Coda Conditions in Korean

Bum-Ki Son*

**Key words:** Korean, coda, coda condition, neutralization, coda simplification, markedness, variation

1. Introduction

Cross-linguistically, asymmetries between onset and coda are ubiquitous with respect to static distribution and phonological alternation. In distributional aspects, the inventories of onsets are larger than those of codas, and in phonological processes, codas tend to be targets and onsets to be triggers. These tendencies also occur in Korean phonology, in which restrictions on coda are not stricter than in Japanese, which has severely restricted codas (Ito 1986), but some coda restriction effects are emergent in some phonological environments. This paper examines the status of coda conditions in Korean based on the constraints interaction framework (Optimality Theory (OT), Prince and Smolensky 1993/2004, McCarthy and Prince 1995). Three points are discussed. First, there is no need to set language-specific CODACond (McCarthy and Prince 1993, Ito and Mester 1994) for coda restriction, which can be explained by interaction with general constraints hierarchies and positional faithfulness constraints (Beckman 1998, 2004) instead. Second, the emergence of the unmarked (McCarthy and Prince 1994) and preservation of the marked (de Lacy 2006) occur in Korean complex coda simplification (hereafter, CCS), neither of which appears in simple coda neutralization. Third, dialectal variation in coda simplification depends on the precedence relation between two hierarchies (i.e., place preservation hierarchy: Max[place], and coda sonority hierarchy: *CODA/X).

This paper is organized as follows: Section 2 begins with the theoretical background on onset/coda asymmetry, coda sonority, and theories related to markedness. In section 3, Korean simplex coda neutralization (§3.1) and CCS (§3.2) are examined. Finally a conclusion is offered in section 4.

2. Theoretical background

2.1. Onset/coda asymmetry

There have been many studies of onset/coda asymmetries in Generative Phonology since 1980s. In particular, Ito (1986, 1989) argues that these asymmetries result from a coda condition, as (1), which bans some features (e.g., the place of articulation) in coda position, and that violated features in the coda can be only licensed by the onset.

(1) Coda condition (Ito 1986, 1989)

```
*C\text{on}

\text{place}
```

In the OT framework, these conditions are retained as violable positional markedness constraints (i.e., CODACond, McCarthy and Prince 1993, Ito and Mester...
1994). CODACOND, however, has fundamental problems with universality because its definition depends on language-specific phonotactic generalization. An alternative OT approach for these asymmetries is positional faithfulness (Beckman 1998 among others), which explains that onset is more preserved than coda because onset has a phonetically robust cue, and has more information for language processing, than coda. Onset/coda asymmetries are analyzed with context-free markedness, faithfulness constraint, and positional faithfulness constraint.

Lombardi (2001) analyzed empirical coverage of two approaches—the same as coda neutralization (e.g., German coda devoicing) but much different from assimilation and epenthesis, which are repair strategies for coda restriction (e.g., Axininca Campa). Positional faithfulness constraint can explain directionality of assimilation but CODACOND cannot. In contrast, the former fails to predict epenthesis but the latter can fully account for it. For that purpose, Lombardi asserted that both approaches are necessary, and positional markedness constraints can illustrate only place-driven epenthesis. Beckman (2004), however, insists that epenthesis can be analyzed by the interaction of positional faithfulness constraint and other independently motivated general constraints— with the complete absence of CODACOND. In this paper, we will follow only the positional faithfulness approach for coda place restriction.

2.2. Coda sonority restriction

There is another restriction on coda sonority (Zec 1995, 2006, Baertsch 2002): more sonorous codas are preferred. That is, a more sonorous segment is ‘better than’ a less sonorous one as a coda. This ‘better than’ relation is converted to a constraint hierarchy by harmonic alignment.

(2) a. Sonority hierarchy:
   \[ V(owel) > L(iquid) > N(asal) > O(bstruent) \]
   b. *CODA/X hierarchy:
   \[ *CODA/O \gg *CODA/N \gg *CODA/L \gg *CODA/V \]

2.3. Theories related to markedness

There are two markedness related effects: the emergency of the unmarked (abbreviated TETU, McCarthy and Prince 1994) and preservation of the marked (abbreviated PoM, de Lacy 2006). First, TETU: McCarthy and Prince argued that a low-ranked markedness constraint can be visibly active in limited morphological or phonological environments. These are observed not only in the neutralization of a contrast in the reduplicant that is retained the base, but in the quality of the epenthetic segment. Second, PoM: marked elements can be the specific targets of preservation so that they avoid undergoing otherwise general processes (pp.11). We will see that these two effects appear in Korean CCS in section 3.2.

3. The status of Korean coda

3.1. Simplex coda neutralization

Korean has 19 phonemic [+consonantal] segments, but their distributions according to the two syllable positions are not uniform, as shown in (3); there are 18 consonants in the onset position, but only 7 consonants in coda position1).

(3) Consonant inventories depending on syllable position

<table>
<thead>
<tr>
<th></th>
<th>Onset</th>
<th>Coda</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>labial</td>
<td>alveolar</td>
</tr>
<tr>
<td>stop</td>
<td>p/p'p'</td>
<td>t/t't'</td>
</tr>
<tr>
<td>affricate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fricative</td>
<td>s/s'</td>
<td>€/€'€'</td>
</tr>
<tr>
<td>nasal</td>
<td>m</td>
<td>n</td>
</tr>
<tr>
<td>liquid</td>
<td>r</td>
<td></td>
</tr>
</tbody>
</table>

This asymmetry is due to coda neutralization—laryngeal features for tenseness (i.e., [+constricted glottis]) and aspirate (i.e., [+spread glottis]) are neutralized in coda position, as is the continuency (i.e., [+continuant]) and the palatality (i.e., [-anterior]) of coronal consonants. Neutralization of /h/ to /t/ is out of our scope. For the phonological behavior of /h/ in Korean, see de Lacy (2006) and Kim and Alderete (2008).
(4) Coda neutralization

\[
\begin{align*}
\text{a.} & \quad /p, p', p^h/ \rightarrow \{p\} \quad /\text{ip}/ \quad \text{‘mouth,’} /\text{ip}^h/ \quad \text{‘leaf’} \quad \rightarrow [\text{ip}] \\
\text{b.} & \quad /t, t', t^h, s, s', \check{\text{c}}, \check{\text{c}}^h/ \rightarrow \{t\} \quad /\text{nat}/ \quad \text{‘rice,’} /\text{nat}^h/ \quad \text{‘a piece’} \\
\text{c.} & \quad /k, k', k^h/ \rightarrow \{k\} \quad /\text{pak}/ \quad \text{‘gourd,’} /\text{pak}^h/ \quad \text{‘outside’} \quad \rightarrow [\text{pak}]
\end{align*}
\]

M. Lee (1997) analyzed coda neutralization through the interaction of general faithfulness constraints and negative CodaCond, with the definition that some features (\{c.g., +s.g., +cont, -ant\}) are banned in coda position. There is much scholarship using this kind of constraint as well as positive CodaCond (J. Lee 2003 and references in J. Lee 2003, e.g., \{p, t, k, m, n, j, l\} are only allowed as a coda), both of which are language-specific. We can instead account for coda neutralization with the interaction of an onset-specific faithfulness constraint (Ident-onset-\{\}), general faithfulness (Ident-\{\}), and markedness (*Ident) constraints (\{c.g., +s.g., +cont, -ant\}).

(5) a. Onset-specific ranking:

\[
\text{Ident-onset-} \gg \text{Ident-} \gg \text{Ident-}\{\}
\]

b. Tableau for hypothetical input /\text{th}^h/ to [\text{th}at] mapping

\[
\begin{array}{ccc}
\text{Ident-}\{\}
\end{array}
\]

\[
\begin{array}{ccc}
\text{a.} & \rightarrow [\text{th}^h] & * & * \\
\text{b.} & [\text{th}^h] & ** & ** \\
\text{c.} & [\text{tat}] & * & **
\end{array}
\]

Korean CodaCond has no filter function for place and sonority, because the restriction on major place and sonority is not strong: [labial], [coronal], and [dorsal] are allowed as coda place, and all levels of sonority (i.e., obstruent, nasal, and liquid) on the coda are allowed as well. This means that faithfulness constraints dominate the markedness constraints for coda restriction (i.e., Faith \_1 \gg \text{Place}; Faith \_2 \gg \text{Coda/X}) in OT.

3.2. Complex coda simplification

Korean syllables have the form (C)(G)V(C) (C: consonant, G: glide, V: vowel; ( ) = optional.). As lexical inputs, complex segments can occur in modern Korean, but complex onsets and codas are banned as output structure and so are resolved by deletion (i.e., /CIC2/ \rightarrow C1 or C2). For the basic ranking of Korean syllable structure, the introduced constraints are \{*Complex, Onset, NoCoda, Max(-seg), Dep(-seg)\}, and their ranking is \*Complex, Dep \_ \_ \_ Onset, NoCoda (e.g., /VCVC/ \rightarrow VCVC, *CVVC, *CVVC\_P, *CV, *CVCC, *VCVC\_C, with C and [ ] indicating epenthetic segments).

The selection of preserved segments is different between two dialects; (6) shows the CCS and dialectal variation between Seoul and Kyungsang (KS hereafter) Korean. (6a-c) reveal variations: [k] and [p] in Seoul dialect and [\_] in KS dialect. (6d-i) exhibit the same patterns for both dialects.


\[
\begin{array}{llllll}
\text{a.} & /\text{lk}/ & \rightarrow & \{k\} & \{\} & /\text{ilk-ta}/ \quad \text{‘read’} & \rightarrow & [\text{ik}ta] & [\text{il}ta] \\
\text{b.} & /\text{lp}/ & \rightarrow & \{p\} & \{\} & /\text{palp-ta}/ \quad \text{‘step’} & \rightarrow & [\text{pap}ta] & [\text{pal}ta] \\
\text{c.} & /\text{lp}^h/ & \rightarrow & \{p\} & \{\} & /\text{lip}^h-ta/ \quad \text{‘chant’} & \rightarrow & [\text{lip}ta] & [\text{il}ta] \\
\text{d.} & /\text{lm}/ & \rightarrow & \{m\} & \{\} & /\text{cilm-ta}/ \quad \text{‘young’} & \rightarrow & [\text{cam}ta] & [\text{cam}ta] \\
\text{e.} & /\text{ls}/ & \rightarrow & \{l\} & \{\} & /\text{wekols}'/ \quad \text{‘single-minded’} & \rightarrow & [\text{wekol}] & [\text{wekol}] \\
\text{f.} & /\text{lp}^h/ & \rightarrow & \{l\} & \{\} & /\text{halp}^h-ta/ \quad \text{‘lick’} & \rightarrow & [\text{hal}p^a] & [\text{hal}p^a] \\
\text{g.} & /\text{nc}/ & \rightarrow & \{n\} & \{\} & /\text{an}c-ta/ \quad \text{‘sit’} & \rightarrow & [\text{an}ta] & [\text{an}ta] \\
\text{h.} & /\text{ps}/ & \rightarrow & \{p\} & \{\} & /\text{aps-ta}/ \quad \text{‘there is no’} & \rightarrow & [\text{ap}ta] & [\text{ap}ta] \\
\text{i.} & /\text{ks}/ & \rightarrow & \{k\} & \{\} & /\text{naks}'/ \quad \text{‘soul’} & \rightarrow & [\text{nak}] & [\text{nak}]
\end{array}
\]
The key point of the dialectal variation of (6a–c) is the preference relation between preservation of marked place hierarchy and coda sonority hierarchy: [dorsal] of [k] and [labial] of [p] are more marked places than [coronal] of [l] (Prince and Smolensky 1993/2004, de Lacy 2006), and [l] is a more sonorous segment than [k] and [p]. Seoul Korean puts preservation of marked place before coda sonority, while KS Korean does the opposite. Characteristics of the other data are as follows: (6e–f) are all coronal consonants and more sonorous ones are preserved, and (6h–i) are all obstruents and more marked places are preserved. Descriptive generalizations are summarized in (7).

(7) Descriptive generalizations of Korean CCS and dialectal variation

a. General: Syllables cannot have complex segments. This requirement is enforced by deletion.
b. Seoul dialect: If two segments have different places, the more marked place is preserved; if two segments have, however, the same places, the more sonorous one is preserved.
c. KS dialect: If two segments have different sonorities, the more sonorous one is preserved; if two segments have, however, the same sonority level, the more marked place is preserved.

TETU and PoM effects occur that do not appear in simplex coda neutralization in Korean CCS: all major places and all sonority levels are allowed as a simplex codas but coda sonority restriction (i.e., low ranked *CODA/X in section 3.1) effects and preservation of marked place (i.e., FAITH, which dominates *PLACE in section 3.1) emerge in limited phonological environments caused by the ranking of *COMPLEX. For preservation of marked placed segments, we adopt the Max[place] approach because *IDENT[place] cannot capture deletion of a segment and its place together (Lombardi 2001). Max[place] is decomposed by place markedness relation as (8b). This hierarchy is constant with reference to place assimilation (Jun 1995 among others).

(8) a. Max[place]: Assign one violation mark for every input [place] which has no correspondence relation to output.
   b. PoM ranking for place

Variation between two dialects depends on the precedence relation between two ranking hierarchies (i.e., Max[place] and *CODA/X): Seoul Korean gives priority to Max[place] over *CODA/X, and KS Korean vice versa. Hasse Diagram (9) reveals elaborated ranking between two hierarchies.

The winner–loser pairs in (10) illustrate the Seoul Korean CCS patterns. (10a) /lk/ → [k] requires Max[dorsal] to dominate *CODA/O. (10b) /lp/ → [p] also suggests that Max[labial] ranks over *CODA/O. (10c) /nE/ → [n] and (10d) /ps/ → [p] are predicted by the *CODA/X and Max[place] hierarchies individually. Losers in (10c, d) are not faithful to inputs; they are codas neutralized by the ranking of (5). The winner in (6e) /lp/ → [p] is also laryngeal-neutralized coda.
(10) CCS in Seoul Korean

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Winners</th>
<th>Losers</th>
<th>*COD/O</th>
<th>MAX[dor]</th>
<th>MAX[lab]</th>
<th>MAX[cor]</th>
<th>*COD/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. /lk/</td>
<td>[k]</td>
<td>[l]</td>
<td>W</td>
<td>L</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. /lp/</td>
<td>[p]</td>
<td>[l]</td>
<td>W</td>
<td>L</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. /nê/</td>
<td>[n]</td>
<td>[l]</td>
<td>W</td>
<td></td>
<td></td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>d. /ps/</td>
<td>[p]</td>
<td>[l]</td>
<td>W</td>
<td></td>
<td>L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comparative tableau (11) presents the KS Korean CCS. For input (11a) /lk/, [l] is more harmonic than *[k] with the ranking of *CODA/O \( \gg \) MAX[dorsal]. /lp/, /lp^h/ → [l] mappings are also predicted because *CODA/O dominates the MAX[place] hierarchy. (11b) /nê/ → [n] and (11c) /ps/ → [p] mappings are also predicted as in Seoul Korean.

(11) CCS in KS Korean

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Winners</th>
<th>Losers</th>
<th>*COD/O</th>
<th>MAX[dor]</th>
<th>*COD/N</th>
<th>MAX[lab]</th>
<th>MAX[cor]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. /lk/</td>
<td>[l]</td>
<td>[k]</td>
<td>W</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. /nê/</td>
<td>[n]</td>
<td>[l]</td>
<td>W</td>
<td></td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. /ps/</td>
<td>[p]</td>
<td>[l]</td>
<td>W</td>
<td></td>
<td>L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It must be accounted for that input /lm/ maps to [m], *[l] in (6d). The Seoul CCS ranking predicts the right winner by the MAX[place] hierarchy; however, the KS ranking favors the wrong winner *[l] over [m]. For [m] to be more harmonic than *[l] in the KS dialect, another constraint is needed which dominates *CODA/X. This new constraint must favor nasality over laterality from input to output. The newly added constraint is MAX[nasal], whose definition is ‘Assign one violation mark for every input [+nasal] which has no correspondence relation to output,’ and it must dominate MAX[lateral]; interaction with MAX[lateral] is omitted for simplification of the ranking arguments.

(12) /lm/ → [m] in KS Korean

<table>
<thead>
<tr>
<th>/lm/</th>
<th>MAX[nas]</th>
<th>*COD/O</th>
<th>MAX[lab]</th>
<th>*COD/L</th>
<th>MAX[cor]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → [m]</td>
<td>*</td>
<td>*</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. [l]</td>
<td>*W</td>
<td>L</td>
<td>*W</td>
<td>*W</td>
<td>L</td>
</tr>
</tbody>
</table>

The summary ranking on Korean coda is presented in (13). Dotted interaction lines point to dialectal variations in the CCS pattern. Seoul CCS ranking (9a) is immediately dominated by *COMPLEX, so both MAX[dorsal] and MAX(-SEG) are in the same stratum. KS ranking (9b) is dominated by MAX, that is, MAX dominates *CODA/O, so that no obstruent is deleted for sonority restriction. Finally, *F also interacts with CCS ranking (9) for evaluating neutralized candidates (6c) /lp^h/ → [p].

(13) Summary ranking

[Diagram of CCS ranking]
4. Conclusions

This paper analyzed Korean coda conditions based on interaction with universal constraints; no language-specific constraint is needed. We have seen that effects related to markedness (i.e., TETU and PoM) occur only in CCS, not in simplex coda neutralization, and that dialectal variation in CCS depends on the precedence relation between two hierarchies.

Previous approaches on Korean CCS are based on two positions: one is the syllable margin approach (Kuwamoto 2008), which introduces the *Coda/X hierarchy preferring less sonorous codas to the more sonorous ones, and the other is based on interaction with the place preservation hierarchy and preservation of [sonorant] (preservation approach: Iverson and Lee 1994, Jun 1998, M. Lee 1998). The former, however, cannot predict dialectal variation, accounting for the Seoul dialect only; the latter can explain two dialectal patterns. That is, both the [sonorant] preservation account and our account can be the answer to the prediction of Korean CCSs. But our *Coda/X approach can be connected to syllable contact (Baertsch 2002, Gouskova 2002, Baertsch and Davis 2008), which requires that coda be more sonorous and onset less sonorous.

Finally, /Ch/-cluster simplification shows different pattern from other CCSs. This may be due to the idiosyncrasy of /h/, which is phonologically regarded as placeless or most sonorous (for sonority of glottal consonants, see de Lacy 2006). We leave the exploration of this matter for future research.

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Notes

1) The distributional asymmetry of nasal onset/coda is reversal (e.g., onset < coda). And [r] and [l] are segments in complement distribution of liquid according to syllable positions.
2) Consonant deletion occurs only in the Native Korean stratum; vowels are inserted as complex segment breakers in the Loanword stratum instead (e.g., [si.ɾa.i.kʰɾ] ‘strike’).

References

Essex.


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