed, as shown below.

(38) /munØtØkØ/  [mundɨk]  *[munɨtɨk]
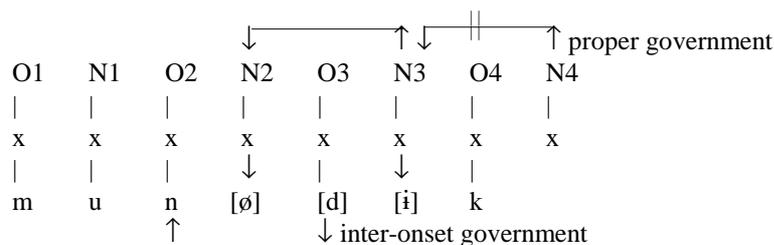


Thus far, I have outlined Heo's analysis of the licensing conditions on internal empty nuclei based upon the ECP, i.e. domain-final licensing, proper government and inter-onset government.    As we have seen above, however, there are problematic cases in which the governing hierarchy may not provide an appropriate account of the phonetic interpretation of empty nuclei with respect to nasals and lenis obstruents.  Consider the following table listing the distribution of the vowel [ɨ] between two consonants, repeated from Chapter 1.

(39) The occurrence of morpheme-internal [ɨ] between two consonants (in the context of C1ØC2V)

| C1 \ C2 | liquid | nasal | lenis obstruent | tensed or aspirated |
|---|---|---|---|---|
| liquid | Ø | Ø | Ø | Ø |
| nasal | ɨ | Ø | *Ø | Ø |
| lenis stop[15] | ɨ | *ɨ | *ɨ | Ø |
| tensed or aspirated | ɨ | ɨ | ɨ | ɨ |

(Ø: absence; ɨ: presence)

The sequences marked by * are problematic in Heo's analysis.  These sequences involve nasals and lenis obstruents.  The following questions arise from Heo's analysis.

(40)    (a) Why is an intervening empty nucleus licensed between two nasals, but not between two lenis obstruents?
        (b) Why is an intervening empty nucleus not licensed between a lenis stop and a nasal despite the fact that nasals are higher in the governing hierarchy than lenis stops?

---

[14] Within Charm Theory (KLV 1985), voiced obstruents containing the element L are negatively charmed. Hence voiced segments can govern neutral segments such as nasals, liquids and neutral obstruents.
[15] The occurrence of lenis stops in a C1 position will be dealt with in section 3.3.

(c) Why is an intervening empty nucleus licensed between a nasal and a lenis stop by virtue of post-nasal voicing rather than phonetic interpretation taking place?

In fact, these problematic sequences may be due to the governing hierarchy and the adoption of a weaker version of the Complexity Condition, as Y. Heo (1995: 141) points out:

> The property of a neutral [headless: SJR] stop (or neutral obstruents in the general sense) is different from that of other segments such as liquids and nasals, which tolerate equal complexity for governor and governee. The Complexity Condition proposed by Harris (1990) can account for the latter case, but not for the former. The first version of the Complexity Condition, proposed by KLV (1990: 218), which states that a neutral segment may govern if it has a complexity greater than its governee, may account for the property of neutral stops, but it cannot solve the cases of liquids and nasals. We cannot help but admit at present that neutral obstruents cannot have a neutral governor.

In the following three sections, I seek answers to the questions raised by Heo's analysis and reconsider how proper government interacts with inter-onset government, regarding the licensing of internal empty nuclei. On the basis of an alternative proposal, I present a revised analysis of these problematic sequences by proposing the Nasal Condition and its extensive application to sequences of NC in which an empty nucleus intervenes.

## 3.2.2. An alternative analysis: interactions between inter-onset and proper government

Consider again Heo's proposal of the Licensing Conditions for Internal Empty Nuclei in (32), as shown below.

(41) Licensing Condition for Internal Empty Nuclei

```
                ↓           ↑        proper government
    X     O1    N1    O2    N2    Y
          |     |     |     |
          x     x     x     x
          |           |     |
          α           β     V
          ↑           ↓        inter-onset government
```
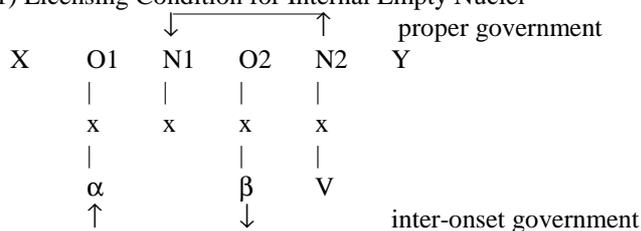
N1 is licensed iff
    (i) it is properly governed
    (ii) O2 governs O1

The main point of his licensing condition is that the failure of inter-onset government blocks proper government, i.e. proper government is a necessary condition and inter-onset government is a sufficient one. Only properly governable empty nuclei are subject to inter-onset government. Whenever the requirements of inter-onset government are not met, a properly governable empty nucleus always receives phonetic interpretation, i.e. inter-onset government overrides proper government. In this sense, the application of proper government is redundant once inter-onset government fails to be established. This redundancy is also found in cases in which both types of government hold.

(42)
```
                   _____
            ↓              ↑ proper government
  X    O1   N1   O2   N2    Y
       |    |    |    |
       x    x    x ⇐⇐ x
       |    ↓    |    |
       α   [ø]   β    V
       ↑_____↓ inter-onset government
```
                              (⇐⇐: government-licensing)
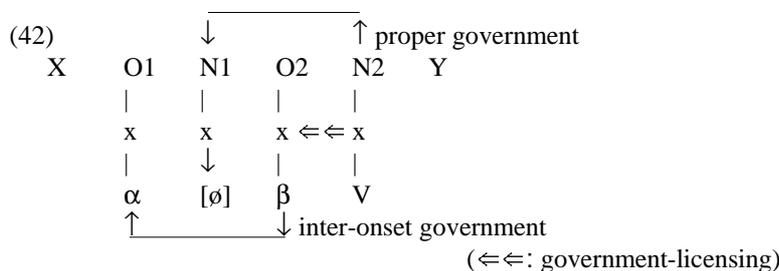
The unlicensed nucleus N2 in (42) has two functions: it is a government-licenser of O2 and a proper governor of N1. The definition of government-licensing is as follows.

(43) Government-licensing

For a governing relation to hold between a non-nuclear head α and its complement β, α must be government-licensed by its nucleus

(Charette 1991: 101)

Government-licensing states that an onset head (either coda-onset or branching onset clusters) should be licensed by a following nucleus in order to govern its complement. This nucleus is called a *government-licenser*. The notion of government-licensing is designed for empty nuclei which are properly governable but they are interpreted phonetically when they follow a well-formed consonant cluster. For instance, consider the French words *souvenir* 'to remember' and *parvenir* 'to reach'. The lexical representations of these words are shown below.

(44) (a) /suvØnirØ/ [suvnir]
```
                      _____
            ↓                  ↑        proper government
  O1   N1   O2   N2   O3   N3   O4   N4
  |    |    |    |    |    |    |    |
  x    x    x    x    x    x    x    x
  |    |    |    ↓    |    |    |
  s    u    v   [ø]   n    i    r
```

(b) /parvØnirØ/  [parvənir]

```
                              ↓              ↑         proper government
   O1    R1      O2    R      O3    R      O4    R
   |     |       |     |      |     |      |     |
   |     N\      |     N2     |     N3     |     N4
   |     |  \    |     |      |     |      |     |
   x     x   x   x ⇐⇐ x      x     x      x     x
   |     |   |   |     ↓      |     |      |
   p     a   r   v    [ə]     n     i      r
                 ↑     ↓
```
                inter-constituent government

In (44b), the empty nucleus N2 is preceded by an obstruent which governs the preceding liquid.  The situation is different in *souvenir* in that the empty nucleus is preceded by a consonant which is not a governor, as in (44a).  The phonetic interpretation of N2 in (44b) is due to governing-licensing, i.e. the government-licenser of an onset is a nucleus which should not be  properly governed (Charette 1991: 102).[16]  In other words, in French, a non-nuclear head requires an unlicensed (empty) nucleus in order to govern its complement.  Then, the requirements of government-licensing are the governing property of an onset head and a following unlicensed (empty) nucleus.

Given the notion of government-licensing, the configuration in (42) is parallel to French, as in (44), precisely because the consonant sequence holding inter-onset government requires a government-licenser which is unlicensed.  Accordingly, the presence of the government-licenser N2 in (42) would be both necessary and sufficient to account for licensing the empty nucleus N1, since proper government alone is not enough to determine the licensed status of N1.  This implies that the role of the proper governor is redundant.  Independently, H.-J. Lee (1999) reaches the same conclusion that an N2-type government-licenser in (42) does not function as a proper governor.  Her argument is based upon the revised definition of proper government in the ECP.

(45) Proper government
    A nucleus $\alpha$ properly governs an empty nucleus $\beta$ iff:
    (a) $\alpha$ and $\beta$ are adjacent on the nuclear projection
    (b) $\alpha$ is not itself licensed
    (c) $\alpha$ is not a government-licenser (for its onset)

                                                    (Charette 1998)

---

[16] There is another possibility available theoretically.  That is, the nucleus remains licensed resulting in the impossibility for the non-nuclear head to govern its complement, yielding deletion of a consonant. This is observed in internal empty nuclei of the Billiri dialect of Tangale (Charette 1990, 1991).  Also, regarding government-licensing, it is noted that there is a difference between internal and final empty nuclei.  In French, Polish and English, among others, licensed final empty nuclei can act as a government-licenser.  However, in Wolof (Charette 1991) and Korean (Y. Heo 1995), this is not the case.  See Chapter 5 for a detailed discussion of this issue.

Note that (45c) effectively eliminates redundancies. A remaining question concerns the role of an N2-type nucleus in (42) which is not a government-licenser: does it act as a proper governor? The answer would be negative, since a preceding empty nucleus is properly governable. Nonetheless it receives phonetic interpretation due to the failure of inter-onset government, i.e. a governing onset does not contain appropriate governing properties. Does this imply that proper government does not play any role at all in Korean? In fact, proper government is required for cases in which no inter-onset governing relations are established. There are many onset-less 'mono-syllabic' Sino-Korean morphemes, e.g. /ØpØ/ [ɨp] 'town', /ØmØ/ [ɨm] 'to drink' and /ØnØ/ [ɨn] 'silver', among others.[17] The phonetic interpretation of initial empty nuclei in these examples is due to the failure of proper government, as shown below.

(46) /ØnØ/ [ɨn] 'silver'

```
            ┌──────┰──────┐
            ↓      ┃      ↑  proper government
    O       N      O      N
            │      │      │
            x      x      x
            ↓      │
           [ɨ]     n
```
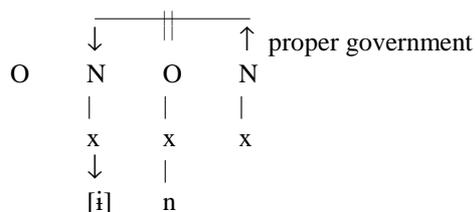
These examples provide positive evidence that proper government is needed to account for the licensing of empty nuclei. In fact, the contexts in which these two governments apply are complementarily distributed. Inter-onset government applies in contexts in which potential inter-onset governing relations are taken into account, i.e. the presence/absence of government-licensers, the qualities of governing onsets determined by a revised governing hierarchy in the next section and the Complexity Condition. Elsewhere, proper government is active in the licensing of empty nuclei. These two mechanisms work independently. This independent effect follows from the fact that proper governing relations are established at the level of nuclear projection and inter-onset governing relations at the level of onset projection. The revised condition of licensing internal empty nuclei is as follows.

---

[17] In Heo's analysis, these examples are dealt with as initial empty nuclei which require a special treatment: properly governable initial empty nuclei are immune to proper government. This analysis, however, misses the generalisation that these examples can be accounted for by either the failure of proper government or the failure of inter-onset government. I will discuss this issue in more detail in section 3.3.

(47) Licensing condition of internal empty nuclei
       An internal empty nucleus is licensed iff:
       (a) The following inter-onset requirements are satisfied
            (i) An unlicensed government-licenser must be present
            (ii) A governing onset (head-final) must have relevant governing properties
       Elsewhere,
       (b) An unlicensed proper governor must be present

In the next section, I will deal with problematic cases for Heo's analysis and propose a revised analysis.

## 3.2.3 The treatment of NN sequences

The most crucial problem of Heo's analysis involves sequences of two nasals separated by an empty nucleus. His governing hierarchy and the Complexity Condition account for the licensed status of the intervening empty nucleus of these sequences morpheme-internally as in (34a), but, as pointed out in Chapter 1, the vowel [ɨ] emerges between two nasals under suffixation, as shown below.

(48)    Stem           Connective /mjə/      Effective /ni/
        /tətØmØ/        [tətɨmɨmjə]           [tətɨmɨni]          'to grope'
        /anØ/           [anɨmjə]              [anɨni]             'to hug'

According to Heo's analysis, connective and effective suffixation are both non-analytic. In other words, these examples are treated as morphologically simplex forms (see section 2.1.4 for analytic and non-analytic suffixation and Chapter 4). Thus, the lexical representations of these examples contain a single domain. Consider the connective and the effective forms of /tətØmØ/ 'to grope'.

(49)    (a) Connective form
        O1    N1    O2    N2    O3    N3    O4    N4
        |     |     |     |     |     |     |     |
        x     x     x     x     x     x     x⇐⇐ x
        |     |     |     ↓     |     ↓     |   | \
        t     ə     t     [ɨ]   m     [ɨ]   m   j ə
                                ↑_____↓         inter-onset government

        (b) Effective form
        O1    N1    O2    N2    O3    N3    O4    N4
        |     |     |     |     |     |     |     |
        x     x     x     x     x     x     x⇐⇐ x
        |     |     |     ↓     |     ↓     |     |
        t     ə     t     [ɨ]   m     [ɨ]   n     i
                                ↑_____↓         inter-onset government
                                            (⇐⇐: government-licensing)

Since the lexical representations are the same as those of mono-morphemic words, we expect N3 in (49a, b) to be licensed due to the fact that segments of the same complexity can govern each other within Heo's analysis. However, the phonetic forms [tətɨmɨmjə] and [tətɨmini] show that it is not licensed. This asymmetrical distribution of the vowel [ɨ] occurring between two nasals is not captured in his analysis. In fact, Y. Heo (1995: 225) notes this problem, leaving "this issue as an open question".

I argue that the problematic cases discussed in the previous section and (49) are due to an inadequacy of the governing hierarchy. Based upon the Revised Theory of Elements, I propose an alternative governing hierarchy.

(50)    Revised Governing Hierarchy[18]
(a)     liquid < nasal, lenis obstruent < tensed or aspirated obstruent
              headless                          headed
(b)     mutual government is not allowed for segments in the same rank.

This governing hierarchy is the same as that of Heo in that liquids are lowest and tensed or aspirated obstruents are highest in the hierarchy, but differs in that nasals and lenis obstruents are equally ranked and mutual government is not allowed for segments in the same rank. In other words, a lenis obstruent cannot govern another lenis obstruent or a nasal, and a nasal cannot govern another nasal or a lenis obstruent. Accordingly, nasals also require a headed segment as a governor in inter-onset governing relations. Evidence for this comes from tensification in verbal conjugation. Consider the following declarative forms. The declarative suffix is /ta/.

(51)    (a)    Liquid-final or vowel-final stem
               /narØ/                 [nalta]              'to fly'
               /ka/                   [kata]               'to go'
        (b)    Lenis obstruent-final stem
               /capØ/                 [capt'a]             'to hold'
               /tatØ/                 [tatt'a]             'to close'
               /məkØ/                 [məkt'a]             'to eat'
        (c)    Nasal-final stem
               /anØ/                  [ant'a]              'to hug'
               /namØ/                 [namt'a]             'to remain'

In the indicative form of a liquid-final stem, there is no tensification. However, in a lenis obstruent-final stem, the suffix-initial /t/ undergoes tensification. As we will see Chapter 4, the motivation of tensification in the declarative forms can be found in the requirements of inter-onset government: the suffix-initial /t/ is tensified

---

[18] This hierarchy is different from that of S.J. Kim (1996) in which lenis obstruents are higher than nasals in the hierarchy. Given her hierarchy, a problem arises in the cases where an empty nucleus between two lenis obstruents receives phonetic interpretation, because the Complexity Condition allows segments to govern each other in the same rank. Like Heo's analysis, she relies on the distributional constraint on lenis obstruents, which requires a headed governor for lenis obstruents.

in order to govern a stem-final lenis obstruent. Note that tensification occurs in nasal-final stems. It indicates that nasals are also governed by only a headed segment.

On the basis of this hierarchy and the revised licensing conditions in (47), let us reconsider sequences of two lenis obstruents intervened by an empty nucleus and those of lenis stop + empty nucleus + nasal. The relevant examples are repeated from (36b) and (34b), respectively.

(52)  (a)   Lenis stop + Ø lenis obstruent + V
            /cikØsi/                [cikɨsi]                'patiently'
            /potØki/                [potɨki]                'dwarfed tree'
            /panØtØsi/              [pandɨsi]               'certainly'
            /muŋØkØcəkØ/            [muŋgɨcək]              'linger'
      (b)   Lenis stop + Ø + nasal + V
            /nakØne/                [nakɨne]                'stranger'
            /sikØmØcʰi/             [sikɨmcʰi]              'spinach'
            /sØrØkØməni/            [sɨlkɨməni]             'secretly'
            /totØmi/                [totɨmi]                'sieve'

Putting aside the two last examples in (52a) for the time being, the revised governing hierarchy accounts for the fact that the underlined intervening empty nuclei of all examples receive phonetic interpretation, due to the prohibition of mutual government for segments in the same rank. Likewise, the same explanation applies to the examples in (52b): nasals cannot govern lenis obstruents. The following configurations illustrate this point.

(53)  (a) /cikØsi/  [cikɨsi]

```
        O     N     O     N     O     N
        |     |     |     |     |     |
        x     x     x     x     x     x
        |     |     |     ↓     |     |
        c     i     k    [ɨ]    s     i
                    ↑     ‖     ↓
                    └─────┼─────┘      inter-onset government
                          ‖
```

      (b) /nakØne/  [nakɨne]

```
        O     N     O     N     O     N
        |     |     |     |     |     |
        x     x     x     x     x     x
        |     |     |     ↓     |     |
        n     a     k    [ɨ]    n     e
                    ↑     ‖     ↓
                    └─────┼─────┘      inter-onset government
                          ‖
```

The revised governing hierarchy can provide an appropriate account of the majority of cases in which the vowel [ɨ] occurs in mono-morphemic words. However, there are two cases which may not be accounted for by the revised governing hierarchy, as shown below.

(54) The occurrence of morpheme-internal [ɨ] between two consonants (in the context of C1ØC2V)

| C2 / C1 | liquid | nasal | lenis obstruent | tensed or aspirated |
|---|---|---|---|---|
| liquid | Ø | Ø | Ø | Ø |
| nasal | ɨ | Ø | Ø | Ø |
| lenis stop | ɨ | ɨ | ɨ | Ø |
| tensed or aspirated | ɨ | ɨ | ɨ | ɨ |

(Ø: absence; ɨ: presence)

In (54), there are two shaded cases in which the revised governing hierarchy predicts that an empty nucleus is not licensed between two nasals, and between a nasal and a lenis obstruent, i.e. nasals and lenis obstruents cannot govern each other. However, it is licensed. While I will deal with sequences of nasal + empty nucleus + lenis obstruent in the next section, reconsider examples which contain two nasals intervened by an empty nucleus.

(55)  (a)  Two nasals before a licensed empty nucleus
$/kØ_3mØ_2mØ_1/$  [kɨmɨm]  'the last day of the month'
$/kanØ_2mØ_1/$  [kanɨm]  'aim'
$/nØ_2nØ_1/$  [nɨn]  'topicaliser'
  (b)  Two nasals before an unlicensed nucleus
/ənØni/  [ənni]  'sister'
/simØmani/  [simmani]  'ginseng-digger'
/k'amØnaŋØ/  [k'amnaŋ]  'ability'
/paŋØmaɲi/  [paŋmaɲi]  'club'
/kumØnirØ/  [kumnil]  'to stretch up'
/maŋØnani/  [maŋnani]  'wretch'

In the examples in (55a), the vowel [ɨ] occurs between two nasals, whereas in the examples in (55b) an empty nucleus does not receive phonetic interpretation in the same context. According to the revised governing hierarchy, intervening empty nuclei between two nasals are expected to receive phonetic interpretation, since a nasal cannot govern a preceding nasal. Thus, the penultimate empty nucleus $Ø_2$ receives phonetic interpretation. The examples in (55b), however, differ from (55a) in that an inter-onset governing relation between two nasals does not hold by the effect of the revised governing hierarchy, and so the intervening empty nucleus is expected to receive phonetic interpretation. The phonetic forms, however, *[ənɨni],

*[simimani], *[k'aminaŋ] etc, are incorrect.  The intervening empty nucleus remains uninterpreted.

At first glance, the examples in (55) seem to constitute exceptions to the revised governing hierarchy.  Any attempt to change a governing hierarchy between nasals and lenis obstruents together with the Complexity Condition, is not fruitful at all, simply because the correct results in terms of one governing hierarchy turn out problematic cases in terms of the other, and vice versa.  Note that there are structural differences between (55a) and (55b), i.e. a potential government-licenser is available in the latter for preceding two nasals but it is not in the former.  The presence of a potential government-licenser in (55b) may provide a clue for the licensing of the intervening empty nucleus between two nasals, as shown below.

(56) The Nasal Condition in Korean

    (a)     O     N     O
            |     |     |
            x     x     x
            |           |
         ([place])    [place]
                         |
                         ?
                         |
                         L
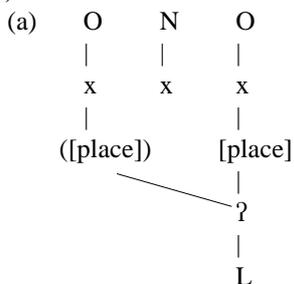
    (b) An unlicensed government-licenser must be present.

The Nasal Condition in (56a) states that morpheme-internal NN sequences form a (partial) geminate in which the first member may contain its own place element, but lacks the nasal element L (occurring in headless position) which is provided by the second member.  Furthermore, this doubly-linked structure requires a following unlicensed government-licenser, as in (56b).  For instance, /simØmani/ 'ginseng digger' and /kənØmanØ/ 'even though' have the representations shown in (57). (57a,b) show a full geminate and a partial geminate, respectively.  In the latter, the governed onset O2 only contains a place element and the rest is provided by the governing onset O3.

(57) (a) /simØmani/

    O1    N1    O2    N2    O3    N3    O4    N4
    |     |     |     |     |     |     |     |
    x     x     x     x     x⇐⇐ x     x     x
    |     |           \_____|     |     |     |
    s     i                 U     a     n     i
                            |
                            ?
                            |
                            L

(b) /kənØmanØ/

```
    O1    N1    O2    N2    O3    N3    O4    N4
    |     |     |     |     |     |     |     |
    x     x     x     x     x     x⇐⇐ x     x
    |     |     |           |     |     |
    k     ə     R           U     a     n
                    \            |
                     \           |
                      \          ?
                       \         |
                        \        L
```
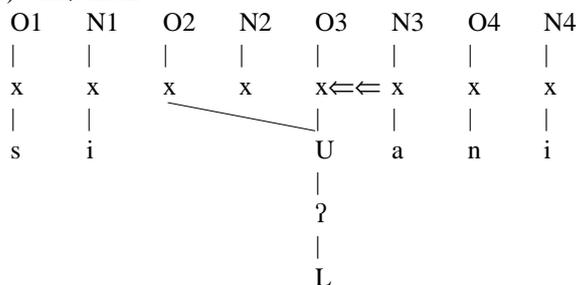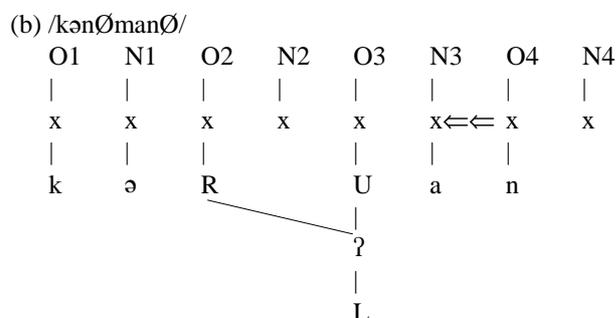
Let us consider how the intervening empty nucleus N2 in (57) is licensed. Cross-linguistically, doubly-linked structures resist epenthesis, i.e. the effect of *integrity* (Hayes 1986a, Schein & Steriade 1986, and Itô 1986, among others). Translating the notion of integrity into my analysis means that an intervening empty nucleus in NN sequences is always licensed. The governing property of an onset head is determined by the governing hierarchy and the Complexity Condition. That is, the onset head is a headed segment or more complex than its governee. In (57a,b), the nasal in governing position is more complex than the nasal in governed position, since the latter acquires some or all relevant elements from the governing nasals. Concretely, in (57a), the presence of the unlicensed government-licenser N3 licenses the onset-head O3 to govern O2. Since O2 is empty, the Complexity Condition enables O3 to govern O2. The same account applies to cases of non-identical NN sequences, as in (57b), a governed onset contains a single place element but a governing one has three elements, i.e. the nasal element L, the element ʔ and its place element. Accordingly, I claim that the inter-onset governing requirements are met and so the intervening empty nucleus is licensed.

Given the notion of government-licensing, the examples in (55) are parallel to French, precisely because consonant sequences that display inter-onset government require a government licenser which is unlicensed, as in (55b). In (55a), on the other hand, the licensed empty nucleus follows two nasals, and so it cannot act as a government-licenser. Consider the word /kØmØmØ/ 'the last day of the month'.

(58) /kØmØmØ/ [kɨmɨm]

```
(a) *O1    N1    O2    N2    O3    N3
        |     |     |     |     |     |
        x     x     x     x     x ⇍⇍ x
        |           \            |
        k            \           m        (⇍⇍: non-licensing)
```

(b)
```
    O1    N1    O2    N2    O3    N3
    |     |     |     |     |     |
    x     x     x     x     x ⇍ ⇍ x
    |     ↓     |     ↓     |
    k    [ɨ]    m    [ɨ]    m
    ↑_____↓
         ‖          inter-onset government
```
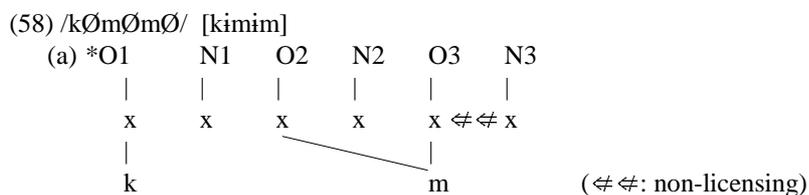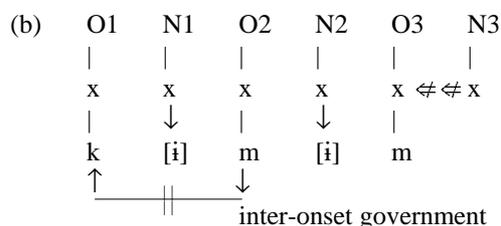
In (58a), the absence of an unlicensed empty nucleus cannot license O3 to govern O2. In other words, the NN sequence cannot be represented by a doubly linked structure. Thus, (58a) is ill-formed. This implies that a doubly-linked structure must be supported by a following unlicensed government-licenser. This requirement gives rise to the representation in (58b) in which two nasals are associated with their own onsets. The phonetic interpretation of N2 is due to the absence of the government-licenser and the prohibition of mutual government in the same rank.

Until now, I have proposed the Nasal Condition to account for the non-phonetic interpretation of an empty nucleus between two nasals, which is seemingly an exception to the revised governing hierarchy. Due to the nature of doubly-linked configurations, the inter-onset governing requirement alone seems to satisfy the licensing conditions on internal empty nuclei. Thus, the Nasal Condition provides supporting evidence that inter-onset government and proper government independently apply to the licensing of empty nuclei, as in the revised analysis proposed in 3.2.2.

## 3.2.4 NC clusters: post-nasal voicing

As noted in 3.2.1, there is an asymmetry between CN and NC clusters regarding the phonetic interpretation of an intervening empty nucleus. Relevant examples are repeated from (34b) and (36a), respectively.

(59)  (a)  Lenis stop + Ø + nasal + V
          /nakØne/              [nakɨne]           'stranger'
          /sikØmØcʰi/           [sikɨmcʰi]          'spinach'
          /sØrØkØməni/          [sɨlkɨməni]         'secretly'
          /totØmi/              [totɨmi]            'sieve'
      (b)  Nasal + Ø + lenis obstruent + V
          /so:ŋØkosØ/           [so:ŋgot]           'gimlet'
          /toŋØpɛ/              [toŋbɛ]             'dividing'
          /caŋØtori/            [caŋdori]           'hammer'
          /si:mØpurØmØ/         [si:mburɨm]         'errand'
          /namØcisØ/            [namdʒit]           'a bit over'
          /kəmØtɛŋØ/            [kəmdɛŋ]            'soot'
          /muntØkØ/             [mundɨk]            'suddenly'

| /tanØkorØ/ | [tangol] | 'customer' |
| /manØpo/ | [manbo] | 'job chit' |

The intervening empty nucleus in the examples in (59a) receives phonetic interpretation due to the failure of inter-onset government between a lenis obstruent and a nasal.  The examples in (59b) are problematic to the revised governing hierarchy, precisely because the intervening empty nucleus is expected to be unlicensed: a lenis obstruent cannot govern a nasal, but instead post-nasal voicing occurs.  Having dealt with Heo's analysis in 3.2.1, I now turn to the question as to why an intervening empty nucleus is licensed between NC clusters by virtue of dynamic post-nasal voicing rather than phonetic interpretation taking place.

With respect to the motivation for post-nasal voicing in this context, Y. Heo (1995: 139) states that the lenis obstruents in the potential governing position motivate the spreading of the element L to avoid the phonetic realisation of an intervening empty nucleus.  However, his argument seems a descriptive statement.  In particular, he does not give any plausible account of why the phonetic interpretation of the intervening empty nucleus is suspended in this context.  On the basis of the Nasal Condition in the previous section, I propose that the licensing of the intervening empty nucleus between NC clusters is due to its position within the doubly-linked structure, as shown below.

(60) The Condition on NC clusters

```
(a)      O     N     O
         |     |     |
         x     x     x
         |           |
      ([place])      H
              \     /
               \   /
             [place]
                |
                ʔ
                |
                L
```
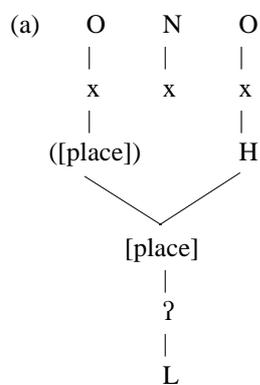
(b) An unlicensed government-licenser must be present.

Like the Nasal Condition (56), NC clusters have a doubly-linked structure, i.e. a governed position contains its own place element for heterorganic NC clusters or does not for homorganic ones.  The differences from (56) are that the elements ʔ and L are shared by the two onsets in question.  Presumably, the element ʔ is provided by a lenis obstruent and the element L by a preceding nasal.  Notice that the latter is headed, which contributes to voicing.  As discussed in Chapter 2, Revised Element

Theory merges the elements L and N into a single element L.[19] As noted above, nasals contain the element L in operator rather than in head position due to the inability of nasals to govern a complement in branching onsets: only headed segments occur in this governing position. The phonetic interpretation of (60) is a nasal + voiced obstruent sequence, since a governed segment must be headless, i.e. the element L in a governed position is construed as the operator and as the head in a governing position. One advantage would be that we achieve a unified account of the licensing of the intervening empty nucleus in (60) in the same way as that of NN clusters without further stipulations, i.e. inter-onset government and the Complexity Condition. The condition on NC clusters confirms that nasals are governed only by a headed segment, as the revised governing hierarchy indicates.

Also, as (60b) indicates, the absence of a government-licenser cannot support a doubly-linked structure and so this results in the phonetic interpretation of an intervening empty nucleus, as shown below.

(61)   /anØ$_1$kØ$_2$/              [anɨk]              'cozy'
       /nØ$_1$kØ$_2$t'ɛ/           [nɨktɛ']            'wolf'

In (61), both empty nuclei Ø$_2$ are not government-licensers; the first one is licensed by domain-final licensing and the second one by inter-onset government in which the government-licenser is a final unlicensed nucleus. Thus, the intervening empty nucleus Ø$_1$ receives phonetic interpretation in both cases.

The condition in (60) would imply the presence of voiced obstruents at the lexical level. Furthermore, there are voicing processes of lenis obstruents in the mainstream approaches. These approaches (S.-C. Ahn 1998 and relevant references therein) have proposed an inter-sonorant voicing rule in which a lenis obstruent becomes voiced between two sonorants including vowels. Thus, post-nasal voicing is treated as part of this process. In GP, however, not all inter-sonorant voicing processes are regarded as voicing. Theory-internally, [20] so-called intervocalic voicing is not regarded as a genuine voicing process, since, as we have seen in Chapter 2, vowels do not contain the element L. In other words, if inter-vocalic voicing were to contribute to the voicing of lenis obstruents, then all vowels would have contained the element L. The result of this would be that all vowels were low-toned. Interestingly, independent evidence against inter-vocalic voicing as a phonological rule is suggested by S.-A. Jun (1994). She examined voicing of an intervocalic lenis obstruent in different segmental and prosodic contexts as well as for different speech rates. The experimental data show that the voicing of an intervocalic lenis stop does not always occur, i.e. it is sensitive to speech rate and the

---

[19] Ploch (1996: 194 and relevant references therein) presents convincing arguments in favour of merging N and L element. The arguments involve (i) postnasal voicing of voiceless obstruents; (ii) alternations between nasal and voiced stops dependent on the nasality/orality of the following vowel; (iii) a unified account of voiced stops blocking high tone spreading and voiceless obstruents nasal spreading; (iv) an integrated approach to two dissimilation laws, i.e. Dahl's and Meinhof's Law.
[20] KLV (1990: 216) claim that the laryngeal elements L and H "involve the state of vocal cords and control (non-spontaneous) voicing properties in consonants and represent tone on vowels".

qualities of neighbouring segments. This result casts doubt on the intervocalic voicing rule as phonologically significant. Consequently, she claims that inter-vocalic voicing must be treated in the phonetics.

With respect to the post-nasal voicing effect, the condition in (60) is understood as a static constraint on NC clusters morpheme-internally. The nasal element is provided by a preceding nasal and this element contributes the voicing of a governing lenis obstruent to fulfil the requirements of inter-onset government, i.e. an empty nucleus is licensed within a doubly-linked structure.[21] In fact, this condition is probably derived from a more general constraint of *NC̥ effects in which sequences of nasal + voiceless obstruent are disfavoured cross-linguistically; among these effects are post-nasal voicing, nasal deletion, denasalisation, fusion of a nasal and voiceless obstruent (Herbert 1986, Pater 1999, and Kula 2000, among others). Thus, the condition in (60) is understood as a morpheme-internal phonotactic constraint due the effect of *NC̥.

Nevertheless, Korean shows some interesting processes which seem beyond the scope of *NC̥ effects. Post-nasal tensification and the phonetic interpretation of an intervening empty nucleus in NC cluster are observed in verbal conjugation,[22] e.g. /sinØ + ta/ [sint'a] 'to put on shoes + declarative suffix', /sin + Øsi/ [siniɨsi] 'to put on shoes + honorific suffix'.[23] As we will see in Chapter 4, these two processes are viewed as the result of the failure of inter-onset government. Nasals are not governed by a lenis obstruent.

A notable exception to (60) is a lenis coronal fricative /s/, which does not undergo post-nasal voicing, as in /nɛmØsɛ/ [nɛmsɛ] 'smell', /kanØsirØ/ [kansil] 'ingratiatingly', among others.[24] As we have seen in Chapter 1, obstruents are classified into three types: lenis, tensed and aspirated. Unlike stops and affricates, however, coronal fricatives have only two types lacking an aspirated counterpart. Among experimental analyses on Korean obstruents, Kagaya (1974) argues in his fiberscopic analysis that /s/ is treated phonologically as an aspirated rather than a lenis obstruent due to its same glottal activity as aspirated ones.[25] By adopting the

---

[21] This interpretation is derivable from the Uniformity Condition (Kaye 1995: 292):

Phonological representations are directly interpretable at every level.

One of the implications of this condition is that elements present in lexical representations contribute to phonetic realisation of final forms. The presence of the element L in the condition in (60) to produce voiced obstruents does not violate this condition.

[22] Indeed, these two processes argue against Pater (1999: 334 and endnote 4). He points out that "apparent lack of *NC̥ epenthesis raises an intriguing question for future research" and "these two processes [nasal devoicing and obstruent aspiration: SJR] cannot be captured by the simple statement of *NC̥" and finally concedes that "I leave *NC̥ in its perhaps overly simple form".

[23] The positions of Ø are slightly different in these examples: the former contain Ø within the stem and the latter within the suffix. See Chapter 4 for a detailed discussion on this matter.

[24] In Y. Heo's (1995 and p.c.) transcriptions, a post-nasal /s/ also undergoes voicing on the basis of an informal acoustic analysis in which this segment shows a greater or smaller voicing effect. Even though I agree with Heo's argument that post-nasal voicing is phonologically significant, perceptually or cognitively in a broad sense, this segment is not realised [z] in this context, according to my intuition and others.

[25] He measures degrees of glottal width at the moment of articulatory release on an arbitrary scale of 0 (minimum) to 30 (maximum). In initial position, the aspirated type consistently scores above 20, the lenis type around 10 and the tensed type 0. Regarding the lenis fricative, it reaches 28.

laryngeal features in Halle & Steven's (1971), Kagaya classifies the aspirated obstruents and the lenis /s/ as [+spread glottis], which contributes to the absence of voicing in inter-vocalic position.[26] However, as Inverson (1983) points out, even though the lenis /s/ is can be classified into the aspirated type phonetically, its phonological behaviour is the same as that of other lenis obstruents. This segment undergoes post-obstruent tensing like other lenis obstruents, but aspirated segments do not, e.g. in Sino-Korean compounds, /pak koŋ/ [pakk'oŋ] 'gable', /pak piŋ/ [pakp'iŋ] 'thin ice', /pak ca/ [pakc'a] 'rhythm', /pak sa/ [paks'a] 'doctor', but, /pak cʰa/ [pakcʰa] *[pakc'a] 'acceleration' (see Chapter 4). Furthermore, in sound symbolism among reduplications (Kim-Renaud 1974: 16), aspirated or tensed obstruents give an intensive connotation, but the lenis /s/ retains the non-intensive interpretation like lenis obstruents, as shown below.

(62)  (a)  [piŋpiŋ]               'round and round (slowly)'
           [pʰiŋpʰiŋ]             'round and round (fast and roughly)'
           [p'iŋp'iŋ]             'round and round (fast and tightly)'
      (b)  [sukɨnsukɨn]           'in a whisper (quiet)'
           [s'ukɨns'ukɨn]         'in a whisper (with a commotion)'

To sum up, the lenis coronal fricative /s/ can be described as a segment which shares laryngeal features with the aspirated type, though its phonological classification is into the lenis category. This idiosyncratic dual aspects of the lenis /s/ may provide a reason why this segment does not undergo post-nasal voicing.

Finally, consider some implications of the Nasal Condition and the Condition on NC Clusters. Recall from (56) that a governed nasal may contain the place element for non-identical NN sequences. The nasal element is supplied from the governing onset. The same structural properties are also found in NC clusters, precisely because Korean has heterorganic NC clusters. This may imply that the place elements are inert in phonological processes. The empirical consequence is that there are no place assimilation processes in Korean. Indeed, as we will see in Chapter 4, phonological processes involved in suffixation are manner-related: tensification, aspiration, nasalisation and so on. In the next chapter, I will present analyses of these processes as the result of the satisfaction of the requirements of the ECP.

---

[26] Kagaya observes that the glottal width of the inter-vocalic /s/ is reduced by about 10 to 15 on the glottal scales (i.e. glottis is partly open) and this invokes weakening to moderate aspiration rather than voicing, while other lenis obstruents show more or less the same effect, but with total adduction of the vocal cords which makes the vocal folds relatively slack to cause spontaneous voicing.

## 3.3 Licensing conditions on empty nuclei in Korean

In 3.1 and 3.2, I presented analyses of the licensing conditions on final and internal empty nuclei. In this section, I will deal with initial empty nuclei in 3.3.1, and I will propose general conditions on licensed empty nuclei in Korean in 3.3.2.

## 3.3.1 Licensing initial empty nuclei

Y. Heo (1995) observes that the behaviour of initial empty nuclei is somewhat different from that of internal empty nuclei in that the former receive phonetic interpretation despite the fact that the requirements of inter-onset and proper government are met, as shown below.

| (63) | (a) | /kØmanØ/ | [kɨman] | 'no more' |
|---|---|---|---|---|
|  |  | /t'Ønɛki/ | [t'inɛki] | 'tramp' |
|  |  | /tØmurØ/ | [tɨmul] | 'rare' |
|  | (b) | /nØk'i/ | [nɨk'i] | 'to feel' |
|  |  | /nØtʰari/ | [nɨtʰari] | 'agaric' |
|  |  | /kØcʰi/ | [kɨcʰi] | 'to stop' |

In (63a), the phonetic interpretation of the initial empty nucleus is due to the failure of inter-onset government, according to the revised governing hierarchy in (50). In the examples in (63b), however, the inter-onset governing relationships are established between the first and the second onset and the presence of a government-licenser indicate that the initial empty nucleus must be licensed. Heo notes that this phenomenon is not an idiosyncratic proper of Korean, but is common to a number of languages, such as Parisian French (Charette 1991) and Tonkawa (Yoshida 1990). The relevant examples are shown in (64).

| (64 | (a) |  | Quebec French | Parisian French |  |
|---|---|---|---|---|---|
|  |  | *petit* | [ptí] | [pətí] | 'small' |
|  |  | *petitesse* | [pətités] | [pətités] | 'smallness' |
|  |  | *cheval* | [ʃfál] | [ʃəvál] | 'horse' |
|  |  | *chevalier* | [ʃəvaljé] | [ʃəvaljé] | 'knight' |
|  | (b) | Tonkawa |  |  |  |
|  | (i) | picnoʔ | 'he cuts it' | notxoʔ | 'he hoes it' |
|  |  | netloʔ | 'he licks it' | naxcoʔ | 'he makes it a fire' |
|  | (ii) | picen | 'castrated one' | notox | 'hoe' |

In (64a), the words *petit* and *cheval* have the stress on the second nucleus. The domain-initial empty nucleus is properly governed by the following stressed vowel in Quebec French, whereas this position resists proper government in Parisian French. Thus, schwa does not emerge in the former, but is present in the latter. The same phenomenon is observed in Tonkawa. In (64bi), any vowel undergoes

syncope if the following vowel is present, but the initial nucleus is inaccessible to this process, as in (64bii). The examples in (63) are parallel to (64). Since Korean also does not allow initial consonant clusters, Heo concludes that the initial empty nucleus must receive phonetic interpretation, irrespective of the satisfaction of inter-onset and proper government. In other words, the initial empty nucleus in Korean is immune to the ECP.

Apart from [ɨ]-initial words ((5a) in Chapter 1), Heo's conclusion neglects the fact that almost all cases in which the initial empty nucleus receives phonetic interpretation is due to the failure of inter-onset government. The only exceptions to this are the examples in (63b) and the following fricative-initial words.

(65)    /sØcʰi/                [sɨcʰi]              'to graze'
        /hØnØcəkØ/            [hɨnɨcək]           'get loose'
        /hØcipuci/            [hɨcipuci]          'hushing up'
        /hØnØrØ/              [hɨnɨl]             'dawdles'
        /hØmØsØ/              [hɨmɨt]             'pleasing'

In these examples, the inter-onset governing relations are established between an initial and a following onset, and so the initial empty nucleus must be licensed. As we will see in the following section, the phonetic interpretation of the initial empty nucleus in this context is due to the special nature of fricatives interacting with the Preservation Principle and the Constraint on Licensed Empty Nucleus (see below (69) and (67), respectively). Accordingly, the only three genuine counter-examples to inter-onset government are in (63b). Thus, it is undesirable to claim that all initial empty nuclei must receive phonetic interpretation irrespective of the effect of the ECP. It would be sufficient to recognise exceptions in terms of the ECP rather than by treating all cases of initial empty nuclei as beyond the scope of the ECP.

## 3.3.2 The constraint on licensed empty nuclei and its consequences

In this section, I summarise the discussions and analyses made so far and investigate the phonotactic constraints on licensed empty nuclei. In 3.1, I dealt with neutralisation which regulates the shapes of segments before a licensed final empty nucleus: only seven segments are allowed to occur in this position: [pˀ, tˀ, kˀ, m, n, ŋ, l]. That is, a licensed final empty nucleus can only license non-contour headless segments which contain the element ʔ. In 3.2, exploring the licensing of internal empty nuclei, I have considered various types of segments involving inter-onset government and conclude that an intervening empty nucleus is licensed if and only if an onset in governing position must govern a preceding onset, and with the presence of a government-licenser. Elsewhere, proper government provides an appropriate account of the phonetic interpretation of a given empty nucleus. Furthermore, I propose the Nasal Condition and the Condition on NC clusters to

account for the licensed status of intervening empty nuclei, i.e. these empty nuclei are within a doubly-linked structure.

Interestingly, the distribution of an onset before a licensed internal empty nucleus is more or less parallel to that of a licensed final empty nucleus, as shown below.

(66)  (a)  Liquids
          /sərØcʰi/              [səlcʰi]              'to run wild'
          /s'ərØmɛ/              [s'əlmɛ]              'sledge'
          /karØpi/               [kalpi]              'rib'
      (b)  Lenis stops
          /kapØc'aki/            [kapc'aki]            'suddenly'
          /akØcʰakØ/             [akcʰak]             'toughness'
      (c)  Nasals
          /toŋØcʰimi/            [toŋcʰimi]           'pickled raddish'
          /pənØc'əkØ/            [pənc'ək]            'sparkling'
          /ə:mØpʰo/              [ə:mpʰo]             'threatening'

Note that the distribution of the segmental content before a licensed internal empty nucleus is almost identical to that of a licensed final empty nucleus, save for the coronal lenis stop [t].[27] The absence of a morpheme-internal [t] may be ascribed to either an accidental gap in native Korean or some phonotactic constraints on the lenis coronal stop morpheme-internally, i.e. this segment cannot occur in governed position.[28] Or, such a different distribution may be due to the different licensing mechanisms. That is, it is plausible to assume that the licensed status of a final empty nucleus derives from the domain-final licensing parameter, while the licensing of an internal empty nucleus is achieved by inter-onset government.[29] To deal with this topic, however, is beyond the scope of the thesis, and I will leave this for future research.

Although there is an asymmetrical distribution of segments occurring before internal and final licensed empty nuclei, the general segmental pattern is expressed as follows.

---

[27] This phonotactic constraint is not active in suffixation, e.g. /tat/ 'close' + /ko/ 'emphatic suffix' [tatk'o]. Also, note that there is a diachronic process /t/→/s/ in the 16th century (K.-M. Ko 1989 and the relevant references therein). The context in which this process occurs is nominal stem-final, not stem-internal position. This process may influence the segmental shape of t-final English loanwords, which will be dealt with in Chapter 5.

[28] Among Indo-European languages (English, German, Greek and Dutch, among others), the voiceless coronal stop does not occur in morpheme-internal 'coda' position (Kaye 1995 and Harris 1994), e.g. *actor* and *chapter*, but *atkor* and *chatper*. Within a strict CV framework (Lowenstamm 1996 and Rowicka 1999, among others), this segment cannot occupy a governed onset position, like in Korean.

[29] In English, a similar asymmetrical distribution between an internal 'coda' and an onset before a final empty nucleus is observed. As mentioned in the above note, the coronal voiceless stop /t/ does not occur in internal 'coda' position, but it occurs before a final empty nucleus. In other words, the positions which this segment occupies may reflect the different phonotactic constraints imposed on each constituent.

(67) The Constraint on a Licensed Empty Nucleus (CLE)
   A licensed empty nucleus can only license non-contour headless segments which
   contain the element ʔ, except the coronal headless stop before a licensed internal
   empty nucleus.

   Y. Heo (1995: 114) points out that final and internal empty nuclei show different
behaviour, when a preceding onset does not meet the CLE (67): the former is
labelled as *nucleus-dominance* and the latter as *onset-dominance*.   Nucleus-
dominance indicates that the licensed status of a final empty nucleus is maintained
due to the parameter setting and causes the preceding onset segment to alternate
with one which can be licensed by a final licensed empty nucleus. Onset-dominance
indicates that the internal empty nucleus resists licensing in order to preserve the
segmental content of the preceding onset.  Neutralisation characterises the former
aspects of a final licensed empty nucleus.  The phonetic interpretation of an internal
empty nucleus characterises the latter cases.  For instance, Heo claims that internal
empty nucleus receives phonetic interpretation when it follows fricatives, affricates
and headed segments.  Some relevant examples are shown in (68).

(68)    (a) after a fricative
        /pusØrumØ/              [pusɨrum]              'ulcer'
        /kak'asØro/             [kak'asɨro]            'narrowly'
        (b) after an affricate
        /kocØnəkØ/              [kocɨnək]              'silent'
        /kacØrənØ/              [kacɨrən]              'in order'
        (c) after a headed segment
        /k'ak'Øraki/            [k'ak'ɨraki]           'bits of rice'
        /kjac'ØmakØ/            [kjac'ɨmak]            'slender'
        /swet'Øki/              [swet'ɨki]             'horsetail'

   Note that not all segments before an internal empty nucleus satisfy the CLE.
According to Heo's claim, the phonetic interpretation of the internal empty nuclei in
(68) is due to onset-dominance in that all preceding segments do not satisfy (67),
and so these empty nuclei receive phonetic interpretation while the segmental
content of the preceding onsets are preserved.  However, the phonetic interpretation
of these empty nuclei can also be accounted for purely by inter-onset government, as
an alternative analysis discussed in this chapter.  That is, the two onsets surrounding
the internal empty nucleus fail to meet the requirements of inter-onset government:
governing onsets do not contain appropriate governing properties.
   To determine which analysis is favoured over the other is both an empirical and
a conceptual matter.  Firstly, even though the onset-dominance forces the internal
empty nuclei in question to receive phonetic interpretation, as in the cases in (68),
onset-dominance alone cannot adequately explain the occurrence of the vowel [ɨ] in
morpheme-internal position.  There are cases in which a segment before an internal
empty nucleus satisfies the CLE, but, nonetheless, the internal empty nucleus

receives phonetic interpretation due to the failure of inter-onset government, e.g. /kakØne/ [nakɨne] 'stranger', /totØmi/ [totɨmi] 'sieve'. In order to account for these examples, additional notions such as inter-onset and proper government, are required in Heo's analysis.

Secondly, onset-dominance requires that the segmental content of a preceding onset in question be preserved when it does not meet the CLE. It seems that this requirement is treated independently as a language-specific condition in Heo's analysis. However, I claim that this can be derived from the interaction among more general principles together with the CLE, e.g. the ECP and the Preservation Principle, as shown in (69).

(69) The Preservation Principle (PP)
    Segmental content is maximally preserved.

The PP requires that segmental content in a given lexical representation is not altered. I assume that the effect of the PP is calculated on the basis of the licensing relation between an onset and a following nucleus. With respect to Korean, the effect of the PP predicts that an onset followed by an unlicensed (empty) nucleus is not subject to segmental change, since this nucleus can license the preceding onset, irrespective of segmental content. On the other hand, when the onset is followed by an empty nucleus, we can see a segmental change, e.g. in neutralisation, tensed or aspirated segments become lenis stops before a final empty nucleus due to the effect of the CLE. Furthermore, when the requirements of inter-onset government are not met, an internal empty nucleus receives phonetic interpretation and the segmental make-up of the preceding onset is left intact. [30] Thus, the interaction between the PP and the CLE together with the ECP formally expresses onset-dominance and nucleus-dominance, as shown below (> signifies precedence).

(70) (a) Nucleus-dominance (final empty nuclei)
        the ECP (domain-final licensing), the CLE > the PP
     (b) Onset-dominance (internal empty nuclei)
        the ECP (inter-onset government), the PP > the CLE

(70) shows that the different behaviour of final from internal empty nuclei is the result of how principles and parameters (the ECP and the PP), and a language specific constraint (the CLE) interact with each other. To account for the phonetic interpretation of empty nuclei in question, two notions, the PP and the CLE, are in conflict.[31] Note that the ECP takes precedence over either the PP or the CLE in (70),

---

[30] One could argue that the PP would be a notational variant of MAX-IO in OT. I argue that the PP is conceptually different from MAX-IO in that the evaluation of the PP is based on local licensing relations between an onset and a following empty nucleus, as I point out above. As noted in the OT literature, the evaluation of MAX-IO, on the other hand, is not based on locality, but rather on the whole string of a given input.

[31] In GP, it is noted that principles are sometimes in conflict and that it is not always possible to meet all their requirements simultaneously. As illustrated in 3.2.2, Charette (1990, 1991) discusses the conflict

probably due to the licensing of empty nuclei involved.  There are two possibilities concerning two notions, i.e. either of the two takes precedence over the other.  The effect of nucleus-dominance is achieved by opting for the ECP and the CLE over the PP.  This consequence pays a price: neutralisation occurs to conserve the domain-final licensing and the CLE, in favour over the PP which preserves the segmental identity of a preceding onset before a final empty nucleus.  The effect of onset-dominance is the result of the preference of the PP and the ECP over the CLE.  In this case, an empty nucleus in question receives phonetic interpretation to preserve the segmental content of a preceding onset.

Note that there are two examples which constitute exceptions to inter-onset government, as shown below.

(71)   /usØk'waŋØ/              [usɨk'waŋ]              'funny'
       /mesØk'opØ/              [mesɨk'op]             'to feel sick'

| O1 | N1 | O2 | N2 | O3 | N3 | O4 | N4 |
|----|----|----|----|----|----|----|----|
| \| | \| | \| | \| | \| | \| | \| | \| |
| x | x | x | x | x | x | x | x |
| \| | \| | \| | ↓ | \| | \| | \| | |
| m | e | s | [ɨ] | k' | o | p | |

↑_____↓ inter-onset government

The examples in (71) show that the requirements of inter-onset government are satisfied due to the presence of a government-licenser N3 and the appropriate governing property of O3 (i.e. headed segment).  Therefore, the empty nucleus N2 is expected to be licensed.  The phonetic interpretation of N2, however, indicates that onset dominance fails to explain these examples.  In fact, we can see that there is a conflict between the ECP (inter-onset government) and the PP, i.e. the PP requires that the segment /s/ be preserved, but this segment is licensed by an unlicensed (empty) nucleus.  Hence, the phonetic interpretation of internal empty nuclei in (71) opts for the PP over the ECP, i.e. the empty nucleus N2 receives phonetic interpretation to conserve the segmental identity of O2.  Parallel cases arise in English loanwords, e.g. *wasp* [wasɨpʰɨ], *test* [tʰesɨtʰɨ] and *desk* [tesɨkʰɨ].[32]  Note that the empty nucleus after /s/ is phonetically realised even though a potential inter-onset governor (i.e. pʰ, tʰ and kʰ) follows this segment.  In native phonology, the examples in (71) can be treated as mere exceptions to (70), since there are only two exceptions.  However, when loanwords are taken into consideration, the phonetic interpretation of internal empty nuclei after /s/ seems to demand special treatment, since there are many examples which require a generalisation of these cases in

between government-licensing and proper government, with respect to French and Polish (also see footnote 15 in this chapter).  Her conclusion is that languages make the different choices of dominance, i.e. which principle takes precedence over which.  In other words, this choice is set parametrically in the grammar, as in OT.  See also Cyran (1996) for a discussion of this matter.

[32] Note that the final empty nucleus receives phonetic interpretation in these examples, unlike native Korean.  I will discuss this in Chapter 5.

which the PP takes precedence over the ECP.  Hence I formulate this generalisation below.

(72) The phonetic interpretation of internal empty nuclei between /s/ and a headed segment: the PP > the ECP (inter-onset government)

Now, consider the segment /r/ in internal position.  In this position, the behaviour of /r/ is rather different from other segments in that this segment undergoes neutralisation in the same context as in (71) rather than the phonetic interpretation of a following empty nucleus.  Some relevant examples are repeated from (29).

(73)    /k'arØt'ɛk'i/                    [k'alt'ɛki]                 'funnel'
        /marØs'əŋØ/                      [mals'əŋ]                   'trouble'
        /tØrØməki/                       [tɨlməki]                   'to shake'
        /karØmi/                         [kalmi]                     'sea cucumber'
        /karØpi/                         [kalpi]                     'rib'
        /t'arØki/                        [t'alki]                    'strawberry'

The treatment of /r/ in this position constitutes a possible exception to (70), i.e. the requirements of inter-onset government together with the presence of a government-licenser are satisfied, but the CLE takes precedence over the PP.  Note that the phonetic realisation of an internal empty nucleus after /r/ is limited to the cases in which a government-licenser is absent, e.g. /jərØmØ/ [jərɨm] 'summer', /kjarØkØ/ [kjarɨk] 'admirable', among others.  Apart from the absence of a government-licenser, there are no forms like *[k'arit'ɛki], *[maris'əŋ], *[tɨrɨməki] and so on, in mono-morphemic words.[33]  In this context, the change from /r/ to [l] seems obligatory.  A plausible account of this segmental change would be that, unlike the segment /s/ discussed above, an internal empty nucleus after the segment /r/ can sustain its licensed status once the licensing conditions are satisfied, because liquids in Korean are the weakest in the governing hierarchy.  Once the internal empty nucleus in question is licensed, the CLE comes into effect to cause the segmental change to [l].  In fact, the same process occurs in morpheme-internal liquid geminates, as shown below.

(74)    /kərØre/                         [kəlle]                     'dust clothes'
        /pərØre/                         [pəlle]                     'insect'
        /cintarØrɛ/                      [cintallɛ]                  'azalea'

---

[33] This constraint may not be active in suffixation of /r/-final verbs, in particular, in children's speech. The connective form of /narØ/ 'to fly' is [nalmjə] in adults speech, but occasionally this is realised as [narimjə] in children speech.

/kərØre/  [kəlle]

```
O1    N1    O2    N2    O3    N3
|     |     |     |     |     |
x     x     x     x     x     x
|     |      \         _|     |
k     ə              r        ɛ
                     ↓
                    [l]
```

Regarding liquid geminates, the intervening empty nucleus N2 is licensed, like NN sequences as discussed in 3.2.2. The governed onset O2 is empty and its segmental content is provided by the following governing onset O3, which satisfies inter-onset government. Despite the satisfaction of the licensing conditions, the segment /r/ undergoes a strengthening process to become [l]. The motivation for this process is that /r/ in the governing position is too weak to be a governor, since /r/ has only a single element. Like NN and NC sequences, I propose that a governing onset contains at least two elements in Korean. Such requirements force the change of /r/ to [l] in this context. The weaker properties of the segment /r/ contribute to the change of /r/ to [l] before a licensed empty nucleus and in a governing onset position.

To summarise, in this chapter I considered how empty nuclei are licensed in mono-morphemic words. Neutralisation and the occurrence of the vowel [ɨ] have been discussed in terms of the ECP, the PP and the CLE. Neutralisation is characterised as the CFE that regulates only a certain set of segments occurs before a final empty nucleus. This is due to the domain-final licensing parameter being set to 'on' in Korean. Thus a segment in question violating the CFE undergoes a segmental change to the extent that the final empty nucleus can license it. I claimed that the occurrence of the vowel [ɨ] in internal position is determined by the ECP: inter-onset government and proper government which are independently active. With respect to the distribution of consonants surrounding an internal empty nucleus, I proposed a governing hierarchy in which nasals and lenis obstruents are equally ranked, with the proviso that mutual government is prohibited among equally ranked segments. This revised ranking can largely accounts for the occurrence of internal [ɨ], and I proposed the Nasal Condition and the Condition on NC clusters for the absence of internal [ɨ] between NN sequences, and between NC sequences, respectively. Finally, I noted that the phonotactic constraint on licensed empty nuclei is almost identical in internal and final position. Hence, I formulated a more general condition, the CLE. In the next chapter, I will consider how empty nuclei are licensed under suffixation.

# Chapter 4
# Licensing empty nuclei in suffixation

This chapter deals with the licensing of empty nuclei in suffixation. Phonological processes that are relevant to suffixation, e.g. ɨ/zero alternation, tensification, and nasalisation, have been discussed within various theoretical frameworks (see, for instance, Kim-Renaud 1976 based on SPE-type rule-formulations, S.-C. Ahn 1985 within Lexical Phonology, H.-S. Sohn 1986 within Underspecification Theory and K.-H. Kim 1987 based on Feature Geometry Theory). These approaches analysed these processes by setting up independent rules, that is, as unrelated phenomena lacking a systematic relation. In this chapter, however, I argue that the main motivation behind these processes is uniformly to satisfy the ECP, in particular, inter-onset government. To achieve this, I consider how the ECP applies to various types of suffixation in Korean and examine to what extent Kaye's (1995) proposals about the interface between morphology and phonology can provide an adequate account of the relevant phonological processes.

This chapter is organised as follows. In the first section, I briefly describe how stems and suffixes are combined in verbs and nouns and I review the previous approaches to the interplay of phonology and morphology in Korean. In the next section, I examine previous GP approaches to Korean and point out that Kaye's proposal is not sufficient to explain the Korean phonological facts by exemplifying the application of ɨ/zero alternation and neutralisation in nominal suffixation. In 4.3, I make a revised proposal with respect to the interface between morphology and phonology by claiming that an independent stem domain is required to properly account for the phonological processes. Then, I analyse ɨ/zero alternation, tensification and nasalisation in suffixation in terms of the ECP based on the revised proposal of the interface between morphology and phonology within GP. The final section summarises and concludes this chapter.

## 4.1 Introduction

Korean is a typical SOV language, i.e. object normally follows subject, while the verb always comes at the end of a sentence, as shown below.

(1)　[ nɛ　ka ]subject　[ pap　il]object　[mək　ət　t'a ]verb
　　　I　NM　　rice　ACC　eat　PAST　DEC
　　'I ate rice'
　　　　(NM: nominative, ACC: accusative, PAST: past tense, DEC: declarative)

   Due to the fact that Korean is an agglutinative language, notice that the pronoun /nɛ/ and the noun /pap/ require a case marker, and that the verb /mək/ needs the tense marker /əs'/ and the sentence final ending /ta/. Accordingly, we observe an abundance of affixes in grammatical categories, in particular, verbs and nouns. In this section, I present a brief descriptive overview of how verbal and nominal affixation (section 4.1.1 and 4.1.2, respectively) proceed in Korean, paying particular attention to suffixation, the focus of this chapter. In section 4.1.3, I review previous approaches to phonological phenomena in suffixation dealt with within various theoretical frameworks.

## 4.1.1 Verbal suffixation[1]

The agglutinative nature of Korean is most distinctively reflected in the morphological structure of verbs. The general consensus on verbal suffixation in Korean is that there are a number of slots following the verbal stem which are filled obligatorily by suffixes that represent various categories, the selection of which depends on the grammatical or functional meaning conveyed in a given sentence, i.e. not all suffixes are used in every verbal construction. Regarding verbal suffix categories, the number of slots varies from 4 (H.-M. Sohn 1999, for inflectional suffixes only), and 6 (Y.-S. Kim 1985, for inflectional suffixes only), up to 7 (S.-C. Ahn 1985 and H.-M. Sohn 1994).[2] Despite various proposals on the number of categories, this strongly suggests that verbal structures are regulated by an ordering hierarchy, with respect to the distribution of suffixes. On the basis of Ahn's proposal, I illustrate the order of the suffixial distribution after verbal stems.[3]

---

[1] In the literature on descriptive Korean grammar (e.g. Choi 1937), verbs and adjectives form an independent lexical category. In this thesis, however, these two are treated as a single category, because there are no significant differences morphologically as well as phonologically, i.e. they more or less follow the same conjugation. I use the term *verb* to cover both categories.

[2] The slots of H.-M. Sohn (1999) contain honorific, tense/aspect, modal and enders, and, in Y.-S. Kim honorific, $tense_1$, $tense_2$, style, aspect and mood. H.-M. Sohn (1994) postulates voice, subject honorific, tense and aspect, modal, addressee honorific, mood and clause type.

[3] The presentation of Ahn's proposal has no theoretical bearing on the discussion in this chapter, and it serves purely an illustrative purpose.

| (2) | group | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| | usage | transitive | voice | honorific | tense | style | aspect | endings |
| | type | derivational | | inflectional | | | | |
| | item | /t'Øri/ /tʰØri/ /cʰi/ | /i/ /hi/ /ri/ /ki/ /u/ /cʰu/ /kʰi/ | /si/ | /A⁴s'Ø/ /kes'Ø/ | /pØ/ /sØpØ/ | /ni/ /mjənØ/ /ci/ /si/ /ni/ /nØnØ/ /Ato/ | /ta/ /ni/ /ka/ /k'a/ /o/ /A/, /se/ /nja/ /Ajo/ /ca/ |

Ahn classifies the first two groups of suffixes as derivational and the rest as inflectional on the basis of Bauer's (1983) proposal. In the literature, this binary classification, i.e. inflection and derivation, is widely-accepted. Concerning the suffixes in group 1, they change intransitive verbs into transitive ones and also intensify the meaning of stems, as in /k'ɛ/ 'to break', /k'ɛ-t'Øri/ [k'ɛt'ri] 'to smash'; /mirØ/ 'to push', /miØrØ-cʰi/ [milcʰi] 'to push away'. Group 2 consists of causative and passive suffixes, which contribute to the change of voice in stems. Note that not all verbs participate in causativisation and passivisation, so that only a limited number of intransitive and transitive verbs can be causativised and passivised. Some relevant examples are shown below.

(3)    Stem                              Causative form
       /məkØ/        'eat'               /mək-i/ [məki]            'feed'
       /capØ/        'hold'              /cap-hi/ [cappʰi]         'give as security'
       /urØ/         'to cry'            /ur-ri/ [ulli]            'cause sb. to cry'
       /usØ/         'to laugh'          /us-ki/ [utk'i]           'make sb. laugh'
       /mirØ/        'to push'           /mir-u/ [miru]            'postpone'
       /totØ/        'rise'              /tot-ku/ [totk'u]         'raise'
       /nØcØ/        'late'              /nØc-cʰu/ [nɨtcʰu]        'delay'
       Stem                              Passive form
       /muk'Ø/       'bind'              /muk'-i/ [muk'i]          'be bound'
       /kətØ/        'lift'              /kət-hi/ [kətcʰi]         'be lifted'
       /c'ocʰØ/      'chase'             /c'ocʰ-ki/ [c'otk'i]      'be chased'
       /tØtØ/        'hear'              /tØr-ri/ [tɨlli]          'be heard'
                                                                  (sb.: somebody)

---

[4] The notation /A/ indicates that this vowel is subject to vowel harmony, i.e. if a preceding vowel is either /a/ or /o/, then /A/ is realised as /a/; elsewhere it is /ə/.

Four of these suffixes, i.e. /i/ , /hi/, /ri/ and /ki/, are used for both causative and passive constructions.  This overlap of causative and passive suffix forms produces many ambiguous words, as in /po-i/ 'show, be seen' and /an-ki/ 'cause somebody to hug, throw oneself in someone's arms'.

Group 3 contains only the honorific suffix /si/.  The occurrence of this suffix is generally conditioned by the presence of the subject whose referent is one who deserves the speaker's deference, such as a social or familial superior.   The following examples illustrate this point.

(4) (a) əməni-ka        ilk-ɨsi-n          simmun
        mother-NM     read-H-T        newspaper
        'the newspaper that mother is reading'
     (b) ai-ka            ilk-ɨn, * ilk-ɨsi-n  simmun
        child-NM   read-T                 newspaper
        'the newspaper that a child is reading'
                                          (NM: nominative, H: honorific, T: tense)

Phonologically, this suffix shows ɨ/zero alternation, i.e. when a stem ends in a vowel or a liquid, the vowel [ɨ] does not occur, e.g. /ka/ 'to go' [kasi], /narØ/ 'to fly' [nasi][5]; elsewhere, this vowel does occur, e.g. /kapʰ/ 'to pay back' [kapʰɨsi], /tatØ/ 'to close' [tatɨsi] (see section 4.3 for the analysis of ɨ/zero alternation in suffixation).

Group 4 contains the tense suffixes, /As'Ø/ (past or perfect tense) and /kes'Ø/ (future or presumptive tense), e.g. /məkØ/ 'to eat' [məkət] 'ate' [məkk'et] 'will eat'. For the present tense, nothing is marked, e.g. [mək] 'eat(s)'. The suffix-initial /A/ of the past tense is deleted or diphthongised after a vowel-final stem in order to avoid vowel-hiatus, e.g. /ka/ 'to go' [kas'], /o/ 'to come' [was']. Group 5 concerns speech style, where the suffix /pØ/ or a variant /sØpØ/ are used only in formal speech: the latter usually occurs after a consonant-final stem, and the former occurs without this constraint and also shows ɨ/zero alternation, e.g. /ka/ 'to go' [kap], *[kasɨp], /məkØ/ 'to eat' [məkɨp] or [məks'ɨp].

Group 6 uses aspect or mood to express whether the action or state is conceived as fact or in some other manner such as command, possibility, condition, obligation, potentiality, and warning or wish. The suffixes /ni/[6] and /nØnØ/ imply progress, e.g. /ka/ 'to go' [kanɨn], /məkØ/ 'to eat' [məŋnɨn]. The retrospective suffixes /ti/ and /tə/ denote an act or state such as the speaker's past observation or experience. The requestive suffix /si/ occurs after the suffix /pØ/, e.g. /ka/ 'to go' [kaps'i], /məkØ/ 'to eat' [məkɨps'i]. Note that the suffix-initial /s/ undergoes tensification, but the honorific suffix /si/ shows ɨ/zero alternation, as shown above. The effective and the conditional suffixes /ni/ and /mjənØ/ show ɨ/zero alternation, e.g. /ka/ 'to go' [kani], [kamjən], /məkØ/ 'to eat' [məkɨni], [məkɨmjən].   The concessive suffix /Ato/

---

[5] As noted in Chapter 1, I will deal with liquid-deletion before a coronal consonant in section 4.3.
[6] The suffix /ni/ usually goes together with the formal style suffix /sØpØ/, e.g. /məkØ/ 'to eat' [məks'ɨpni], /tatØ/ 'to close' [tats'ɨpni].

undergoes vowel-deletion or diphthongisation after a vowel-final stem, e.g. /ka/ 'to go' [kato], /o/ 'to come' /wato/, /məkØ/ 'to eat' [məkəto].

Group 7 suffixes contain not only the four sentence endings, viz. declarative, interrogative, propositive and imperative, but also the six speech levels, viz. plain, intimate, familiar, blunt, polite and deferential, as shown below (H.-M. Sohn 1999: 236-238).

| (5) | | Declarative | Interrogative | Propositive | Imperative |
|-----|----------------|--------------|-----------------|-------------|------------|
| | Plain | /ta/ | /nja/ or /ni/ | /ca/ | /Ara/ |
| | Intimate | /ə/ | /ə/ | /ə/ | /ə/ |
| | Familiar | /ne/ | /n-ka/ | /se/ | /ke/ |
| | Blunt | /so/ or /o/ | /so/ or /o/ | /se/ | /ke/ |
| | Polite[7] | /Ajo/ | /Ajo/ | /Ajo/ | /Ajo/ |
| | Deferential | /ni-ta/ | /ni-k'a/ | /si-ta/ | /si-o/ |

As has been already shown in (2), all types of suffixes can be used maximally, as shown below (S.-C. Ahn 1985: 26).

(6) /t'ərə    t'Øri    u    si    əs'Ø    ØpØ    ni    ta/
    [t'ərətɨriusiəs'ɨmnita]
    stem    transitive    voice    honorific    tense    style    aspect    endings
            1            2        3            4        5        6        7
    'somebody (honorific) made (it) fall down'

Although the example in (6) is theoretically possible, it is more common to use only a few suffixes and the grammatical function of each suffix contributes to the accumulated meaning for a given verbal construction. That is, suffixes in each slot are usually used optionally. Nonetheless, a construction violating this ordering hierarchy is treated as ungrammatical, as shown below.

(7)  * cap    -si    -hi        cap    -hi    -si
     'to catch'  3      2                2      3    'to be caught' (honorific)'
     * mək    -ta    -əs'      mək    -əs'    -ta
     'to eat'    7      4                4      7        'ate'

## 4.1.2 Nominal suffixation[8]

Nominal suffixes carry major syntactic and semantic functions. Unlike Indo-European languages, no suffix agrees for any grammatical category with the noun it

---

[7] Notice that the same form is used in the four types of sentence ending. Each sentence meaning is realised by intonation pitch contours and contextual factors.

[8] In the literature, nominal suffixes are often called *postpositional particle* or simply *particle* (H.-M. Sohn 1994, 1999). The term *suffix* in this thesis is used to refer to involving nominal as well as verbal inflection and does not contain any theoretical bias.

governs. There is another set of suffixes which are often labelled *delimiters*. Their functions are to delimit the meaning of the element to which they are attached, or to perform some other function such as plurality, conjunction, or politeness. Following H.-M. Sohn (1999: 213-215), some examples of these two types are illustrated in (8).

(8)  (a) Case marking

| | |
|---|---|
| Nominative | /ka/ (after consonant-final stems), /i/ (elsewhere) /k'esə/ (honorific) |
| Accusative | /rØrØ/ (after consonant-final stems), /rØ/ (elsewhere) |
| Dative | /e/, /eke/, /hant$^h$e/, /k'e/ (honorific), 'to' |
| Goal | /e/, /eke/, /hant$^h$e/, /k'e/ (honorific), 'to' |
| Locative-static | /e/, /eke/, /hant$^h$e/, 'on, at, in' |
| Locative-dynamic | /esə/, /ekesə/, /hant$^h$esə/, 'on, at, in' |
| Source | /esə/, /ekesə/, /hant$^h$esə/, 'from' |
| Ablative | /put$^h$ə/ 'from' |
| Connective | /kwa/, /iraŋØ/ (after consonant-final stems), /wa/, /raŋØ/ (elsewhere) /hako/, 'with, and' |
| Comparative | /pota/ 'than' |
| Instrument | /ro/ 'with' |
| Equative | /c$^h$ərəm/ 'as, like'; /kat$^h$i/ 'like'; /mank$^h$ØmØ/ 'as much as' |
| Genitive | [ij][9] 'of' |

(b) Delimiter

| | |
|---|---|
| Topic-contrast | /nØnØ/ (after consonant-final stems), /nØ/ (elsewhere) 'as for' |
| Inclusion | /to/ 'also, too, indeed' |
| Limitation | /manØ/ 'only, solely' |
| Plurality | /tØrØ/ |
| Exhaustion | /macə/ 'so far as, even' |
| Addition | /coc$^h$a/ 'even, as well' |
| Alternative | /ina/ (after consonant-final stems), /na/ (elsewhere) 'rather, or something' |
| Contrariness | /k$^h$ənjəŋØ/ 'far from, on the contrary' |

Sohn (1999) further divides case marking suffixes into two groups: those that mainly indicate syntactic function of nominals, such as nominative, accusative and genitive, and those that mainly express semantic functions, such as dative, locative, source, directional, and instrumental. As in the case of verbal suffixation, the

---

[9] I am aware that the phonetic form of the genitive [ij] poses a problem within GP, regarding its lexical representation, because there seems no way to represent this diphthong appropriately. Since the vowel [i] is represented by an empty nucleus, its underlying form would be /Øj/. However, this diphthong is realised as [ij] in initial position and as either [e] or [i] elsewhere. The occurrence of [i] would be accounted for by the element I which represents the glide [j]. It is very difficult to account for the phonetic forms [e] and [ij] from /Øj/. In this thesis, I just point out that the diphthong [ij] is problematic within the current element theory in GP.

ordering of nominal suffixes is more or less fixed. Generally speaking, the group of semantic case-marking suffixes is followed by the group of delimiters, and is in turn followed by the group of syntactic case-marking suffixes, as shown below.

| (9) | plural | locative, dative | instrumental | connective | delimiters | nominative, accusative | topic contrast | genitive |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

As is the case with verbal suffixation, nominal constructions which do not obey the order in (9) are ungrammatical. Some examples are shown in (10).

(10)    cip        -e           -man        *cip        -man        -e
             'house'    2          5                   5         2
                         'locative'  'only'
             sakwa   -tɨl      -rɨl     *sakwa    -rɨl     -tɨl
             'apple'    1          6                   6         1
                         'plural'   'accusative'

    To summarise, I have outlined how verbal and nominal suffixes are constructed in Korean. Verbal suffixes carry grammatical or functional meaning and nominal ones contain syntactic and semantic functions. Both types of suffixation observe the ordering hierarchy for the distribution of suffixes. In the next section, I review previous approaches to the interface between morphology and phonology, paying particular attention to suffixation.

## 4.1.3 Overview of previous approaches

Since the advent of Lexical Phonology, Korean phonologists have been interested in how the lexicon is organised, and how morphology and phonology interact. Two main issues have dominated the discussion.

(11)    (a) Are multiple strata necessary in the lexicon?
         (b) How do phonological rules apply in the lexicon?

    Regarding (11a), S.-C. Ahn (1985) argues that four strata are required: sub-compounding (stratum 1), co-compounding (stratum 2), derivation (stratum 3) and inflection (stratum 4). The postulation of four strata is based upon the fact that C-epenthesis (*bindung-s* or epenthetic /s/) is sensitive to the morphological structures of compounding[10] and affixation, i.e. derivation and inflection, and it usually occurs

---

[10] *Bindung-s* refers to a process in which /s/ or /t/ or /n/ is inserted between the morphemes that compose a sub-compounding structure (a modifier followed by a head), which does not occur in a co-compounding structure (two heads). Examples of sub-compounding are [[nɛ] [ka]] 'stream' 'side' [nɛtk'a] 'stream side', [[səul] [jək]] 'Seoul' 'station' [səulnjək] 'Seoul station' and so on. Note that /k/ in the second member is tensified in the former and /n/ is inserted in the latter. In co-compounding, however, there is no

after compounding. In affixation, derivation is followed by inflection. To exemplify his proposal, consider some compounding and derivation processes.

(12  (a)    Compounding followed by inflection
           (i)    [ [o]        [ka] ]: compounding
                  'to come' 'to go'                    'to come and go'
           (ii)   [ [oka]   mjən]: suffixation
                         'conditional'                 'if come and go'
      (b)   Derivation followed by inflection
           (i)    [ [mək]    ki]: derivation
                  'to eat'  'nominaliser'              'eating'
           (ii)   [ [məkki]   ka]: suffixation
                         'nominative'                  'eating'

(12a) and (12b) show that inflection follows compounding and derivational processes. Ahn argues that inflection does not occur inside compounding structures and that it follows derivational processes. Otherwise, the outputs are ungrammatical, i.e. *[[o + mjən] [ka]] and *[[mək + i[11]] ki]. This ordering may provide evidence for strata in the lexicon. However, others such as Y.-S. Kim (1985), J.-M. Kim (1986) and H.-S. Sohn (1986) argue that no stratal distinction between compounding and affixation is required in Korean. They point out that the following examples illustrate a reverse ordering compared to Ahn's proposal.[12]

(13)  (a)    Derivation precedes sub-compounding
           (i)    [ [pe]              kɛ]: derivation
                  'to pillow on' 'nominaliser'         'pillow'
           (ii)   [ [pekɛ]         is]: sub-compounding
                  'pillow'     'case'                  'pillow cover'
      (b)   Co-compounding precedes sub-compounding.
           (i)    [ [arɛ]      [wi]]: co-compounding
                         'under' 'upper'               'lower and upper parts'
           (ii)   [ [arɛwi]               [saram]]: sub-compounding
                  'under and upper'    'man'       'juniors and seniors'

Obviously, the examples in (13) cast serious doubts on Ahn's stratum ordering, because (13a) is a case of stratum 3 feeding back to stratum 1 and (13b) is a case in which stratum 2 feeds back to stratum 1. The presence of such level recursion or. *looping* (Mohanan 1982), undermines the stratum ordering hypothesis. Therefore,

---

consonant epenthesis, as in [[ma] [so]] 'horse' 'cow' [maso] 'horse and cow', [[pom] [kail]] 'spring' 'autumn' [pomkail] 'spring and autumn' and so on. In this thesis, I will not deal with these processes. See H.-M. Sohn (1999) for further data and see S.-C. Ahn (1998) for a review of previous proposals.

[11] Note that the nominative suffix /i/ occurs after a consonant-final stem, as shown in the previous section. If /i/ is a causative suffix, then this form would be grammatical.

[12] This reverse ordering is also found in English, e.g. *–abil-ity*, *-ist-ic* and *–ment-al*. See Fabb (1988) for a detailed discussion and relevant references.

the question arises as to how to specify where phonological rules apply in the lexicon, which brings us to the issue (11b).

Regarding (11b), H.-S. Sohn (1986) develops two types of morphological structures: *endocentric* and *exocentric* ones.[13] Informally speaking, endocentric structures represent stem + suffix (inflectional or derivational) constructions and exocentric constructions represent compound constructions. These two structures are notationally differentiated in terms of brackets: [[A] B] and [[A] [B]], respectively. As we will see, the structures in Sohn's proposal are technically different from analytic and non-analytic constructions in GP, as discussed in Chapter 2. However, unlike in GP, each bracket does not constitute an independent phonological domain to which phonological processes apply.[14] Rather, phonological rules applying in the selective domain of the lexicon are represented in terms of the type of structure generated by the morphological operation, i.e. whether these rules are sensitive to endocentric or exocentric constructions. Thus, the morphological information must be specified in rule-reformulations. For instance, the context in which neutralisation occurs is at the right edge of an exocentric structure, i.e. a final coda, as shown below.

(14) The context of neutralisation

```
        σ
       /|
      / |
     /  \
    x   x
        |
        __ ] [
```
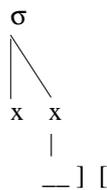
(σ: syllable)

Give the context in (14), neutralisation does not occur in an endocentric construction of which the structure is represented by [[A] B]. This implies that a stem-final consonant does not undergo neutralisation if a stem is followed by a suffix. For instance, when a stem ending in a consonant is followed by a vowel-initial suffix, this construction blocks the application of neutralisation, i.e. [[kap$^h$] a ] from /kap$^h$/ 'to pay back', /a/ 'stative suffix'. After inner bracket erasure, the stem-final consonant [p$^h$] is resyllabified as an onset for the following vowel [a].

In fact, this analysis can avoid the extrinsic rule ordering which may have been required to yield a correct form as in the analysis of S.-C. Ahn (1985). The two rules, i.e. neutralisation and resyllabification, derive [kap$^h$a] from /kap$^h$ + a/. If we were to apply neutralisation to the stem /kap$^h$/ first, then the phonetic form would be *[kapa]. Thus, in order to derive the correct form, it is crucial that resyllabification must be applied first. That is, by resyllabification of the stem-final segment into a

---

[13] Her proposal is based upon the notion of the *Feature Percolation Convention* (henceforth FPC) proposed by Lieber (1981).
[14] Implicitly, though, H.-S. Sohn assumes that the application of syllabification rules proceeds separately in stems and affixes.

following onset, this segment is immune to the application of neutralisation when the stem is followed by a vowel-initial suffix such as the stative suffix /a/. By virtue of the specification that the context in which neutralisation occurs is sensitive to exocentric constructions as in (14), the structural description of /kap$^h$ + a/ is not met for neutralisation, because this form has the endocentric construction, i.e. [[kap$^h$] a].

Arguably, this analysis provides a less arbitrary account in that it does not resort to extrinsic rule ordering. The rule-formulation in (14), however, suffers a crucial empirical difficulty. By restricting neutralisation to exocentric constructions, all endocentric constructions are predicted to be beyond the scope of neutralisation. But this is not the case, as seen when consonant-initial suffixes are added to a stem. For instance, the phonetic form [kapt'a] from [[kap$^h$] ta], /ta/ 'declarative suffix'. The phonetic form of this is.[15] Notice that the stem-final consonant /p$^h$/ undergoes neutralisation. Accordingly, (14) is insufficient to cover the contexts in which neutralisation occurs.

Another problem involves resyllabification. As Rice (1989) points out, the most undesirable consequence of a resyllabification analysis is the ensuing necessity for extrinsic rule ordering (e.g. Kim-Renaud 1982, O. Kang 1992, among others). A further significant problem with resyllabification appears to be its arbitrariness. In the literature, resyllabification from a coda to an onset would commonly occur when a vowel-initial suffix is added to a stem. For instance, Myers (1987) proposes a rule whereby an onset is resyllabified to a coda to deal with vowel shortening in English,[16] and H.-S. Sohn (1986) proposes that a coda glide is resyllabified to a following nucleus to yield a diphthong.[17] Given these additional resyllabification rules, there seems to be no constraint on how resyllabification operates.

Furthermore, as Harris (1994: 186) argues, by exemplifying optional syncope in English, one empirical result of adopting resyllabification is a significant increase in the set of possible grammars defined by phonological theory. The syncope site is located in the second of three nuclei in a strong-weak-weak metrical configuration such as the word *separate* (adjective) in which the second nucleus is suppressed as in [sɛ́p(ə)rət]. If we treat this syncope as the deletion of a nuclear position together with its melodic content, this approach requires resyllabification to repair the damage inflicted by the deletion of a nuclear position. The reasonable resyllabification would be [sɛ.prət] on the basis of the sonority sequencing principle (Selkirk 1984a, among others) and onset maximisation (Clements & Keyser 1983, Selkirk 1982, among others) ('.' indicates a syllable boundary.). Harris notes that this resyllabification is not possible when the result of syncope contains the sequences of *sr* from *mis(e)ry*, *mr* from *cam(e)ra*, *pn* from *op(e)ner* and so on.

---

[15] Tensification of the stem-initial /t/ is discussed in section 4.3.

[16] His paper aims to provide a unified analysis of various vowel shortening phonological processes at level 1 in English (Kiparsky 1985), in terms of a closed syllable effect. For instance, *trisyllabic shortening* is accounted for by resyllabifying a root-final consonant into a coda of the preceding syllable, e.g. *sane/sanity* where the root-final /n/ is resyllabified to the presuffixal syllable in order to produce closed syllable shortening.

[17] In her analysis of so-called p-irregular verbs in which the stem-final /p/ becomes [w], the stem-final [w] in the coda, resulting from the application of a consonant weakening rule and vowel shortening, is resyllabified to a following nucleus, e.g. /ko:p + a/ 'pretty' [kowa] via /ko:[w].a/.

These sequences form neither a branching onset nor a coda-onset cluster. In other words, one type of cluster generated by syncope can be reanalysed as a branching onset. However, there is another type of cluster which cannot be appropriately resyllabified. Thus, there is a phonotactic mismatch between underlying and resyllabified representations.[18]

In GP, in any analysis, resyllabification is prohibited by the *Projection Principle*, stated below.

(15)    Projection Principle
        Governing relations are defined at the level of lexical representation and remain constant throughout a phonological derivation.

                                               (KLV 1990: 221)

The Projection Principle ensures that existing governing (and licensing) relations cannot be altered in the course of the derivation.[19] This indicates that resyllabification is impossible, because resyllabification from a coda to an onset causes a change of governing relations. The absence of resyllabification is desirable in that it makes the theory more constrained than other frameworks, as discussed above. As we will see, GP can provide appropriate explanations of the phonological processes involved in suffixation without recourse to resyllabification.

To summarise, most phonologists agree that word-formation in Korean occurs in the lexicon.[20] Regarding the organisation of the lexicon, there is no stratal distinction between compounding and affixation, because affixation can occur inside compound constructions and vice versa. In fact, the absence of stratal distinction in the lexicon is compatible with Kaye's (1995) proposal on the interplay of morphology and phonology. In the next section, I will examine previous GP analyses of phonological processes occurring in suffixation and evaluate to what extent Kaye's proposal can provide an adequate account of these processes.


## 4.2. Previous GP approaches

To recapitulate the introduction to the morphology-phonology interface in Chapter 2, GP recognises two types of morphological constructions regarding suffixation: analytic and non-analytic structures, represented by [[A] B] and [AB], respectively. In an analytic structure, morphology is visible to phonology by the recognition of an internal domain in which a root or stem resides in suffixation contexts, while in a

---

[18] This implies that the underlying phonotactics must be shut off at some point in derivation. According to Borowsky (1989), among others, this mismatch can be handled by a stipulation that underlying phonotactics is preserved only up to level 1.
[19] Brockhaus (1995b: 192) points out that the Projection Principle allows for governing relations to be added in the course of derivation, while changing or deleting existing governing relations is prohibited. This refinement is required for dealing with phonological processes in suffixation, as we will see below.
[20] There is an exception to this. Following Anderson (1982), O. Kang (1993) adopts the position of *Split Morphology* in which inflectional affixation takes place in the syntax.

non-analytic structure, morphology is invisible to phonology by the non-distinction between a root or stem and a following suffix.   The brackets here represent instructions as to how phonological strings are processed.  Regarding the structure [[A] B], relevant phonological processes apply to A and concatenate the result with B, with phonological processes then applying to the result of the concatenation, i.e. [AB].   In the non-analytic structure [AB], phonological processes simply apply to the result of concatenation.  Given this brief view of the morphology-phonology interface in GP, let us consider how to classify the Korean suffixes into these two types.

## 4.2.1. Analytic and non-analytic suffixes in Korean

S.J. Rhee (1996) classified suffixes into analytic or non-analytic on the basis of whether or not a stem-final consonant undergoes neutralisation.   If it does, a following suffix is analytic; otherwise it is non-analytic.   Consider the following verbal conjugation.

| (16) | stem | declarative /ta/ | conjunctive /ko/ | stative /A/ | connective /mjə/ | |
|------|------|------------------|------------------|-------------|------------------|---|
| | /təpʰØ/ | [təpt'a] | [təpk'o] | [təpʰə] | [təpʰɨmjə] | 'to cover' |
| | /katʰØ/ | [katt'a] | [katk'o] | [katʰa] | [katʰɨmjə] | 'to be like' |
| | /is'Ø/ | [itt'a] | [itk'o] | [is'ə] | [is'ɨmjə] | 'to exist' |
| | /muk'Ø/ | [mukt'a] | [mukk'o] | [muk'ə] | [muk'ɨmjə] | 'to tie' |

In (16), we observe that there are consonant alternations between headless (lenis stop) and headed (aspirated or tensed) segments in stem-final position, in that a stem-final segment occurs as it is before an unlicensed nucleus, as in the stative and the connective forms, but undergoes neutralisation in the declarative and conjunctive forms.  Recall that Korean does not allow domain-internal 'coda'-onset sequences, as discussed in Chapter 2. This indicates that an empty nucleus intervenes between a stem-final and a suffix-initial segment.  Furthermore, neutralisation is sensitive to the presence of a domain-final empty nucleus, as discussed in Chapter 3.  In other words, the fact that a stem-final consonant undergoes neutralisation in the declarative and the conjunctive forms signifies that the stem-final consonant is followed by a domain-final empty nucleus.  This is the context for neutralisation, as shown below.

(17)   O     N     O     N
       |     |     |     |
   [ [ x     x     x     x ] + suffix]
       |     |     |
       α     β     C̲
                   ↓
                  [C°]          (C̲: headed segment, C°: headless segment)

The declarative and the conjunctive suffix are classified as analytic, which triggers neutralisation of a stem-final consonant.

In the stative and the connective forms, however, a stem-final consonant does not undergo neutralisation. To express this, we assume that there is no domain-final empty nucleus between a stem and a suffix. The stative suffix /A/ is directly attached to a stem without the intervention of an internal domain, as shown below.

(18)   O     N     O     N
       |     |     |     |
   [   x     x     x     x ]
       |     |     |     |
       α     β     <u>C</u>     A

The underlying representation of the connective suffix /mjə/, in particular, deserves attention. As seen in (16), the connective suffix shows ɨ/zero alternation. The vowel [ɨ] occurs when a stem-final segment is not a vowel or a liquid, e.g. /ka/ 'to go' [kamjə], /narØ/ 'to fly' [nalmjə], but /tatØ/ 'to close' [tatɨmjə], /məkØ/ 'to eat' [məkɨmjə]. One possible underlying representation of the connective suffix would contain an initial empty nucleus like /Ømjə/ to account for ɨ/zero alternation. This underlying form is more or less the same as that in the previous analyses discussed in Chapter 1, where the vowel /ɨ/ is specified in the underlying representation. Given this underlying form, the deletion of an underlying empty nucleus is necessary when a vowel-final stem precedes the suffix, as shown below.

(19) /ka/ 'to go' + /Ømjə/ [kamjə]
     O     N1    O     N2    O     N3
     |     |           |     |     |
     x     x           x     x     x
     |     |                 |     | \
     k     a                 m     j  ə

The deletion of the empty nucleus N2 may be ascribed to the effect of *reduction*, as we will see in 4.2.2.[21]

However, this analysis is not simpler than an analysis which is based on an underlying form without an initial empty nucleus /mjə/. Given this form, we do not need the deletion of N2 in (19), because the suffix /mjə/ can be directly attached to a stem. With respect to a consonant-final stem, the syllabification of the connective form follows the syllabic structure of Korean, as presented in Chapter 2, because Korean does not allow either 'coda'-onset clusters or branching onsets: an empty nucleus must intervene between two consonants. Consider the connective form of /nopʰØ/ 'high'.

---

[21] The retention of the empty nucleus N2 in this representation would yield a long vowel [a:] which is not a correct phonetic form.

(20)   O1   N1   O2   N2   O3   N3
       |    |    |    |    |    |
       x    x    x    x    x    x
       |    |    |    ↓    |    | \
       n    o    pʰ   [ɨ]  m    j  ə
                  ↑       ‖       ↓ inter-onset government


Note that an inter-onset governing relation between O2 and O3 cannot be established.  The phonetic interpretation of N2 is due to the fact that the headless segment /m/ cannot govern the headed segment /pʰ/.  The phonetic form [nopʰɨmjə] is derived.  In fact, (20) illustrates that non-analytic constructions are treated in the same way as morphologically simplex words, precisely because, like morphologically simplex words, non-analytic constructions themselves constitute a single domain.  One obvious merit of this analysis is that the interpretation of empty nuclei in mono-morphemic words and non-analytic constructions is analysed in a unified way.  This is predicted by Kaye's (1995: 308) proposal that the phonology reacts as if there were no morphology at all.  The examples in (19) and (20) therefore suggest that a suffix involved in ɨ/zero alternation does not necessarily contain an initial empty nucleus at all.   The syllabification of non-analytic constructions proceeds in the same way as that of mono-morphemic words.

To summarise, the criterion for distinguishing between analytic and non-analytic structures is whether or not a stem-final consonant undergoes neutralisation.  If neutralisation occurs before a given suffix, then this suffix is regarded as analytic.  Otherwise, the suffix is treated as non-analytic.  Before discussing nominal suffixes in the next section, the following table shows, though not exhaustively, a list of both types of verbal suffixes.

(21)   (a)   Analytic verbal suffixes
             /ta/            'declarative'      /ni/        'interrogative'
             /ca/            'propositive'      /kes'Ø/     'intentive'
             /tə/            'retrospective'    /ci/        'suppositive'
       (b)   Non-analytic verbal suffixes
             /A/             'stative'          /ni/        'effective'
             /Ato/           'concessive'       /mjə/       'connective'
             /mjən/          'conditional'      /si/        'honorific'

## 4.2.2. Nominal suffixation: paradoxical cases

As shown in (8a), in nominal suffixes there are allomorphs which are sensitive to whether a nominal stem ends in a vowel or a consonant, e.g. /ka/ or /i/ 'nominative', /rØrØ/ or /rØ/ 'accusative', /wa/ or /kwa/ 'connective', among others.  I assume that morphology chooses one of these allomorphs to constitute a lexical representation.

For instance, regarding nominative forms, the lexical representations of /napi/ 'butterfly' and /cip/ 'house' are /napi + ka/ and /cip + i/, respectively.

The classification of nominal suffixes into analytic and non-analytic categories is the same as that of verbal suffixes in that neutralisation provides a criterion. Some examples of these two suffixes are shown below.

(22)    (a) Analytic nominal suffixes
        /to/            'also, too'             /macə/          'even, so far as'
        /pota/          'than'                  /putʰə/         'ablative, from'
        /k'esə/         'nominative, horific'
        (b) Non-analytic nominal suffixes
        /i/             'nominative'            /rØ/            'accusative'
        /e/             'dative'                /esə/           'locative', 'source'
        /nØ/            'topicaliser'           /ina/           'alternative'
        /ro/            'instrument'

After this preliminary note, consider nominal suffixation in which these suffixes behave non-analytically with respect to neutralisation, i.e. a stem-final consonant does not undergo neutralisation, as shown below.

(23)    Stem            Nominative      Dative or locative      Source
        /cipʰØ/         [cipʰi]         [cipʰe]                 [cipʰesə]       'straw'
        /puəkʰØ/        [puəkʰi]        [puəkʰe]                [puəkʰesə]      'kitchen'
        /patʰ/          [pacʰi]²²       [patʰe]                 [patʰesə]       'field'
        /pak'Ø/         [pak'i]         [pak'e]                 [pak'esə]       'outside'
        /pəsØ/          [pəsi]          [pəse]                  [pəsesə]        'friend'
        /marØ/          [mari]          [mare]                  [maresə]        'horse'
        /k'ocʰØ/        [k'ocʰi]        [k'ocʰe]                [k'ocʰesə]      'flower'
        /picØ/          [pici]          [pice]                  [picesə]        'debt'

Regarding the phonetic interpretation of empty nuclei within a stem, a problem arises when a stem contains a penultimate empty nucleus followed by a segment which is potentially subject to neutralisation. The relevant examples are shown below.

(24)    Stem            Nominative      Dative or locative      Source
        /murØpʰØ/       [murɨpʰi]       [murɨpʰe]               [murɨpʰese]     'knee'
        /k'ØtʰØ/        [k'ɨcʰi]        [k'ɨtʰe]                [k'ɨtʰesə]      'end'
        /kØrØsØ/        [kɨrɨsi]        [kɨrɨse]                [kɨrɨesə]       'dish'
        /itʰØrØ/        [itʰɨri]        [itʰɨre]                [itʰɨresə]      'two days'

---

²² As noted earlier, a coronal stop undergoes palatalisation before a suffix /i/.

The retention of the segmental content of stem-final consonants indicates that these three suffixes are non-analytic. This would predict, however, contrary to fact, that the penultimate empty nuclei in (24) should not be phonetically interpreted.

(25) /murØpʰi/  [murip̄ʰi] *[mulpʰi]

```
    O1   N1   O2   N2   O3   N3
    |    |    |    |    |    |
    x    x    x    x    x    x
    |    |    |    ↓    |    |
    m    u    r   *[ø]  pʰ   i
              ↑_____↓ inter-onset government
```

Here, the requirements of inter-onset government are satisfied in that the government-licenser N3 is unlicensed and O3 can govern O2. Thus, we would expect N2 to be licensed, but the phonetic form [murip̄ʰi] indicates that this is not the case.

A possible solution to this problem is that these suffixes are treated as analytic. In this case, the penultimate empty nucleus N2 is followed by a domain-final empty nucleus, and so this empty nucleus is not licensed due to the absence of a government-licenser, as shown below.

(26)

```
        O1   N1   O2   N2   O3   N3   O4   N4
        |    |    |    |    |    |    |    |
    [ [  x    x    x    x    x    x ]       x ]
        |    |    |    ↓    |              |
        m    u    r   [ɨ]  pʰ             i
                   ↑_____‖_____↓ inter-onset government
                          ‖      ↓
                       [p] neutralisation
```

Since N3 is licensed by virtue of domain-final licensing, it cannot act as a government-licenser of O3 to govern O2. Accordingly, N2 receives phonetic interpretation. Also, the stem-final segment /pʰ/ undergoes neutralisation to become [p]. After bracket erasure, the following representation emerges.

(27)

```
        O1   N1   O2   N2   O3   N3    O4   N4
        |    |    |    |    |    |     |    |
    [    x    x    x    x    x    x          x ]
        |    |    |    ↓    |               |
        m    u    r   [ɨ]   p               i
                              ↓
                           [pʰ]      reduction
```

Note that the empty nucleus N3 is followed by a pointless onset O4. This sequence is not allowed due to the effect of reduction (see Chapter 2). The consequence is that N4 is available as a new licenser of O3.[23] As discussed in Chapter 3, segmental changes in neutralisation are construed, not as deletion of elements in question, but as non-interpretation. That is, those elements which are not licensed by a domain-final empty nucleus are still present rather than deleted in a given representation. The implication is that non-interpreted elements can be recovered in later stages, if appropriate conditions are met. Since N4 is an unlicensed nucleus, this nucleus has sufficient licensing abilities to reinterpret suppressed elements from the previous cycle, i.e. the headed element H which is doubly linked to express aspiration (see Chapter 2 for relevant segmental structures). What about the licensing status of N2? This empty nucleus is unlicensed in the internal domain, but can be licensed in the external domain, due to the fact that the potential government-licenser N4 is available and O3 can govern O2. The phonetic form [muripʰi], however, clearly indicates that N3 is not a government-licenser for O3 to govern O2 for the licensing of N2. Thus, the retention of the phonetic interpretation of N2 shows that it resists licensing by a government-licenser from an outer domain, i.e. N4 is not part of the internal domain in which N2 resides, as in (26). Thus, what the examples in (24) suggest is that an internal domain in an analytic construction displays an opacity effect, with respect to the application of the ECP.[24] I claim that this effect is derived from the Strict Cyclicity Condition (henceforth SCC) in the sense of Kean (1974) (See further discussions in the next section).

This analytic analysis can provide an appropriate account for the preservation of the phonetic interpretation of empty nuclei in a previous cycle for words ending in a headed stop. However, when a stem-final segment such as /s/ or /r/ requires addition of element(s) in order to be licensed by a domain-final empty nucleus, the analytic analysis suffers a technical problem. Consider the nominative form of /kØrØsØ/ 'dish'. The lexical representation of this form is /[[kØ₁rØ₂sØ₃] i]/. In the internal domain, the stem-final /s/ undergoes neutralisation to become [t] and the first two empty nuclei receive phonetic interpretation due to the failure of inter-onset government. After bracket erasure, /[kiritØ₃i]/ is derived. Ø₃ is deleted due to the

[23] I am aware that it would violate the Projection Principle in that the removal of a nuclear position seems to be an operation which affects the licensing relations established earlier. In fact, this issue has been raised in the GP literature, e.g. by Harris (1994) and Brockhaus (1995b). Though tentative conclusions have been drawn, according to Brockhaus (1995a: 103), the consensus seems that the Projection Principle is intended to prevent changes in constituent structure from taking place and eliminating an empty nuclear position is not in conflict with this as far as "onsets remain onsets and nuclei remain nuclei" (Kaye 1995). Also, Harris (1994: 204) points out that the identity of the nucleus which licenses the onset position O3 is immaterial, provided that the licensing requirements of this position are met, even after the application of reduction.

[24] The same treatment is needed in Polish (Gussmann & Kaye 1993). For instance, the double diminutive form /[[[pØ₁sØ₂]Ø₃kØ₄]Ø₅kØ₆]/ 'dog' [pesekek] (palatalisation effect is ignored), the bolded empty nuclei are potentially licensed by the following unlicensed nucleus. That is, Ø₁ is unlicensed because Ø₂ is not a proper governor. After bracket erasure, Ø₃ is not licensed due to Ø₄ being licensed and Ø₂ is deleted owing to reduction. In this case, unlicensed Ø₃ immediately follows Ø₁ to form a proper governing relation. The phonetic form [pesekek] indicates that the unlicensed status of Ø₁ is preserved.

application of reduction and these two empty nuclei retain phonetic interpretation owing to the SCC. Thus, the final phonetic form *[kɨrɨti] is derived, although the correct form is [kɨrɨsi], as in (24). The same problem is observed in a /r/-final nominal stem like /itʰØrØ/ 'two days' in that the analytic approach yields an incorrect nominative form *[itʰɨli] rather than the correct form [itʰɨri], as in (24), because the stem-final /r/ becomes [l] before a domain-final empty nucleus in the internal domain.

When we look at cases of other analytic suffixation, such as /to/ 'also' and /putʰə/ 'from', the phonetic forms of these two nouns are [kɨrɨtt'o] and [kɨrɨtp'utʰə], and [itʰɨlto] and [itʰɨlputʰə]. The presence of [t] and [l] in these cases indicates a context in which neutralisation occurs in the internal domain, on the one hand. The presence of [s] and [r] in the nominative forms, on the other, shows that there are no such internal domains. In other words, the nominative suffix /i/ behaves as if it were analytic regarding the phonetic interpretation of empty nuclei, and as non-analytic regarding neutralisation. The same phenomenon is observed in locative and source suffixation, e.g. [kɨrɨse] and [kɨrɨsesə]; [itʰɨre] and [itʰɨresə]. Given the nominal suffixation discussed so far, we encounter paradoxical cases in which the behaviour of a certain suffix varies in different phonological processes.[25]

In fact, Y. Heo (1995: 200) notes the same problem in discussing nominative suffixation and summed up as follows:

> We see that nominal suffixation in Korean cannot be fully accounted for by the morphological structure proposed by Kaye (1993) [(1995) SJR], thus, the theory requires extending to a certain degree.

To recapitulate, Kaye's (1995) proposal for the morphology-phonology interface needs a modification to accommodate the Korean facts discussed so far. As we will see below, I will not abandon his proposal completely, but will attempt to revise it by refining the degree of morphological analyticity to provide an adequate account of the licensing of empty nuclei in suffixation.

## 4.3. A revised analysis

The main purpose of this section is two-fold: (a) to refine the notion of morphological analyticity; (b) to account for the effect of opacity. Regarding the first issue, the presence of an internal domain in analytic constructions is insufficient to adequately account for ɨ/zero alternation in nominal suffixation, as was discussed in 4.2.2. I will argue that stems themselves constitute a domain of their own, i.e. without the final empty nucleus. This blocks the application of the ECP to stem-

---

[25] Rebrus, Siptár, Szigetvári & Törkenczy (1996), as cited in Polgárdi (1998: 55) and Rowicka (1999: 22), point out that the analytic and non-analytic distinction is not refined enough to deal with some facts of Hungarian. Hungarian suffixes do not seem to behave consistently as analytic or non-analytic regarding different phonological processes.

internal empty nuclei. The fact that an internal domain in an analytic construction displays an opacity effect goes against the minimalist hypothesis proposed by Kaye (1995: 291).

(28)    Minimalist Hypothesis
        Processes apply whenever the conditions that trigger them are satisfied.

One consequence of (28) is that the application of phonological processes completely disregards the derivational history they are involved in. The discussions in the previous section, however, show that the minimalist hypothesis is too strong to account for the licensing of empty nuclei in suffixation and so needs to be refined to account for the mode of the application of phonological processes, i.e. the effect of opacity must be taken into consideration. In this section, I explore various versions of the Strict Cyclicity Condition (SCC) (cf. Kean (1974), Kiparsky (1982, 1985) and Cole (1995), among others) to establish constraints on the way phonology works, paying particular attention to the application of the ECP to analytic constructions.

## 4.3.1. Stems as their own domain

As discussed in the previous section, the nominative suffix /i/ behaves non-analytically regarding neutralisation, but analytically with respect to ɨ/zero alternations. The fact that the segmental content of stem-final consonants is preserved, irrespective of whether this suffix is analytic or non-analytic, suggests that the stem-final consonant is visible to the following suffix /i/, i.e. the stem-final segment is licensed by the following suffix /i/ without an intervening domain-final empty nucleus. Yet, the phonetic interpretation of the preceding empty nucleus is retained despite the presence of a potential government-licenser. Given this situation, one plausible way of resolving the paradoxical behaviour of the nominal suffix /i/ is that stems constitute a domain of their own, as shown below.

(29) [<stem>[26] i]

Independent evidence that the stem domain is required comes from palatalisation.[27] As noted in earlier examples, a stem-final coronal stop undergoes palatalisation when the suffix /i/ follows, whether this is a nominative suffix or adverbialiser, as shown below.

---

[26] Henceforth, the stem-domain is represented by angled brackets. For the interpretation of this bracket together with the square bracket, see below.
[27] The segment changes from /t$^h$/ to [c$^h$] and /t/ to [c] are involved in the shift to the contour structure. See Yoshida (2001) for a detailed discussion of this matter.

(30)   (a)   Nominative suffix /i/
                 /pat^h-i/              [pac^hi]              'field'
                 /k'Øt^h-i/             [k'ɨc^hi]             'end'
                 /hɛ-tot-i/             [hɛtoci]              'sunrise'
                 /mi-tat-i/             [mitaci]              'sliding door'
         (b)   Adverbialiser /i/
                 /kat^h-i/              [kac^hi]              'together'
                 /kut-i/                [kuci]                'positively'
                 /nat^h-nat^h-i/        [natnac^hi]           'one by one'

However, palatalisation does not occur within a stem, even though the context in which this process occurs is exactly the same as that in (30). In other words, the presence of palatalisation signals a boundary.

(31)   /mati/            [mati] *[maci]        'knot'
         /pət^hi/          [pət^hi] *[pəc^hi]    'to endure'
         /t^hɨ/            [t^hɨ] *[c^hɨ]        'dust'
         /cipØ/            [cip]                 'house'
         /cicØ/            [cit]                 'to bark'

Note that coronal stops within stems occur before the vowel /i/ without palatalisation. Furthermore, affricates also occur before the same vowel. Thus, (30) and (31) show that the applicability of palatalisation is sensitive to the boundary between stem and suffix. Given the palatalisation facts in Korean, the minimalist hypothesis in (28) is too strong and so the mode of application of phonological processes must be constrained. In fact, the context in which palatalisation occurs requires the presence of a boundary marker, as in (29), i.e. /[<stem> i]/.

What about the application of the ECP to stem-internal empty nuclei? Recall that these empty nuclei are licensed either by inter-onset government if government-licensers are present, or by proper government elsewhere, as discussed in Chapter 3, on the assumption that each morpheme constitutes its own domain ending in a nucleus. By setting up the stem domain as in (29), however, the licensing will work slightly differently.

Before discussing the application of the ECP to the stem domain, let me clarify some terminological matters. As shown in (32), I propose that the onset-final stem domain is contained within square brackets and a domain-final empty nucleus is outside the stem domain. Until now, the square bracket notation has been implicitly regarded as stem domain, when I discussed the licensing of empty nuclei within a morpheme in Chapter 3. Since I now introduce the stem domain within angled brackets, a new term referring to phonological strings within square brackets is needed in order to avoid confusion. Henceforth, I reserve the term *stem domain* for phonological material within angled brackets and *extended stem* domain for

phonological material ending in an empty nucleus within square brackets.[28]  Very often, when a stem ends with a vowel, the stem domain coincides with the extended stem domain, as shown in (32a), while (32b) represents a stem ending in a consonant.

(32)   (a) Vowel-final stem                     (b) Consonant-final stem
         [<stem>]                                    [<stem> Ø]

Furthermore, I retain the notions of analytic and non-analytic constructions to account for phonological processes involved in suffixation.  Given the introduction of the stem domain, analytic and non-analytic suffixation result in the following structures.

(33)   (a) Non-analytic suffixation
         [<stem> suffix]
         (b) Analytic suffixation
         [[<stem> (Ø)] suffix]

(33a) shows that a non-analytic suffix is attached to the stem domain without intervening square brackets.  This construction differs from that of the extended stem domain in that the latter may end in a final empty nucleus, but the former does not, e.g. /[<cip$^h$> Ø]/ 'straw' and /[<cip$^h$> i]/ 'straw, nominative suffix'.  The structure resulting from analytic suffixation contains three domains: the stem domain, the extended stem domain, and the concatenation of the extended stem domain with a following suffix, e.g. /[[<cip$^h$> Ø] to]/ 'straw, also'.

Bearing this in mind, consider, for instance, /[<kotØrØm>Ø]/ [kotɨrɨm] 'icicle'.  The lexical representation is shown below.

(34)   /[<kotØrØm>Ø]/  [kotɨrɨm]



                                                    inter-onset government

In this structure, I propose that phonological processes apply first to the innermost domain, i.e. the stem domain.  Thus, the ECP inspects this domain first.  Note that this domain is onset-final and so the empty nucleus N3 of the stem domain does not have a following government-licenser to license it.  In other words, the

---

[28] One may argue that the extended stem domain corresponds to *phonological word* (Selkirk 1984b, Nespor & Vogel 1986, among others).  Nouns in the extended stem domain may constitute phonological words, since they can stand alone without affixation.  However, verbal stems require affixation to constitute a phonological word, and thus the extended stem domain does not coincide with the domain of phonological words.  This situation is more or less the same in Georgian (Butskhrikidze 2002).

extended stem domain-final empty nucleus N4 is invisible to the application of the ECP. With respect to the penultimate empty nucleus N2, the unlicensed status of this empty nucleus is due to the failure of inter-onset government between O2 and O3. Compared with the analysis in the previous chapter, the difference lies in the fact that the domain-final empty nucleus N4 in the extended stem is not available while the ECP directly applies to the stem domain. The stem domain is only visible to the extended stem domain-final empty nucleus N4 after doing phonology to the stem domain. The phonetic form is [kotɨrɨm].

What about cases in which a stem-final consonant undergoes neutralisation? Since I assume that the stem domain can end in an onset for consonant-final stems, the application of neutralisation proceeds after bracket erasure of the stem domain. For instance, consider /[<cip$^h$> Ø]/ [cip] 'straw'. In this example, after bracket erasure, the stem-final /p$^h$/ occurs before an extended stem domain-final empty nucleus: the context for neutralisation. This segment therefore undergoes neutralisation to become [p].

I am aware that the analysis of onset-final stems raises the question as to whether or not the postulation of the stem-domain violates the Coda Licensing Principle and the Onset Licensing Principle, both of which require that each domain ends in a nuclear position.[29] With respect to this question, I assume that the stem domain is *parasitic* in the sense that this domain does not constitute an independent phonological domain.[30] For instance, the extended stem domain is subject to these two principles but the stem domain is not. In other words, the domain of syllabification is based on the extended stem domain and the effect of these principles is temporarily suspended within the stem domain. Thus, domain-final licensing applies to an extended stem domain and so neutralisation takes place in this domain, not in the stem domain. In fact, the parasitic nature of the stem domain is confirmed by the fact that the result of the application of the ECP to the stem domain is the same as the result after bracket erasure of the stem domain, as in (34). That is, the presence of a final empty nucleus in the extended stem domain does not override the licensing of empty nuclei within the stem domain.

Thus far, I have demonstrated the way in which phonology applies to the stem and the extended stem domain. The interpretation of the bracketing is more or less the same as in Kaye's (1995) proposal. Let us now turn to non-analytic constructions to see how phonology proceeds there. First, consider the nominative forms of /[<cip$^h$>Ø]/ 'straw' and /[<pat$^h$>Ø]/ 'field'. Their lexical representations are as follows.
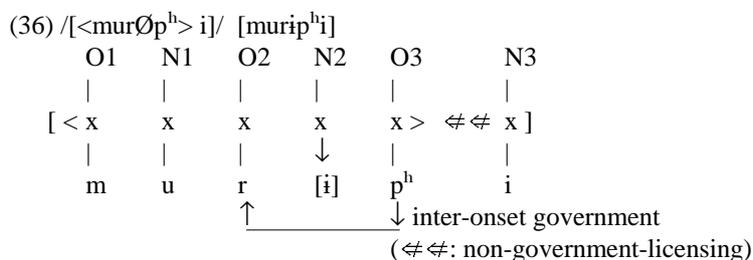
---

[29] Nancy Kula (p.c.) also assumes all morphological and phonological domains to be consonant final in her analysis of Bemba phonology, despite the strict CV syllable structure of the language. This assumption follows from the fact that the obligatory final vowel of every verb form is phonologically inactive but merely plays the role of specifying the parameter setting on domain final empty nuclei (i.e. 'off'). Support for this position is given by the processes of consonant mutation and imbrication (a form of infixation) within the verbal complex. For details, see Kula (in prep.).

[30] This is also the reason why the introduction of the distinction between stem and extended stem domains does not replicate the lexical strata of Lexical Phonology: each stratum is independent phonologically.

(35)　(a) /[<cip$^h$>i]/　[cip$^h$i]

```
      O1    N1    O2      N2
      |     |     |       |
 [ <  x     x     x >     x ]
      |     |     |       |
      c     i     pʰ      i
```

　　　(b) /[<pat$^h$>i]/　[pac$^h$i]

```
      O1    N1    O2      N2
      |     |     |       |
 [ <  x     x     x >     x ]
      |     |     |       |
      p     a     tʰ      i
                  ↓
                  [cʰ]
```
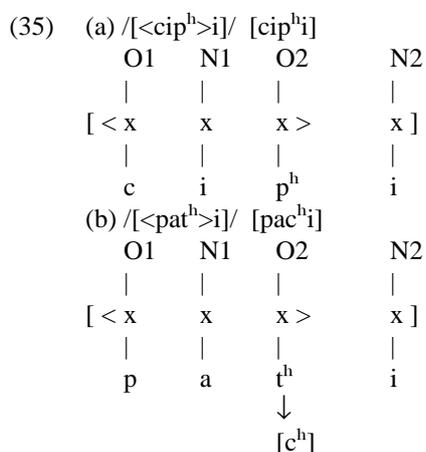
In (35a), after erasure of the stem domain, the stem-final /p$^h$/ is followed by the nominative suffix /i/. Since /i/ is an unlicensed nucleus, the stem-final segment is realised as it is. The phonetic form is [cip$^h$i]. In (35b), as noted in (30) above, the stem-final /t$^h$/ becomes /c$^h$/ before the vowel /i/, since palatalisation is regarded as a cross-boundary process.

　　Now consider the problematic cases in which licensable empty nuclei in the stem domain resist being licensed by a following potential government-licenser, for instance, the nominative form of /<murØp$^h$> Ø/ 'knee'.

(36) /[<murØp$^h$> i]/　[murɨp$^h$i]

```
      O1    N1    O2    N2    O3       N3
      |     |     |     |     |        |
 [ <  x     x     x     x     x >  ⇍ ⇍ x ]
      |     |     |     ↓     |        |
      m     u     r    [ɨ]    pʰ       i
                  ↑_____ ↓ inter-onset government
                            (⇍ ⇍: non-government-licensing)
```

Within the stem domain, the empty nucleus N2 is not licensed, as witnessed by its phonetic interpretation, due to the absence of a government-licenser in this domain, even though an inter-onset governing relation between O2 and O3 can be established. After bracket erasure of the stem domain, the stem-final /p$^h$/ is licensed by the unlicensed nucleus N3 and so it is realised, as it is. As noted in (25), however, the empty nucleus N2 is not licensed by the government-licenser N3 outside the stem-domain, which produces an opacity effect regulated by the SCC, as will be discussed in the next section.

　　Regarding the licensing of empty nuclei, the analysis based on the stem domain achieves the same opacity effect as the analysis based on Kaye's proposal, as discussed in 4.2.2. One merit of the postulation of the stem domain is that this

analysis provides a consistent account of the behaviour of the nominative suffix /i/ which was problematic within the analysis based on analytic and non-analytic constructions discussed earlier. The absence of neutralisation before the nominative suffix /i/ is directly explained by the adjacency of the stem-final consonant and the suffix /i/, as in the case of palatalisation in which a stem-final coronal stop is visible to the following /i/. Furthermore, this analysis avoids problems involving the stem-final segments /s/ and /r/. If the suffix /i/ is treated as analytic, the phonetic forms of the stem-final segments become [t] and [l], respectively, due to the application of neutralisation in the innermost domain. However, such problems do not arise owing to the fact that the stem-final consonants are directly visible to the following suffix /i/.

## 4.3.2. The opacity effect: Strict Cyclicity Condition

In this section, I will show that the opacity effect is derivable from the Strict Cyclicity Condition (SCC) and the effect of the SCC plays an active role in various suffixes involved in non-analytic and analytic constructions. In the literature, there have been various proposals based on the SCC (Kean 1974, Mascaró 1976, Kiparsky 1982, 1985, among others). According to Cole (1995: 72), the empirical effects of the SCC can be summarised as the *Reaching Back Constraint* (henceforth RBC) and the *Derived Environment Constraint* (henceforth DEC). The former prevents a cyclic rule *R* applying on cycle *j* from reaching back inside an earlier cycle *i* to apply to a string contained wholly within cycle *i*. The implication of this constraint is that the domain of an earlier cycle is opaque to phonological processes in a current cycle.[31] The effect of the latter, originally responsible for limiting the abstractness of phonological analysis, prevents *R* from applying to a string contained within a

---

[31] The formulations of the RBC of Kean and of Cole are slightly different. The formulation of Kean (1976: 179) is as follows.

"on any cycle A no cyclic may apply to material within a previous cycle B without making crucial use of material uniquely in A."

For instance, there are two rules in a given language in which (a) is ordered before (b).

(a) $X \rightarrow Y$ / [ __ Z]        (b) $P \rightarrow Q$ / [ ___ Y]

In the string (c), the domain of the cycle *i* is *PX* and any reflex of *PX* wholly contained within the *i* brackets.

(c) $[_j [_i PX _i] Z _j]$

By the SCC, no rule may apply on cycle *j* unless it makes crucial reference to Z. The SCC regulates that the form [PYZ] is possible but *[QYZ] is not on cycle *j*. Thus, the SCC blocks the application of (b). The empirical consequence of the SCC of the Kean's version is that phonological processes sensitive to a morpheme boundary are allowed to apply but processes which trigger the change of material inside are not allowed. According to Cole, however, the effect of the RBC ignores the application of rules sensitive to a morpheme boundary. In her presentation, there are two rules in which (d) is ordered before (e).

(d) $A \rightarrow B$ / ___ D        (e) $C \rightarrow D$ / ___ E

Given [ACE] on cycle 1, only (e) applies to yield the form [ADE]. Given [X ADE Y] on cycle 2, the application of (d) is blocked to yield  *[X BDE Y] due to the SCC. The SCC of the Cole version only shows an opacity effect of material contained on an earlier cycle.

single morpheme.[32] Thus, the SCC regulates the ways in which cyclic rules typically apply across a morpheme boundary and are prohibited from applying within a morpheme. The empirical consequence is that phonological rules fail to apply within a stem (or root) or other monomorphemic environments.

Implementing the insights of the SCC into my analysis, the preservation of phonetic interpretation of empty nuclei in stem domains and palatalisation facts involved in nominative forms may be derived by either constraint. Because palatalisation is sensitive to cross-morpheme boundaries and does not apply morpheme internally, a result of the application of the ECP on an earlier cycle is preserved despite the fact that there is a potential government-licenser available on a current cycle.[33]

So far we have considered cases in which a domain contains a stem and a single non-analytic suffix. I will test whether or not these two effects can hold in multiple suffixation contexts. Consider the following examples in which the nominaliser /mØ/[34] and the nominative suffix /i/ are added to a stem.

(37)   (a) Vowel-final stem

| | | |
|---|---|---|
| /[<ka> m i ]/ | [kami] | 'to go' |
| /[<o> m i ]/ | [omi] | 'to come' |

     (b) Obstruent-final stem

| | | |
|---|---|---|
| /[<mək> Øm i ]/ | [məkɨmi] | 'to eat' |
| /[<mit> Øm i ]/ | [mitɨmi] | 'to close' |
| /[<us> Øm i]/ | [usɨmi] | 'to laugh' |
| /[<kapʰ> Øm i]/ | [kapʰɨmi] | 'to pay back' |
| /[<katʰ> Øm i]/ | [katʰɨmi] | 'to be the same' |

     (c) Nasal-final stem

| | | |
|---|---|---|
| /[<kam> Øm i]/ | [kamɨmi] | 'to wind' |
| /[<an> Øm i]/ | [anɨmi] | 'to hug' |

The nominaliser /mØ/ is classified as non-analytic in that the segmental content of the stem-final segment does not change at all, as in the examples /kapʰØ/, /usØ/ and /katʰØ/. Also, I assume that the underlying representation of this suffix begins without an empty nucleus. As in the examples (37b,c), the presence of a preceding empty nucleus follows from the syllable structure of Korean. Thus, the non-

---

[32] There is an exception to this statement in that a cyclic rule *R* can apply to a monomorphemic string only if that string has been altered by the prior application of another phonological rule, e.g. the rule of spirantisation in Finnish and the Ruki rule in Sanskrit (Kiparsky 1973).

[33] The original version of the DEC (Kiparsky 1982) requires that no structure-changing rules should apply to monomorphemic domains. The question arises as to whether or not the application of the ECP to the stem domain is regarded as a structure-changing process. Since the application of the ECP is an interpretation process without invoking changes of syllabification and segments, it does not contain aspects of structure-change rules (Kooij p.c.).

[34] Since the nominative suffix /i/ is non-analytic, this suffix follows by the nominaliser without postulating an intervening empty nucleus. When an analytic suffix, such as /to/ 'also', follows the nominaliser, the following construction emerges, /[[<stem> mØ] to]. Thus, the lexical representation of the nominaliser is /mØ/.

occurrence of the vowel [ɨ] after vowel-final stems as in (37a) is not the result of the deletion of an empty nucleus due to the OCP, as discussed in the case of conjunctive suffix /mjə/ in the previous section.  Rather, it is simply the result of syllabification.

    As discussed previously, the nominative suffix /i/ is also non-analytic.  The forms in (37) are involved in a stem followed by two non-analytic suffixes.  Thus, the lexical representations in (37) contain a single domain in which a stem domain resides.  Let us consider how the ECP and the SCC apply in these representations.

(38)    (a) /[<mək> Øm i ]/  [məkɨmi]  'to eat'
           O1     N1     O2     N2     O3     N3
            |       |      |       |      |       |
        [ < x      x      x >     x      x      x ]
            |       |      |       ↓      |       |
            m       ə      k      [ɨ]     m       i
                                  ↑_____‖_____↓ inter-onset government
                                           ‖

        (b) /[<kam> Øm i]/  [kamɨmi]  'to wind'
           O1     N1     O2     N2     O3     N3
            |       |      |       |      |       |
        [ < x      x      x >     x      x      x ]
            |       |      |       ↓      |       |
            k       a      m      [ɨ]     m       i
                                  ↑_____‖_____↓ inter-onset government
                                           ‖

In (38a), we try to establish an inter-onset governing relation between the stem-final and the suffix-initial segments.  Even though the government-licenser N3 is present, O3 cannot govern O2 due to the prohibition of mutual government among segments of the same rank.  Thus, the intervening empty nucleus N2 receives phonetic interpretation.  (38b) illustrates an asymmetrical distribution of NN sequences, as discussed in section 3.2.2 in Chapter 3.  Recall that stem-internal NN sequences are syllabified as a doubly-linked structure which accounts for the absence of the phonetic interpretation of an intervening empty nucleus.  In suffixation, however, each nasal, i.e. O2 and O3 in (38b), has its own association line, due to the fact that these two nasals are separated by a stem domain.  This would provide another piece of evidence that a stem and a suffix are treated differently in non-analytic suffixation.  The phonetic interpretation of the intervening empty nucleus N2 is the same as that of (38a), because. mutual government is disallowed for equally ranked segments.  The intervening empty nucleus N2 is therefore phonetically realised between the two nasals.[35]

    In multiple suffixation, as analysed in (38), the phonetic interpretation of an empty nucleus between a stem-final and a suffix-initial segment follows the

_____

[35] The mode of the application of the ECP to the two nasals in (38) can be derivable from the Linking Constraint (Hayes 1986b) which requires that all association lines be exhaustively interpreted.

procedure, as proposed so far; failure of inter-onset government between stem-final and suffix-initial segments contributes to the phonetic interpretation of an intervening empty nucleus. What happens in cases where the requirements of inter-onset government are met between these segments? These cases arise in liquid-final verb stems, as shown below.

(39)  Liquid-final stem
    /[<cor> Øm i]/        [corɨmi]        'to doze'
    /[<kar> Øm i]/       [karɨmi]       'to grind'

Let us suppose that the examples in (39) have the same lexical representations as those in (38).

(40)   /[<cor> Øm i]/  [corɨmi]  *[colmi]

```
        O1      N1      O2      N2      O3      N3
        |       |       |       |       |       |
    [ < x       x       x >     x       x       x ]
        |       |       |       ↓       |       |
        c       o       r      *[ø]     m       i
                                ↑_____↓  inter-onset government
```

In this configuration, the intervening empty nucleus N2 is licensed by virtue of the satisfaction of inter-onset government between O2 and O3 and the presence of a government-licenser N3. In addition, the segment /r/ becomes [l] before a licensed empty nucleus, as discussed in Chapter 3. The phonetic form [colmi] is, however, not correct. The correct form [corɨmi] indicates that the intervening empty nucleus N2 is not licensed. In fact, the context in which N2 receives phonetic interpretation is exactly the same as that of the nominative form /[<murØp^h> i]/ [murip^hi] 'knee', which was shown in (36). Recall that the phonetic interpretation of the empty nucleus preceding the stem-final segment /p^h/ provides evidence that the stem domain is required to produce the SCC effect. In other words, the nominative suffix /i/ is unable to function as a government-licenser to license this empty nucleus. This suggests that the treatment of the examples in (40) and in (36) is the same, as shown below.

(41)   /[<<cor> Øm> i]/  [corɨmi]  *[colmi]

```
        O1      N1      O2      N2      O3          N3
        |       |       |       |       |           |
    [ << x      x       x >     x       x > ⇍ ⇍     x ]
        |       |       |       ↓       |           |
        c       o       r      [ɨ]      m           i
                                ↑_____↓
```
                      (⇍ ⇍: non-government-licensing)

The fact that N3 cannot act as a government-licenser of O3 necessitates another domain for the nominaliser /mØ/. That is, O3 must be separated by another internal stem-like domain which blocks government-licensing from N3, i.e. O3 is blind to the presence of N3. The phonetic interpretation of N2 is due to the failure of inter-onset government, since a potential government-licenser is outside the domain for the application of the ECP. Thus, we come across another type of domain ending in an onset in this construction.

Morphologically, the configuration (41) contains a nominalised form followed by an inflectional suffix, i.e. the stem and the nominaliser constitute a complex stem. Note that this complex stem is derived through nominalization and shows an opacity effect by blocking the application of inter-onset government. This strongly indicates that the DEC may not provide an appropriate account of the opacity effect for complex stem cases, precisely because this constraint is only responsible for the non-derived environment blocking effect. The RBC effect, however, does not have non-derived restrictions such that this constraint allows an opacity effect in derived environments like multiple suffixation as in (41), i.e. the RBC only prevents a given phonological processes on cycle $j$ from reaching back inside an earlier cycle $i$ to apply to a string contained wholly within cycle $i$. This indicates that the RBC does not care about whether or not material contained in an earlier cycle constitutes a derived or a non-derived environment. Thus, the opacity effect in (41) is ascribed to the SCC, in particular, the RBC.[36]

The discussion so far shows that the minimalist hypothesis in (28) does not hold in non-analytic constructions and that a constraint limiting the domain of application of phonological processes is required. The SCC regulates the way in which phonological processes apply to a non-analytic construction involved in multiple suffixation. In the next section, I will consider how the SCC interacts with analytic constructions.

## 4.3.3 The SCC in analytic structures

Consider the honorific and the declarative forms in nasal-final stems.

(42)   stem                honorific /si/      declarative /ta/
       /namØ/              [namɨsi]            [namt'a]              'to remain'
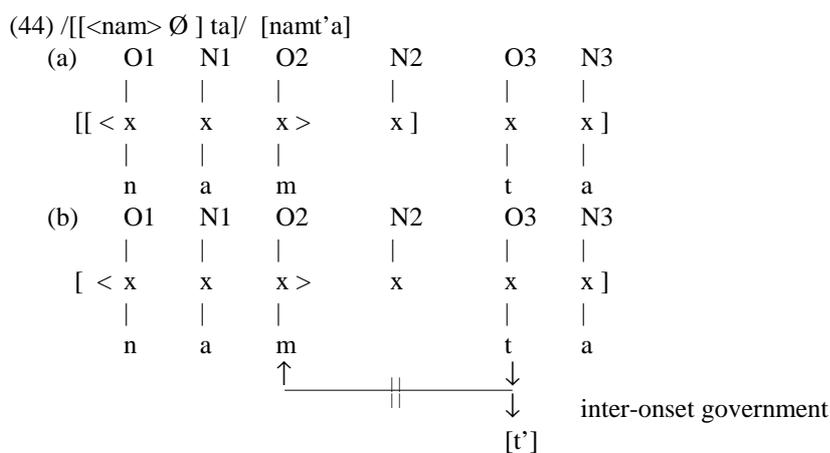       /anØ/               [anɨsi]             [ant'a]               'to hug'

In (42), we observe that the vowel [ɨ] occurs in the honorific forms and the suffix-initial segment /t/ undergoes tensification in the declarative forms. The presence of [ɨ] between stem-final nasals and suffix-initial /s/ indicates that honorific suffixation is non-analytic, as shown below.

---

[36] From now on, I will use the more general term SCC to refer to an opacity effect in a given representation.
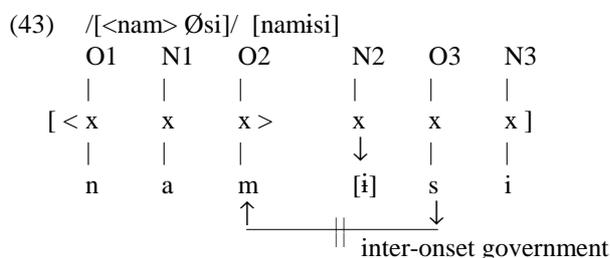
(43)  /[<nam> Øsi]/  [namɨsi]

```
     O1   N1   O2       N2      O3   N3
     |    |    |        |       |    |
  [ < x    x    x >      x       x    x ]
     |    |    |        ↓       |    |
     n    a    m       [ɨ]      s    i
                  ↑              ↓
                  └──────╫──────┘ inter-onset government
```

The phonetic interpretation of N2 is due to the failure of inter-onset government between O2 and O3, because the lenis obstruent /s/ cannot govern the nasal /m/.

In the declarative forms, however, an N2-type nucleus in (43) does not receive phonetic interpretation, and instead the suffix-initial /t/ becomes tensed. Like (43), in the declarative forms, the inter-onset governing relation between the stem-final nasals and the suffix-initial /t/ cannot be established because segments in the same rank are prohibited from being mutually governed. Apparently, the non-occurrence of the vowel [ɨ] in the declarative suffixation indicates that this suffix /ta/ cannot be non-analytic. If this suffix is analytic, the lexical representation of /[<nam> Ø]/ 'to remain' is shown below.

(44) /[[<nam> Ø ] ta]/  [namt'a]

```
 (a)    O1   N1   O2       N2      O3   N3
        |    |    |        |       |    |
     [[ < x    x    x >      x ]     x    x ]
        |    |    |                  |    |
        n    a    m                  t    a

 (b)    O1   N1   O2       N2      O3   N3
        |    |    |        |       |    |
     [ < x    x    x >      x       x    x ]
        |    |    |                  |    |
        n    a    m                  t    a
                     ↑              ↓
                     └──────╫──────┘ inter-onset government
                                   ↓
                                 [t']
```

In (44a), N2 is an extended stem domain final empty nucleus. This empty nucleus is licensed due to domain-final licensing. After bracket erasure, the configuration in (44b) emerges. In this configuration, we can set up the inter-onset governing relation between O2 and O3 across N2, as in non-analytic suffixation. The crucial difference between (43) and (44) is that the failure of inter-onset government in the latter produces tensification: a lenis stop /t/ cannot govern a nasal /m/. The motivation for tensification is to satisfy inter-onset government, because nasals require a headed segment to be governed. This implies that the licensed status of N2 is not altered after bracket erasure. I also ascribe the preservation of the licensed

status of N2 to the SCC: the result of application of the ECP in an earlier cycle is preserved on the next cycle. The licensed status of N2 enables the surrounding consonants to be visible, and so inter-onset government applies to these sequences. Furthermore, the SCC effect on N2 in (44) predicts that various consonant-related processes occur in order to meet the requirements of inter-onset government in analytic constructions. These processes are discussed in section 4.3.5.

Thus far, I have discussed the effect of the SCC on various constructions. In non-analytic suffixation, the SCC accounts for the preservation of the phonetic interpretation of an empty nucleus in a stem domain. In multiple suffixation, the notion of complex stem is required in order to explain the preservation of the phonetic interpretation of an empty nucleus of a certain suffix in terms of the SCC, in particular, the RBC. In analytic constructions, a final empty nucleus in an extended stem domain is licensed due to domain-final licensing, and its licensed status is kept in subsequent cycles. In these constructions, various consonant-related processes are invoked to satisfy inter-onset government. Regarding the satisfaction of the ECP, there is a crucial difference between analytic and non-analytic constructions in that the former involves consonant-related processes and the latter involve the occurrence of the vowel [ɨ] in a given context. In the next section, I will deal with ɨ/zero alternations under non-analytic suffixation.

## 4.3.4. ɨ/zero alternations in suffixation

The list of following non-analytic suffixes showing ɨ/zero alternations emerges from the discussion in the previous sections.

(45)　(a) Verbal inflectional suffixes

|  |  |  |  |
|---|---|---|---|
| /mjən/ | 'conditional' | /ni/ | 'effective' |
| /si/ | 'honorific' | /mjə/ | 'connective' |

　　　(b) Nominal inflectional suffixes

|  |  |  |  |
|---|---|---|---|
| /rØ/ | 'accusative' | /nØ/ | 'topicaliser' |
| /ro/ | 'instrumental' | | |

　　　(c) Derivational suffixes

|  |  |
|---|---|
| /mØ/ | 'nominaliser' |

Based on the governing hierarchy among segments and the notion of stem domains, the results of ɨ/zero alternations in constructions with these suffixes are more or less predictable. First, consider cases in which suffixes do not contain a vowel, such as the accusative suffix /rØ/, the topicaliser /nØ/ and the nominaliser /mØ/. Each consonant is followed by an empty nucleus. When these suffixes attach to a stem, an intervening empty nucleus between a stem-final and a suffix-initial segment always receive phonetic interpretation, irrespective of the segmental content of surrounding consonants, because there are no government-licensers to satisfy the requirements of inter-onset government. Examples are shown below.

(46)  Stem         Accusative      Topicaliser     Nominaliser
      /torØ/        [torɨl]         [torɨn]                         'stone'
      /corØ/                                        [corɨm]         'to doze'
      /t'amØ/       [t'amɨl]        [t'amɨn]                        'sweat'
      /tamØ/                                        [tamɨm]         'to fill'
      /cipØ/        [cipɨl]         [cipɨn]                         'house'
      /ətØ/                                         [ətɨm]          'to get'
      /cipʰØ/       [cipʰɨl]        [cipʰɨn]                        'straw'
      /nopʰØ/                                       [nopʰɨm]        'high'
      /pisØ/        [pisɨl]         [pisɨn]                         'comb'
      /pəsØ/                                        [pəsɨm]         'to take off'
      /nacØ/        [nacɨl]         [nacɨl]                         'daytime'
      /macØ/                                        [macɨm]         'correct'

(47) /[<tor> ØrØ]/  [torɨl] 'stone ACC'

```
      O1    N1    O2    N2    O3    N3
      |     |     |     |     |     |
   [ < x    x     x >   x     x     x ]
      |     |     |     ↓     |
      t     o     r    [ɨ]    r
                              ↓
                             [l]
```

In (47), the inter-onset governing relation between O2 and O3 is not established, because N3 is licensed and thus cannot act as a government-licenser. The intervening empty nucleus N2 therefore receives phonetic interpretation. The segment /r/ in O3 occurs before a domain-final empty nucleus N3 and so undergoes neutralisation to become [l]. The phonetic form [torɨl] is derived. An N2-type empty nucleus in the other examples in (46) receives phonetic interpretation in the same way, as in (47).

Apart from liquid-final verbal stems, an intervening empty nucleus between a stem-final and a suffix-initial segment receives phonetic interpretation in non-analytic suffixation, since a suffix-initial segment, a nasal /m/ or /n/, or a coronal headless fricative /s/, cannot govern a preceding stem-final consonant.[37] Some examples of ɨ/zero alternations are shown below.

(48)  Stem      Conditional    Effective    Honorific    Connective
      /ətØ/     [ətɨmjən]      [ətini]      [ətisi]      [ətɨmjə]     'to get'
      /məkØ/    [məkɨmjən]     [məkini]     [məkisi]     [məkɨmə]     'to eat'
      /pəsØ/    [pəsɨmjən]     [pəsini]     [pəsisi]     [pəsɨmjə]    'take off'
      /macØ/    [macɨmjən]     [macini]     [macisi]     [macɨmjə]    'correct'

---

[37] Note that there are no non-analytic suffixes beginning with a headed segment. If these suffixes existed, an intervening empty nucleus would be licensed. It seems that the absence of these suffixes is due to accidental gaps regarding the shape of suffixes.

| /anØ/ | [anɨmjən] | [anɨni] | [anɨsi] | [anɨmjə] | 'to hug' |
| /kamØ/ | [kamɨjən] | [kamɨni] | [kamɨsi] | [kamɨmjə] | 'to wind' |
| /nopʰØ/ | [nopʰɨmjən] | [nopʰɨni] | [nopʰɨsi] | [nopʰɨmjə] | 'high' |
| /katʰØ/ | [katʰɨmjən] | [katʰɨni] | [katʰɨsi] | [katʰɨmjə] | 'same' |

As discussed in section 4.3.2, since nasals cannot govern each other, the vowel [ɨ] intervenes between a stem-final and a suffix-initial nasal. In other examples, all stems end in either a headed or a headless obstruent and so a headless suffix-initial segment cannot govern the preceding stem-final segment. Therefore, we can observe the occurrence of the vowel [ɨ] between a stem and a suffix.

With respect to liquid-final stems, non-analytic suffixation is more complicated than those of other consonant-final stems. Consider first conditional and connective suffixation.

(49)     Stem                 Conditional          Connective
         /narØ/               [nalmjən]            [nalmjə]            'to fly'
         /torØ/               [tolmjən]            [tolmjə]            'to turn
         /tØrØ/               [tɨlmjən]            [tɨlmjə]            'to carry'

As predicted from the segmental governing hierarchy, an intervening empty nucleus is licensed, i.e. a suffix-initial nasal can govern a stem-final liquid. As discussed in Chapter 3, a governed liquid becomes [l] due to the effect of the CLE, i.e. a licensed empty nucleus can license a segment containing the element ʔ. Regarding /n/-initial and /s/-initial suffixes after liquid-final stems, the intervening empty nucleus is expected to be licensed, as in (49). However, when a suffix-initial segment containing the coronal element R is added to liquid-final stems, the stem-final liquid is deleted instead.

(50)     Stem                 Honorific            Effective
         /narØ/               [nasi] *[nalsi]      [nani] *[nalni]    'to fly'
         /torØ/               [tosi] *[tolsi]      [toni] *[tolni]    'to turn
         /tØrØ/               [tɨsi] *[tɨlsi]      [tɨni] *[tɨlsi]    'to carry'

(51) /[<nar> Øni]/  [nani]  *[nalni]

        O1    N1    O2    N2    O3    N3
    [ < |     |     | >   |     |     | ]
        x     x     x     x     x     x
        |     |     |     ↓     |     |
        n     a     r    [ø]    n     i
                    ↓↑_____↓ inter-onset government
                   [l]
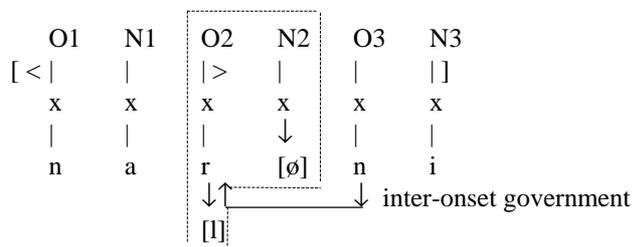
In (51), inter-onset government between O2 and O3 is established with the presence of the government-licenser N3 and so the empty nucleus N2 is licensed. The liquid /r/ in O2 becomes [l] due to the CLE. Contrary to fact, the phonetic form [nalni] is derived. One plausible motivation for the deletion of the stem-final liquid in this context is the absence of morpheme-internal [ls] and [ln] sequences.[38] That is, once phonetic forms are produced by suffixation, these forms are checked as to whether there would be a violation against the phonotactic constraints governing mono-morphemes. Put another way, this phonotactic constraint acts as a filter against phonetic outputs under suffixation. The deletion of the liquid in favour of the suffix-initial /n/ or /s/ is that a segment in a governed position is more susceptible to deletion than one in a governing position.

To summarise, the suffixes showing i/zero alternations are classified as non-analytic. The phonetic interpretation of an empty nucleus spanning a stem-final and a suffix-initial segment is determined by inter-onset government and the segmental governing hierarchy. This implies that consonant sequences generated by suffixation are the same as those of mono-morphemic words, except nasal sequences which are subject to the Nasal Condition. This implication is confirmed by the deletion of the stem-final liquid occurring after a coronal nasal or fricative, i.e. ill-formed sequences *[ln] and *[ls] are filtered out through in suffixation.

## 4.3.5. The phonological processes in analytic suffixation

As discussed in section 4.3.3, the SCC effect regulates that a final empty nucleus in an extended stem domain maintains its licensed status after bracket erasure. In analytic suffixation, therefore, various phonological processes are invoked to satisfy the requirements of inter-onset government. In this respect, analytic suffixation crucially differs from non-analytic suffixation, i.e. the latter involves i/zero alternations, while consonant-related processes occur in the former, if inter-onset governing relations fail to be established. The types of these processes are more or less predictable from segmental content of surrounding consonants. The list of analytic suffixes is repeated from (21) and (22).

(52)  (a) Analytic verbal suffixes

| /ta/ | 'declarative' | /ni/ | 'interrogative' |
|------|---------------|------|-----------------|
| /ca/ | 'propositive' | /kes'Ø/ | 'intentive' |
| /tə/ | 'retrospective' | /ci/ | 'suppositive' |

(b) Analytic nominal suffixes

| /to/ | 'also, too' | /macə/ | 'even, so far as' |
|------|-------------|--------|-------------------|
| /pota/ | 'than' | /putʰə/ | 'ablative, from' |

---

[38] Interestingly, note that [ls'] sequences are possible, e.g. /<kərØs'aŋ>Ø/ [kəls'aŋ] 'persistent', /<kØrØs'e>/ [kils'e] 'well', /<marØs'əŋ>Ø/ [mals'əŋ] 'trouble', and so on. In particular, regarding the absence of [ln] sequences, Korean is not the only language which displays this phonotactic constraint. Other languages such as English and Dutch behave in the same way (an exception is found in English, *kiln*, though). Though I will not deal with this constraint further in the thesis, the constraint *[ln] seems to require cross-linguistic explanation.

/k'esə/                    'nominative, horific'

First, consider tensification and post-nasal voicing occurring before a stop-initial analytic suffix. Examples are shown in (53).

(53)    (a) Verbal suffixation

| Stem | Declarative | Propositive | Intentive | |
|------|-------------|-------------|-----------|--|
| /ka/ | [kata] | [kaca] | [kaket] | 'to go' |
| /narØ/ | [nalta] | [nalca] | [nalket] | 'to fly' |
| /anØ/ | [ant'a] | [anc'a] | [ank'et] | 'to hug' |
| /məkØ/ | [məkt'a] | [məkc'a] | [məkk'et] | 'to eat' |
| /təpʰØ/ | [təpt'a] | [təpc'a] | [təpk'et] | 'to cover' |
| /usØ/ | [utt'a] | [utc'a] | [utk'et] | 'to laugh' |
| /cʰacʰØ/ | [cʰatt'a] | [cʰatc'a] | [cʰatk'et] | 'to search' |

(b) Nominal suffixation

| Stem | 'also' | 'than' | |
|------|--------|--------|--|
| /sori/ | [sorito] | [soripota] | 'sound' |
| /narØ/ | [nalto] | [nalpota] | 'day' |
| /patakØ/ | [patakt'o] | [patakp'ota] | 'floor' |
| /papØ/ | [papt'o] | [papp'ota'] | 'rice' |
| /nonØ/ | [nondo] | [nonbota] | 'rice field' |
| /səmØ/ | [səmdo] | [səmbota] | 'island' |
| /osØ/ | [ott'o] | [otp'ota] | 'cloth' |
| /nacØ/ | [natt'o] | [natp'ota] | 'daytime' |
| /patʰØ/ | [patt'o] | [patp'ota] | 'field' |
| /kʰocʰØ/ | [k'ott'o] | [k'otp'ota] | 'flower' |

Tensification occurs when a consonant other than a liquid is stem-final. Exceptions are nasal-final stems in nominal suffixation, in which post-nasal voicing occurs instead. The absence of tensification in liquid-final stems is straightforwardly accounted for by inter-onset government because a suffix-initial stop can govern a preceding liquid. In other cases, tensification occurs simply because a suffix-initial stop cannot govern a stem-final consonant, as shown below. In the extended stem domain, the stem-final aspirated consonant undergoes neutralisation to become [p].

(54)    /[[<təpʰ> Ø] ta]/  [təpt'a]

```
        O1    N1    O2      N2      O3    N3
        |     |     |       |       |     |
  [[ <  x     x     x >     x ]     x     x ]
        |     |     |               |     |
        t     ə     pʰ              t     a
                    ↓
                    [p]
```

After internal square bracket erasure, the following configuration emerges.

(55)   O1    N1    O2          N2          O3    N3
        |     |     |           |           |     |
   [    x     x     x           x           x     x ]
        |     |     |                       |     |
        t     ə     pʰ                      t     a
                    ↓
                   [p]
                    ↑
                    └─────────────────┘  ↓   inter-onset government
                                    ‖
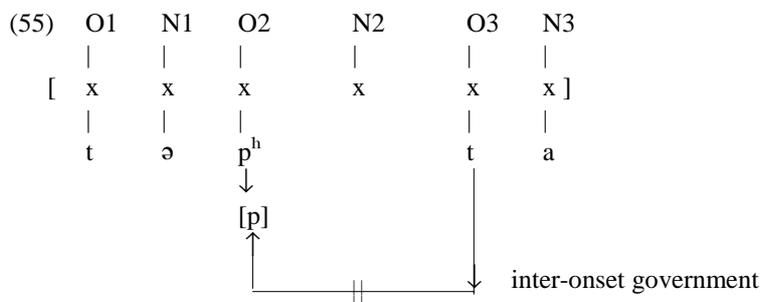
An inter-onset government relation is set up between O2 and O3 across a licensed empty nucleus N2. As pointed out in the previous section, the licensed status of N2 is protected by the effect of the SCC. Since O3 cannot govern O2, in order to meet the requirements of inter-onset government, O3 in the governing position undergoes tensification, i.e. to become a headed segment to govern O2.[39] The same applies to stems which contain a segment (other than a liquid) which is not licensed by a final empty nucleus.

In terms of elements, the tensification process is involved in the headship change. The element H in O3 acquires headship to become a tensed stop [t']. In fact, this analysis, based on the revised theory of elements, captures tensification better than an analysis based on KLV (1985, 1990) which recognises two elements, i.e. the neutral element h° and the negatively charmed H-, representing obstruents. In the KLV framework, the headless segment /t/ and the headed segment /t'/ are represented by (R°.ʔ°.h°) and (R°.ʔ°.h°.H-), respectively. Given these two representations, tensification requires an ambient element H- which is not available in the given context. In the current framework, however, this problem is avoided in that the element H simply acquires headship. The acquisition of headship is also well-motivated on the basis of the requirements of inter-onset government.

Concerning nasal-final stems, verbal and nominal suffixation show different strategies: tensification occurs in the former and post-nasal voicing in the latter. In purely phonological terms, this difference relies on grammatical categories. The motivation behind the two processes, however, is to achieve the same purpose, i.e. the satisfaction of the requirements of inter-onset government. Consider nominal suffixation which involves post-nasal voicing.

---

[39] Another possibility is that O2 in the governed position undergoes a weakening process. Given the segmental representation of the labial stop, a possible outcome of lenition of O2 would be either [w] or [h] or [ʔ]. But this option is ruled out, since [w], [h] and [ʔ] cannot occur before a licensed empty nucleus which requires a preceding segment to contain the element ʔ and a place element at least.

(56) /[[<səm> Ø] to]/  [səmdo] 'island, also'
```
        O1    N1    O2    N2         O3    N3
        |     |     |     |          |     |
[ [ <  x     x     x >   x ]        x     x ]
        |     |     |                |     |
        s     ə     m                t     o
                    ↑_____  ↓ inter-onset government
                            ‖
```
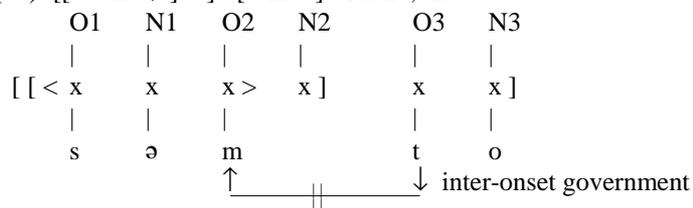
After bracket erasure of the extended stem domain, we set up an inter-onset
governing relation between O2 and O3 across the licensed empty nucleus N2: the
headless obstruent /t/ cannot govern the nasal /m/.  To satisfy the requirements of
inter-onset government, O3 must be a headed segment.  Unlike what happens in
verbal suffixation, I propose that post-nasal voicing takes place in nominal
suffixation.  This is achieved by the fusion of elements, as shown below.
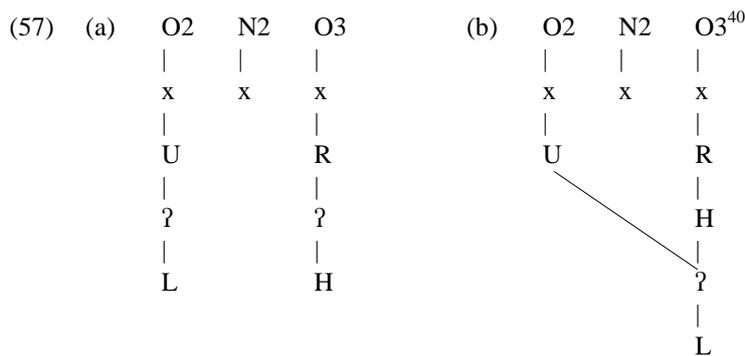
(57)   (a)    O2    N2    O3          (b)     O2    N2    O3[40]
              |     |     |                   |     |     |
              x     x     x                   x     x     x
              |           |                   |           |
              U           R                   U           R
              |           |                    \          |
              ʔ           ʔ                      \         H
              |           |                       \       |
              L           H                        \      ʔ
                                                   |
                                                   L̲
```

(57) shows that the elements ʔ and L in O2 are fused with the elements in O3,
resulting in a voiced coronal stop [d].  The voicing of O3 is achieved by a headship
change, in order to govern the nasal in O2.

The same fusion process is required in interrogative suffixation with nasal-final
and obstruent-final stems, as shown below.

(58)   (a)    Nasal-final stem        Interrogative
              /anØ/                   [anni]        'to hug'
              /kamØ/                  [kamni]       'to wind'
       (b)    Obstruent-final stem
              /məkØ/                  [məŋni]       'to eat'
              /cupØ/                  [cumni]       'to pick up'
              /tatØ/                  [tanni]       'to close'
              /usØ/                   [unni]        'to smile'

---

[40] As pointed out in (60) in Chapter 3, the doubly-linked L is construed as voicing in the governing
position and as nasality in the governed position.

| | | |
|---|---|---|
| /cʰacØ/ | [cʰanni] | 'to search' |
| /nopʰØ/ | [nomni] | 'high' |

(58a) shows that two nasals occur across a licensed empty nucleus and (58b) shows that a stem-final obstruent undergoes nasalisation. Both cases yield a sequence of two nasals across a licensed empty nucleus, as shown below.

(59)　(a) /[[<kam> Ø] ni]/　[kamni]

```
        O1    N1    O2    N2        O3    N3
        |     |     |     |         |     |
  [[ <  x     x     x >   x ]       x     x ]
        |     |     |               |     |
        k     a     m               n     i
                    ↑                ↓
                    |_____||_____|
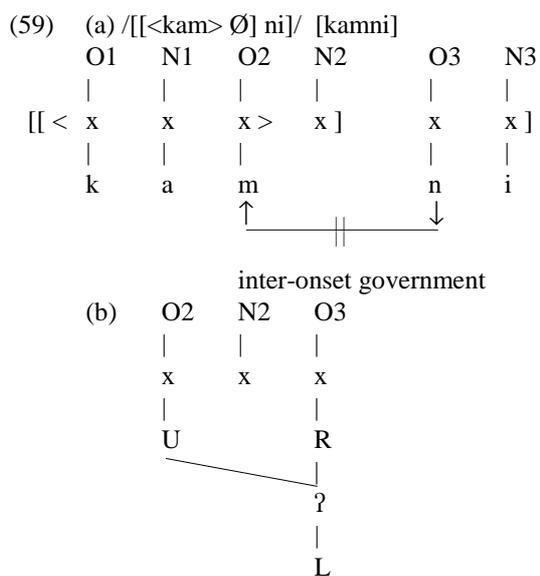
              inter-onset government
```

　　(b)
```
        O2    N2    O3
        |     |     |
        x     x     x
        |           |
        U           R
         _____   |
                 \  |
                    ?
                    |
                    L
```

After bracket erasure of the extended stem domain in (59a), the coronal nasal in O3 cannot govern the labial nasal in O2. Recall that stem-internal sequences containing nasals with a licensed intervening empty nucleus form a doubly-linked structure. To satisfy inter-onset government in this configuration, fusion of elements is necessary in order for O3 to govern O2, yielding a doubly-linked structure, as shown in (59b). O3 can govern O2 in terms of the Complexity Condition.

　　Regarding obstruent-final stems in interrogative suffixation, as in (58b), nasalisation is invoked to meet the requirements of inter-onset government.

(60) [[/<cup> Ø/ ] ni] [cumni] 'to eat'
```
(a)     O1    N1    O2    N2        O3    N3
        |     |     |     |         |     |
  [[ <  x     x     x >   x ]       x     x ]
        |     |     |               |     |
        c     u     p               n     i
                    ↑                ↓
                    |_____||_____|
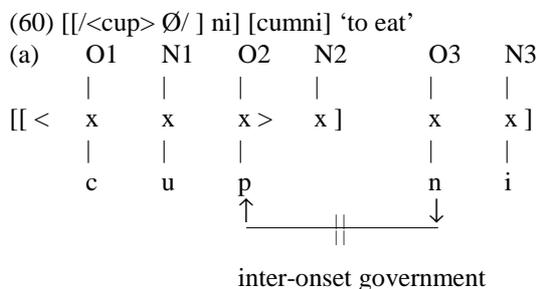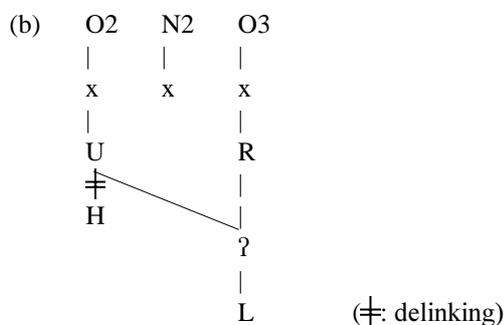
              inter-onset government
```

(b)     O2    N2    O3
         |     |     |
         x     x     x
         |           |
         U           R
        ╪ ╲          |
         H   ╲       |
              ╲      |
               ╲     ʔ
                     |
                     L          (╪: delinking)

After bracket erasure in (60a), inter-onset government fails to be established between O2 and O3, because the nasal /n/ cannot govern the lenis stop /p/. As in nasal fusion in (59), the resolution is for O2 to become a labial nasal [m] to form a doubly-linked nasal sequence. The phonetic form is [cumin]. In terms of elements in this process, the element H is delinked from O2, as shown in (60b).

In this section, I have considered various phonological processes in analytic suffixation, viz. tensification, post-nasal voicing, nasal fusion and nasalisation. The motivation for these processes is simply to satisfy the requirements of the ECP, in particular inter-onset government. The effect of the SCC is to preserve the licensed status of a final empty nucleus in an extended stem domain, so that consonant-related processes are invoked. In the next section, I will discuss the implications of the analyses proposed in this chapter.

## 4.4. Implications and conclusions

To recapitulate, I have considered how to refine the notion of morphological analyticity and how to account for the effect of opacity involved in ɨ/zero alternations in certain suffixation contexts. This implies that the notion of morphological analyticity proposed by Kaye (1995) is not compatible with the phonological phenomena in Korean. Regarding morphological analyticity, I propose the notion of stem domains to account for the retention of occurrence of the vowel [ɨ] despite the presence of a government-licenser. Independent evidence for stem domains comes from the process of palatalisation in which stem-internal vowels do not trigger this process but a stem-final coronal lenis stop undergoes it when it is followed by the vowel /i/. With respect to opacity, this effect is derivable from the SCC, in particular the RBC. Thus, the SCC dictates that the licensed status of a final empty nucleus is preserved throughout derivations. The consequence is that various consonant-related processes are triggered across a licensed empty nucleus in analytic constructions.

Analysing the occurrence of the vowel [ɨ] in non-analytic suffixation and the consonant-related processes in analytic suffixation, the major motivation for all these phenomena is invariably to satisfy the requirements of the ECP, in particular

inter-onset government. This motivation, however, creates a classical duplication problem. As discussed in Chapter 3, the phonetic interpretation of morpheme-internal (i.e. stem-internal) empty nuclei is determined by the ECP. Thus, apart from morpheme-internal (or stem-internal) nasal sequences governed by the Nasal Condition, it is predictable that the distribution of the vowel [ɨ] in non-analytic suffixation is the same as that of morpheme-internal empty nuclei, precisely because these two have identical morphological constructions, i.e. a stem domain followed by a final empty nucleus in an extended stem domain.

Furthermore, outputs of phonological processes in analytic suffixation yield the same morpheme-internal consonant sequences, i.e. tensification, nasalisation, post-nasal voicing and nasal fusion are motivated to create well-formed sequences of mono-morphemic words. In other words, all consonant sequences produced in suffixation also observe the morpheme structure conditions, and so we state the same conditions twice in the grammar, i.e. the static constraints on morpheme structure conditions turn out to be dynamic processes in suffixation.

In order to solve this duplication problem, one might argue that all phonetic forms resulting from suffixation are individually listed in the lexicon. This solution, however, seems inadequate, because the postulation of stem domains already requires a distinction between a stem and a suffix. Furthermore, ɨ/zero alternation in non-analytic suffixation and pertinent processes in analytic suffixation are very productive in the sense that there are no exceptions. Accordingly, listing each outcome of both suffixations in the lexicon misses linguistically significant generalisations and so holds unnecessary redundancies.

The fact that all outcomes from non-analytic and analytic suffixation conform to phonotactic constraints of underived lexical items suggests a reconsideration of Kaye (1995). In his proposal, based on English, analytic constructions in suffixation concern regular morphology while non-analytic ones concern irregular morphology. For instance, the past form of the verb *peep* has an analytically complex form /[[peep] ed]/ of which the phonetic form contains a sequence of a long vowel followed by [pt]. This sequence violates phonotactic regularities governing non-derived forms. Thus, the presence of such a cluster provides us with a parsing cue that there is more than one domain involved. The irregular past form *keep*, on the other hand, has a simplex form /[kept]/ in which morphology is invisible to phonology, i.e. forms "derived" non-analytically are not derived at all, but are listed as separate lexical items in the lexicon.[41] In English, this implies that non-analytically derived forms are indistinguishable from morphologically underived forms, i.e. both types of forms are consistent with phonotactic constraints for the latter.

In comparison with English, Korean shows a completely different picture. The independently motivated stem domains rule out non-analytic constructions in English such as *kept*, in which the distinction between a stem and a suffix is

---

[41] The consequence is that SPE-type rules such as velar softening and the Great Vowel Shift, among others, are not active in English phonology. Rather, the forms resulting from either or both of the rules are no more than historical relics.

obliterated. Unlike analytic constructions in English in which ill-formed sequences such *peeped* are permissible, phonetic outputs of analytic suffixation in Korean invariably yield well-formed sequences. Given this perspective, the organisation of the lexicons of both languages are different, as shown below.

(61)    (a) English

```
┌─────────────────────────────────────────────────────────────────┐
│ Derived lexicon                                                   │
│   ┌───────────────────────────┐   ┌─────────────────────────┐     │
│   │ Basic lexicon             │   │ analytic derivation     │     │
│   │ non-derived               │   │ [[A] B]                 │     │
│   │ [A]                       │   │ [[A] [B]]               │     │
│   │ non-analytic derivation   │   │                         │     │
│   │ [AB]                      │   │                         │     │
│   └───────────────────────────┘   └─────────────────────────┘     │
│                                                                   │
└─────────────────────────────────────────────────────────────────┘
```

                                                            (Polgárdi 1998: 57)
        (b) Korean

```
┌─────────────────────────────────────────────────────────────────┐
│ Lexicon                                                           │
│   ┌──────────────────────────────┊──────────────────────────┐     │
│   │ Basic lexicon                ┊                           │     │
│   │ non-derived (extended stem)  ┊    analytic derivation    │     │
│   │ [<A>(Ø)]                     ┊    [[<A> Ø] B]            │     │
│   │ non-analytic derivation      ┊                           │     │
│   │ [<A>B]                       ┊                           │     │
│   └──────────────────────────────┊──────────────────────────┘     │
│                                                                   │
└─────────────────────────────────────────────────────────────────┘
```

In (61), the organization of the lexicon of each language is that non-derived forms and non-analytically derived forms constitute a basic form component (containing well-formed sequences) separated by an analytically derived form component (ill-formed sequences permitted), as in (61a) for English. For Korean, as in (61b), however, these three forms constitute a single component in which analytically derived forms are separated by a dotted line from other forms. The dotted line indicates that there is a distinction between non-derived and non-analytical forms, and analytically derived forms, i.e. well-formed sequences are controlled by static constraints in the former and by dynamic processes in the latter.

With respect to (61), it is evident that there is a different interpretation of how to utilise non-analytic and analytic suffixation between English and Korean. In (61a), non-analytic and analytic constructions provide a criterion for morphological complexity. In (61b), however, these two constructions do not serve this criterion.

Rather, they provide a distinction of what type of phonological process occurs, i.e. ɨ/zero alternations in non-analytic construction and consonant-related processes in analytic constructions.[42]

Regarding the duplication problem, the dotted line in the basic lexicon component in (61b) marks the mode of the application of phonological processes, i.e. static constraints control extended stems and non-analytic suffixation while analytic suffixation controls dynamic processes. Thus, the well-formedness of sequences is governed by the basic lexicon component. In this way, the duplication problem is encoded in the lexicon.

Outside the basic lexicon in (61b), it is reasonable to assume that some lexical items such as loanwords do not conform to the phonotactic constraints set by the basic lexicon. In the next chapter, I will consider the behaviour of loanwords and examine to what extent loanwords differ from native words and how the native phonotactics applies to loanwords, in particular, from English.

---

[42] One could argue that processes in analytic constructions can also be accounted for by 'coda'-onset relations. As pointed out earlier, consonant-related processes must be listed independently in this approach. Thus, this approach misses the generalisation that all processes involve satisfying the ECP.

# Chapter 5

# Licensing empty nuclei in loanwords

This chapter is concerned with the question of how empty nuclei in loanwords, particularly English ones, are licensed. The main focus of the chapter is to explore to what extent loanword phonology is different from native phonology in Korean. In the OT literature on loanwords in Korean (H.-K. Cho 1998, O. Kang 1996 H.-S. Kang 1996, among others), the general consensus is that loanword phonology constitutes a distinct component from native phonology and so it has a different constraint hierarchy. As pointed out in Chapters 1 and 3, however, constraint-based approaches disregard the fact that the morpheme-internal (i.e. stem-internal) distribution of the vowel [ɨ] in loanwords is identical to that of native words. In other words, loanword phonology is not completely different from native phonology. So the question is justified whether the occurrence of the internal [ɨ] of loanwords can be treated in the same way as the internal [ɨ] of native lexical items, i.e. whether the distribution of [ɨ] is determined by the ECP.

Regarding loanwords ending in an obstruent which a final empty nucleus cannot license, we observe that final empty nuclei are realised as [ɨ], which is not the case among native lexical items in which neutralisation occurs in this position, as was discussed in Chapter 3. I claim that this difference can be treated as a conflict of the ECP and the PP and a language-specific constraint, the CLE. The PP and the CLE take precedence over the ECP in loanwords. This is due to the fact that the preservation of segmental content of a final consonant is crucial in order to identify the distinction between voiced and voiced obstruents from the source language. I will also consider some phenomena specific to loanwords, such as the nominative suffixation in which the change of the segment /t/ of English to /s/ in native Korean is involved, and r-deletion, the result of which makes phonetic forms of English loanwords non-rhotic.

This chapter is organised as follows. In the first section, I will consider relevant loanword data and review previous approaches to loanword phonology. In 5.2, the distribution of [ɨ] in internal position of loanwords is considered and I show that this distribution can be handled in the same way as that of native words. In 5.3, I will analyse the occurrence of [ɨ] in final position, which distinguishes loanword phonology from native phonology. In 5.4, I will consider the deletion of /r/ before a licensed empty nucleus, and the nominative suffixation of loanwords which exhibits interesting properties with respect to t-final English loanwords. In the final section, I summarise the analysis and discuss the organisation of the lexicon regarding the issue of how the native and the loanword phonology interact.

## 5.1. Introduction

## 5.1.1. Data

The data presented in this chapter are largely based on 'The Compilations of Orthography of Loanwords in Korean' (1988) published by The National Academy of the Korean Language (henceforth *Compilations*) which presents 8,500 examples of loanwords, though not all examples are from English. This book provides a single representation for each example. As noted in (S.-C. Rhee & Y.-K. Choi 2001, among others), some examples, in particular those ending in a stop, may have an alternating form, e.g. *strike* [sɨtɨraik] or [sɨtɨraikʰɨ], napkin [nɛpʰɨkʰin] or [nɛpkʰin] etc. As we will see in later sections, these examples are also taken into consideration and play a crucial role in my analysis.

The segmental adaptations from English to Korean are shown below (repeated from Chapter 1).[1]

(1)    English                          Korean
       /p/, /t/, /k/ ———————⟶ [pʰ], [tʰ], [kʰ]
       /b/, /g/ ————————⟶ [p], [k]
       /d/ ————————————⟶ [t]
       /ð/
       /f/, /v/ ————————⟶ [pʰ], [p]
       /m/, /n/, /ŋ/ ————————⟶ [m], [n], [ŋ]
       /ʃ/, /tʃ/ ————————⟶ [sj], [cʰ]
       /s/ ————————————⟶ [s]
       /θ/
       /z/ ————————————⟶ [c]
       /ʒ/
       /dʒ/
       initial /l/ ————————⟶ [l]
            /r/
       internal /l/ ————————⟶ [ll]
       internal /r/ ————————⟶ [r]

---

[1] In this thesis, I do not deal with the segmental adaptation processes in (1), in terms of elements, mainly because elements in GP are conceived of as phonological entities rather than phonetic ones as other frameworks assume (see Ploch 1999 for a detailed discussion). In a given language, segmental representations on the basis of elements are motivated by phonological behaviour such as headed vs. headless segments on the basis of language-specific phonotactic constraints. For instance, the voiceless segmental representations of English (Harris 1994) are different from those of aspirated segment in Korean (see Chapter 2), despite the fact that these two types of stops phonetically are very similar. Regarding aspirated bilabial stops, they are represented by (U.H.h.ʔ) (within the revised element theory (U.H̲ ʔ)) and (U.ʔ.H̲) (H) in English and Korean, respectively. Therefore, unlike the binary feature system based on articulatory phonetics, it is difficult to set up one-to-one correspondences of segmental comparison between the two languages in GP.

Look at the occurrence of [ɨ] in non-final position in English loanwords containing branching onset clusters.

(2)    (a) Branching onset: Cr cluster

| | | | |
|---|---|---|---|
| _printer_ | [pʰɨrintʰə] | _brazier_ | [pɨreicə] |
| _training_ | [tʰɨreiniŋ] | _drama_ | [tɨrama] |
| _crew_ | [kʰɨru] | _gravy_ | [kɨrɛpi] |
| _fry-pan_ | [pʰɨraipʰɛn] | | |

    (b) Branching onset: Cl cluster

| | | | |
|---|---|---|---|
| _plan_ | [pʰɨllɛn] | _blender_ | [pɨllendə] |
| _clean_ | [kʰɨllin] | _glory_ | [kɨllori] |
| _fly_ | [pʰɨllai] | | |

In (2), we observe that [ɨ] occurs between an aspirated (i.e. headed) segment and a liquid, or between a lenis (i.e. headless) segment and a liquid. This vowel also appears occur after the segment /s/, as shown below.

(3)

| | | | |
|---|---|---|---|
| _speaker_ | [sɨpʰikʰə][2] | _spike_ | [sɨpʰaikʰɨ] |
| _wasp_ | [wasɨpʰɨ] | | |
| _street_ | [sɨtʰɨrit] | _stew_ | [sɨtʰju] |
| _test_ | [tʰesɨtʰɨ] | _last_ | [lasɨtʰɨ] |
| _skate_ | [sɨkʰeitʰɨ] | _scope_ | [sɨkʰopʰɨ] |
| _mask_ | [masɨkʰɨ] | _desk_ | [tesɨkʰɨ] |
| _smoke_ | [sɨmokʰɨ] | _smog_ | [sɨmokɨ] |
| _snow_ | [sɨnou] | _snack_ | [sɨnɛk] |
| _sleeve_ | [sɨllipɨ] | _slide_ | [sɨllaitɨ] |

On the basis of the data in (2) and (3), the following observation can be made.

(4)    (a)    [ɨ] occurs between a headed segment and a liquid.
      (b)    [ɨ] occurs after the segment /s/, irrespective of the nature of the following consonant.

With respect to 'coda'-onset (or complex 'coda' in final position, in terms of the 'standard' syllabic analysis) sequences from English, except sC clusters[3], we do not observe the occurrence of [ɨ] between these two consonants.

(5)    (a)    Liquid-obstruent sequences

| | | | |
|---|---|---|---|
| _pulp_ | [pʰəlpʰɨ] | _belt_ | [peltʰɨ] |
| _bulk_ | [pəlkʰɨ] | | |

---

[2] Phonetically, /p, t, k/ after /s/ are realised as unaspirated in English. In loanwords adaptation, these stops are realised as aspirated in Korean. It is assumed that spelling, rather than the pronunciation of the source language, has affected phonetic forms (H. Kang 1996).

[3] Recall that sC clusters in Indo-European languages are syllabified as 'coda'-onset sequences. See Kaye (1992) for a detailed discussion.

    *bulb*             [pəlpɨ]        *building*      [piltiŋ]

(b)   Nasal-obstruent sequences

    *camp*         [kʰɛmpʰɨ]    *tent*         [tʰentʰɨ]

    *bank*         [pɛŋkʰɨ]

(c)   Obstruent-obstruent sequences

    *actor*        [ɛktʰə]      *adaptor*   [ətɛptʰə]

On the basis of (2), (3) and (5), the presence or absence of [ɨ] in non-final position is summarised as follows.

(6) The occurrence of the vowel [ɨ] between two consonants in non-final position (C1 and C2)

| C2 <br> C1 | Liquid | Nasal | Lenis obstruent | Headed obstruent |
|---|---|---|---|---|
| Liquid | **Ø** | ___ [4] | **Ø** | **Ø** |
| Nasal | ___ [5] | ___ | **Ø** | **Ø** |
| Lenis obstruent except /s/ | ɨ | ___ | ___ | **Ø** |
| Headed obstruent | ɨ | ___ | ___ | ___ |
| /s/ | ɨ | ɨ | ___ | ɨ |

(—: absence of clusters in English)

The shaded areas in (6) indicate that sequences in these areas are absent in the source language.  The vowel [ɨ] occurs after the segment /s/, irrespective of the following consonant.  Bearing in mind the governing hierarchy among segments in Korean, the occurrence of [ɨ] in (6) is more or less predictable, because an inter-onset governing relation between C1 and C2 determines the occurrence of the vowel [ɨ].  This strongly implies that the occurrence of [ɨ] in (6) can be dealt with in the same way as that of native words (see 5.2 for a detailed discussion).

Let us turn our attention to the occurrence of [ɨ] in final position in loanwords. First, consider loanwords ending in either a nasal or a liquid.

(7)   (a) Nasal-final words

    *dam*          [tɛm]        *gum*        [kəm]

    *pen*          [pʰen]      *neon*    [neon]

---

[4] The treatment of *film* and *kiln* will be discussed in section 5.3.

[5] I am aware that the word *only* is well-formed in English.  In this case, the underlying representation would be /onØli/, but the sequence –nlV- (V: vowel) is not allowed in Korean.  Its phonetic form would be either [onni] or [olli].

| | | | |
|---|---|---|---|
| *king* | [kʰiŋ] | *(pop) song* | [soŋ] |

(b) l-final words

| | | | |
|---|---|---|---|
| *HIL* | [hil] | *hotel* | [hotʰel] |

(c) r-finals

| | | | |
|---|---|---|---|
| *bar* | [pa] | *cigar* | [sika] |

All examples in (7) show that there is no [ɨ] in final position. It is of interest to note that a final /r/ does not surface phonetically, as shown in (7c).[6] The same phenomenon is observed in words containing /r/ before another consonant, e.g. *cart* [kʰatʰɨ], *fork* [pʰokʰɨ], *party* [pʰati] and so on. This indicates that English loanword adaptation is basically non-rhotic.

Next, consider fricative-final and affricate-final words.

(8)　(a) s-final and z-final words

| | | | |
|---|---|---|---|
| *bus* | [pəsɨ] | *gas* | [kasɨ] |
| *cheese* | [cʰicɨ] | *size* | [saicɨ] |

(b) f-final and v-final words

| | | | |
|---|---|---|---|
| *beef* | [pipʰɨ] | *scarf* | [sɨkʰapʰɨ] |
| *valve* | [pɛlpɨ] | *rove* | [lopɨ] |

(c) ʃ-final and ʒ-final words

| | | | |
|---|---|---|---|
| *sash* | [sɛsi] | *fish* | [pʰisi] |
| *beige* | [peici] | *garage* | [karaci] |

(d) θ-final words

| | |
|---|---|
| mouth | [mausɨ] |

(e) tʃ-final and dʒ-final words

| | | | |
|---|---|---|---|
| *coach* | [kʰoucʰi] | *torch* | [tʰocʰi] |
| *college* | [kallici] | *gauge* | [keici] |

We observe that the vowel [ɨ] occurs in final position in (8a,b,d) and that [i] occurs in (8c,e), in which the place of consonants of the source language is palato-alveolar. However, note that [ɨ] also occurs after [c] and [s], as in (8a) when the place of articulation of the source language is coronal. This implies that the consonantal identities of the source language may affect the quality of the vowel in final position.

In fact, the occurrence of [ɨ] in final position indicates that the behaviour of loanwords is different from that of native words, precisely because native Korean chooses a parameter in which a final empty nucleus is licensed and therefore, as we have seen so far, there are no words ending in [ɨ]. Let us consider more examples in which we observe the occurrence of [ɨ] in final position.

(9)　(a) p-final words

| | | | | | |
|---|---|---|---|---|---|
| (i) | *chip* | [cʰip] *[cʰipʰɨ] | *cup* | [kʰəp] *[kʰəpʰɨ] |
| (ii) | *rope* | *[lop] [lopʰɨ] | | |

---

[6] There are some exceptions to this statement, e.g. *tar* [tʰarɨ], *czar* [c'arɨ], *ester* [estʰerɨ], among others. For the treatment of these words, see section 5.4.

| (iii) | *type* | [tʰaip] [tʰaipʰɨ] | *tape* | [tʰeip] [tʰeipʰɨ] |
|---|---|---|---|---|
| (b) t-final words | | | | |
| (i) | *asset* | [eset] *[esetʰɨ] | *reset* | [liset] *[lisetʰɨ] |
| (ii) | *beat* | *[pit] [pitʰɨ] | *boat* | *[pot] [potʰɨ] |
| (iii) | *diskette* | [tisɨkʰet] [tisɨkʰetʰɨ] | *circuit* | [səkʰit] [səkʰitʰɨ] |
| (c) k-final words | | | | |
| (i) | *trick* | [tʰɨrik] *[tʰɨrikʰɨ] | *block* | [pɨllok] *[pɨllokʰɨ] |
| (ii) | *knock* | *[nok] [nokʰɨ] | *lake* | *[leik] [leikʰɨ] |
| (iii) | *check* | [cʰek] [cʰekʰɨ] | *cake* | [kʰeik] kʰeikʰɨ] |
| (d) b-final words | | | | |
| (i) | *tab* | [tʰɛp] *[tʰɛpɨ] | *club* | [kʰilləp] *[kʰilləpɨ] |
| (ii) | *hub* | *[həp] [həpɨ] | *tube* | *[tʰjup] [tʰjupɨ] |
| (e) d-final words | | | | |
| (ii) | *grid* | *[kɨrit] [kɨritɨ] | *side* | *[sait] *[saitɨ] |
| (f) g-final words | | | | |
| (i) | *big* | [pik] *[pikɨ] | | |
| (ii) | *league* | *[lik] [likɨ] | *jog* | *[cok] *[cokɨ] |

The data in (9) concern stop-final words. I classify three types of phonetic forms in each example set: type (i) allows forms in which [ɨ] does not occur, and type (ii) allows forms in which this vowel occurs in the final position, and type (iii) allows either of the two forms. Contrary to (7) and (8), it appears that the occurrence of [ɨ] in final position is arbitrary or optional in the sense that in the same environments this vowel occurs in some examples, but not in others. One generalisation that could be drawn is that type (iii) is not present among voiced stop-final words', in particular, only type (ii) is allowed in d-final words.

To summarise, the distribution of [ɨ] in loanwords is identical to that of native lexical items apart from the final position. This suggests that the occurrence of this vowel can be treated in the same way as in the native phonology. Regarding the occurrence of [ɨ] in final position, we observe non-occurrence of [ɨ] in sonorant-final words. In affricate-final and fricative-final words, either [ɨ] or [i] occurs depending on the place of articulation of the consonants of the source language. Regarding stop-final words, however, the occurrence of [ɨ] seems hard to generalize. In the next section, I review previous analyses of loanwords in Korean, which have mainly been cast in the OT framework.

## 5.1.2 Previous analyses

Rule-based analyses of loanwords in Korean, (S.-C. Ahn 1991 and Nam & Southard 1994, among others), treat the occurrence of [ɨ] in loanwords as epenthetic. They propose a set of [ɨ]-insertion rules to describe the sites in which consonant clusters from the source language are broken up. However, as pointed out in Chapter 1, putting aside the occurrence of the final-[ɨ] in loanwords, the [ɨ]-insertion rules copy the context in which [ɨ] occurs within native stems, causing a duplication problem.

Since the publication of Yip (1993), research on loanwords in Korean has flourished within the framework of OT (Hirano 1994, P. Lee 1995, H. Kang 1996, M. Oh 1996, O. Kang 1996, H. Yoo 1996, H. Cho 1998, P.-S. Ku 1999, B. Lee, S. Lee, C.-B. Park & S. Kang 1999, H.-S. Sohn 2001, B. Lee 2001, S.-C. Rhee & Y.-K. Choi 2001, and H. Lee 2001, among others). Unlike Yip's proposal, in which the loanword phonology is part of the native phonology in Cantonese, there is a consensus among constraint-based analyses that loanword phonology is different from native phonology and therefore the loanword phonology in Korean constitutes a separate constraint hierarchy, due to the fact that the epenthetic vowel [ɨ] occurs in final position in loanwords.

With respect to input forms to the loanword phonology of the host language from the source language, like Yip (1993), most analyses adopt the proposal of Silverman (1992: 289) in which a distinction is made between two levels: a perceptual level and an operative level. At the perceptual level, the inputs, consisting of "a superficial acoustic signal, lacking all phonological representation" of the source language, are interpreted as strings of native segments, i.e. segmental adjustments take place at this level. At the operative level, the native phonology applies to the outputs of the perceptual level, i.e. syllabic repairs such as epenthesis and deletion take place at this level. On the basis of the two-level scansion model, the outputs of the perceptual level enter as inputs to be evaluated. This implies that most OT-analyses postulate an independent component which deals with segmental adaptation in the host language.[7] Due to the occurrence of final-[ɨ] in loanwords, which is not allowed in native Korean, constraint-based analyses set up a separate constraint hierarchy for loanword phonology. Therefore, the OT approaches focus on the occurrence of [ɨ] in final position.

Apart from the final-[ɨ], however, the OT analyses do not pay particular attention to the occurrence of [ɨ] in other positions. The epenthesis of [ɨ] in these positions is captured by the constraint *COMPLEX which does not allow consonant clusters. For instance, the word *stream* has the following input: /strim/. The optimal output [sith ɨrim] is selected due to non-violation of *COMPLEX in comparison with other candidates such as *[sth ɨrim], *[sth rim], *[sith rim] and so on. Thus, in most OT analyses, the general pattern of the constraint hierarchies of the native and the loanword phonology is as follows.

(10)  (a)   Native phonology
            *COMPLEX, CODA CONDITION » DEP-IO » MAX-IO
      (b)   Loanword phonology
            *COMPLEX, CODA CONDITION » MAX-IO » DEP-IO

---

[7] Regarding this assumption, H. Lee (2001) argues that the segmental adaptation component is incorporated into the constraint hierarchy of the loanword phonology by the interaction of the markedness constraints. The same approach is found in Jacobs & Gussenhoven (2000) which treats the loanword phonology of Cantonese.

These ranking have several implications.

(11)  (a)  The lower ranked DEP-IO allows the epenthetic vowel [ɨ] to occur in appropriate contexts.

      (b)  The highest ranked *COMPLEX indicates that consonant clusters are not allowed in optimal outputs except internal well-formed 'coda'-onset sequences.

      (c)  MAX-IO in favour of DEP-IO ensures that segmental content in an input is preserved rather than deleted.

Consider (11a). Like the rule-based approaches, constraint-based analyses assume that within native stems the vowel [ɨ] is lexically specified. This vowel is not subject to deletion or insertion. For instance, the stem-final segment /s/ in the native stem /pəs/ 'friend' undergoes neutralisation, emerging as [pət]. If MAX-IO were to outrank DEP-IO as in the loanword phonology, an optimal form would be [pəsɨ]. This form corresponds to the loanword *bus*. Thus, in the native phonology, DEP-IO must be higher ranked than MAX-IO in order to prevent the vowel [ɨ] from occurring in final position, interacting with the CODA CONDITION. This example provides crucial evidence that the native phonology is distinct from the loanword phonology in Korean.

Comparing (11a) to (11b), the interactions between *COMPLEX and DEP-IO produce multiple [ɨ]-epenthesis in loanwords containing complex onsets and 'codas' from the source language. As noted in (6) above, the sites of [ɨ]-epenthesis coincide with those of native words apart from [ɨ] in final position in loanwords. The distribution of the vowel [ɨ] in this position is shown below (repeated from Chapter 1 for native words and (6) in this chapter for loanwords). Relevant examples are shown in (13).

(12) (a) Native words

| C1 \ C2 | Liquid | Nasal | LO | AO or TO |
|---|---|---|---|---|
| Liquid | Ø | Ø | Ø | Ø |
| Nasal | ɨ | Ø | Ø | Ø |
| LO | ɨ | ɨ | ɨ | Ø |
| AO or TO | ɨ | ɨ | ɨ | ɨ |

      (b) Loanwords

| C1 \ C2 | Liquid | Nasal | LO | AO or TO |
|---|---|---|---|---|
| Liquid | Ø | — | Ø | Ø |
| Nasal | — | — | Ø | Ø |
| LO | ɨ | — | — | Ø |
| AO or TO | ɨ | — | — | ɨ |

(LO: lenis obstruent, AO: aspirated obstruent, TO: tensed obstruent, —: absence of clusters in the source language)

(13)  (a) Absence of the vowel [ɨ] between two consonants

| loanword | | Korean | |
|---|---|---|---|
| [pʰilølɨm] | *film* | [kʰəløle] | 'a pair' |
| [piløtiŋ] | *building* | [kaløtɛ] | 'reed' |
| [siløkʰɨ] | *silk* | [təløkʰɨtək] | 'click' |
| [penødiŋ] | *vending* | [cʰənøduŋ] | 'thunder' |
| [pɛŋøkʰɨ] | *bank* | [səŋøkʰɨm] | 'with big strides' |
| [ɛkøtʰə] | *actor* | [akøcʰak] | 'toughness' |
| [sekøs'i] | *sexy* | [sɛkøs'i] | 'young lady' |

(b) Presence of the vowel [ɨ] between two consonants

| [pipɨrapʰon] | *vibraphone* | [sinapɨro] | 'gradually' |
|---|---|---|---|
| [ətɨresiŋ] | *addressing* | [kotɨrɨm] | 'icicle' |
| [piakɨra] | *viagra* | [ciŋkɨrəp] | 'creepy' |
| [pʰɨrintʰə] | *printer* | | |
| [tʰɨreiniŋ] | *training* | [kʰɨtʰɨraki] | 'piece' |
| [kʰɨru] | *crew* | | |

    (ø: absence of the vowel [ɨ]; Underlined sequences are taken into consideration.)

In (12), apart from the areas marked by ‾ in loanwords, the shaded areas show that the presence/absence of [ɨ] in non-final position is identical in native and loanwords contexts.

Given this identical distribution, the question arises as to whether the constraint hierarchies for the native and loanword phonology can handle the parallel behaviour of [ɨ]. As noted above, since OT approaches assume that the stem-internal [ɨ] is lexically specified and DEP-IO outranks MAX-IO in the native phonology, this parallel distribution cannot be accounted for in a non-arbitrary way, precisely because the nature of the vowel [ɨ] is different in each case, i.e. the vowel [ɨ] in native words is lexically specified and the vowel [ɨ] in loanwords is epenthesised. Rather, the identical distribution is an accidental result, which implies that OT approaches also have a duplication problem, as pointed out in Chapter 1.

Consider (11c). Apart from 'coda'-/r/ of English which is not phonetically realised in loanwords, as discussed in the previous section, most segmental content from the source language is preserved. In terms of constraint ranking, therefore, MAX-IO must be highly ranked to prevent segment deletion. Highly ranked MAX-IO in the loanword phonology is not specific to Korean at all. As pointed out by Paradis (1996) and Paradis & Lacharité (1997), in most languages, the same tendency is observed in loanword adaptation. Thus, the ordering of MAX-IO over DEP-IO appears to be universal in this component of the grammar. Within the OT framework, however, there is no internal mechanism to handle this generalisation, since constraint ranking is conceived of as being language-specific, even though each constraint is assumed to be universal. Thus, the strong preference for segment preservation in loanwords is treated as accidental in the OT analyses.

Now, let us turn our attention to [ɨ] in final position. I consider loanwords containing final complex 'codas' in comparison with loanwords ending in a single

stop from English.  The relevant data end in clusters such as *mp*, *lp*, *nt*, *ld* and so on, as shown below.

(14)   [pʰəlpʰɨ]    *pulp*    [kʰəltʰɨ]    *cult*    [milkʰɨ]    *milk*
                               [kiltɨ]      *guild*

       [kʰɛmpʰɨ]    *camp*    [tʰentʰɨ]    *tent*    [pɛŋkʰɨ]    *bank*
                               [lɛndɨ]      *land*

In contrast to the examples ending in a single stop, as shown in (9), the occurrence of [ɨ] in final position in (14) has a different property.  The occurrence of [ɨ] in (14) is obligatory, i.e. without the final [ɨ] forms, like *[kʰempʰ], *[kʰemɨp] etc., are ill-formed.  However, the occurrence of the final-[ɨ] in (9) is optional in the sense that some examples have this vowel finally and others do not.  In order to capture the optional occurrence of the vowel [ɨ] in (9), some analyses such as O. Kang (1996) and H. Kang (1996) introduce the feature [±release] and formalise the faithfulness constraint IDENT-IO(release).  For instance, regarding a contrasting pair such as [kʰəp] *cup* and [lopʰɨ] *rope*, the optional occurrence of the vowel [ɨ] in this pair is controlled by the encoding of the release feature in the inputs in question.  Accordingly, the input for *cup* contains [-release] but the input for *rope* contains [+release].  The constraint IDENT-IO(release) ranks between MAX-IO and DEP-IO in the constraint hierarchy, as shown in (15).  The following tableau shows how the optimal output is selected.

(15)

| | | *COMPLEX | CODA CON. | MAX-IO | IDENT-IO(rel.) | DEP-IO |
|---|---|---|---|---|---|---|
| (a) | /lopʰ/[8] | | | | | |
| | 1. lop | | | *! | * | |
| ☞ | 2. lopʰɨ | | | | | * |
| | 3. lopʰ | | *! | | | |
| (b) | /kʰəp˺/ | | | | | |
| ☞ | 1. kʰəp˺ | | | | | |
| | 2. kʰəpʰɨ | | | *! | * | * |
| (c) | /kʰɛm˺pʰ/ | | | | | |
| | 1. kʰɛmip˺ | | | *! | * | * |
| ☞ | 2. kʰɛm˺pʰɨ | | | | | * |
| | 3. kʰɛmipʰɨ | | | | *! | ** |

Given the constraint hierarchy, the optimal outputs are the candidate 2, 1, and 2 in (15a), (15b) and (15c), respectively.  In this analysis, the specification of the feature [±release] in inputs and the constraint IDENT-IO(release) correctly produces optimal outputs.

This analysis, however, overlooks a distinction between the obligatory and the optional occurrence of the vowel [ɨ] in final position, by ignoring the fact that the presence or absence of a 'coda'-onset cluster determines the obligatory occurrence

---

[8] The symbols /ʰ/ and /˺/ in this tableau represent [+release] and [-release], respectively.

of the following vowel [ɨ]. Accordingly, the analysis in (15) does not provide an account of the reason why /pʰ/ in *camp* must have the feature [+release] and /pʰ/ in *rope* and *cup* can contain either [-release] or [+release] (see section 5.4. for a detailed discussion), i.e. an unnecessary stipulation is required.

To summarise, I have reviewed previous OT analyses of the loanword phonology in which I point out three problems involved, i.e. a duplication problem regarding the occurrence of the internal-[ɨ], the failure of expressing the apparently universal ranking in which MAX-IO outranks DEP-IO, and the unnecessary stipulation of input forms regarding the occurrence of the final-[ɨ]. In the next section, I present a principles-and-parameters based account of loanwords in Korean and argue that this approach provides a better explanation, paying particular attention to the problems I discussed.

## 5.2. Licensing internal empty nuclei in loanwords

## 5.2.1. Loanword adaptation in Korean

Before I present an analysis of how internal empty nuclei are licensed in loanwords, I briefly consider how loanwords are adapted in Korean. Following Paradis & LaCharité (1997), I assume that the phonological outputs of the source language are directly incorporated into the host language.[9] Regarding inputs to the loanword phonology in Korean, the segmental content of L2 is transformed into that of L1 through segmental conversion, as depicted in (1). The results of the segmental adaptations into Korean (cf. footnote 1 in this chapter) are subject to phonological processing in the host language. After segmental adaptation has occurred, a given segmental string is syllabified to conform to the syllable structure of Korean and this syllabic representation is phonologically interpreted in terms of the ECP, the PP and other language-specific constraints. For instance, when the English word *dam* is adopted in Korean, the host language turns this into /tɛmØ/ after syllabification of the segmental string and this lexical representation is subject to phonological interpretation. The following configuration schematises the process from the foreign word to the adapted lexical representation and the final phonetic form.

---

[9] This implies that I do not adopt the multi-level model of Silverman (1992) in which two levels, the perceptual and the operative, are postulated, as discussed above. This is because most segmental information from the source languages are preserved in the phonological outputs in Korean, unlike Cantonese in which segmental identities of the source language are not preserved, as in Yip (1993). See Paradis & Lacharité (1997) for a critical review of Silverman's model.

(16)                                FOREIGN WORD
                                         ↓
                         | SEGMENTAL CONVERSION |
                                         ↓
                         | SYLLABIFICATION |
                                         ↓
                         | UNDERLYING REPRESENTATION |
                                         ↓
                         | PHONOLOGICAL INTERPRETATION |
                         | THE ECP, THE PP, THE CLE |
                                         ↓
                                 PHONETIC FORM

With respect to segmental conversion, the liquids of English, /r/ and /l/, deserve special attention.  As noted in (1), the segmental transformation of the liquids in English is rather more complicated than those of other segments.  In initial position, /r/ and /l/ of English are realised as [l].  In internal position, /r/ is realised as it is, but /l/ becomes a geminate [ll].  In fact, the realisation of an internal geminate [ll] suggests that Korean speakers can recognise the segmental distinction between these two liquids, despite the fact that they are allophones of /r/ in native Korean, i.e. [r] occurs intervocally and [l] elsewhere.[10]  This implies that the segmental identities of the source language may influence the perception of the host language (cf. O. Kang 1996).  For instance, in the words *HIL* [hil] and *car* [kʰa], we notice that the liquid [l] from /l/ survives in the former but /r/ is deleted in the latter.  In dealing with this pair, a technical problem arises, if these two liquids are treated as allophones, as in native Korean.  It is hard to provide a plausible account of the reason why one of the same underlying /r/s is deleted in one example and is retained and realised as [l] in the other (see section 5.4. for the analysis of /r/-deletion).  Indeed, this pair gives a piece of evidence that native speakers are phonologically aware of the difference between /r/ and /l/ of English.

Implementing this perceptual distinction between the two liquids of English into the loanword phonology in Korean, I argue that these two segments are represented differently in the lexical representations of loanwords, i.e. by /r/ and /l/.[11]  Thus, the underlying representations of the pairs of words *colour* and *carrot* are /<kʰalla>/ and /<kʰɛrot>Ø/, and *HIL* and *car*, /<hil>Ø/ and /<kʰar>Ø/, respectively.  Bearing this in

---

[10] For Korean speakers, one of the most frequent mistakes in the pronunciation of English words is the intervocalic-/l/, e.g. *colour*, *balance*, *tele-marketing* and so on, which is realised as [r], as in native Korean.  In order to avoid the mistake, the orthography of  the intervocalic-/l/ of loanwords is transcribed as a double-/l/ in the *Compilations*, like the native word /<kʰərØre>/ [kʰəlle] 'a pair'.

[11] This might be possible because of the fact that phonetically Korean has both [r] and [l].  This is different from the opposition between /θ/ and /s/, which are both realised as [s], and represented underlyingly as such.  The postulation of /l/ and /r/ allows us to treat them in a different way, e.g. /r/-deletion  occurs before a licensed empty nucleus, but /l/-deletion in the same context does not (see above and also section 5.4).

mind, I will deal with the issue of how internal empty nuclei of loanwords are licensed in the next section.

## 5.2.2. The treatment of internal empty nuclei in loanwords

As we anticipate from the discussion in the previous section, I will show that the occurrence of the internal [ɨ] is treated in the same way as that of native Korean. Let us consider examples containing branching onsets from the source language, including initial sC clusters. The list of relevant data is shown below, repeated from (3).

(17)    (a) Cl clusters
    *plan*          [pʰɨllɛn]          *blender*          [pɨllendə]
    *clean*          [kʰɨllin]          *glory*          [kɨllori]
    *fly*          [pʰɨllai]
    (b) Cr clusters
    *printer*          [pʰɨrintʰə]          *brazier*          [pɨreicə]
    *training*          [tʰɨreiniŋ]          *drama*          [tɨrama]
    *crew*          [kʰɨru]          *gravy*          [kɨrɛpi]
    fry-pan          [pʰɨraipʰɛn]
    (c) sC clusters
    *speaker*          [sɨpʰikʰə]          *spike*          [sɨpʰaikʰɨ]
    *street*          [sɨtʰɨritʰɨ]          *stew*          [sɨtʰju]
    *skate*          [sɨkʰeitʰɨ]          *scope*          [sɨkʰopʰɨ]
    *smoke*          [sɨmokʰɨ]          *smog*          [sɨmokɨ]
    *snow*          [sɨnou]          *snack*          [sɨnɛk]
    *sleeve*          [sɨllipɨ]          *slide*          [sɨllaitɨ]

With respect to branching-onset clusters as in (17a) and (17b), the occurrence of [ɨ] between an obstruent and a liquid is straightforwardly accounted for by the inter-onset governing relation.

(18)    (a) /<pʰØlØlɛn>Ø/  [pʰɨllɛn] *plan*

```
        O1    N1    O2    N2    O3    N3    O4    N4
        |     |     |     |     |     |     |     |
 [  <   x     x     x     x     x     x     x >   x ]
        |     ↓     ↓        /     |     |     |
        pʰ   [ɨ]    ↓       l      ε     n
        ↑_____||_____↓
                ||   inter-onset government
```

(b) /<tØrama>/  [tɨrama] *drama*

```
        O1    N1    O2    N2    O3    N3
        |     |     |     |     |     |
[  <  x     x     x     x     x     x  > ]
        |     ↓     |     |     |     |
        t    [ɨ]    r     a     m     a
        ↑_____╫_____↓
                 ╫  inter-onset government
```

The lexical representations in (18) are derived through segmental conversion and the resultant strings are syllabified, as schematised in (16). In (18b), the phonetic interpretation of N1 is due to the failure of the inter-onset government between O1 and O2, i.e. /r/ cannot govern /t/. The phonetic form [tɨrama] is derived.

In (18a), as discussed in the previous section, the intervocalic /l/ in this example is geminated. Furthermore, this geminate has a doubly-linked structure, even though this representation differs from the analysis in Chapter 3 in that the double [ll] is derived from underlying /r/ through a strengthening process, as in /kʰərØre/ [kʰəlle] 'a pair'. This difference marks one of the differences between the loanword phonology and the native phonology. Nonetheless, the occurrence of [ɨ] in (18a) is simply due to the failure of the inter-onset government between O1 and O2. Since the segmental content of O2 is empty, O2 cannot govern /pʰ/ in O1 and therefore the intervening empty nucleus N1 receives phonetic interpretation.

Now, consider initial sC clusters in (17c) in which an intervening empty nucleus is phonetically realised. Regarding s+nasal and s+liquid sequences, the phonetic realisation of the intervening empty nucleus is due to the failure of inter-onset government, i.e. a nasal or a liquid cannot govern a preceding lenis obstruent. This is illustrated below.

(19)    /<sØnɛkʰ>Ø/  [sɨnɛk] *snack*

```
        O1    N1    O2    N2    O3    N3
        |     |     |     |     |     |
        x     x     x     x     x     x
        |     ↓     |     |     |
        s    [ɨ]    n     ɛ     kʰ
        ↑_____↓
                 ╫          ↓
                          [k]¹²
        inter-onset government
```

With respect to s+aspirated obstruent clusters, the intervening empty nucleus is phonetically manifested despite the fact that a following aspirated segment has an appropriate governing property and a potential government-licenser is present, as shown below.

---

¹² I will discuss cases in which aspirated stops are realised as lenis stops in final position in section 5.3.

(20) /<sØpʰikʰə>/  [sɨpʰikʰə] *speaker*

```
O1    N1    O2    N2    O3    N3
|     |     |     |     |     |
x     x     x     x     x     x
|     ↓     |     |     |     |
s     [ɨ]   pʰ    i     kʰ    ə
↑_____↓ inter-onset government
```

In (20), the requirements of inter-onset government are fulfilled in that the aspirated segment /pʰ/ in O2 can govern the lenis obstruent /s/ in O1 and the government-licenser /i/ in N2 is present.  Even though (20) satisfies the requirements of inter-onset government, the phonetic interpretation of N1 is due to the nature of the fricative /s/.  Recall from Chapter 3 that there are parallel cases in native Korean, i.e. /<usØk'waŋ>Ø/ [usɨk'waŋ] 'funny' and /<mɛsØk'əp>Ø/ [mɛsɨk'op] 'nauseated'.  Also in these examples, /s/ is followed by a headed segment and an unlicensed nucleus, which satisfies the requirements of inter-onset government.  In Chapter 3, I claim that the phonetic interpretation of the empty nucleus after /s/ is due to the conflict between the PP and the ECP (inter-onset government) and the CLE.  Specifically, internal empty nuclei are onset-dominant in that a segment preceding this empty nucleus is preserved rather than undergoing neutralisation to become [t] with the following empty nucleus being licensed: the PP is stronger than the CLE and overrides the requirements of inter-onset government.  Thus, the phonetic interpretation of N1 in (20) follows that of internal empty nuclei in native words.

Now, consider the contexts in which empty nuclei are licensed in loanwords. Given the notion of inter-onset government, the non-occurrence of [ɨ] is predictable in that the intervening empty nucleus is licensed between two consonants forming a well-formed internal coda-onset cluster of English, except for sC clusters in which the vowel [ɨ] follows /s/, as discussed above.  The relevant examples are shown below (some examples repeated from (13a)).

(21)   (a) lC clusters
       [elpou]            *elbow*           [piltiŋ]          *building*
       [alkoritɨm]        *algorithm*
       [tolpʰin]          *dolphin*         [məltʰi]          *multi(-screen)*
       [alkʰol]           *alchol*
       (b) NC clusters
       [ɛmbjulˈlənsɨ]     *ambulance*       [pendiŋ]          *vending*
       [ɛŋgɨl]            *angle*
       [kʰɛmpʰiŋ]         *camping*         [sentʰəriŋ]       *centering*
       [pɛŋkʰiŋ]          *banking*
       (c) Other clusters
       [ətɛptʰə]          *adapter*         [taktʰə]          *doctor*

An intervening empty nucleus between a given cluster in (21) is always licensed. The licensing of the intervening empty nucleus is due to the satisfaction of the requirements of inter-onset government; a following government-licenser is present and the second member can govern the first, as shown below.

(22) /<pilØtiŋ>Ø/ [piltiŋ] *building*

```
    O1   N1   O2   N2   O3   N3   O4   N4
    |    |    |    |    |    |    |    |
[ < x         x    x    x    x    x >  x ]
    |    |    |    ↓    |    |    |
    p    i    l   [ø]   t    i    ŋ
                  ↑_____↓  inter-onset government
```

An interesting phenomenon is observed in stop-stop sequences. In English, the coronal stop occupies an onset and the non-coronal stop occurs in a 'coda' in genuine sequences, as in (21c) (KLV 1990 and Harris 1994). As noted, the vowel [ɨ] does not occur between these sequences. The word *napkin* contains a bogus cluster, i.e. -pk-, [13] and has alternating forms, [napkʰin] or [napʰɨkin]. The intervening empty nucleus between /pʰ/ and /kʰ/ is optionally realised, as shown below.

(23) /<nɛpʰØkʰin>Ø/ [nɛpʰɨkin] or [nɛpkʰin]

```
    O1   N1   O2   N2   O3   N3   O4   N4
    |    |    |    |    |    |    |    |
[ < x    x    x    x    x    x    x >  x ]
    |    |    |         |    |    |
    n    ɛ    pʰ        kʰ   i    n
```

I speculate that the choice of the alternating forms varies entirely from individual to individual.[14] For [napʰɨkʰin], the occurrence of [ɨ] is straightforwardly accounted for by the failure of inter-onset government, i.e. a headed segment cannot govern another headed segment. Note that the occurrence of [ɨ] in this context is not observed in native Korean.[15] This may provide a plausible account of the other phonetic form [napkʰin], because there are sequences of lenis stop + headed segment in mono-morphemic words as well as in suffixation contexts, e.g. [sɛks'i] 'young lady', [nɨkt'ɛ] 'wolf', [kakt'uki] 'pickled radish', and [nopt'a] /[<mopʰ>Ø] ta] 'high + declarative suffix' and [kipk'o] /[[<kipʰ>Ø] ko]/ 'deep + emphatic suffix'.

---

[13] According to the OED, the word *napkin* is analysed as a morphologically complex form, i.e. a stem *nap* followed by a diminutive suffix *kin*. Note that etymologically there are no internal –kp- sequences in English.

[14] I am aware that the proper name *Hopkins* has only a single phonetic form, i.e. [hopkʰins].

[15] With this point, I agree with Yip (1993: 262), who asserts that "the apparent absence of comparable processes in the native phonology is an artifact of the lack of inputs for which such processes are needed."

There are two possible ways of explaining the form [napkʰin]. One way is that the sequence -pk- is treated in the same way as that of -pt- or -kt- in (21c). Native speakers then regard the second member of the sequences as headed and the first as headless, as in mono-morphemic words. The other way is that the word *napkin* is treated as morphologically complex in the same way as in suffixation or compounding in Korean, i.e. /<napʰ>Ø/ /<kʰin>Ø/ or /[[<napʰ>Ø] kʰinØ]/. In these representations, /pʰ/ occurs before a final empty nucleus and so undergoes neutralisation, and is therefore realised as [p]. Nonetheless, it is important to note that the sequences -pʰɨkʰ- and -pkʰ- of both outputs are well-formed in terms of the ECP.

To summarise, I argue that the treatment of internal empty nuclei in loanwords is the same as that of native words when we assume the presence of empty nuclei. I show that this approach provides a unified way of the occurrence of the vowel [ɨ] without causing any duplication problem. It follows that the phonetic interpretation of empty nuclei in loanwords is also controlled by the ECP. An empirical consequence is that the epenthesis of [ɨ] is no longer part of the grammar of Korean.

## 5.3. Licensing of final empty nuclei in loanwords

In this section, I deal with the licensing of final empty nuclei in loanwords. The occurrence of [ɨ] in final position marks a significant diversion from the native phonology. However, as we will see below, [ɨ] does not always occur in final position. I will show that the distribution of the vowel [ɨ] in this position is mainly determined by the interactions of the ECP, the PP and the CLE. There are some cases which are not accounted for by these interactions of the three mechanism. I will claim that these cases are due to a suspension of the effect of the CLE.

## 5.3.1. Sonorant-final loanwords

Apart from /r/-final words in English discussed in section 5.4, we observe that final [ɨ] does not occur in sonorant-final loanwords, as shown below. The relevant examples are repeated from (7).

(24)  (a) Nasal-final words
| /<tɛm>Ø/ | [tɛm] | *dam* | /<kəm>Ø/ | [kəm] | *gum* |
| /<pʰen>Ø/ | [pʰen] | *pen* | /<neon>Ø/ | [neon] | *neon* |
| /<kʰiŋ>Ø/ | [kʰiŋ] | *king* | /<soŋ>Ø/ | [soŋ] | *song* |

(b) l-final words
| /<hil>Ø/ | [hil] | *HIL* | /<hotel>Ø/ | [hotʰel] | *hotel* |

As in the native phonology, the non-occurrence of [ɨ] in this position is simply due to the CLE, i.e. the sonorants, [l, m, n, ŋ], can be licensed by a final empty nucleus. Thus, sonorant-final loanwords behave in the same way as in native words.

## 5.3.2. Fricative-final and affricate-final loanwords

In this section, I deal with fricative-final and affricate-final English words. As we have seen above, some examples end in [ɨ] and others in [i]. I claim that the different realisations of the vowel in this position are to preserve the identity of the segments from the source language. The relevant examples are repeated from (8).

(25)   (a) s-final and z-final words
     /<pəs>Ø/     [pəsɨ]     *bus*     /<kas>Ø/     [kasɨ]     *gas*
     /<cʰic>Ø/     [cʰicɨ]     *cheese*     /<saic>Ø/     [saicɨ]     *size*
    (b) f-final and v-final words
     /<pipʰ>Ø/     [pipʰɨ]     *beef*     /<sØkʰapʰ>Ø/     [sɨkʰapʰɨ]     *scarf*
     /<laip>Ø/     [laipɨ]     *live*     /<top>Ø/     [topɨ]     *Dove*
    (c) ʃ-final and ʒ-final words
     /<sɛsj>Ø/     [sɛsi]     *sash*     /<pʰisj>Ø/     [pʰisi]     *fish*
     /<peic>Ø/     [peici]     *beige*     /<karac>Ø/     [karaci]     *garage*
    (d) θ-final words
     /<maus>Ø/     [mausɨ]     *mouth*
    (e) tʃ-final and dʒ-final words
     /<kʰoucʰ>Ø/     [kʰoucʰi]     *coach*     /<pʰicʰ>Ø/     [pʰicʰi]     *peach*
     /<kʰalØlic>Ø/     [kallici]     *college*     /<keic>Ø/     [keici]     *gauge*

In (25), all segments before a final empty nucleus are subject to the CLE, except v-final words ending in /p/, i.e. only [p, t, k, m, n, ŋ, l] occur before a final empty nucleus. As discussed in Chapter 3, these segments undergo neutralisation in the native phonology. If neutralisation were to apply to these final segments, the outcome would be [t], except for f-final and v-final words. In that case, the identities of loanwords would in all cases be indistinguishable. In order to make a distinction among these segments, the loanword phonology preserves the segmental content of final consonants by the phonetic interpretation of the final empty nucleus, because the unlicensed nucleus can license a preceding consonant. For instance, the underlying form /<pəs> Ø/ is represented by both 'friend' and *bus*. When the final segment /s/ of the loanword *bus* undergoes neutralisation, the phonetic form [pət] emerges, and so we are not able to distinguish between these two words phonetically. In order to do so, the final empty nucleus receives phonetic manifestation to license the preceding /s/, i.e. [pəsɨ].

This phonetic realisation of the final empty nucleus in the loanword phonology marks a significant difference from the native phonology. The difference is characterised by the different precedence order among the ECP, the PP and the CLE. Regarding the different behaviour of the final empty nuclei between the native and the loanword phonology, the orders of both phonological components are shown below.

(26)  (a) Native phonology
      the ECP (domain-final licensing), the CLE > the PP
      (b) Loanword phonology
      the PP, the CLE > the ECP (domain-final licensing)      (>: precedence)

In the native phonology, as in (26a), domain-final licensing precedes the PP and so the application of neutralisation is favoured over the PP. In the loanword phonology, as in (26b), the PP is favoured and so the final empty nucleus is phonetically realised in order for the content of the preceding consonant to be preserved.

With respect to the different phonetic interpretation of final empty nuclei above, e.g. /<saic>Ø/ [saicɨ] *size* and /<keic>Ø/ [keici] *gauge*, the segmental content of the source language influences the phonetic shapes of final empty nuclei. Since the segment /c/ in Korean represents both the palato-alveolar affricate /dʒ/ and the coronal fricative /z/ of English, these segments would be indistinguishable if the final empty nucleus was uniformly realised as [ɨ]. As noted in the segmental structures of the affricates in Korean, the spreading of the element I is used as a device to maintain a distinction between the two segments. The presence of spreading indicates that the segmental identity of the final consonant is a palato-alveolar affricate of English and its absence indicates that the segmental content of the final consonant is a coronal fricative, as shown below.

(27)  (a) /<saic>Ø/ [saicɨ] *size*

```
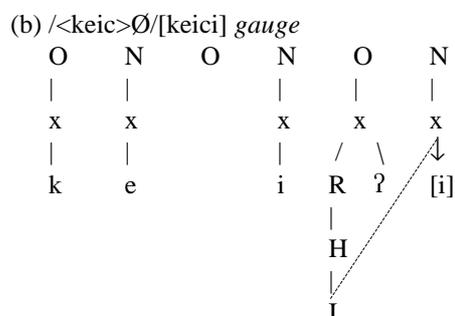        O    N    O    N    O    N¹⁶
        |    |         |    |    |
        x    x         x    x    x
        |    |         |   / \   ↓
        s    a         i   R  ʔ  [ɨ]
                           |
                           H
                           |
                           I
```

---

[16] In the native phonology, if there are two contiguous nuclei without a skeletal point of the intervening onset, these two nuclei are subject to the avoidance of vowel-hiatus, e.g. by diphthongisation or vowel-deletion, as discussed in Chapter 2. However, loanwords including Sino-Korean words do not show the effect of vowel-hiatus in the same context, as shown in (27). Two accounts are possible to explain this difference. One would be due to the preservation of segmental identity, since either diphthongisation or vowel-deletion causes changes of the segmental shapes of loanwords. The other would be that all heavy diphthongs of English loanwords are lexically assigned a skeletal point of a preceding onset of the second member of the diphthong to prevent diphthongisation from applying to the sequences in question.

(b) /<keic>Ø/[keici] *gauge*

```
O   N   O   N   O   N
|   |       |   |   |
x   x       x   x   x
|   |       |  / \  ↓
k   e       i  R  ? / [i]
               |  /
               H /
               |/
               I
```

With respect to /z/-final words, as in (27a), the absence of spreading of the element I produces the vowel [ɨ] in final position. Regarding /dʒ/-final words, as in (27b), the element I spreads to the following unlicensed empty nucleus to yield [i].[17] The same account applies to /tʃ/-final words in which the element I spreads to the following unlicensed empty nucleus, yielding [i] in final position, e.g. /<kʰoucʰ> Ø/ [kʰoucʰi] *coach*. This illustrates the fact that the segmental content of the source language affects the phonetic interpretation of the final empty nucleus to preserve the distinction among segments.

Let us consider /ʃ/-final and /ʒ/-final words in which the final empty nucleus is also realised as [i], e.g. /<sasj> Ø/ [sɛsi] *sash* and /<peic>Ø/ [peici] *beige*. Regarding /ʒ/-final words, the realisation of in final position is the same as that of /dʒ/-final words in that the element I of /c/ spreads to the following unlicensed empty nucleus.[18] As for /ʃ/-final words, the source of [i] in final position does not come from the segmental structure of /s/. Rather, in the process of the segmental adaptation, /ʃ/ is transformed into /sj/ in Korean, as was shown in (1). In GP, as shown in Chapter 2, the glide /j/ is also represented by the element I. Thus, the source of the vowel [i] in final position, comes from the element I of the glide /j/, as shown in (28).

(28)    /<sɛsj> Ø/ [sɛsi] *sash*

```
O   N   O   N
|   |   |   |
x   x   x   x
|   |   |  / ↓
s   ɛ   s  I [i]
```

In (28), I treat the element I as floating.[19] This floating element is linked to the following unlicensed empty nucleus to become [i]. The same effect is observed

---

[17] Since the content of an unlicensed empty nucleus is empty, the outcome of the spreading of the element I is [i].

[18] This may provide a plausible account of why Korean speakers have articulatory and perceptual difficulties in distinguishing between /ʒ/ and /dʒ/.

[19] If we treat this element as belonging to an onset, a technical problem arises in that the delinking of the element I from the onset and the spreading of this element to the following nucleus are required. That is,

when an unlicensed nucleus follows this segment, e.g. /<sjo>/ [sjo] *show*. In this case, the sequence [jo] constitutes a light diphthong.

Finally, consider f-final and v-final words in which the vowel [ɨ] emerges in final position. /f/ and /v/ of English are adapted as [pʰ] and [p], respectively, e.g. /<pipʰ>Ø/ [pipʰɨ] *beef*, /<laip>Ø/ [laipɨ] *live*. The phonetic realisation of [ɨ] after /pʰ/ is dealt with in the same way as other fricative-final words, because the segment /pʰ/ is not licensed by a final empty nucleus and so this empty nucleus receives phonetic interpretation to license the segment /pʰ/, in order to preserve the segmental identity of the source language.

The occurrence of [ɨ] after /p/ for v-final words, however, violates the CLE in that /p/ can be licensed by a final empty nucleus and so [ɨ] is not expected to occur in this position. Recall that sonorant-final words, as discussed in 5.3.1, do not have the final [ɨ], due to the fact that all sonorants except /r/ can be licensed by a final empty nucleus. Also, the distribution of the final [ɨ] is limited to cases in which final consonants are not licensed by the final empty nucleus. The question arises as to why [ɨ] occurs after the segment that the final empty nucleus can license. This question will be tackled in section 5.3.4.

So far, I have discussed the presence/absence of [ɨ] in final position. This is controlled by the interaction among the ECP, the PP and the CLE. The precedence of domain-final licensing over the PP triggers neutralisation in the native phonology, but when the PP dominates domain-final licensing the occurrence of [ɨ] occurs in final position, which prominently characterises the loanword phonology. Note that the presence/absence of [ɨ] in final position, as discussed in 5.3.1 and 5.3.2, is obligatory in the sense that there are no alternating forms for sonorant-final, affricate-final and fricative-final words. In the next section, I will discuss stop-final loanwords in which the occurrence of the in final position is more complicated than in the data discussed so far.

## 5.3.3. Stop-final loanwords ending in a consonant cluster

Stop-final loanwords can be classified into two types. First, there are loanwords ending in a consonant cluster and second, there are loanwords ending in a single stop. In view of the occurrence of [ɨ] in final position, these two types clearly show a difference in that the former usually contain the final [ɨ] obligatorily and the latter contain it optionally, in the sense that the occurrence of [ɨ] varies between individual words and perhaps between speakers. In this section, I will deal with the former type in a detailed way. Some relevant data are repeated from (5).

(29)  (a)  Liquid-obstruent sequences

| | | | |
|---|---|---|---|
| *pulp* | [pʰəlpʰɨ] | *belt* | [peltʰɨ] |
| *bulk* | [pəlkʰɨ] | | |
| *bulb* | [pəlpɨ] | *cold* | [kʰoltɨ] |

---

resyllabification from the onset to the nucleus is involved in this process. Theory-internally, however, this operation is prohibited due to the Projection Principle which does not allow resyllabification.

(b)    Nasal-obstruent sequences
       *camp*        [kʰɛmpʰɨ]           *tent*              [tʰentʰɨ]
       *bank*        [pɛŋkʰɨ]
       *band*        [pɛndɨ]

The consonant sequences in (29) are well-formed coda-onset clusters of English. These sequences are syllabically mapped onto two onsets intervened by an empty nucleus and followed by a final empty nucleus, as shown below.

(30) /[<tʰentʰ>Ø]/ [tʰentʰɨ] *tent*

```
      O1    N1    O2    N2    O3    N3
      |     |     |     |     |     |
   [ < x     x     x     x     x> ⇐ x ]
      |     |     |           |     ↓
      tʰ    e     n           tʰ   [ɨ]
                  ↑_____↓ inter-onset government
                                      (⇐: government-licensing)
```

In (30), there are two possible sites for phonetic interpretation, i.e. N2 and N3. The onsets O2 and O3 constitute an inter-onset governing domain, since the coronal aspirated segment in O3 can govern the coronal nasal in O2. Recall from Chapter 3 that a government-licenser is required to sustain inter-onset government between two preceding consonants, since otherwise the intervening empty nucleus receives phonetic interpretation. Some relevant examples of native words are shown below.

(31)   (a) The presence of a government-licenser
       /<mjərØcʰi>/              [mjəlcʰi]             'anchovy'
       /<nakØc'i/                [nakc'i]              'octopus'
       /<əmØpʰo>/               [əmpʰo]               'threat'
       (b) The absence of a government licenser
       /<turØp>Ø/               [turɨp]               'aralia shoots'
       /<sirØm>Ø/               [sirɨm]               'anxiety'
       /<murØpʰ>Ø/              [murɨp]               'knee'

In (31), the consonant sequences surrounding the penultimate empty nucleus (underlined) may potentially enter into an inter-onset governing relation. With respect to the data in (31a), the final vowel acting as a government-licenser provides licensing potential to a preceding consonant to govern its complement. The outcome is that the penultimate empty nucleus is licensed. The data in (31b), however, end in a final empty nucleus which cannot act as a government-licenser and so the final consonant does not receive the licensing ability to establish the inter-onset governing relation. Thus, the penultimate empty nucleus must be phonetically interpreted.

Bearing in mind (31), the situation of (30) is the same as that of (31b) in that there are two empty nuclei and the penultimate one is surrounded by a consonant sequence holding a potential inter-onset governing relation. If the penultimate empty nucleus N2 receives phonetic interpretation in the same way as in the native phonology, the outcome is [tʰenɨt] in which the final consonant /tʰ/ undergoes neutralisation. Obviously, this form is not phonetically similar to the form of the source language, which is [tent]. Thus, the strategy in the loanword phonology is different, in that the final empty nucleus N3 must receive phonetic interpretation in order to act as a government-licenser to preserve the preceding consonant sequences from the source language. [20] The phonetic interpretation of N3 prevents the occurrence of [ɨ] in N2 and so sustains the identity of the consonant sequences, which makes the phonetic form similar to that of the source language. [21] The examples in (29) provide another instance of the difference between the loanword and the native phonology.

In this sense, the motivation of the phonetic interpretation of the final empty nucleus in (30) is different from that of the cases discussed in the previous section. Both cases have in common the obligatory realisation of the final empty nucleus and the predominance of the PP, but the role of the unlicensed final empty nucleus is different in that it acts as a government-licenser in the former but as a licenser of a preceding consonant in the latter case.

Finally, let us consider loanwords ending in a cluster but in which the penultimate empty nucleus receives phonetic interpretation, instead of the final empty nucleus. The examples are shown below.

(32)   (a) Cl cluster final
    /<ɛpʰØl>Ø/    [ɛpʰɨl]    *apple*    /<litʰØl>Ø/    [litʰɨl]    *little*
    /<tʰɛkʰØl>Ø/    [tʰɛkʰɨl]    *tackle*
    /<təpØl>Ø/    [təpɨl]    *double*    /<mitØl>Ø/    [mitɨl]    *middle*
    /<kokØl>Ø/    [kokɨl]    *goggle*
    (b) lN cluster final
    /<pʰilØlØm>Ø/    [pʰillɨm]    *film*    /<kʰilØlØn>Ø/    [kʰillɨn]    *kiln*

---

[20] In fact, Korean also has words ending in a consonant cluster, e.g. /<tark>Ø/ [tak] 'chicken', /<moks'>Ø/ [mok] 'share' and so on. In isolation, one of these two consonants is deleted but both consonants are realised when a vowel-initial nominative suffix follows, e.g. /<tark> i> [talki] and /<moks'> i/ [moks'i]. These facts show that the native phonology is also different from the loanword phonology regarding the treatment of final consonant clusters. I am aware that the treatment of the native words ending in a cluster may be problematic within the current syllable inventory proposed in this thesis. I will discuss problems involving these words in Chapter 6.

[21] In the loanword phonology, this analysis implies that the domain of the application of the ECP is an extended stem rather than a stem domain. For the preservation of the segmental content of the source language, the example in (30) shows that the algorithm of the ECP would consider the presence of a final empty nucleus outside the stem domain. Since the penultimate empty nucleus N2 is in (30) not a proper site, the application of the ECP extends to the final empty nucleus N3. The phonetic realisation of N3 provides another difference from the native phonology.

(32a) contains Cl cluster-final loanwords in which the penultimate empty nucleus receives phonetic interpretation. [22]   When we observe consonant sequences surrounding the penultimate empty nucleus, an inter-onset governing relation is not established, due to the inability of the liquid to govern the preceding stop. Thus, the phonetic interpretation of the penultimate empty nucleus is due to the failure of inter-onset government. The following configuration illustrates this point.

(33) /<tʰɛkʰØl>Ø/ [tʰɛkʰɨl] *tackle*

```
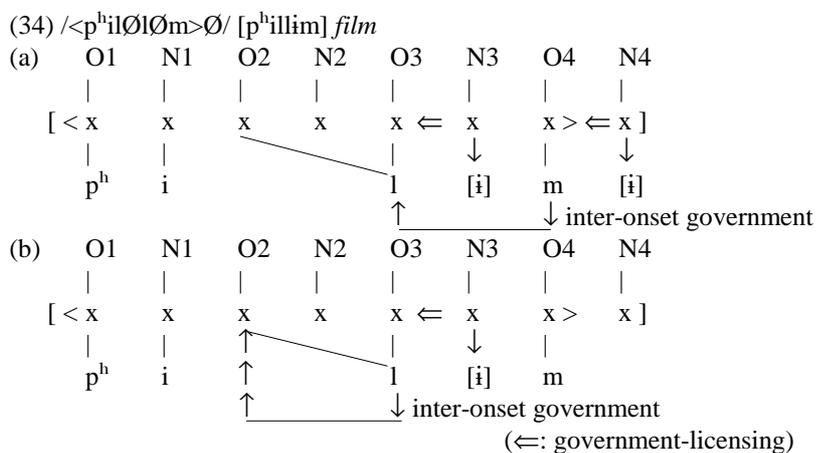     O    N    O    N    O    N
     |    |    |    |    |    |
     x    x    x    x    x    x
     |    |    |    ↓    |
     tʰ   ɛ    kʰ   [ɨ]  l
                ↑_____↓ inter-onset government
                      ‖
```

The two examples in (32b) are of interest in comparison with those in (29) and (32a), in that the consonant clusters in (32b) are coda-onset sequences from the source language as in (29), and yet the penultimate empty nucleus receives phonetic interpretation, as in (32a). This is mainly due to the consonant adaptation of the inter-vocalic liquid /l/ from English to Korean, i.e. /l/ in English is doubled in this position to preserve the segmental identity. The lexical representation of *film* is shown below.

(34) /<pʰilØlØm>Ø/ [pʰillɨm] *film*

```
(a)   O1   N1   O2   N2   O3   N3   O4   N4
      |    |    |    |    |    |    |    |
    [ < x  x    x    x    x ⇐ x    x > ⇐ x ]
      |    |     \        |    ↓    |    ↓
      pʰ   i      \       l   [ɨ]   m   [ɨ]
                   ↑_____↓ inter-onset government
```

```
(b)   O1   N1   O2   N2   O3   N3   O4   N4
      |    |    |    |    |    |    |    |
    [ < x  x    x    x    x ⇐ x    x >  x ]
      |    |    ↑          |    ↓    |
      pʰ   i    ↑  \       l   [ɨ]   m
                ↑   _____↓
                ↑_____↓ inter-onset government
                           (⇐: government-licensing)
```

---

[22] In the GP literature (KLV 1990 and Harris 1994), the final Cl clusters in English are not treated as genuine consonant sequences, since an empty nucleus intervenes between these clusters. Thus, the syllabification of these sequences is /– CØlØ/. The empirical evidence for this syllabification is that the penultimate empty nucleus is optionally realised as [ə], as in [simpəl], [litəl] and [tækəl].

If we treat (34) in the same way as (29) and (30), i.e. the phonetic interpretation of the final empty nucleus enables the preceding onset to govern its complement, then the problem arises as to how the intervening empty nucleus N2 is licensed, as in (34a), because there is another inter-onset governing relation which requires a government-licenser. That is, there is no government-licenser to establish the inter-onset government between O2 and O3. In order to maintain inter-onset government between O2 and O3, N3 must receive phonetic interpretation, which would result in the incorrect phonetic form *[pʰillɨmɨ]. In fact, this form is in conflict with the CLE in that the final /m/ can be licensed by a final empty nucleus N4 and yet N4 must be unlicensed to government-license the preceding /m/. Furthermore, the form [pʰillɨmɨ] shows that government-licensing takes place twice and so the phonetic realisation occurs in two nuclear positions. To resolve the conflict between the CLE and domain-final licensing, the proper site of [ɨ] is the penultimate empty nucleus, as in (34b), i.e. [pʰillɨm]. This form provides a simpler and yet more appropriate account of the presence of a doubly-linked /l/ which requires a government-licenser and the fact that the final /m/ can occur before a final empty nucleus.

## 5.3.4 Loanwords with a single final stop

In this section, I deal with loanwords ending in a single stop, paying particular attention to the occurrence of [ɨ] in final position. As we have seen in 5.1, the distribution of [ɨ] in this position is hard to generalise, since this vowel seems to occur randomly, depending on individual loanwords. In order to seek a proper account of this optional occurrence of the vowel [ɨ], I will consider the data in a more detailed way.

(35) shows how the *Orthography System of Foreign Word*s published by the National Academy of the Korean Language, regulates the occurrence of the final [ɨ] of English loanwords.

(35)    (a)    Voiceless stops
             (i) A final voiceless stop after a short (lax) vowel occurs without a following [ɨ].
             (ii) Otherwise, i.e. when a long (tense) vowel precedes a final voiceless stop, the vowel [ɨ] occurs in final position.
        (b)    Voiced stops
             The vowel [ɨ] occurs after a final voiced stop.

According to the regulation in (35a), the quality of a preceding vowel determines the occurrence of the final [ɨ]. For instance, *cap* and *cape* are realised as [kʰɛp] and [kʰeipʰɨ], since the former contains a short vowel and the latter a long one (or heavy diphthong), respectively. Notice that the final stop /p/ of English is realised as [p], as in *cap*, when the vowel [ɨ] does not follow, i.e. this segment undergoes neutralisation, as in native words. This implies that some loanwords behave in the same way as native words because they show neutralisation, instead the phonetic

realisation of [ɨ] in final position (see below for a detailed analysis of this type of loanwords).

With respect to voiced stop-final words, as in (35b), *hub*, *kid* and *egg* are realised as [həpɨ], [kʰitɨ] and [ekɨ], respectively. (35b) shows that the CLE does not apply to these forms, because the lenis stops occur before the vowel [ɨ]. Hence there are three ways of representing loanwords ending in a single stop, i.e. an aspirated stop followed by the vowel [ɨ] as in (35ai), a lenis stop followed by the vowel [ɨ], as in (35b), and a lenis stop without the vowel [ɨ], as in (35aii). In this way, loanwords ending in a single stop show a significant difference from loanwords ending in consonants other than a stop, in that these loanwords obligatorily contain a final [ɨ] in a fricative- or an affricate-final word and do not for sonorant-final words.

Let us consider how the regulations in (35) apply to 420 words containing a single final-stop, collected from the *Compilations* and various previous analyses on loanwords (see Appendix).[23] The following table shows the frequency of the occurrence of [ɨ] in final position, depending on place of articulation and the laryngeal state of the final stops.

| (36) | Ø | | [ɨ] | | Ø or [ɨ] | | TOTAL |
|---|---|---|---|---|---|---|---|
| p-final word | 46 | 65. 7% | 17 | 24.2% | 7 | 10% | 70 |
| t-final word | 65 | 38.9% | 88 | 52.6% | 14 | 8.3% | 167 |
| k-final word | 60 | 50.8% | 48 | 40.6% | 10 | 8.4% | 118 |
| SUBTOTAL | 171 | 48.1% | 153 | 43% | 31 | 8.7% | 355 |
| b-final | 6 | 30% | 14 | 70% | 0 | 0 | 20 |
| d-final | 0 | 0 | 30 | 100% | 0 | 0 | 30 |
| g-final | 1 | 6.6% | 14 | 93.3% | 0 | 0 | 15 |
| SUBTOTAL | 7 | 10.7% | 58 | 89.2% | 0 | 0 | 65 |
| TOTAL | 178 | 42.3% | 211 | 50.2% | 31 | 7.3% | 420 |

(Ø: absence of the final-[ɨ], [ɨ]: presence of the final-[ɨ], Ø or [ɨ]: alternating forms)

The table in (36) shows the rate of occurrence of the final [ɨ], irrespective of the quality of the preceding vowel. First, the occurrence of the final [ɨ] in voiced stop-final words is far more frequent than in voiceless stop-final words: the rate of the former and the latter is 89.2% and 43%, respectively. This may be due to (35b). The distribution between the presence and the absence of the final [ɨ] among voiceless stop-final words is almost evenly balanced, i.e. 43% in the former and 48.1% in the latter. With respect to place of articulation, among voiceless stop-final words, more than half of labial-final and velar-final words do not have final [ɨ], but more than half of coronal-final words do have final [ɨ]. The presence of alternating forms is not affected by place of articulation among the voiceless stop-final words, in that its percentage is more or less similar, i.e. 10% for the labial, 8.3% for the

---

[23] Note that not all phonetic forms of the examples in (36) follow the regulations in (35). On the basis of my intuition with the consultations from informants and the data in the previous analyses, some phonetic forms are modified in the course of the collection.

coronal and 8.4% for the velar. Note that there is no variation among the voiced stop-final words.

In order to examine the data in (36) in more detail, let us consider exceptions to (35). I found that there are 65 cases out of 420, i.e. 15.4%. Some examples are shown below.

(37)  (a) Non-occurrence of the vowel [ɨ] after a long vowel

| | | | | | |
|---|---|---|---|---|---|
| *group* | [kɨrup] | *[kɨrupʰɨ] | *leap* | [lip] | *[lipʰɨ] |

(b) Occurrence of the vowel [ɨ] after a short vowel

| | | | | | |
|---|---|---|---|---|---|
| *bat* | [pɛtʰɨ] | *[pet] | *edit* | [ɛtitʰɨ] | *[etit] |
| *knot* | [notʰɨ] | *[not] | *knit* | [nitʰɨ] | *[nit] |
| *unit* | [junitʰɨ] | *[unit] | *wit* | [witɨ] | *[wit] |
| *knock* | [nokʰɨ] | *[nok] | *shock* | [sjokʰɨ] | *[sjok] |

(c) Non-occurrence of the vowel [ɨ] after a voiced stop

| | | | | | |
|---|---|---|---|---|---|
| *web* | [wep] | *[wepɨ] | *tab* | [tʰɛp] | *[tʰɛpɨ] |
| *big* | [pik] | *[pikɨ] | | | |

(d) Alternating forms

| | | | | | |
|---|---|---|---|---|---|
| *cut* | [kʰət] | [kʰətʰɨ] | *tape* | [tʰeip] | [tʰeipʰɨ] |
| *cake* | [kʰeik] | [kʰeikʰɨ] | | | |

The number of exceptions to (35) is as follows: 2 out of 130 (1.5%) in (37a), 25 out of 204 (12.3%) in (37b), 7 out of 65 (10.8%) in (37c) and 31 for alternating forms. Note that the rate of exceptional cases in (37a) is the lowest. In other words, when a tense vowel precedes a stop, the vowel [ɨ] almost always occurs finally. Furthermore, exceptions in (37b) show the highest rate. Interestingly, among these exceptions, there are no exceptions for labial voiceless stop-final words. Overall, regarding place of articulation, the labial stop behaves consistently with the regulations in (35) (there are only two exceptions). The coronal stop-final words show the worst behaviour, in that there are 20 exceptions.

On the basis of the observations made thus far, the exceptional cases in (37a) and (37b) may provide a plausible account of why the set of exceptional loanwords with a single stop-final lacks the final [ɨ]. First consider the word *group* [kɨrup] in (37a). This word is frequently used in compounding with Sino-Korean words, e.g. [kɨrup əhɛŋ] *group* 'tour', 'group tour', [cɛpəl kɨrup] 'conglomerate' *group*, 'big company group'. Also, it is used in loanword compounds such as [sitʰəti kɨrup] *study group*. An interesting exception is the word *web* [wep] in (37b). The phonetic form of *web* is [wepɨ] in the *Compilations* (published in 1988). However, at present, this form [wepɨ] is never used in daily conversations and the media since the advent of the Internet age, i.e. the mid-90's. For instance, in compounds, e.g. [wep s'aitʰɨ] *web-site* and [wem munsə] *web-*'document', the final [ɨ] never surfaces. In particular, in the latter form, the final [p] undergoes nasalisation when the following consonant is a nasal. In the former, the following /s/ undergoes tensification. These two processes have the same contexts as those in suffixation, as discussed in Chapter 4. The change from [wepɨ] to [wep] is definitely influenced by social factors, one of

which is frequent usage. Frequent usage implies that a loanword in question is more familiar with the native speakers and hence more entrenched in the native phonology.

In fact, all exceptions in (37b), e.g. *club* [kʰilləp], *jab* [cɛp], *job* [jap], *tab* [tʰɛp], *big* [pik] and *bag* [pɛk], are frequently used among native speakers and so they become familiar. The notion of familiarity is hard to define in terms of quantitative measurement or frequency, but the fact that English is the first foreign language in Korea and English education starts from middle school indicates that Korean speakers more or less know some basic English vocabulary. Also, in the media, in particular in advertisements, the use of foreign words has become commonplace. Therefore, it is reasonable to assume that native speakers get used to loanwords which are frequently used and so feel familiar with them.

On the basis of the notion of familiarity, I argue that the loanwords in (37a,b) are familiar with the native speakers and that familiarity causes them to be assimilated into the native vocabulary. In this way, the phonological behaviour of these loanwords is parallel to that of native lexical items, in particular in suffixation with the word *web*, as shown above. Thus, phonologically, the notion of the familiarity is interpreted as a means for classifying some loanwords as part of the native lexical items. Thereafter, I will call these loanwords *pseudo-native words*. The term *pseudo* indicates that these loanwords are still recognised as foreign words by the native speaker, even though their phonological behaviour is the same as that of native words.

The criterion for the classification of pseudo-native words depends on whether or not those loanwords end in a stop without final [i]. The category of pseudo-native words comprises exceptions to (35) and cases observing (35ai). In other words, I treat all loanwords without final [i] as pseudo-native words. This criterion is phonologically plausible in that the phonological behaviour in suffixation between pseudo-native and loanwords shows a clear contrast. As we will see in section 5.4, the pseudo-native category actively participates in phonological processes in suffixation, precisely because we can set up an inter-onset governing relation between a final segment, i.e. the extended stem domain, and a suffix-initial segment, across a licensed empty nucleus. In contrast, those loanwords ending in final [i] do not exhibit any active phonological operations in suffixation, due to the fact that the presence of final [i] eliminates an inter-onset governing relation between the final and the suffix-initial segment.

Regarding the treatment of the identity of the final stop in pseudo-native words, I claim that the lenis stop is the underlying segment, irrespective of its laryngeal state in the source language. For instance, the words *cap* [kʰɛp] and *web* [wep] have underlying representations /<kʰɛp>Ø/ and /<wep>Ø/, respectively. One piece of evidence for these underlying representations comes from nominative suffixation. The nominative forms of these two words are [kʰepi] and [wepi], respectively. Recall that the nominative suffix /i/ is non-analytic so that stem-final segments are realised without segmental changes. If /<kʰɛpʰ>Ø/ is the lexical representation of *cap*, then the nominative form would be *[kʰɛpʰi]. Given this lexical representation, a stipulation is required to derive the correct phonetic form in that the behaviour of

the nominative suffix /i/ must be analytic for voiceless stops of English, i.e. the final /pʰ/ undergoes neutralisation and becomes [p] before a final empty nucleus and the suffix /i/ is added. Obviously, this approach is undesirable. Thus, the change from the aspirated to the lenis stop in the word *cap* is treated as *lexicalised* in the sense that this process is not visible in the loanword phonology.

Loanwords with a final stop other than pseudo-native words receive a final [ɨ]. The phonetic interpretation of the final empty nucleus is motivated by considerations of maximal preservation of the segmental content of the source language. For instance, the words *mat* and *mad* are represented by [mɛtʰɨ] and [mɛtɨ], respectively. The phonetic interpretation of the final [ɨ] in both loanwords makes it possible to retain the distinction between a voiceless and a voiced stop of English. The presence of the final [ɨ] in *mad* indicates that the effect of the CLE is suspended, i.e. the suspension of the CLE allows [ɨ] to occur in final position. The same effect is observed in other English loanwords ending in a voiced stop, e.g. *hub* [həpɨ] and *bug* [pəkɨ]. The suppressive effect of the CLE in these examples shows another instance of how the loanword phonology differs from the native phonology.

In comparison with the regulations in (35) in which there are three ways of representing the final [ɨ], the postulation of the category of the pseudo-native words provides a simpler account of how the phonetic interpretation of the vowel [ɨ] in final position proceeds. By classifying loanwords without final [ɨ] as pseudo-native words,[24] the remaining loanwords contain the vowel [ɨ] in final position. The occurrence of the vowel [ɨ] in this position is due to the maximal preservation of the segmental content of the source language, which leads to the partial suspension of the application of the CLE, i.e. the vowel [ɨ] occurs after a lenis stop. The following configuration illustrates how loanwords are organised within the lexicon.

(38)    The organisation of loanwords



Loanwords are divided into two parts. The division depends on the occurrence of the final [ɨ], i.e. its absence constitutes the component of the pseudo-native

---

[24] Regarding sonorant-final loanwords which lack final [ɨ], the effect of the CLE prevents the vowel [ɨ] from occurring in final position. In fact, not all sonorant-final loanwords are familiar to native speakers. Nonetheless, the phonological behaviour of these words is parallel to that of the pseudo-native words in suffixation, i.e. an inter-onset governing relation can be set up across a licensed final empty nucleus in analytic suffixation. Therefore, I classify them as pseudo-native words.

category and its presence constitutes the component of the genuine loanwords. Note that part of the pseudo-native component is outside the loanword component which indicates that these words undergo phonological processes in the native phonology. The component of the genuine loanwords with the final [ɨ] is inside the loanwords, which shows that these words are not subject to the native phonology, due to the effect of the presence of the final [ɨ].

To recapitulate, consider how relevant principles and the CLE interact, regarding the presence/absence of [ɨ] in final position, among obstruent-final loanwords, as shown below.

(39)    (a) Fricative-final and affricate-final words
        The PP, the CLE > the ECP (domain-final licensing)
        e.g. *bus* [pəsɨ], *cheese* [cʰicɨ], *coach* [kʰocʰi], *college* [kʰallici]
        (b) Voiceless stop-final words
        The PP, the CLE > the ECP (domain-final licensing)
        e.g. *harp* [hapʰɨ], *mat* [mɛtʰɨ], *lake* [leikʰɨ]
        (c) Voiced stop-final words
        The PP > the ECP (domain-final licensing) and the suspension of the CLE
        e.g. *tube* [tʰjupɨ], *kid* [kʰitɨ], *egg* [ekɨ]

Note that the effect of the CLE holds in the cases in (39a,b), in that the phonetic realisation of the final [ɨ] is mainly due to the precedence of the PP over the ECP. In (39c), however, the CLE does not prevent [ɨ] from occurring in final position in order to preserve the distinction between the voiceless and the voiced stop of the source language. In this sense, the application of the CLE is suppressed and so a lenis stop can occur before the vowel [ɨ]. In this case, the scope of the application of the CLE is suppressed in the series of lenis stops, but not in sonorants. The occurrence of the vowel [ɨ] in final position, as in (39), characterises the loanword phonology as a component that is distinct from the native phonology.

Finally, consider loanwords with alternating forms, e.g. *tape* [tʰeip] or [tʰeipʰɨ], *mascot* [masɨkʰot] or [masɨkʰotʰɨ], *cake* [kʰeik] or [kʰeikʰɨ]. Given the organisation in (38), I argue that these alternating forms vacillate between pseudo-native words and loanwords with final [ɨ]. As pseudo-native words, they undergo relevant phonological processes in suffixation and as loanwords with final [ɨ], they are immune to these processes. For instance, in nominative suffixation, a sharp distinction is drawn between them. For the loanwords with the final [ɨ], the nominative forms are [tʰeipʰɨka], [masɨkʰotʰɨka] and [kʰeikʰɨka] in which the suffix /ka/ follows. This indicates that the presence of [ɨ] in final position plays a crucial role in the selection of the nominative suffix /ka/. For the pseudo-native part, the nominative forms are [tʰeipi], [masɨkʰosi] and [kʰeiki] in which the suffix /i/ follows, like other pseudo-native words as discussed above. Interestingly, note that the final segment in the nominative form of *mascot* is realised as [s]. This is one of the topics of the next section.

## 5.4. Loanwords in suffixation and the treatment of 'coda' /r/ in English

## 5.4.1 Loanwords in suffixation

This section is concerned with the question of how pseudo-native loanwords undergo relevant phonological processes in suffixation. As is predicted by the discussion in the previous section, the phonological behaviour of this category is exactly the same as that of its native counterpart, because the context in which a given process occurs in suffixation is the same. First, I briefly discuss phonological processes involved in suffixation. Second, I deal with the pseudo-native loanwords which show an alternation between [s] and [t] in non-analytic suffixation.

In analytic suffixation, like the native phonology discussed in Chapter 4, we observe nasalisation, tensification and post-nasal voicing. Examples of each process are shown below.

(40)  (a)    Nasalisation: the suffix /manØ/ 'only'
             /[<wep>Ø] manØ]/            [wemman]           *web*
             /[<tʰØrək>Ø] manØ]/         [tʰɨrəŋman]        *truck*
             /[<masØkʰot>Ø] manØ]        [masɨkʰonman]      *mascot*
      (b)    Tensification: the suffix /to/ 'also'
             /[<kØrup>Ø] to]/            [kɨrupt'o]         *group*
             /[<sɛk>Ø] to]/              [sɛkt'o]           *sack*
             /[<masØkʰot>Ø] to]          [masɨkʰott'o]      *mascot*
      (c)    Post-nasal voicing: the suffix /to/ 'also'
             /[<tɛm>Ø] to]/              [tɛmdo]            *dam*
             /[<pʰen>Ø] to]/             [pʰendo]           *pen*
             /[<kʰiŋ>Ø] to]/             [kʰiŋdo]           *king*

As expected, the outcomes in (40) are due to inter-onset governing relations between an extended stem-final and a suffix-initial segment after bracket erasure. Because the suffix-initial segment in the head position cannot govern the preceding segment, various resolutions of inter-onset government are made through nasalisation, as in (40a), tensification, as in (40b) and post-nasal voicing, as in (40c).

Regarding non-analytic suffixation, consider the nominative and the instrumental forms, as shown below.

(41)  (a)    Nominative /i/
             /[<wep> i]/                 [wepi]             *web*
             /[sɛk> i]/                  [sɛki]             *sack*
             /[<masØkʰot> i]/            *[masɨkʰoci], [masɨkʰosi]    *mascot*
      (b)    Instrumental /ro/ 'with'
             /[<wep>Øro]/                [wepɨro]           *web*
             /[<sɛk>Øro]/                [sɛkɨro]           *sack*

/[<masØkʰot>Øro]/        *[masɨkʰotɨro] [masɨkʰosɨro]        *mascot*

In (41), the p-final and k-final words show that their phonological behaviour is the same as that of the native words, in that the final consonants are realised as they are in the nominative and the instrumental forms and the intervening empty nucleus between the final and the suffix-initial consonant is phonetically interpreted due to the failure of inter-onset government in the latter type of suffixation. With respect to the t-final words, however, the expected forms [masɨkʰoci] and [masɨkʰotɨro] are not correct. Note that the occurrence of [c] in the nominative form is due to palatalisation, as discussed in Chapter 4, e.g. [<patʰØ>i] [pacʰi] 'field' and [<kut>i] [kuci] 'firmly'. Instead, [s] emerges in both forms. Contrary to analytic suffixation, in which [t] occurs, as in (40a), the presence of [s] in (41) casts doubt on the identity of the t-final pseudo-native words. If we assume that the coronal /t/ is a final consonant, then a phonological process from /t/ to [s] would be required. Among pseudo-native words, this process is not plausible in that this particular segment undergoes a lenition process but other lenis segments /p/ and /k/ in the same context do not.

In order to investigate the nature of this alternation, first consider how loanwords are adapted in Korean with respect to grammatical category. As pointed out by H.-S. Sohn (2001), all loanwords from English appear to be borrowed as nouns. For instance, when English verbs, like *behave*, *save* and *demand*, are adapted in Korean, they require the bound verbal root /ha/ 'to do', which gives rise to the verbal stems and constitutes the bases for verbal suffixation, as shown.

(42)   Source language      Nominative form        Verbal derivation
       *behave*             [piheipɨka]            [piheipɨha]
       *save*               [seipɨka]              [seipɨha]
       *demand*             [timandɨka]            [timandɨha]

Furthermore, adjectives in the source language also behave like nouns and function as adjectives by the addition of the verbal root /ha/ followed by the adjectival suffix /n/, as shown below.

(43)   Source language      Verbal derivation      Adjectival derivation
       *nice*               [naisɨha]              [naisɨhan]
       *kind*               [kʰaindɨha]            [kʰaindɨhan]
       *ugly*               [əkɨlliha]             [əkɨllihan]

(42) and (43) demonstrate that loanwords are listed in the lexicon as nouns, regardless of their grammatical category in the source language. The nominal lexical status of loanwords provides a plausible account of the alternation between [t] and [s], because pseudo-native words can be treated in the same way as native nominal stems, with respect to phonotactic restrictions.

As pointed out in Chapter 3, the stem-internal /t/ cannot occur before an internal licensed empty nucleus, i.e. there are no internal sequences such as -tØC'- or -tØC$^h$- (C': tensed obstruent, C$^h$: aspirated obstruent).  A similar phonotactic restriction is imposed on the final position in nominal stems.[25,26]  On the basis of the fact that loanwords are adapted as nouns and the absence of t-final stems in the nouns, the alternation between [t] and [s] would be due to an analogical change of the final coronal segment in the pseudo-native vocabulary: the phonetic realisation of [t] in final position invokes a reanalysis of this segment as a final-/s/ for native speakers.[27]

Given the fact that /s/ is an underlying segment in t-final words, the alternation between /s/ and [t] is accounted for in a non-arbitrary way.  The occurrence of [t] before a final empty nucleus is due to neutralisation.  The occurrence of [s] in (41) is simply due to the fact that the nominative suffix /i/ can license this segment.  In other words, the [t]-final pseudo-native words behave in the same way as /s/-final native words.

In fact, the [t]-final pseudo-native words provide justification for the distinction between the pseudo-native and genuine loanwords in the loanword component, as depicted in (38).  Both categories contain /s/-final words, e.g. /<masØk$^h$os>Ø/ *mascot* and /<pəsØ>Ø/ *bus*.  However, the phonetic realisation of the stem-final segment /s/ differs in isolation, e.g. [masɨk$^h$ot] and [pəsɨ].  The former is subject to the native phonology and the latter to the loanword phonology.  The former form actively takes part in phonological processes in suffixation of the native phonology and so the final segment /s/ is subject to nasalisation and tensification, e.g. /[<masØk$^h$os>Ø] manØ/ 'only' [masɨk$^h$onman], /[<masØk$^h$os>Ø] to/ 'also' [masɨk$^h$ott'o].  The latter form, however, does not play any active role in suffixation due to the presence of the final [ɨ] which eradicates relevant inter-onset governing relations in suffixation contexts.

To summarise, only pseudo-native words are subject to phonological processes in suffixation in the sense that the outcomes are the same as those of native words.  Dealing with [t]-final pseudo-native words, I point out that all loanwords are adapted as nouns in Korean and so that the phonotactic constraints on native nouns also apply to them.  The absence of /t/-final nouns invokes an analogical change from /t/ to /s/ and so [s] appears in the nominative form.

---

[25] Note that the same phenomenon is observed in Sino-Korean words.

[26] Diachronically, the same process occurs in Middle Korean (K.-M. Ko 1989 and the relevant references therein), in t-final nouns such as /<kat>Ø/ 'hat worn by married gentlemen', /<kot>Ø/ 'spot', /<nat>Ø/ 'sickle', /<mot>Ø/ 'nail', among others, the final /t/ undergoes an analogical change to become /s/.

[27] Logically, an alternative candidate would be /t$^h$/.  The postulation of underlying /t$^h$/, however, may be ruled out due to a phonotactic restriction on the final segment of pseudo-native words which says that only lenis obstruents can occur in this position.  Recall that the final consonants of this category are lexicalised in which all voiceless stops of the source language become their lenis counterparts, as discussed earlier.

## 5.4.2. The treatment of the 'coda' /r/ of English

One fundamental division in English accent types depends on the phonotactic distribution of the segment /r/. In rhotic accents, /r/ can occur in preconsonantal and final positions as well as in initial and intervocalic positions. In non-rhotic accents, on the other hand, /r/ may occur initially and intervocalically but not in preconsonantal and final positions. The rhotic accents include those of Scotland, Ireland, Canada, Barbados, certain western parts of England, and most of the United States of America, including General American (GA). The non-rhotic accents include those of Australia, New Zealand, South Africa, Trinidad, certain eastern and southern parts of the United States, and most of England and Wales, including Received Pronunciation (RP). In the standard rule-based literature (Wells 1982 and Giegerich 1992, among others), non-rhoticity is analysed as *r-dropping* or *r-deletion*. Those analyses imply that there is no difference between the rhotic and the non-rhotic varieties on the underlying representation since /r/ is present. The difference between them is that the rule of r-deletion is active in RP but not in GA.[28]

   Bearing in mind the brief discussion of rhoticity, this section focuses on how the English segment /r/ is treated in the loanword adaptation in Korean. Consider loanwords ending in /r/.

(44)   *bar*          [pa]              *tear*           [tʰiə]
       *tour*         [tʰuə]            *mirror*         [mirə]

In (44), we observe that there are no phonetic realisations of final /r/ in English. These examples suggest that the loanword adaptation in Korean is modelled on a non-rhotic accent, like RP. The question arises as to whether or not the segment /r/ in English is present underlyingly in the host language. Among the previous studies on this topic, H. Yoo (1996) argues that native speakers cannot recognise the final /r/ at the perceptual level (Silvermann 1992) so that the final /r/ is not part of the input to the loanword phonology, and O. Kang (1996) claims that this segment is treated as a ghost segment, i.e. its segmental content is not present underlyingly but leaves behind a skeletal point. Both analyses agree that /r/ is not part of the input to the loanword phonology.

   Unlike the previous approaches, I argue that the final /r/ is present underlyingly but this segment is not phonetically realised and so is deleted due to the notion of *unlicensibility*, as discussed below. My argument is based on the obligatory realisation of the final [ɨ] in words ending in a consonant cluster of the source language, e.g. *pulp* [pʰəlpʰɨ], *camp* [kʰɛmpʰɨ], *tent* [tʰentʰɨ] etc. Recall that the

---

[28] However, the application of this rule is suspended when the next word beginning with a vowel follows at phrase level. For instance, the phrases 'near me' and 'far gone' are realised as [nɪə miː] and [fɑː gɒn], but 'near us' and 'far away' are realised as [nɪər ʌs] and [fɑːr əweɪ]. This liaison effect is known as 'linking-/r/' (cf. Gimson 1989). Furthermore, there is an analogous process of linking-/r/: 'intrusive-[r]' (cf. Gimson 1989). [r] is frequently inserted after a schwa: e.g. 'Russia and China' [rʌsɪər ən tʃaɪnə], 'idea of' [aɪdɪər əv] etc. For a government-based approach to the treatment of /r/ in English, see Harris (1994).

obligatory realisation of final empty nuclei is due to government-licensing, i.e. the government-licenser must be unlicensed (see section 3.2). Consider the following examples containing an rC cluster.

(45)  *cart*          [kʰatʰɨ] *[kʰat]     *heart*          [hatʰɨ] *[hat]

  *sort*          [sotʰɨ] *[sot]         *harp*          [hapʰɨ] *[hap]

The obligatory phonetic realisation of the final empty nuclei in (45) clearly indicates that there is an inter-onset governing relation between /r/ and a following obstruent, as shown below.

(46) /<sorØtʰ>Ø/  [sotʰɨ] *sort*

```
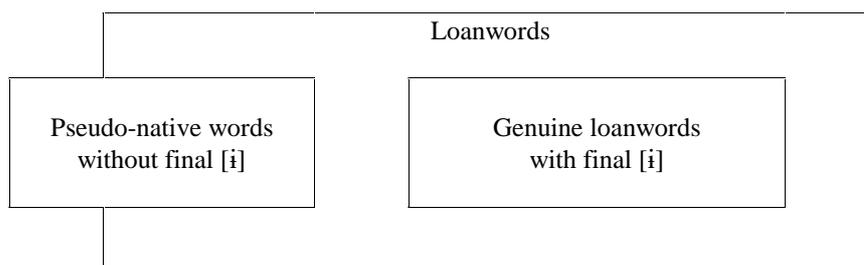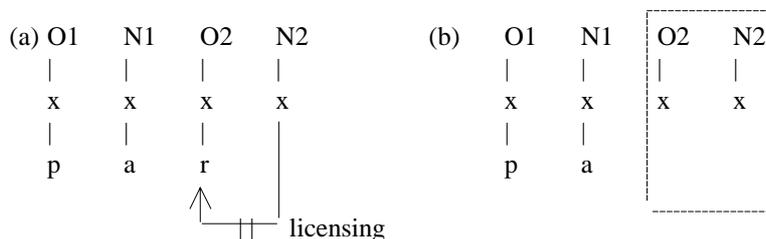    O1   N1   O2   N2   O3   N3
    |    |    |    |    |    |
    x    x    x    x    x ⇐ x
    |    |    |    ↓    |    ↓
    s    o    r   [ø]   tʰ  [ɨ]
                ↑_____↓ inter-onset government
```

(⇐: government-licensing)

Hence, if /r/ were absent in the lexical representation, we could not account for the obligatory presence of the final [ɨ], i.e. the lack of government-licensing. In other words, if /r/ is not present lexically, then it is predicted that the same treatment would be needed as in loanwords ending in a single final stop, as discussed in 5.3.4. That is, the phonetic interpretation of the final [ɨ] is parallel to be optional, depending on individual lexical items.

The remaining question is to find the reason why /r/ does not surface phonetically before a licensed empty nucleus in the loanword phonology. Recall that the segment /r/ in the native Korean is realised as it is before an unlicensed nucleus but as [l] before a licensed empty nucleus (see sections 3.1 and 3.2). Thus, when /r/ is followed by an unlicensed nucleus, it surfaces as it is, e.g. *bearing* [peariŋ], *cherry* [cʰeri], etc. If the native phonology were to apply to the structure in (46), the phonetic form [soltʰɨ] would emerge, because /r/ occurs before a licensed empty nucleus. The problem with [soltʰɨ] is that this form is indistinguishable from *salt* of which the underlying form is /<solØtʰ>Ø/ and the phonetic form is also [soltʰɨ].

As pointed out in 5.2.1, the distinction between /l/ and /r/ in English is required for inputs to the loanword phonology, i.e. they are separate underlying segments in the loanword phonology. Stem-internally, these segments are adapted as [ll] and [r], respectively, before an unlicensed nucleus and so the segmental difference of the source language is achieved, as in *lorry* [lori] and *lily* [lilli]. For the context in which these two segments occur before a licensed empty nucleus, a different strategy is employed to distinguish one from another, e.g. *KAL* (Korea Air Lines) /<kʰal>Ø/ [kʰal] and *car* /<kʰar>Ø/ [kʰa]. In the latter form, we note that /r/ does

not receive phonetic interpretation. The deletion of /r/ in this position can be regulated by the following condition.

(47)   The licensing condition on /r/
         /r/ must be licensed by a following unlicensed nucleus.

The effects of the condition (47) provide two options when the occurrence of /r/ does not satisfy this condition. As discussed in Chapter 3, /r/ becomes [l] in the native phonology, as the result of the application of neutralisation. In the loanword phonology, on the other hand, this option would be ruled out, since the application of neutralisation to *KAL* and *car* would yield the identical form [kʰal]. To avoid this result, the loanword phonology employs a different strategy to satisfy (47), i.e. the deletion of /r/ before a licensed empty nucleus. The same account applies to /r/ in (46) in that this segment occurs before the licensed empty nucleus N2. Thus, in the loanword phonology, the deletion of /r/ is due to the unlicensibility of /r/ for the licensed empty nucleus to satisfy (47). The consequence of the deletion of /r/ produces the appearance of a non-rhotic accent in English loanword adaptation in Korean, as illustrated with the word *bar*.[29]

(48) /<par>Ø/ [pa] bar



In (48), the deletion of /r/ in O2 due to (47) creates two contiguous empty constituents, i.e. O2 and N2, as shown in (48b). There are two possible ways of the treatment of the sequence: one is that O2 with the deletion of /r/ and N2 remains in the representation and the other is that O2 and N2 are deleted, as indicated by the dotted square.[30]

---

[29] The appearance of a non-rhotic accent as a model for English loanword adaptation is also found in Cantonese (Silvermanm 1992 and Yip 1993). They argue that the non-rhoticity of this language can be attributed to historical and social factors, e.g. that Hong Kong was a British colony until 1997. However, when we closely examine the phonotactics of consonants in 'coda' position of Cantonese, /r/ is prohibited from occurring in this position. This suggests that the choice of the non-rhotic accent is determined by phonological rather than non-linguistic factors. See S.J. Rhee (2000) for a detailed discussion of this matter.

[30] The two contiguous empty constituents are not subject to *reduction* (Gussmann & Kaye 1993 ) whereby a pointless empty onset and a following empty nucleus are deleted. However, Nancy Kula (p.c.) points out that the former option would trigger compensatory vowel lengthening to avoid contiguous empty constituents. In fact, in North Kyungsang Korean (Kenstowicz & Sohn 1998) which recognises vowel-

Interestingly, there is another option to meet the requirement of (47), viz. a following empty nucleus would be phonetically interpreted.   This phonetic interpretation ensures that /r/ can surface.  This option is usually utilised in non-English loanword adaptation and terminology related to natural science, as shown below.

(49)   /<c'ar>Ø/                    [c'arɨ]                         *czar* or *tzar*
       /<tʰar>Ø/                    [tʰarɨ]                        *tar*
       /<wikur>Ø/                   [wikurɨ]                       *Uighur*
       /<pomparØt>Ø/                [pombarɨtɨ]                    *bombarde*
       /<kʰatʰarØsis>Ø/             [kʰatʰarɨsisɨ]                 *catharsis*
       /<aŋØkʰor>Ø/                 [aŋkʰorɨ]                      *encore*
       /<pʰerØmjum>Ø/               [pʰerɨmjum]                    *fermium*
       /<pʰorØtʰe>/                 [pʰoritʰe]                     *forte*
       /<pʰerillarØtʰin>Ø/          [pʰerillarɨtʰin]               *perillartine*

The phonetic interpretation of the empty nuclei after /r/ in (49) requires the same precedence order of the ECP, the PP and CLE as that of the cases in which /s/ is followed by a headed segment in the loanwords with an sC cluster and the native words, e.g. /<sØpʰikʰə>/ [sɨpʰikʰə] *speaker* and /<usØk'waŋ>Ø/ [usɨk'waŋ] 'funny'. The effect of the PP takes precedence over that of the ECP (inter-onset government), i.e. /r/ is preserved and a following empty nucleus is phonetically realised due to the effect of (47).

To recapitulate, the treatment of /r/ in the loanword phonology provides two strategies conditioned by (47).  The non-interpretation of /r/ before a licensed empty nucleus produces non-rhoticity in English loanword adaptation.[31]   Second, the phonetic interpretation of an empty nucleus makes it possible to license the preceding /r/ in the other loanword adaptation.  The different strategies imply that the deletion of /r/ can be perceptually tolerated for the native speaker in the former but not in the latter case.  In other words, the perception of /r/ in non-English loanwords adaptation is more salient than that of English.  I am not ready for an answer why there should be a difference in perceptual tolerance in the loanword phonology and leave this question for future research.

## 5.4 Conclusions

Let us consider the question raised in the beginning of this chapter, i.e. to what extent the loanword phonology is different from the native phonology.  Within the

---

length distinction (N.-J. Kim 1997), compensatory lengthening is observed, as in [pa:ken] *bargain*, [kʰa:ti] *card*, [ka:tin] *garden*, etc.

[31] Interestingly, in German loanword adaptation, the treatment of /r/ varies depending on the context in which it occurs.  Internally, /r/ is phonetic realised, as in [horimon] *Hormon* and [herimesɨ] *Hermes*. Finally, however, it is not, as in [heə] *Herr*, [pʰatʰə] *Vater*, and [tʰwiə] *Tür*.

epenthetic [ɨ] approaches in OT, the loanword phonology constitutes a separate component in the lexicon, because the loanword phonology requires a constraint ranking which is different from the ranking of the native phonology. However, we have seen that the distribution of the internal [ɨ] of native words is the same as that of loanwords. The recognition of empty nuclei enables us to provide an appropriate account of the same distribution without causing the duplication problem. Thus, this principle-and-parameter approach shows that the loanword phonology is not completely different from the native phonology, i.e. only the distribution of the final [ɨ] differs from that of the native phonology. The following interactions of principles and the language-specific constraint account for this.

(50)    (a) Internal [ɨ] in both native and loanwords except the cases in (b)
        the ECP (inter-onset and proper government), the PP > the CLE
        (b) /s/ followed by an internal empty nucleus
        the PP > the ECP (inter-onset government), the CLE
        (c) Final [ɨ]
        (i) the native phonology
        the ECP (domain-final licensing), the CLE > the PP
        (ii) The loanword phonology
        the PP, the CLE > the ECP (domain-final licensing)   (>: precedence)

The prime motivation for the occurrence of final [ɨ] in loanwords is to preserve the segmental oppositions that exist in the source language. In particular, voiced-stop final words of the source language contain the final [ɨ], which invokes the suspended effect of the CLE, i.e. the final [ɨ] occurs after a lenis stop. Regarding the occurrence of the final [ɨ] among stop-final words, a distinction between obligatory and optional occurrence is required for words ending in a 'coda'-onset cluster of the source language and those ending in a single stop. The notion of government-licensing provides a non-arbitrary criterion for this, since government-licensing triggers the obligatory final [ɨ]-realisation. Furthermore, with respect to loanwords ending in a single stop of the source language, I postulate the category of pseudo-native words without final [ɨ]. This category behaves in the same way as the native words, in particular, regarding phonological processes in suffixation. Given this category, the organisation of the lexicon is illustrated, as shown below.

(51) The organisation of the lexicon in Korean

```
┌─────────────────────────────────────────────────────────────────┐
│                                                                   │
│   ┌──────────────────────────┊──────────────────────────┐        │
│   │ Native words             ┊                           │        │
│   │ non-derived              ┊                           │        │
│   │                          ┊        analytic suffixation│        │
│   │ non-analytic suffixation ┌──────────┐                │        │
│   └──────────────────────────│pseudo-native──────────────┘        │
│   ┌──────────────────────────│words without─────────────┐        │
│   │ Loanwords                │final [ɨ]  ┊               │        │
│   │                          └──────────┘                │        │
│   │                          ┊                           │        │
│   │            genuine loanwords ending in [ɨ]           │        │
│   └──────────────────────────────────────────────────────┘        │
│                                                                   │
└─────────────────────────────────────────────────────────────────┘
```

The consequence of the postulation of the category is that we can draw a sharp line between pseudo-native and genuine loanwords, i.e. the genuine loanwords are immune to phonological activity in suffixation. This is due to the presence of final [ɨ] which potentially eradicates any inter-onset governing relation with a suffix-initial consonant. However, the pseudo-native words not only have the same distribution of the internal [ɨ] but also the non-occurrence of final [ɨ]. This results from the same phonotactic constraints as that of the native words, so it is plausible to assume that this category undergoes the same phonological processes in suffixation as in the native phonology. Within the epenthetic approach, however, this distinction cannot be achieved, since this approach treats the occurrence of the vowel [ɨ] in internal position in the same way as that in final position. Hence the pseudo-native words still are part of the loanword component together with other loanwords ending in final [ɨ].

# Chapter 6
# Summary and conclusions

## 6.1 Summary

In this thesis, I have investigated a number of phonological phenomena in Korean, such as [ɨ]/zero alternation, neutralisation, nasalisation, post-nasal voicing, tensification and the distribution of [ɨ] in loanwords, within the framework of GP. It was noted that the distribution of the vowel [ɨ], unlike other vowels, is highly constrained and predictable. This leads to the idea that empty nuclei are postulated underlyingly when [ɨ] appears and between consonant clusters. Final empty nuclei occur in consonant-final words, due to the effect of the Coda Licensing Principle and the Onset Licensing Principle. Thus, multiple empty nuclei can be present in a given lexical representation.

I have showed that the phonetic interpretation of empty nuclei in various contexts provides a adequate account of relevant phonological activities. Neutralisation is analysed as a licensing constraint on final empty nuclei. Only [p, t, k, m, n, ŋ, l] can occur and other segments undergo elemental adjustments. This is due to the weaker licensing ability of licensed empty nuclei, in comparison with that of unlicensed ones. With respect to [ɨ] in morpheme-internal position and in non-analytic suffixation, the distribution of [ɨ] is determined by the interaction of the ECP (inter-onset government, proper government and the domain-final licensing parameter), the PP and the CLE. In particular, head-final inter-onset government together with the notion of government-licensing account for the majority of cases where [ɨ] appears. In analytic suffixation, due to the fact that the effect of the SCC preserves the licensed status of a final empty nucleus in an extended domain, we can establish an inter-onset governing relationship between a stem-final and a suffix-initial consonant. Unless the requirements of inter-onset government are met, various phonological processes are triggered to adjust the segmental shape: post-nasal voicing, tensification and nasalisation. Accordingly, we can treat these phenomena in a unified way.

Regarding the distribution of [ɨ] in loanwords, it is pointed out that the loanword phonology is not completely different from the native phonology. Internal [ɨ] in loanwords is distributed in the same way as that of native words and accordingly analysed in the same way. The presence of final [ɨ] in loanwords is analysed as a result of the precedence of the PP over the ECP, since the segmental identity of segments in the source language is maximally preserved. The loanwords ending in final [ɨ] are classified as belonging to the genuine loanword category and those without as pseudo-native words. The postulation of the two categories provides an

appropriate criterion for active phonological participation of the latter category in the native phonology.

In comparison with previous approaches, the contributions that I have made are as follows:
• The reformulation of how internal empty nuclei are licensed, i.e. proper and inter-onset government are independently active.
• The revision of the governing hierarchy to provide a more adequate account of problematic cases in previous GP approaches.
• The proposals of the Nasal Condition and the Condition on NC Clusters for the asymmetrical distribution of the vowel [ɨ] between mono-morphemic words and in suffixation in the former, and that of CN and NC clusters in the latter.
• The refinement of domainhood in GP and the postulation of stem domains and extended-stem domains to account for the effect of opacity in suffixation, regarding the preservation of the vowel [ɨ] in a given stem domain.
• A more appropriate account of the fact that internal [ɨ] in native and loanwords are distributed in an identical way.
• The classification of obligatory and optional realisation of final [ɨ] in loanwords, which leads to postulate the category of pseudo-native words and genuine loanwords.

## 6.2. Theoretical implications: inter-onset government

In this thesis, I have argued that the postulation of empty nuclei enables us to provide proper explanations of various phonological phenomena, by the interactions of the ECP, the PP and the CLE. Particularly, head-final inter-onset government plays a crucial role to determine the phonetic interpretation of empty nuclei in numerous contexts. However, one may argue that the notion of head-final inter-onset government is simply no more than a notational variant of representing 'coda'-onset sequences, since the phonotactic constraint in the former approach is the same as that of the latter.

In the mainstream phonological analyses within the framework of the non-linear phonology, internal consonant sequences are syllabified as a 'coda' followed by an onset and final consonants are also 'codas'. Given this syllabification, phonological processes occurring in suffixation are treated independently by setting up separate rules for each phonological process, as in S.-C. Ahn (1985) and H.-S. Sohn (1986) among others. In constraint-based approaches, such as S. Hong (2001) and K.-R. Kim (2001) among others, these phonological processes are analysed in a sonority-based way (Vennemann 1988, Clements 1990). The tenet of the sonority-based account is that the sonority of an onset is not more than that of a preceding coda, with a sonority scale in which the sonority of obstruents is lower than that of nasals and liquids. These analyses can provide a plausible account for why nasalisation occurs when a stem-final obstruent is followed by a suffix-initial nasal, e.g. /kuk/ + /man/ [kuŋman] 'soup', 'only'. Nasalisation is construed as a repair strategy of the ill-formed sonority contour between an obstruent and a following nasal. Post-nasal

tensification, however, may not be explained within the sonority-based analysis, since its context already satisfies the sonority requirement, e.g. /kam/ + /ko/ [kamk'o] 'to wind', 'connective suffix'.

On the other hand, the notion of inter-onset government enables us to explain both in a unified way - not only the distribution of morpheme-internal [ɨ], but also [ɨ]/zero alternations and various consonant-related processes in suffixation. Post-nasal tensification is invariably motivated by the satisfaction of the requirements of inter-onset government, which is part of the ECP, on the basis of the governing hierarchy in which lenis obstruents do not govern nasals and vice versa.

The notion of inter-onset government assumes the presence of empty nuclei. In this respect, North Kyungsang Korean (henceforth NK) provides supporting evidence for the postulation of empty nuclei. One of the interests of NK is that it has no lexical distinction between [ɨ] and [ə], unlike Standard Korean (henceforth SK). The vowel [ə] is a lexical vowel but also emerges as an 'epenthetic' vowel in loanwords, e.g. SK [pəsɨ] and NK [pəsə] *bus*. In native NK phonology, the two vowels behave differently with regard to umlaut in suffixation (Choi 1998), e.g. /[<kəp> i]/ [kɛpi] 'fear', 'nominative suffix'; /[<kəm> i]/ 'line' [kimi] (in SK, the underlying representations of these two words are /kəpØ/ and /kØmØ/, respectively). Note that /ə/ is realised as [ɛ] in the former but as [i] in the latter. The umlaut facts suggest that the two /ə/s should be treated differently in NK, e.g. by specifying one as a lexical vowel and the other as an empty nucleus, so that the nominative form [kimi] in the latter is accounted for by the spreading of the element I of the suffix to the preceding empty nucleus at the level of nuclear projection, as shown below.

(1)    / [<kØm> i>] /  [kimi]
            N              N
            |    <<<<      |
      O     N     O        N
      |     |     |        |
   [ < x    x     x >      x ]
      |     ↓     |        |
      k    [i]    m        I

Furthermore, in the literature on the NK phonology (N.-J. Kim 1997 and the relevant references therein), the behaviour of empty nuclei in NK is the same as that of SK: this vowel also shows [ə]/zero alternations in suffixation, as shown below.

(2)   | Stem    | Honorific /si/ | Effective /ni/ | Connective /mjə/ |             |
      |---------|----------------|----------------|------------------|-------------|
      | /ca/    | [casi]         | [cani]         | [camjə]          | 'to sleep'  |
      | /u:rØ/  | [u:si]         | [u:ni]         | [u:lmjə]         | 'to cry'    |
      | /sinØ/  | [sinəsi]       | [sinəni]       | [sinəmjə]        | 'to put on' |
      | /capØ/  | [capəsi]       | [capəni]       | [capəmjə]        | 'to hold'   |
      | /kapʰ/  | [kapʰəsi]      | [kapʰəni]      | [kapʰəmjə]       | 'to pay back' |

Note that the distribution of [ə] in NK is exactly the same as that of [ɨ] in SK, as discussed Chapter 4. The facts of [ə] in NK indicate that the postulation of empty equally applies to NK phonology without major theoretical modifications. Hence the notion of inter-onset government can also provide an appropriate account of [ə]/zero alternations in NK.

## 6.3. A remaining problem and future research

I present a remaining problem in the current analysis. The problematic cases concern words ending in a consonant cluster in native Korean. In Chapter 5, it observed that final [ɨ] occurs after a consonant-cluster in loanword adaptation, e.g. *camp* [kʰɛmpʰɨ], *tent* [tʰentʰɨ] and *bank* [pɛŋkʰɨ]. In contrast, in native Korean, one of the consonants is deleted, as shown below.[1]

(3)  Stem          Stative         Declarative
     irk           [ilkə]          [ikt'a]               'to read'
     parp          [palpa]         [papt'a]              'to tread'
     əps'          [əps'ə]         [əpt'a]               'not to exist'

The process is referred to as Consonant Cluster Simplification. Regarding the lexical representations of the examples in (3), there are two possibilities, viz. /<irØk> Ø/ and /<irk> Ø/. The first option is ruled out, since the intervening empty nucleus in the stem domain receives phonetic interpretation and so the phonetic form would be *[irɨk]. Thus, let us consider the declarative form of /<irk> Ø/.

(4) /[[<irØkØ>] ta]/  [ikt'a]
    O1    N1    O2    N2    O3    N3
          |     |     |     |     |
    [ [<   x     x  >  x ]   x     x ]
          |     |           |     |
          i     r   k       t     a

In (4), these two consonants are floating and one of them is associated with O2, i.e. /k/ is selected.[2] After the association, the procedure is the same as in the analysis in Chapter 4, i.e. after bracket erasure tensification occurs in the suffix-initial /t/ in order to meet the requirements of inter-onset government.

Given this floating analysis, let us consider the stative form of /<irk> Ø/.

---

[1] Other consonant clusters are -ks'-, -nc-, -rtʰ-, -rpʰ- and -rs-.

[2] The choice of the two depends on the dialect and age of speakers (S.-C. Ahn 1985, G.-R. Kim 1998, among others). Here, I follow the standard pronunciation.

(5) /[<irk> ə]/  [ilkə]
   O1   N1   O2   N2
         |    |    |
[<     x    x  >  x ]
         |        |
      i   r  k   ə

In (5), we note that there is a problem of how these two consonants are associated with skeletal points within the stem domain, as the phonetic form [ilkə] emerges. The floating analysis does not provide a plausible account of the stative form.

In fact, the number of consonant cluster-final words is only 28 and so it may be argued that these words are mere exceptions to the analysis in this thesis.[3] Nonetheless, at present, in the current analysis, I admit that there is no solution for this problem and leave it for future research.

Finally, another topic of future research is the behaviour of nasals in Korean. As noted in Chapter 4, the behaviour of nasals is different from other segments in that they are not a target but a trigger, as in nasalisation, post-nasal voicing, and post-nasal tensification. This is attributed to the language-specific condition on nasals, since nasals are a target in denasalisation and nasal deletion in other languages, such as Toba Batak and Kaingang in the former, and Kelanatan Malay and Swahili in the latter (Pater 2001 and the relevant references therein).

However, as pointed out above, post-nasal tensification is not captured by the sonority-based account. The proposal that nasals are governed by only a headed segment (a tensed or an aspirated obstruent) in Korean, suggests that we might reconsider the phonotactic constraint on NC clusters in a wider perspective. In Indo-European languages and in Japanese, morpheme-internal homorganic NC clusters can be syllabified as a doubly-linked structure in which the place element of a nasal is autosegmentally licensed by a following obstruent (Itô 1986 and Goldsmith 1990). In Korean, as discussed in Chapter 3, a heterorganic NC cluster is also syllabified as a doubly-linked structure in which the manner element of a nasal is supported by a following obstruent.

In terms of Element Theory in GP, the implication would be that the well-formedness of the doubly-linked structure of NC clusters can be accounted not by sonority, but by the Complexity Condition, i.e. the number of elements in obstruents is more than that of nasals. Along these lines, we can predict that various phonological processes would take place when an NC cluster spans across the boundary between a stem and a suffix. The stem-final nasal and the following obstruent have their own association line and so the governing relation between these two may not be satisfied. Post-nasal voicing and post-nasal tensification in Korean, as discussed in Chapter 4, illustrated the changes in the segmental shapes to

---

[3] Regarding nominal words ending in a consonant cluster, an interesting phenomenon is observed. For instance, the nominative forms of /<tark>Ø/ 'chicken' and /<moks'>Ø/ 'share' are realised as [taki] and [moki], respectively, in which only one consonant emerges before a vowel-initial suffix. This may imply that nouns ending in a consonant cluster are gradually disappearing.

satisfy the governing requirements.  Obviously, to evaluate the proposal that nasals are not governed by a headless obstruent requires more extensive data on NC clusters cross-linguistically.  A further refinement of Element Theory will be needed to account for various phonological phenomena invoked on NC clusters.

# Appendix

## List of loanwords ending in a single stop

### (1) Words without final [ɨ]

**(a) p-final words (46)**

| | | | |
|---|---|---|---|
| *backup* | [pɛkəp] | *bishop* | [pisjop] |
| *cap* | [kʰɛp] | *championship* | [cʰɛmpʰionswip] |
| *chip* | [cʰip] | *clap* | [kʰɨllɛp] |
| *clip* | [kʰɨllip] | *crap* | [kʰɨrɛp] |
| *cup* | [kʰəp] | *dip* | [tip] |
| *drip* | [tɨrip] | *drop* | [tɨrap] |
| *flap* | [pʰɨllɛp] | *gallop* | [kɛllop] |
| *Gallup* | [kɛlləp] | *gossip* | [kasip] |
| *grip* | [kɨrip] | *group* | [kɨrup] |
| *handicap* | [hɛndikʰɛp] | *hop* | [hop] |
| *jeep* | [cip] | *lap* | [lɛp] |
| *laptop* | [lɛptʰap] | *leap* | [lip] |
| *lip* | [lip] | *nip* | [nip] |
| *pickup* | [pʰikəp] | *rap* | [rɛp] |
| *rebop* | [ripop] | *scrap* | [sɨkʰɨrɛp] |
| *scrip* | [sɨkʰɨrip] | *skip* | [sɨkʰip] |
| *slip* | [sɨllip] | *snap* | [sɨnɛp] |
| *snip* | [sɨnip] | *step* | [sɨtʰep] |
| *stop* | [sɨtʰap] | *strap* | [sɨtʰɨrɛp] |
| *syrup* | [sirəp] | *sysop* | [sisop] |
| *tap* | [tʰɛp] | *tip* | [tʰip] |
| *trap* | [tʰɨrɛp] | *trip* | [tʰɨrip] |
| *tulip* | [tʰjullip] | *wrap* | [lɛp] |

**(b) t-final words (65)**

| | | | |
|---|---|---|---|
| *air pocket* | [eəpʰokʰet] | *asset* | [eset] |
| *ballot* | [pɛllot] | *basket* | [pasɨkʰet] |
| *becket* | [pekʰit] | *billet* | [pillit] |
| *blanket* | [pɨllɛŋkʰit] | *bucket* | [pəkʰit] |
| *cabinet* | [kʰɛpinet] | *camlet* | [kʰɛmlit] |
| *capelet* | [kʰeipʰillit] | *carat* | [kʰɛrət] |
| *carlet* | [kʰallit] | *cermet* | [səmet] |

| | | | |
|---|---|---|---|
| *chocolate* | [cʰokʰollet] | *clarinet* | [kʰɨllarinet] |
| *clat* | [kʰɨllɛt] | *coelostat* | [kʰollosɨtɛt] |
| *collet* | [kʰollit] | *cornet* | [kʰonet] |
| *corset* | [kʰorɨset] | *cricket* | [kʰɨrikʰet] |
| *cutlet* | [kʰətʰɨllet] | *digit* | [ticit] |
| *doughnut* | [tounət] | *dugout* | [təkɨaut] |
| *fagot* | [pʰakot] | *flat* | [pʰɨllɛt] |
| *fox trot* | [pʰoksɨtʰɨrot] | *fret* | [pʰɨret] |
| *garnet* | [kanit] | *gasket* | [kasɨkʰit] |
| *helmet* | [helmet] | *hotspot* | [hatsɨpʰat] |
| *ingot* | [iŋgot] | *inkjet* | [iŋkʰɨcet] |
| *jacket* | [cakʰet] | *lancet* | [nɛnsit] |
| *leaflet* | [lipʰɨlit] | *locknut* | [lokʰɨnət] |
| *lockout* | [lokʰɨaut] | *Magnet* | [makɨnet] |
| *mallet* | [mɛllit] | *omelette* | [omɨllet] |
| *out* | [aut] | *outlet* | [aullet] |
| *output* | [autpʰut] | *pellet* | [pʰellit] |
| *pallet* | [pʰɛllit] | *pamphlet* | [pʰampʰɨllit] |
| *picket* | [pʰikʰet] | *pivot* | [pʰipot] |
| *plot* | [pʰɨllot] | *pocket* | [pʰokʰet] |
| *poppet* | [pʰopʰit] | *preset* | [pʰɨriset] |
| *racket* | [lakʰet] | *reset* | [liset] |
| *rivet* | [1ipet] | *roulette* | [lullet] |
| *shot* | [sjot] | *silhouette* | [silluet] |
| *slot* | [sɨllot] | *trumpet* | [tʰɨrəmpʰet] |
| *violet* | [paiolet] | | |

**(c) k-final words (60)**

| | | | |
|---|---|---|---|
| *air lock* | [eəlok] | *atactic* | [ətʰɛktʰik] |
| *attack* | [ətʰɛk] | *automatic* | [otʰomɛtʰik] |
| *back* | [pɛk] | *basic* | [peicik] |
| *black* | [pɨllɛk] | *bloc* | [pɨllok] |
| *block* | [pɨllok] | *brick* | [pɨrik] |
| *brunak* | [pɨrunak] | *Cadillac* | [kʰɛtillak] |
| *Catholic* | [kʰatʰollik] | *ceramic* | [seramik] |
| *chock* | [cʰok] | *chuck* | [cʰək] |
| *classic* | [kʰɨllasik] | *click* | [kʰɨllik] |
| *clinic* | [kʰɨllinik] | *cock* | [kʰok] |
| *comic* | [kʰomik] | *Compaq* | [kʰəmpʰɛk] |
| *cosmetic* | [kʰosɨmɛtik] | *crick* | [kʰɨrik] |

| | | | |
|---|---|---|---|
| *cronak* | [kʰɨronak] | *elastic* | [illɛsɨtʰik] |
| *feedback* | [pʰitɨpɛk] | *Gothic* | [kotik] |
| *jack* | [cɛk] | *kick* | [kʰik] |
| *lac* | [lɛk] | *lack* | [lɛk] |
| *lilac* | [laillak] | *lock* | [lak] |
| *magic* | [mɛcik] | *neck* | [nek] |
| *nick* | [nik] | *pack* | [pʰɛk] |
| *Paralymic* | [parallimik] | *philharmonic* | [pʰilhamonik] |
| *pick* | [pʰik] | *picnic* | [pʰikʰinik] |
| *plastic* | [pʰillasɨtʰik] | *puck* | [pʰək] |
| *quick* | [kʰwik] | *rack* | [rɛk] |
| *rock* | [lok] | *romantic* | [lomantʰik] |
| *ruck* | [lək] | *sack* | [sɛk] |
| *smock* | [sɨmok] | *stack* | [sitʰɛk] |
| *stick* | [sitʰɨk] | *stock* | [sɨtak] |
| *tack* | [tʰɛk] | *technique* | [tʰekʰinik] |
| *track* | [tʰɨrɛk] | *trick* | [tʰɨrik] |
| *truck* | [tʰɨrək] | *tunic* | [tjunik] |

**(d) b-final words (6)**

| | | | |
|---|---|---|---|
| *bag* | [pɛk] | *club* | [kʰilləp] |
| *jab* | [cɛp] | *job* | [cap] |
| *tab* | [tʰɛp] | *web* | [wep] |

**(e) g-final words (1)**

| | |
|---|---|
| *big* | [pik] |

## (2) Words with final [ɨ]

**(a) p-final words (17)**

| | | | |
|---|---|---|---|
| *ape* | [eipʰɨ] | *cape* | [kʰeipʰɨ] |
| *chronoscope* | [kʰɨronosɨkʰopʰɨ] | *conoscope* | [kʰonosɨkʰopʰɨ] |
| *creep* | [kʰɨripʰɨ] | *dope* | [topʰɨ] |
| *drape* | [tɨreipʰɨ] | *electrotype* | [illektʰrotʰaipʰɨ] |
| *grape* | [kɨreipʰɨ] | *hope* | [hopʰɨ] |
| *Hula-Hoop* | [hullahupʰɨ] | *loop* | [lupʰɨ] |
| *pipe* | [pʰaipʰɨ] | *rope* | [lopʰɨ] |
| *sloop* | [sɨllopʰɨ] | *slope* | [sɨllopʰɨ] |
| *spectroscope* | [spʰektʰɨrosɨkʰopʰɨ] | | |

**(b) t-final words (88)**

| | | | |
|---|---|---|---|
| *acetate* | [aset$^h$eit$^h$ɨ] | *Aleut* | [alljut$^h$ɨ] |
| *alumite* | [allumait$^h$ɨ] | *ammonite* | [amonait$^h$ɨ] |
| *aplite* | [ɛp$^h$ɨllait$^h$ɨ] | *bakelite* | [peik$^h$ɨllait$^h$ɨ] |
| *bat* | [pɛt$^h$ɨ] | *beat* | [pit$^h$ɨ] |
| *bit* | [pit$^h$ɨ] | *bite* | [pait$^h$ɨ] |
| *bitt* | [pit$^h$ɨ] | *boat* | [pot$^h$ɨ] |
| *butt* | [pət$^h$ɨ] | *butte* | [pjut$^h$ɨ] |
| *byte* | [pait$^h$ɨ] | *carnallite* | [k$^h$arɨnallait$^h$ɨ] |
| *carnegieite* | [k$^h$anekiait$^h$ɨ] | *celite* | [sellait$^h$ɨ] |
| *cleat* | [k$^h$ɨllit$^h$ɨ] | *concrete* | [k$^h$onk$^h$ɨrit$^h$ɨ] |
| *coordinate* | [k$^h$ootineit$^h$ɨ] | *cot* | [k$^h$ot$^h$ɨ] |
| *date* | [teit$^h$ɨ] | *debate* | [tipeit$^h$ɨ] |
| *diet* | [taiət$^h$ɨ] | *edit* | [etɨt$^h$ɨ] |
| *electrojet* | [illekt$^h$ɨrocet$^h$ɨ] | *elite* | [ellit$^h$ɨ] |
| *estate* | [est$^h$eit$^h$ɨ] | *firepot* | [p$^h$aiəp$^h$ot$^h$ɨ] |
| *float* | [p$^h$illot$^h$ɨ] | *flout* | [p$^h$ɨllaut$^h$ɨ] |
| *fruit* | [p$^h$urut$^h$ɨ] | *gate* | [keit$^h$ɨ] |
| *GATT* | [kat$^h$ɨ] | *Goth* | [kot$^h$ɨ] |
| *great* | [kɨreit$^h$ɨ] | *grout* | [kɨraut$^h$ɨ] |
| *gut* | [kət$^h$ɨ] | *hat* | [hɛt$^h$ɨ] |
| *hit* | [hit$^h$ɨ] | *Hite* | [hait$^h$ɨ] |
| *Hittite* | [hitt$^h$ait$^h$ɨ] | *illite* | [illait$^h$ɨ] |
| *kit* | [k$^h$it$^h$ɨ] | *knit* | [nit$^h$ɨ] |
| *knot* | [not$^h$ɨ] | *light* | [lait$^h$ɨ] |
| *mat* | [mɛt$^h$ɨ] | *mate* | [meit$^h$ɨ] |
| *merit* | [merit$^h$ɨ] | *nacrite* | [nɛk$^h$ɨrait$^h$ɨ] |
| *net* | [net$^h$ɨ] | *night* | [nait$^h$ɨ] |
| *note* | [not$^h$ɨ] | *nut* | [nət$^h$ɨ] |
| *octet* | [okt$^h$et$^h$ɨ] | *pat* | [pɛt$^h$ɨ] |
| *peat* | [p$^h$it$^h$ɨ] | *penninite* | [p$^h$enninait$^h$ɨ] |
| *pit* | [p$^h$it$^h$ɨ] | *plate* | [p$^h$illeit$^h$ɨ] |
| *pleat* | [p$^h$illit$^h$ɨ] | *pot* | [p$^h$ot$^h$ɨ] |
| *rebate* | [lipeit$^h$ɨ] | *remote* | [limout$^h$ɨ] |
| *right* | [lait$^h$ɨ] | *root* | [lut$^h$ɨ] |
| *route* | [lut$^h$ɨ] | *scout* | [sɨk$^h$aut$^h$ɨ] |
| *seat* | [sit$^h$ɨ] | *sheet* | [swit$^h$ɨ] |
| *shout* | [sjaout$^h$ɨ] | *site* | [sait$^h$ɨ] |
| *slate* | [sɨlleit$^h$ɨ] | *sonnet* | [sonet$^h$ɨ] |

| *straight* | [sitʰɨreitʰɨ] | *street* | [sitʰɨritʰɨ] |
| *strut* | [sitʰɨrətʰɨ] | *suit* | [sutʰɨ] |
| *suite* | [sɨwitʰɨ] | *sweet* | [sɨwitʰɨ] |
| *template* | [tʰempʰillitʰɨ] | *watt* | [watʰɨ] |
| *weight* | [weitʰɨ] | *white* | [hwaitʰɨ] |
| *wit* | [witʰɨ] | *yacht* | [jotʰɨ] |

### (c) k-final words (48)

| *artichoke* | [aticʰokʰɨ] | *balk* | [pokʰɨ] |
| *baroque* | [parokʰɨ] | *bike* | [paikʰɨ] |
| *blake* | [pɨlleikʰɨ] | *brake* | [pɨreikʰɨ] |
| *chalk* | [cʰokʰɨ] | *choke* | [cʰokʰɨ] |
| *cloak* | [kʰillokʰɨ] | *coak* | [kʰokʰɨ] |
| *coat* | [kʰotʰɨ] | *cornflake* | [kʰonpʰilleikʰɨ] |
| *creek* | [kʰɨrikʰɨ] | *fake* | [pʰeikʰɨ] |
| *flake* | [pʰilleikʰɨ] | *gate* | [keitʰɨ] |
| *knock* | [nokʰɨ] | *lake* | [leikʰɨ] |
| *mark* | [makʰɨ] | *Mark* | [marɨkʰɨ] |
| *motorbike* | [motəpaikʰɨ] | *mook* | [mukʰɨ] |
| *nuke* | [njukʰɨ] | *Newsweek* | [njusɨwikʰɨ] |
| *oak* | [okʰɨ] | *opaque* | [opʰeikʰɨ] |
| *peak* | [pʰikʰɨ] | *pike* | [pʰaikʰɨ] |
| *rake* | [reikʰɨ] | *shake* | [sjeikʰɨ] |
| *shock* | [sjokʰɨ] | *slake* | [sɨlleikʰɨ] |
| *smoke* | [sɨmokʰɨ] | *snake* | [sɨneikʰɨ] |
| *spike* | [sɨpʰaikʰɨ] | *spoke* | [sɨpʰokʰɨ] |
| *stake* | [sitʰeikʰɨ] | *strake* | [sitʰreikʰɨ] |
| *stroke* | [sitɨrokʰɨ] | *talk* | [tʰokʰɨ] |
| *take* | [intʰeikʰɨ] | *teak* | [tʰikʰɨ] |
| *torque* | [tʰokʰɨ] | *unique* | [junikʰɨ] |
| *water-smoke* | [wətʰəsɨmokʰɨ] | *week* | [wikʰɨ] |
| *yak* | [jakʰɨ] | *yoke* | [jokʰɨ] |

### (d) b-final words (14)

| *babe* | [peipɨ] | *Carib* | [kʰaripɨ] |
| *cube* | [kʰjupɨ] | *globe* | [kɨllopɨ] |
| *hob* | [hopɨ] | *hub* | [həpɨ] |
| *jibe* | [caipɨ] | *knob* | [nopɨ] |
| *probe* | [pʰɨropɨ] | *rib* | [ripɨ] |
| *scab* | [sɨkʰɛpɨ] | *slab* | [sɨllɛpɨ] |

| *slub* | [sɨlləpɨ] | *tube* | [tʰjupɨ] |

**(e) d-final words (30)**

| *bad* | [bɛtɨ] | *bed* | [petɨ] |
| *code* | [kʰotɨ] | *chloride* | [kʰɨlloraitɨ] |
| *fade* | [pʰeitɨ] | *flood* | [pʰɨllətɨ] |
| *grid* | [kɨritɨ] | *guide* | [kaitɨ] |
| *head* | [hetɨ] | *kid* | [kʰitɨ] |
| *lead* | [litɨ] | *mode* | [motɨ] |
| *node* | [notɨ] | *pad* | [pʰɛtɨ] |
| *parade* | [pʰəreitɨ] | *pod* | [pʰotɨ] |
| *pride* | [pʰɨraitɨ] | *rad* | [rɛtɨ] |
| *red* | [retɨ] | *reed* | [ritɨ] |
| *rod* | [rotɨ] | *salad* | [sɛllətɨ] |
| *seed* | [sitɨ] | *side* | [saitɨ] |
| *slide* | [sɨllaitɨ] | *speed* | [sɨpitɨ] |
| *stride* | [sɨtʰɨraitɨ] | *stud* | [sɨtʰətɨ] |
| *tide* | [tʰaitɨ] | *tread* | [tʰɨretɨ] |

**(f) g-final words (14)**

| *bug* | [pəkɨ] | *egg* | [ekɨ] |
| *gag* | [kɛkɨ] | *gig* | [kikɨ] |
| *jig* | [cikɨ] | *jog* | [cokɨ] |
| *league* | [likɨ] | *log* | [lokɨ] |
| *lug* | [ləkɨ] | *pig* | [pʰikɨ] |
| *shag* | [sjɛkɨ] | *slag* | [sɨllɛkɨ] |
| *slug* | [sɨlləkɨ] | *tag* | [tʰɛkɨ] |

# (3) Words with alternating forms

**(a) p-final words (10)**

| *crape* | [kʰɨreip] | [kʰɨreipʰɨ] |
| *hip* | [hip] | [hipʰɨ] |
| *Nescape* | [nesɨkʰeip] | [nesɨkʰeipʰɨ] |
| *snipe* | [sɨnaip] | [sɨnaipʰɨ] |
| *soup* | [sup] | [supʰɨ] |
| *shape* | [sweip] | [sweipʰɨ] |
| *stripe* | [sɨtʰɨraip] | [sɨtʰɨraipʰɨ] |
| *swap* | [sɨwəp] | [sɨwəpʰɨ] |

| | | |
|---|---|---|
| *tape* | [tʰeip] | [tʰeipʰɨ] |
| *type* | [tʰaip] | [tʰaipʰɨ] |

**(b) t-final words (14)**

| | | |
|---|---|---|
| *biscuit* | [pisɨkʰet] | [pisɨkʰetʰɨ] |
| *cassette* | [kʰaset] | [kʰasetʰɨ] |
| *circuit* | [səkit] | [səkitʰɨ] |
| *delicate* | [tellikit] | [tellikitʰɨ] |
| *diskette* | [tisɨkʰet] | [tisɨkʰetʰɨ] |
| *dot* | [tat] | [totʰɨ] |
| *flute* | [pʰɨllut] | [pʰɨllutʰɨ] |
| *foot* | [pʰut] | [pʰutʰɨ] |
| *format* | [pʰomɛt] | [pʰomɛtʰɨ] |
| *jet* | [cet] | [cetʰɨ] |
| *mascot* | [masɨkʰot] | [masɨkʰotʰɨ] |
| *pilot* | [pʰaillət] | [pʰaillotʰɨ] |
| *robot* | [lopot] | [lopotʰɨ] |
| *set* | [set] | [setʰɨ] |

**(c) k-final words (10)**

| | | |
|---|---|---|
| *cake* | [kʰeik] | [kʰeikʰɨ] |
| *check* | [cʰek] | [cʰekʰɨ] |
| *coke* | [kʰok] | [kʰokʰɨ] |
| *Czech* | [cʰek] | [cʰekʰɨ] |
| *dock* | [tok] | [tokʰɨ] |
| *pancake* | [pʰɛnkʰeik] | [pɛnkʰeikʰɨ] |
| *speak* | [sɨpʰik] | [sɨpʰikʰɨ] |
| *steak* | [sitʰeik] | [sitʰeikʰɨ] |
| *strike* | [sitɨraik] | [sitʰraikʰɨ] |
| *Uzbek* | [ucɨbek] | [ucɨbekʰɨ] |

# References

Ahn, Sang-Cheol (1985) *The Interplay of Phonology and Morphology in Korean.* Ph. D. Dissertation, University of Illinois. Seoul: Hanshin Publishing Company.

Ahn, Sang-Cheol (1991) Vowel deletion and epenthesis: the vowel ɨ. *Studies in the Linguistic Sciences* 21-2, 1-18.

Ahn, Sang-Cheol (1998) *An Introduction to Korean Phonology*. Seoul: Hanshin Publishing Company.

Anderson, Stephen R. (1982) Where's Morphology? *Linguistic Inquiry* 13, 571-612.

Archangeli, Diana (1984) *Underspecification in Yawelmani Phonology and Morphology*. Ph. D. Dissertation, MIT. [Reproduced by New York: Garland].

Aronoff, Mark & Oehrle, Richard T. (eds.) (1984) *Language Sound Structure*. Cambridge: MIT Press.

Bauer, Laurie (1983) *English Word-Formation*. Cambridge: Cambridge University Press.

Bezooijen van, Renée & Kager, René (eds.) (1999) *Linguistics in the Netherlands 1999*. Amsterdam: John Benjamins Publishing Company.

Booij, Geert (1995) *The Phonology of Dutch*. Oxford: Oxford University Press.

Borowsky, Toni J. (1986) Topics in the Lexical Phonology of English. Ph.D. Dissertation, University of Massachusetts at Amherst.

Borowsky, Toni J. (1989) Structure Preservation and the Syllable Coda in English. *Natural Language & Linguistic Theory* 7, 145 - 166.

Brockhaus, Wiebke (1995a) *Final devoicing in the phonology of German*. Tübingen: Niemeyer.

Brockhaus, Wiebke (1995b) Skeletal and suprasegmental structure within Government Phonology. In Durand & Katamba (eds.), 180-221.

Brockhaus, Wiebke (1999) Closed syllables in a syllable-denying framework: A case of déjà vu? In Rennison & Kühnhammer (eds.), 29-48.

Broselow, Ellen (1993) Transfer and universals in second language epenthesis. In Gass & Selinker (eds.), 71-86.

Butskhrikidze, Marika (2002) Consonant Phonotactics in Modern Georgian. Ph. D. dissertation, Leiden University.

Charette, Monik (1988) Some Constraints on Governing Relations in Phonology. Ph.D. Dissertation, McGill University.

Charette, Monik (1990) Licence to govern. *Phonology* 7, 233-254.

Charette, Monik (1991) *Conditions on Phonological Government*. Cambridge: Cambridge University Press.

Charette, Monik (1992) Mongolian and Polish Meets Government Licensing. *SOAS Working Papers in Linguistics & Phonetics 2*, 275-291.

Charette, Monik (1998) Empty and pseudo-empty category. *SOAS Working Papers in Linguistics and Phonetics* 8, 167-176.

Charette, Monik & Göksel, Ashli (1994) Switching and Vowel Harmony. *SOAS Working Papers in Linguistics and Phonetic* 4, 31-52.

Charette, Monik & Göksel, Ashli (1998) Licensing constraints and vowel harmony in Turkic languages. In Cyran (ed.), 65-88.

Cho, Hyeonkwan (1998) English loanwords and Syllable Structures. *Studies in Phonetics, Phonology and Morphology* 4, 273-290.

Choi, Hyon-Pai (1937) *The Grammar of Our Language* (in Korean). Seoul: Cheongemsa.

Choi, Myeong-Ok (1998) *Korean Phonology and data* (in Korean). Seoul: Thaehaksa.

Cho, Young-mee Yu & Inkelas, Sharon (1994) Post-obstruent tensification in Korean and geminate inalterability. In Kim-Renaud (ed.), 44-60.

Chung, Kuk (1980) Neutralization in Korean: A Functional View. Ph. D. Dissertation, University of Texas, Austin.

Clements, George N. (1985) The Geometry of Phonological Features. *Phonology Yearbook 2*, 225-252.

Clements, George N. (1990) The Role of the Sonority Cycle in Core Syllabification. In Kingston & Beckman (eds.), 283-333.

Clements, George N. & Keyser, S. Jay (1983) *CV Phonology: A Generative Theory of the Syllable*. Cambridge: MIT Press.

Cobb, Margaret (1995) Vowel Harmony in Zulu and Basque. *SOAS Working Papers in Linguistics and Phonetics* 5, 23-39.

Cole, Jennifer (1995) The Cycle in Phonology. In Goldsmith (ed.), 70-113.

Cyran, Eugeniusz (1996) Licensing properties of nuclei and principle ranking in Irish. *The Linguistic Review* 13, 1-13.

Cyran, Eugeniusz (ed.) (1998) *Structure and Interpretation: Studies in Phonology*. Lublin: Wydawnictwo Folium.

Cyran, Eugeniusz & Gussmann, Edmund (1999) Consonantal Clusters and Governing Relations: Polish Initial Consonant Sequences. In Hulst van der & Ritter (1999).

Da Silva, T. (1992) Nuclear Phenomena in Brazilian Portuguese. Ph. D. Dissertation, SOAS, University of London.

Dekkers, Joost, Leeuw van der, Frank & Weijer van de, Jeroen (eds.) (2000) *Optimality Theory: Phonology, Syntax and Acquisition*. Oxford: Oxford University Press.

Durand, Jacques & Katamba, Francis (eds.) (1995) *Frontiers of Phonology: Atoms, Structures, Derivations*. London: Longman.

Durand, Jacques & Laks, Bernard (eds.) (1996) *Current Trends in Phonology*. Manchester: ESRI, University of Salford.

Gass, Susan M & Selinker, Larry (eds.) (1993) *Language Transfer in Language Learning*. Amsterdam: John Benjamin.

Giegerich, Heinz (1992) *English Phonology: An Introduction*. Cambridge: Cambridge University Press.

Gimson, Alfred C. (1989) *An Introduction to the Pronunciation of English* (4th edition, revised by Susan Ramsaran). London: Edward Arnold.

Fabb, Nigel (1988) English Suffixation is Constrained only by Selectional Restrictions. *Natural Language & Linguistic Theory* 6, 527-540.

Féry, Caroline, Green, Antony Dubach & Vijver van de, Ruben (eds.) (2001) *Linguistics in Potsdam 12: Proceedings of HILP 5*. Potsdam: Universitätsbibliothek Publikationsstelle.

Fujimura, Osamu (ed.) (1973) *Three Dimensions of Linguistic Theory*. Tokyo: Taikusha.

Goldsmith, John A. (1990) *Autosegmental & Metrical Phonology*. Oxford: Basil Blackwell Ltd.

Goldsmith, John A. (ed.) (1995) *The Handbook of Phonological Theory*. Oxford: Blackwell Publisher Ltd.

Gussmann, Edmund (1998) Domains, relations, and the English agma. In Cyran (ed.), 101-126.

Gussmann, Edmund & Cyran, Eugeniusz (1998) Polish consonantal sequences: a phonological testing ground. In Cyran (ed.), 127-138.

Gussmann, Edmund & Kaye, Jonathan (1993) Polish notes from a Dubrovnik Café. *SOAS Working Papers in Linguistics & Phonetics* 3, 427-462.

Halle, Morris & Stevens, Kenneth (1971) A Note on Laryngeal Features. *Quarterly Progress Report* 101, 198-213. Research Laboratory of Electronics, MIT.

Hangin, John G. (1968) *Basic Course in Mongolian*. Bloomington: Indiana University.

Hargus, Sharon & Kaisse, Ellen (eds.) (1993) *Phonetics and Phonology: Studies in Lexical Phonology*. San Diego: Academic Press, Inc.

Harris, John (1990) Segmental Complexity and Phonological Government. *Phonology* 7, 255-300.

Harris, John (1992) Licensing inheritance. *UCL Working Papers in Linguistics* 4, 359-406.

Harris, John (1994) *English Sound Structure*. Oxford: Blackwell.

Harris, John & Lindsey, Geoff (1995) The Elements of Phonological Representation. In Durand & Katamba (eds.), 34-79.

Harris, John & Gussmann, Edmund (1998) Final codas: why the west wrong. In Cyran (ed.), 139-162.

Hayes, Bruce (1986a) Assimilation as Spreading in Toba Batak. *Linguistic Inquiry* 17, 467-499.

Hayes, Bruce (1986b) Inalterability in CV Phonology. *Language* 62, 321-352.

Heo, Yong (1995) Empty Category and Korean Phonology. Ph. D. Dissertation, SOAS, University of London.

Hirano, Hideyuki (1994) A Constraint-Based Approach to Koran Loanwords. *Language Research* 30, 707-739.

Hong, Sunghoon (2001) Richness of the base, lexicon optimization, and suffix /ɨ/~ø alternation in Korean. *Studies in Phonetics, Phonology and Morphology* 7, 215-242.

Huffman, Marie K. & Krakow, Rena A. (eds.) (1993) Nasals, Nasalization and the Velum. San Diego: Academic Press.

Hulst van der, Harry & Ewen, Colin J. (2001) *The Phonological Structure of Words*. Cambridge: Cambridge University Press.

Hulst van der, Harry & Ritter, Nancy (1998) Kammu minor syllables in head-driven phonology. In Cyran (ed.), 163-182.

Hulst van der, Harry & Ritter, Nancy (eds.) (1999a) *The Syllable: Views and Facts*. Berlin: Mouton de Gruyter

Hulst van der, Harry & Ritter, Nancy (1999b) Head-Driven Phonology. In Hulst & Ritter (eds.), 113-168.

Hulst van der, Harry & Smith, Norval (eds.) (1982) *The Structure of Phonological Representations*. Dordrecht: Foris.

Iverson, Gregory K. (1983) Korean *s*. *Journal of Phonetics* 11, 191-200.

Iverson, Gregory K. & Sohn, Hyang-Sook (1994) Liquid representation in Korean. In Kim-Renaud (ed.), 77-100.

Itô, Junko (1986) *Syllable Theory in Prosodic Phonology*. Ph. D. Dissertation, University of Massachusetts at Amherst. [Reproduced by New York: Garland].

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

Jacobs, Haike & Gussenhoven, Carlos (2000) Loan Phonology: Perception, Salience, the Lexicon and OT. In Dekkers, Leeuw van der & Weijer van de (eds.), 193-210.

Jun, Sun-Ah (1994) The status of the lenis stop voicing rule in Korean. In Kim-Renaud (ed.), 101-114.

Kagaya, Yoshioka (1974) A Fiberscopic and Acoustic Study of the Korean Stops, Affricates, and Fricatives. *Journal of Phonetics* 2, 161-180.

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

Kager, René, Hulst van der, Harry & Zonneveld, Wim (eds.) (1999) *The Prosody-Morphology Interface*. Cambridge: Cambridge University Press.

Kager, René & Zonneveld, Wim (1999) Introduction. In Kager, Hulst van der & Zonneveld (eds.), 1-38.

Kaisse, Ellen (1986) Locating Turkish Devoicing. *Proceedings of the 5th West Coast Conference on Formal Linguistics*, 119-128.

Kang, Hyunsook (1996) English loanwords in Korean. *Studies in Phonetics, Phonology and Morphology* 2, 21-47.

Kang, Ongmi (1992) Word-Internal Prosodic Words in Korean. *NELS* 22, 243-257.

Kang, Ongmi (1993) *Korean Prosodic Phonology*. Ph. D. Dissertation, University of Washington. Seoul: Thaehaksa.

Kang, Ongmi (1996) An Optimal Approach on Korean Loanword Phonology (in Korean). *Journal of Korean Linguistics* 28, 113-146.

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

Kang, Ongmi (1999b) A Correspondence Analysis on Hiatus Resolution in Korean. *Studies in Phonetics, Phonology and Morphology* 5, 1-24.

Kang, Yongsoon (1996) English Loanwords in Korean. *Studies in Phonetics, Phonology and Morphology* 2, 21-28.

Kaye, Jonathan (1987) Government in Phonology: The Case of Moroccan Arabic. *The Linguistic Review* 6, 131-160.

Kaye, Jonathan (1990) 'Coda' licensing. *Phonology* 7, 301-330.

Kaye, Jonathan (1992) Do You Believe in Magic? The Story of s+C Sequences. *SOAS Working Papers in Linguistics and Phonetics* 2, 293-313.

Kaye, Jonathan (1995) Derivations and Interfaces. In Durand & Katamba (eds.), 289-332.

Kaye, Jonathan, Lowenstamm, Jean & Vergnaud, J.-R. (1985) The Internal Structure of Phonological Elements: A Theory of Charm and Government. *Phonology Yearbook* 2, 305-328.

Kaye, Jonathan, Lowenstamm, Jean & Vergnaud, J.-R. (1990) Constituent Structure and Government Phonology. *Phonology* 7, 193-231.

Kean, Mary-Louise (1974) The Strict Cycle in Phonology. *Linguistic Inquiry* 5, 179-203.

Kenstowicz, Michael & Kisseberth, Charles (1977) *Topics in Phonological Theory*. New York: Academic Press.

Kenstowicz, Michael & Kisseberth, Charles (1979) *Generative Phonology: Description and Theory*. New York: Academic Press.

Kenstowicz, Michael & Sohn, Hyang-Sook (1998) Accentual Adaptation in North Kyungsang Korean. http://roa.rutgers.edu/ ROA 345-0999.

Kim, Chin-Woo (1968) The Vowel System of Korean. *Language* 44, 516-527.

Kim, Chin-Woo (1970) Boundary Phenomena in Korean. *Papers in Linguistics* 2, 1-26.

Kim, Chin-Woo & Kim, Hyung-Youp (1991) The Character of Korean Glides. *Studies in the Linguistic Sciences* 21, 113-126.

Kim, Gyung-Ran (1998) Leveling in Korean. *Studies in Phonetics, Phonology and Morphology* 4, 89-108.

Kim, Gyung-Ran (2001) Manner Assimilation in Korean. *Language Research* 37, 157-176.

Kim, Hyunsoon (1994) On the obligatory contour principle related to sonority. In Kim-Renaud (ed.), 115-132.

Kim, Jong-Mi (1986) *Phonology and Syntax of Korean Morphology*. Ph. D. Dissertation, University of Southern California. Seoul: Hanshin Publishing Company.

Kim, Ki-Ho (1987) *The Phonological Representation of Distinctive Features: Korean Consonantal Phonology*. Ph. D. Dissertation, University of Iowa. Seoul: Hanshin Publishing Company.

Kim, Kong-On & Shibatani M. (1976) Syllabification in Korean. *Language Research* 12, 91-98.

Kim, Noh-Ju (1997) Tone, segment, and their interaction in North Kyungsang Korean: a correspondence theory account. Ph. D. dissertation, Ohio State University.

Kim, Seon Jung (1996) The Representations of Korean Phonological Expressions and Their Consequences.  Ph. D. Dissertation, SOAS, University of London.

Kim, Soo-Gon (1977) Remarks on p-irregular verbs in Korean (in Korean). *Linguistic Journal of Korea* 2, 1-16.

Kim, Sung-Hwa (1992) The Function of Inserted Vowel 'ɨ' (in Korean). *Journal of Korean Linguistics* 22. 87-156.

Kim, Young-Seok (1985) *Aspects of Korean Morphology*.  Ph. D. Dissertation, University of Texas, Austin.  Seoul: Pan Korea Book Corporation.

Kim-Renaud, Young-Key (1974) *Korean Consonantal Phonology*.  Ph. D Dissertation, University of Hawaii, Manoa, Hawaii.  Seoul: Tower Press.

Kim-Renaud, Young-Key (1982) ɨ-deletion in Korean.  In I.-S. Yang (ed.), 478-488.

Kim-Renaud, Young-Key (ed.) (1994) *Theoretical issues in Korean linguistics*. Stanford: CSLI, Stanford Linguistics Society.

Kingston, John C. & Beckman, Mary E. (eds.) (1990) *Papers in Laboratory Phonology I: Between the Grammar and Physics of Speech*.  Cambridge: CUP.

Kiparsky, Paul (1973) Abstractness, opacity and global rules.  In Fujimura (ed.), 1-136.

Kiparsky, Paul (1985) Some Consequences of Lexical Phonology.  *Phonology Yearbook* 2, 85-138.

Kiparsky, Paul (1993) Blocking in Non-derived Environments.  Hargus & Kaisse (eds.), 277-314.

Ko, Kwang-Mo (1989) Explaining the Noun-final Change t > s in Korean (in Korean). *Eoneohag* (Journal of the Linguistic Society of Korea) 11, 3-22.

Ku, Pon-Seok (1999) English Loanwords and Vowel Epenthesis in Optimality Theory (in Korean). *Studies in Phonetics, Phonology and Morphology* 5, 59-77.

Kula, Nancy Chongo (1999) On the Representation of NC Clusters in Bemba.  In Bezooijen & Kager (eds.), 135-148.

Kula, Nancy Chongo (in prep.) The phonology of derivation in Bemba.  Ph. D. Dissertation, Leiden University.

Kula, Nancy Chongo & Marten, Lutz (1998) Aspects of Nasality in Bemba. *SOAS Working Papers in Linguistics and Phonetics* 8, 191-208.

Kula, Nancy Chongo & Marten, Lutz (2000) Constraints and processes: Evidence from Bemba, Herero and Swahili.  *SOAS Working Papers in Linguistics and Phonetics* 10, 91-102.

Kwon, Jae-Il (ed.) (1996) *Phonetics and Linguistics (in honour of Prof. Hyun Bok Lee)*. Seoul: SNU Press.

Lee. Borim (2001) The liquid lexicalization and nativization in Sino-Korean and English loans. *Studies in Phonetic, Phonology and Morphology* 7, 101-124.

Lee, Borim, Lee, Sook-hyang, Park, Cheon-Bae & Kang, Seok-keun (1999) Korean speakers' perception and production of English word-final voiceless stop release (in Korean). *Malsori* 38 (Journal of the Phonetic Society of Korea), 41-70.

Lee, Byung-Gun (1976) *Generative Phonology of Modern Korean* (in Korean). Seoul: Ilcisa.

Lee, Byung-Gun (1982) A well-formed condition on syllable structure. In I.-S. Yang (ed.), 489-506.

Lee, Duck-Young & Yoshida, Shohei (1998) A-head alignment: the case of vowel harmony in Korean. In Cyran (ed.), 195-204.

Lee, Eun-Young & Kim, Seon-Jung (2000) French Loanwords in Korean: A Government Perspective. A paper presented in The 12th International Conference on Korean Linguistics.

Lee, Hyoeun (2001) English Loanword Phonology in Korean. *Language Research* 37, 177-200.

Lee, Hyun-Joo (1999) Inter-onset government: its needs and interaction with proper government. *SOAS Working Papers in Linguistics and Phonetics* 9, 253-274.

Lee, Ponghyung (1995) Korean Loanword Phonology: An Optimality Perspective. *Korean Journal of Linguistics* 20, 121-151.

Lieber, Rochelle (1981) *On the Organization of the Lexicon*. Ph. D. Dissertation, MIT. [Reproduced by the Indiana University Linguistic Club].

Lindsey, Geoff & Harris, John (1990) Phonetic interpretation in Generative Grammar. *UCL Working papers in Linguistics* 2, 355-369.

Lombardi, Linda (ed.) (2001) *Segmental phonology in Optimality Theory*. Cambridge: CUP.

Lowenstamm, Jean (1996) CV as the only syllable type. In Durand & Laks (eds.), 419-443.

Mascaró, Joan (1976) Catalan phonology and the phonological cycle. Ph. D. Dissertation, MIT.

McCarthy, John (1986) OCP Effects: Gemination and Antigemination. *Linguistic Inquiry* 17, 207-263.

McCarthy, John (1999) Sympathy and phonological opacity. *Phonology* 16, 331-399.

McCarthy, John & Prince, Alan (1993) Prosodic Morphology I: Constraint interaction and satisfaction. Ms., University of Massachusetts and Rutgers University.

McCarthy, John & Prince, Alan (1999) Faithfulness and identity in Prosodic Morphology. In Kager, Hulst van der & Zonneveld, 218-310.

Mohanan, K.P. (1982) *Lexical Phonology*. Ph. D. Dissertation, MIT. [Reproduced by Indiana University Linguistic Club]

Moore, John & Rodchue, Saowalak (1994) *Colloquial Thai*. London: Routledge.

Myers, Scott (1987) Vowel Shortening in English. *Natural Language & Linguistic Theory* 5, 485-518.

Nam, Ji Young & Southard, Bruce (1994) Orthographic Representation and Resyllabification of English Loanwords in Korean. *Language and Speech*, 259-281.

Nespor, Marina & Vogel, Irene (1986) *Prosodic Phonology*. Dordrecht: Foris.

Oh, Jung-Ran (1997) A Correspondence Approach to the Phonological Constraints in Korean Ending Inflection (in Korean). *Studies in Phonetics, Phonology and Morphology* 3, 141-166.

Oh, Mira (1994) A reanalysis of consonant cluster simplification and s-neturalization. In Kim-Renaud (ed.), 157-174.

Oh, Mira (1996) Linguistic Input to Loanword Phonology. *Studies in Phonetics, Phonology and Morphology* 2, 117-126.

Paradis, Carole (1988) On constraints and repair strategies. *The Linguistic Review* 6, 71-97.

Paradis, Carole (1996) The inadequacy of filters and faithfulness in loanword adaptation. In Durand & Laks (eds.), 509-534.

Paradis, Carole & Lacharité, Darlene (1997) Preservation and minimality in loanword adaptation. *Journal of Linguistics* 33, 379-430.

Park, Jeong-Woon (1994) Variation of vowel length in Korean. In Kim-Renaud (ed.), 175-188.

Pater, Joe (1996) * NC̥. *Proceedings of the North East Linguistic Society* 26, 227-239.

Pater, Joe (1999) Austronesian Nasal Substitution and Other NC̥ Effects. In Kager, Hulst van der & Zonneveld (eds.), 310-343.

Pater, Joe (2001) Austronesian nasal substitution revisited: what's wrong with *NC̥ (and what's not). In Lombardi, (ed.), 159-182.

Ploch, Stefan (1999) Nasals on My Mind. The Phonetic and Cognitive Approach to the Phonology of Nasality. Ph. D. Dissertation, SOAS, University of London.

Polgárdi, Krisztina (1998) *Vowel Harmony. An Account in Terms of Government and Optimality*. Ph. D. Dissertation, Leiden University. The Hague: Holland Academic Graphics.

Rebrus, A., Siptár, P., Szigetvári, P. & Törkenczy, M. (1996) Hungarian Morphology doesn't Meet GP. Paper presented at the Government Phonology Workshop, at the 8th International Phonology Meeting, Vienna.

Rennison, John R. & Kühnhammer, Klaus (eds.) (1999) *Phonologica 1996*. Proceedings of the 8th International Phonology Meeting. The Hague: Holland Academic Graphics.

Rhee, Sang Jik (1996) The constraint on final empty nuclei in Korean. In J.-I. Kwon (ed.), 691-731.

Rhee, Sang Jik (2000) Why do Koreans and Cantonese use a non-rhotic accent in English loanword adaptation? *The Proceedings of the 2nd Seoul International Conference on Phonetic Sciences*, 321-331.

Rhee, Sang Jik & Heo, Yong (1998) A Government Approach to Korean Syllable Structure (in Korean). *Hangeul* (Journal of Korean Language Society) 240-241, 7-42.

Rhee, Seok-Chae (1995) A Constraint on Coda Aperture and Neutralization (in Korean). *Korean Journal of Linguistics*, 20-4, 183-211.

Rhee, Seok-Chae & Choi, Yoo-Kyung (2001) A Statistical Observation of Vowel Epenthesis in English Loanwords in Korean and its Significance (in Korean). *Studies in Phonetics, Phonology and Morphology 7*, 153-176.

Rice, Keren D. (1989) On Eliminating Resyllabification into Onsets. *Proceedings of the Eighth West Coast Conference on Formal Linguistics*, 429-444.

Rice, Keren D. (1992) On Deriving Sonority: a Structural Account of Sonority Relationships. *Phonology* 9, 61-100.

Rowicka, Grażyna (1998) The audibility and visibility of Mohawk ghost. In Cyran (ed.), 247-260.

Rowicka, Grażyna (1999) *On Ghost Vowels: A Strict CV Approach.* Ph. D. Dissertation, Leiden University. The Hague: Holland Academic Graphics.

Rubach, Jerzy & Booij, Geert (1990) Edge of Constituent Effects in Polish. *Natural Language and Linguistic Theory* 8, 427-464.

Sagey, Elisabeth (1986) *The Representation of Features and Relations in Nonlinear Phonology.* Ph. D. Dissertation, MIT.

Scheer, Tobias (1998) Governing domains are head-final. In Cyran (ed.), 261-286.

Schein, Barry & Steriade, Donca (1986) On Geminates. *Linguistic Inquiry* 17, 691-744.

Selkirk, Elisabeth (1982) Syllable. In Hulst van der & Smith (eds.), 337-383.

Selkirk, Elisabeth (1984a) On the major class features and syllable theory. In Aronoff & Oehrle (eds.), 107-136.

Selkirk, Elisabeth (1984b) *Phonology and Syntax: The Relation between Sound and Structure.* Cambridge: MIT Press.

Silverman, Daniel (1992) Multiple scansions in loanword phonology: evidence from Cantonese. *Phonology* 9, 289-328.

Singh, Rajendra (1985) Prosodic adaptation in interphonology. *Lingua* 67, 269-282.

Smith, Kenneth D. (1975) *Phonology and syntax of Sedang, a Vietnam Mon-Khmer language.* Ph. D. Dissertation, University of Pennsylvania. [Reproduced by Ann Arbor: Xerox University Microfilm].

Sohn, Ho-Min (1994) *Korean.* London: Routledge.

Sohn, Ho-Min (1999) *The Korean Language.* Cambridge: Cambridge University Press.

Sohn, Hyang-Sook (1986) *Underspecification in Korean Phonology.* Ph. D. Dissertation, University of Illinois. Seoul: Hanshin Publishing Co.

Sohn, Hyang-Sook (2001) Optimization of Word-final Coronals in Korean Loanword Adaptation. In Féry, Green & Vijver van de (eds.), 159-177.

Steriade, Donca (1982) Greek Prosodies and the Nature of Syllabification. Ph. D. Dissertation, MIT.

Steriade, Donca (1993) Closure, release and nasal contours. In Hoffman & Krakow (eds.), 401-470.

The National Academy of the Korean Language (1988) *The Compilations of Orthography of Loanwords in Korean.*

The National Academy of the Korean Language. *The Orthography System of Foreign Word*s. http://www.korean.go.kr/

Vennemann, Theo (1988) *Preference laws for syllable structure.* Berlin: de Gruyter.

Weijer van de, Jeroen (1996) *Segmental Structure and Complex Segment*s. Tübingen: Max Niemeyer Verlag.

Weijer van de, Jeroen & Nishihara, Tetsuo (eds.) (2001) *Issues in Japanese Phonology and Morphology.* Berlin: Mouton de Gruyter

Wells, John C. (1982) *Accents of English*.  Cambridge: Cambridge University Press.

Yang, In-Seok (ed.) (1982) *Linguistics in the Morning Calm*.  Seoul: Hanshin.

Yip, Moira (1987) English Vowel Epenthesis.  *Natural Language & Linguistic Theory* 5, 463-484.

Yip, Moira (1988) The Obligatory Contour Principle and Phonological Rules: A Loss of Identity.  *Linguistic Inquiry* 19, 65-100.

Yip, Moira (1993) Cantonese Loanword Phonology and Optimality Theory.  *Journal of East Asian Linguistics* 2, 261-291.

Yoo, Hyebae (1996) A Constraint-Based Analysis of Korean Loanwords.  *Studies in Phonetics, Phonology and Morphology* 2, 147-168.

Yoshida, Yuko (1990) Government in Tonkawa: Vowel Elision and Cyclicity.  *SOAS Working Papers in Linguistics and Phonetics* 1, 53-70.

Yoshida, Shohei (1991) Some Aspects of Governing Relations of Japanese Phonology.  Ph. D. Dissertation, SOAS, University of London.

Yoshida, Shohei (2001) An Element-based Analysis of Affrication in Japanese.  In Weijer van de & Nishihara (eds.), 169-190.

# Summary

In this thesis, I deal with various phonological phenomena in Korean, such as ɨ/zero alternation, neutralisation, tensification, nasalisation, post-nasal voicing and the distribution of the vowel [ɨ] in loanwords, within the framework of Government Phonology (GP). I argue that the prime motivation for these processes is to satisfy the requirements of the Empty Category Principle (ECP), in particular, inter-onset government and domain-final licensing. In order to achieve a unified account, I postulate empty nuclei of which the phonetic interpretation is the vowel [ɨ], if certain conditions are met. In Chapter 1, I show that, unlike the distribution of other lexical vowels, the distribution of the vowel [ɨ] is not arbitrary, but that it is highly constrained in mono-morphemic words as well as in suffixation contexts and in loanwords.

In Chapter 2, I introduce GP notions relevant to the thesis. With respect to syllable structure in Korean, I argue that Korean has neither branching onsets nor branching rhymes, so that surface consonant sequences are syllabified as two onsets with an intervening empty nucleus. In consonant-final words, final empty nuclei are postulated, due to the effect of the Coda Licensing Principle and the Onset Licensing Principle. Hence, there may be multiple empty nuclei in a given lexical representation. In the remaining chapters, I explore how these empty nuclei are licensed in various contexts, i.e. morpheme-internally, in suffixation contexts and in loanwords.

In Chapter 3, I examine how empty nuclei in mono-morphemic words are licensed. The final empty nucleus is licensed by the fact that domain-final licensing is activated parametrically in Korean. A certain set of segments cannot occur before a final empty nucleus. This neutralisation phenomenon is captured by postulating that a licensed final empty nucleus cannot license the element H [noise burst]. In terms of elements, only non-contour headless segments containing the element ʔ can occur in final position, as formulated in the Constraint on Final Empty Nuclei (CFE).

With respect to the licensing of internal empty nuclei, I claim, against previous GP approaches (Y. Heo 1995 and S.-J. Kim 1996), that inter-onset government and proper government apply independently to empty nuclei, i.e. the contexts in which they apply are complementarily distributed. With regard to the application of inter-onset government, the notion of government-licensing (Charette 1991, 1992) is required to account for the phonetic interpretation of empty nuclei. The merit of this analysis is to eliminate the redundancy involved in the previous analyses, which assumed that properly governable empty nuclei are also subject to inter-onset government.

With respect to the distribution of consonants surrounding an internal empty nucleus, I propose a revised governing hierarchy in which nasals and lenis obstruents are equally ranked, with the proviso that mutual government is prohibited

among equivalently ranked segments in Korean. This revised hierarchy enables us to adequately account for the occurrence of [ɨ] between a lenis obstruent and a nasal, which was problematic in earlier analyses. Regarding the absence of [ɨ] between two nasals, and between a nasal and a lenis obstruent, I propose the Nasal Condition and the Condition on NC Clusters, in which pertinent sequences are doubly-linked. Two nasals constitute a geminate or a partial geminate and NC clusters share the element L. An empty nucleus within a doubly-linked structure is licensed due to the Complexity Condition, accounting for the integrity effect. Furthermore, I point out that this doubly-linked structure requires a following unlicensed government-licenser, to account for the asymmetry in the occurrence of the vowel [ɨ] between two nasals, e.g. /kØmØmØ/ [kɨmɨm] 'the last day of a month' and /əmØma/ [əmma] 'mom'.

On the basis of the discussion in this chapter, I note that the analysis of neutralisation in terms of the CFE and the phonotactic constraint on the occurrence of [ɨ] in internal position can be further refined as a general condition, since the distribution of consonants before a licensed empty nucleus is virtually identical in final and internal position. Hence, I generalise this observation as the Constraint on Licensed Empty Nuclei (CLE) in which only headless and non-contour segments containing the element ʔ may occur before a licensed empty nucleus. The presence of [ɨ] in mono-morphemic words is regulated by the CLE in Korean.

In Chapter 4, I analyse various phonological processes in suffixation contexts. Regarding the interface of morphology and phonology, I refine the proposal for morphological domainhood of Kaye (1995) and postulate stem domains and extended-stem domains to explain the effect of opacity. That is, the phonetic interpretation of empty nuclei within stem domains is preserved in subsequent cycles, despite the fact that there is a potential government-licenser available on a next cycle, e.g. /<murØpʰ> i/ [murɨpʰi] 'knee + nominative suffix'. The empty nucleus in the stem domain receives phonetic interpretation on the basis of the assumption that the ECP applies to the stem domain first, in which no government-licenser is available. After bracket erasure, the vowel [ɨ] is maintained on a subsequent cycle (i.e. the stem domain), even though a potential government-licenser, the vowel [i], becomes available. I show that the opacity effect is derivable from the Strict Cyclicity Condition (SCC), in particular the Reaching Back Constraint (RBC), which stipulates that the domain of an earlier cycle is opaque to phonological processes on a current cycle. I present palatalisation effects as independent evidence for the postulation of stem domains. This process is a cross-boundary phenomenon, which does not apply within a stem, e.g. /titi/ 'to tread' [titi] *[cici], but /<patʰ> i/ 'field + nominative suffix' [pacʰi] *[patʰi].

Given this refinement of domainhood, I analyse ɨ/zero alternation and consonant-related processes under suffixation. Due to the nature of non-analytic suffixation, in which a given suffix is attached directly to a stem domain, ɨ/zero alternations occur. The occurrence of the vowel [ɨ] is predictable from the segmental content of a suffix-initial consonant, because it is subject to the requirements of inter-onset government. In particular, I show that there is an adequate account of the

asymmetrical distribution of [ɨ] between NN and between NC sequences. This vowel is absent in mono-morphemic words and present in suffixation. In mono-morphemic words, these sequences occur internally and the Nasal Condition and the Condition on NC Clusters regulate the absence of the vowel [ɨ]. In suffixation contexts, on the other hand, these sequences span a stem domain and a following suffix, so that each consonant has its own association line, which forces the phonetic interpretation of an intervening empty nucleus because of the failure of inter-onset government: segments in the same category cannot govern each other.

In analytic suffixation, various consonant-related processes take place. I argue that this is due to the preservation of the licensed status of final empty nuclei in extended stem domains, owing to the effect of the SCC. The licensed status of this empty nucleus enables neighbouring consonants to form an inter-onset governing relation. When the requirements of inter-onset government are not met, this triggers tensification, nasalisation and post-nasal voicing, depending on the segmental content of the consonants in question. Thus, the occurrence of the vowel [ɨ] in mono-morphemic words and relevant phonological processes in suffixation can be dealt with in a unified way in terms of the ECP, which was not possible in previous approaches.

The implications of the analysis presented in Chapter 4 force us to reconsider Kaye's proposal for the morphology-phonology interface and the minimalist hypothesis that phonological processes apply whenever the conditions for their application are met. The fact that all phonological outcomes in suffixation contexts follow the phonotactic constraints of non-derived words crucially undermines the original sense of analytic (i.e. regular morphology) and non-analytic (i.e. irregular morphology) constructions in Kaye's proposal. Non-permissible sequences are allowed in the former, as in the verb *peeped*, while in the latter the morphological complexity is invisible and all sequences are well-formed, as in the verb *kept*. I point out that Korean is different from English regarding the morphology-phonology interface. In Korean, the distinction between analytic and non-analytic suffixation is construed as a difference in mode of application of phonological processes. Furthermore, I argue that the postulation of stem domains goes against the minimalist hypothesis in that the mode of application in phonology must be constrained in order to appropriately account for the effect of opacity in non-analytic suffixation contexts.

In Chapter 5, I deal with the occurrence of the vowel [ɨ] in loanwords, in particular loanwords from English. I raise the question of to what extent loanword phonology differs from native phonology. Contrary to previous approaches, which argue that loanword phonology constitutes a separate component, I show that the distribution of internal [ɨ] in loanwords is identical to that in native words. The distribution can therefore be handled in the same way in the native phonology in that the ECP, in particular inter-onset government, provides a unified explanation for the occurrence of [ɨ] in internal position. A difference with native phonology lies in the occurrence of [ɨ] in final position. With respect to this difference, I propos that the occurrence of final [ɨ] can largely be ascribed to a conflict among principles, i.e. the

Preservation Principle (PP) and the ECP (domain-final licensing). The PP dictates that segmental content is maximally preserved. When a final consonant violates the CLE, the interaction of the PP and the ECP produces two possible outcomes: if the ECP dominates the PP, as in the native phonology, neutralisation is triggered, while the reverse order results in the occurrence of final [ɨ], as in the loanword phonology. The interaction of these two principles accounts for the majority of cases involving final [ɨ] in loanwords.

Regarding the occurrence of final [ɨ] among stop-final loanwords, I distinguish two types of 'insertion': obligatory and optional. Obligatory [ɨ] realisation is found in loanwords ending in a consonant cluster. Government-licensing provides a straightforward account of the occurrence of the vowel [ɨ] in this position. Optional [ɨ] realisation characterises loanwords ending in a single stop. The occurrence of final [ɨ] in this category depends on individual words, since it is hardly possible to find a general pattern, i.e. some words end in the vowel [ɨ], some occur without final [ɨ] and others exhibit alternating forms. I note that words without final [ɨ] constitute pseudo-native words in the sense that these words actively participate in native phonological processes in suffixation contexts. This is expected, because the absence of final [ɨ] enables a final consonant to establish an inter-onset governing relation with a following suffix-initial consonant. I treat words ending in final [ɨ] as genuine loanwords in that these words are not active in suffixation, precisely because the presence of the vowel [ɨ] makes any inter-onset governing relations with a following suffix-initial consonant impossible. Words with alternating forms enter either category, i.e. one actively participates in phonological process and the other does not.

I discuss the alternation between [s] and [t] in t-final pseudo-native words and /r/-deletion in English loanword adaptation. As for the alternation between [s] and [t], I assumed that t-final loanwords have been reanalysed as /s/-final, since there are no nominal words ending in /t/ in native Korean. The nominal status of loanwords in Korean, irrespective of their grammatical category in the source language, is supported by the fact that English verbs like *behave*, *demand* and *save*, require the bound verbal root /ha/ 'to do'. This give rises to verbal stems which are the bases for verbal suffixation. Since they are treated as nouns and nominal words in Korean lack final /t/, the underlying segment of t-final words is /s/. This provides a plausible account of the occurrence of [s] in nominative forms and that of [t] in final position, since the nominative suffix /i/ can license /s/ and /s/ undergoes neutralisation to [t]. /r/-deletion, which yields a non-rhotic type of loanword adaptation, is due to the fact that the occurrence of /r/ before a licensed empty nucleus violates the CLE, as formalised in the licensing condition on /r/: /r/ must be licensed by a following unlicensed nucleus.

Finally, I note that native words ending in a consonant cluster are problematic in the current analysis. The problem is how a final consonant cluster is represented lexically, since the current analysis may be unable to account for the phonetic realisation of both consonants when a non-analytic vowel-initial suffix follows. I admit that there is no solution for this and leave it for future research.

## Curriculum Vitae

Sang Jik Rhee was born on 2 February 1960 in Pusan, Korea. In 1982, he finished a B.A. Course in the department of Linguistics at Seoul National University. In 1986, he received an M.A. degree in the department of Linguistics at School of Oriental and African Studies (SOAS), University of London. He attended a Ph. D. course at SOAS, for three years. From 1991 to 1999, he taught linguistics and English in various universities in Korea as a part-time lecturer. In 2000, he finished the Advanced Master Program in Linguistics at HIL, Leiden University. From September 2000, he was a Ph. D. student at ULCL/HIL, Leiden University, working on a project on Korean phonology within the framework of Government Phonology. This dissertation is the result of this research project.