A Moraic Account of Liquid Alternation in Korean[*]

YOUNGJOO LEE
Massachusetts Institute of Technology

1. Introduction

This paper investigates a long-standing issue of Korean consonantal phonology, namely the alternation of liquid between lateral [l] and flap [ɾ] (henceforth [r] for convenience' sake). More specifically, I address the following three questions regarding this issue: First, what is the correct generalization of the well-known [l]-[r] alternation in Korean? Secondly, how does the generalization in native Korean affect the adaptation of English liquids. And lastly, how is the variation *within* loanwords, which is ob-

served in the adaptation of intervocalic [l], accounted for? Addressing these questions, I propose a set of new constraints governing liquid distribution in Korean, whereby lateral [l] is licensed in moraic positions and flap [r] appears in non-moraic positions. I show that the proposal made here clarifies the distinction between native phonology and loanword adaptation, and furthermore explains the variation within loanwords as well.

This paper is organized as follows. Section 2 briefly summarizes the descriptive generalization about the liquid alternation, and points out problems with previous approaches. Section 3 proposes a moraic approach, and provides an OT analysis of the phenomenon. Section 4 and 5 deal with the adaptation of English liquids and their variation, and suggests stratification of the lexicon. Section 6 concludes the paper.

2. The Syllable Position Approach

This section lays out the basic facts about the allophonic variation of Korean liquids and briefly reviews previous approaches. Let us begin with the descriptive generalizations.

Korean has one liquid, which has two allophones, lateral [l] and flap [r]. They are in complementary distribution, as exemplified in (1): the lateral [l] occurs in syllable codas, and the flap [r] in onset positions (Kim-Renaud 1974; Iverson & Sohn 1994).

(1) a. [tal]   'moon'
       [sal.ku]   'apricot'
       [sin.pal]   'shoes'

    b. [o.ri]   'duck'
       [na.ra]   'country'
       [sa.ram]   'person'

This positional realization results in regular alternation between the two sounds. When followed by an onsetless syllable, lateral [l] is realized as flap [r] in the onset of the following syllable.

(2) a. [tal] 'moon'   vs.   /tal-i/ 'moon-NOM' → [ta.ri]
    b. [mal] 'horse'   vs.   /mal-i/ 'horse-NOM' → [ma.ri]

While [l] is not allowed in the onset, it does occur as an onset when it forms a geminate [l] in intervocalic positions. Interestingly, in this case, geminate [l] and singleton [r] are contrastive, although singleton [l] and [r] are not.

(3) a. [mol.lɛ]   'secretly'   vs.   [mo.rɛ] 'sand'
    b. [mul.li]   'physics'   vs.   [mu.ri] 'group'
    c. [əl.li.ta] 'freeze'   vs.   [ə.ri.ta] 'be young'

Given that coda [l] is syllabified as onset [r] when followed by a vowel, as shown in (2), gemination is the only way [l] can appear in onset position. Also important is that liquid geminate is always [l], and there is no geminate [r].

    The predominant approach to this complementary distribution has been to count upon the syllable structure such as onset and coda, which I call the syllable position approach. Assuming one of the two sounds as a phoneme, previous studies proposed some rule or constraint which derives the other sound in certain contexts. The example cases are given below.

(4) a. *l*-weakening: l → r / V___V
    b. Onset constraint: *$_s$[l

L-weakening given in (4a) assumes the phonemic status of [l] and converts [l] to [r] in intervocalic positions (Kim-Renaud 1974 among others). In the constraint-based system, a Markedness constraint prohibits [l] from onset positions, as in (4b) (McDonough 1995; Yoo 1996).

    Whether it is formulated as a rule or a constraint, it is clear that geminate [l] is exceptional. The rule *l*-weakening does not apply to geminate [l], but only to singleton [l]. In the same way, the onset constraint does not apply to geminate [l]. As one way of explaining the exceptional behavior of geminate [l], previous studies adopted geminate inalterability of Hayes (1986). Hayes shows that geminates are special in many languages since they resist rules or constraints which affect singletons. This special behavior is attributed to the doubly-linked structure of geminates. Geminate is a segment associated to two prosodic units, and given the generalization that association lines in structural descriptions are interpreted as exhaustive (Linking Constraint), geminates are exempt from a rule or constraint due to their dual association. If we follow this line of account, then, we could also say that geminate [l] is exempt from the constraint on singleton [l], and McDonough (1995) and Yoo (1996) take this approach.

    However, Inkelas & Cho (1993) and Cho (1997) raise objections about this line of explanation. They point out that the dual association of a geminate does not redeem a segment from an onset constraint although it certainly does in coda constraints. In many languages including Korean, [ŋ] is not a licit onset, and being a geminate does not change the situation. Whether a singleton or a geminate, [ŋ] is not a well-formed onset (*[ŋa], *[aŋŋa]). Given this fact, inconsistency arises if we rest on geminate inal-

terability to license onset [l]. Geminate inalterability ameliorates one violation of an onset constraint, but does not another one in the same language. Coda Condition provides similar arguments. Flap [r] is not allowed in the coda, but gemination does not get rid of this positional markedness (*[ar], *[arra]). If geminate inalterability accounts for onset [l], why is it not able to redeem onset [ŋ] and coda [r]? This is not an agreeable solution, and thus geminate inalterability cannot be a proper account of onset [l] in geminates.

3. Liquid Alternation in Native Korean

In this section, I propose a new generalization for the liquid alternation, which does not depend upon geminate inalterability.[1] We know that lateral [l] occurs both as a coda and as a geminate, while flap [r] occurs as an onset, but not as a geminate. Given that geminates are universally moraic, and codas are moraic in Korean (Jun 1993, 1994),[2] a new generalization emerges. Liquid alternations in Korean depend on moraicity: lateral [l] is licensed in a moraic position, and [r] appears in a non-moraic position. And following the previous analyses, I also assume that [l] is less marked than [r]. The non-existence of geminate [r] and markedness of coda [r] naturally follow from this assumption.

   Now the constraints governing the liquid alternation boil down to the following.

(5) a. *Non-moraic-l: Do not have [l] in a non-moraic position.
  b. Ident-IO(lateral): Correspondent segments have identical values for
       feature [lateral].
  c. *r/*l: Do not have [r]/[l].

The first constraint, *Non-moraic-l, prohibits [l] from a non-moraic position, i.e. onset. Lateral [l] in a moraic position, i.e. coda and geminate [l] does not violate this constraint, and thus is allowed on the surface. The second one, Ident-IO(lateral), is a familiar constraint, which requires that corresponding segments have identical values for feature [lateral]. And two Markedness constraints, *r and *l, are justified on the basis of their existence in Korean.

   Now let us see how these constraints lead to the surface alternation. Allophonic variation results from the interaction of Markedness constraints and Faithfulness constraints (McCarthy & Prince 1995). The as-

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[1] Lat-Licensing proposed in Cho (1997) - Laterality is licensed only in coda position - does not depend upon geminate inalterability, either. Without the markedness hierarchy between [l] and [r], however, her proposal does not adequately choose the correct output in certain cases.

[2] See Tak (1997) for a different view about coda moraicity in Korean and relevant discussions.

sumption that [l] is less marked than [r] is reflected into the rankings of constraints, i.e. the dominance of *r over *l. In order to ensure the allophonic alternation, *r also dominates Ident-IO(lateral): *r >> Ident-IO(lateral), *l. If Ident-IO(lateral) were ranked over *r, there would be no allophonic variation. The following tableau is a case of [r] being in a coda, and the current ranking results in the correct output.

(6)   Native

	/tar/ 'moon'	*r	Ident-IO(lateral)	*l
a.	tar	*!		
b. ☞	tal		*	*

In tableau (6), candidate (a) has [r] rather than [l], and thus is ruled out. Candidate (b) becomes the winner although it violates Ident-IO(lateral). If the ranking were otherwise, candidate (a) would be incorrectly chosen as the winner.

The current ranking, however, eliminates all [r]'s from the output. It wrongly predicts [r] in the input to surface as [l] in every case. Since [l] is not allowed in a non-moraic position, *Non-moraic-l is added to the hierarchy, allowing the alternation in the onset. In tableau (7) below, candidate (a) fatally violates higher-ranked *Non-moraic-l, and is ruled out although it is faithful to the input. Instead candidate (b) becomes the winner although it has the more marked [r] and violates Ident-IO(lateral).

(7)   Native[3]

	/tali/ 'leg'	*Non-moraic-l	*r	Ident-IO(lateral)	*l
a.	ta.li	*!			*
b. ☞	ta.ri		*	*	

Irrespective of the input, this ranking ensures the correct realization of liquids in the output. Yet now, we see that another constraint needs to be added to the current formulation. Given that geminate [l] and singleton [r] are contrastive (see (3) in Sec. 2), both gemination and degemination should be blocked in order to preserve the underlying contrast. This contrast is not considered in the current system. If we add another candidate [tal.li] to tab-

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[3] It should be noted that other Faithfulness constraints, e. g. Max and Ident-IO(nasal) also dominate *r. Otherwise, non-moraic [l] in the input could get deleted or change to nasal sound in order to avoid violating *Non-moraic-l.

leau (7), this candidate is wrongly chosen as the winner, allowing gemina-
tion.

(8)   Native – wrong prediction
        (!! indicates the intended winner)

	/tali/ 'leg'	*Non-moraic-l	*r	Ident-IO(lateral)	*l
a.	ta.li	*!			*
b. !!	ta.ri		*!	*	
c. ☞	tal.li				*

In tableau (8), candidate (a) is ruled out by *Non-moraic-l. But neither of
candidate (b) and (c) is subject to *Non-moraic-l. Since candidate (c) has
the less marked [l] and does not violate Ident-IO(lateral), it is predicted to
win, but candidate (b) is the intended winner.

        In order to solve this problem, I adopt moraic Faithfulness pro-
posed in McCarthy (1997) and Keer (1999). If a language has a gemi-
nate/non-geminate distinction (e.g. Italian, Japanese, etc.), some constraint
should work to prohibit gemination or degemination to keep the underlying
contrast. The relevant constraints are given in (9), where Max and Dep
Faithfulness constraints hold for the moras between the input and the out-
put. Max-μ prohibits deleting a mora, and Dep-μ prohibits inserting a mora.

(9) Mora Faithfulness (McCarthy 1997: 10)
        Max-$\mu_{S1\text{-}S2}$: Every mora in S_1 has a correspondent in S_2.
        Dep-$\mu_{S1\text{-}S2}$: Every mora in S_2 has a correspondent in S_1.

These Mora Faithulness constraints are undominated. Otherwise the under-
lying contrast would be lost in the output. When Dep-μ is added to tableau
(8), we get the correct result:

(10)   Native

	/tali/ 'leg'	*Non-moraic-l	Dep-μ	*r	Ident-IO(lateral)	*l
a.	ta.li	*!				*
b. ☞	ta.ri			*	*	
c.	tal.li		*!			*
d.	tar.ri		*!	*	*	

The dominance of Dep-μ over *r enables candidate (b) to win over (c), dif-
ferently from tableau (8). Geminate [r] in candidate (d) is also ruled out due
to the violation of Dep-μ.

To summarize this section, I proposed two constraints, *Non-moraic-l and Dep-μ for the liquid alternation in Korean, and the following ranking of constraints has been confirmed.

(11) Liquid alternation in native Korean:
 Non-moraic-l, Dep-μ >> *r >> Ident-IO(lateral), *l

In the following section, I will extend the analysis to loanwords, and see what pattern of reranking emerges for the adaptation of English liquids.

4. Adaptation of English liquids

In this section we turn to the liquid distribution in loanwords. The following data is showing the adaptation of [l] and [r] in onset, coda, and intervocalic positions, respectively.

(12) Adaptation of English [l] and [r]

a. [ren.jɨ]	'lens'	[ra.di.o]	'radio'
[ra.un.ji]	'lounge'	[ri.dɨm]	'rhythm'
b. [ho.tʰel]	'hotel'	[pə.tʰə]	'butter'
[sɛn.dal]	'sandal'	[kʰə.tʰen]	'curtain'
c. [kʰol.la]	'cola'	[pa.i.rə.sɨ]	'virus'
[cʰel.lo]	'cello'	[a.i.bo.ri]	'ivory'

A few general patterns appear from the data in (12) (O. Kang 1996; Kenstowicz & Sohn 2000). In a word-initial onset, both [l] and [r] are adapted as [r]. In coda positions, [l] is realized as [l], but coda [r] appears to be deleted.[4] In intervocalic positions, [r] is faithfully adapted as onset [r], but [l] is adapted as geminate [l] (but see discussion in the next section on the variation of this tendency).

Now let us think about these generalizations in terms of constraints. For the ease of reference, relevant constraints for the native case are summarized in (13).

(13) Liquid alternation in native Korean:
 *Non-moraic-l, Dep-μ >> *r >> Ident-IO(lateral), *l

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[4] Note that the deletion is not a ubiquitous phenomenon. A vowel and [r] sequence is realized as a back vowel when preceded by a front vowel [i] or [e], as in [tʰa.i.ə] 'tire'. It is not clear whether the non-existence of [r] sound noted above results from deletion, or it is not present in the input to begin with. This issue is open to further discussion.

*Non-moraic -l: Do not have [l] in a non-moraic position.
Dep-μ: Do not insert a mora.
Ident-IO(lateral): Correspondent segments have identical values
for feature [lateral].

First, the adaptation of [l] to [r] in the onset indicates that *Non-moraic -l is undominated in loanword adaptation as well, and confirms its higher ranking over Ident-IO (lateral). No adjustment is necessary in the native ranking yet.

(14)   Loan[5]

	'lens' [lenz]	*Non-moraic -l	…….	Ident-IO(lateral)
a.	len.jɨ	*!		
b. ☞	ren.jɨ			*

Candidate (b) is not a faithful candidate, but candidate (a), which is faithful, violates the higher-ranked *Non-moraic-l, a fatal violation.

Second, the gemination of intervocalic [l] suggests the higher ranking of Ident-IO(lateral) in loanword adaptation. Recall that in the native case intervocalic [l] changes to [r]. To avoid violating *Non-moraic-l, [l] becomes [r] in native Korean, but undergoes gemination in loanword adaptation. Since gemination takes place for a faithful adaptation, we can infer that Ident-IO(lateral) pro motes to a higher position. It should be ranked higher than Dep-μ to allow gemination, but cannot outrank *Non-moraic-l, as pointed out in (14).

Combining these two relations, it follows that Ident-IO(lateral) should be placed between *Non-moraic -l and Dep-μ. This ranking can be derived from the native one by promoting Ident-IO(lateral) to a higher position between *Non-moraic-l and Dep-μ, which is given below in (15).

(15) Liquid distribution in loanword adaptation:
*Non-moraic -l >> Ident-IO(lateral) >> Dep-μ >> *r >> *l.

This ranking accounts for the adaptation patterns of intervocalic [l] and [r]. First, tableau (16) is for intervocalic [l].

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[5] Following Paradis & Lacharite (1997), I assume that the input is lexical rather than phonetic in loanword adaptation. Thus, in all the tableaux for loanwords throughout the paper, the phonemic representation is presented as input.

(16)   Loan

	'cola' [koulə]	*Non-moraic -l	Ident-IO(lateral)	Dep-μ	*r	*l
a.	k^ho.la	*!				*
b. ☞	k^hol.la			*		*
c.	k^ho.ra		*!		*	
d.	k^hor.ra		*!	*	*	

Candidate (a) violates *Non-morai-l and is thus excluded. Candidate (b) is faithful to the input [l] via gemination. Being a geminate, and thus moraic, it does not violate *Non-moraic -l, and satisfies Ident-IO(lateral) as well. Candidate (c) and (d) fatally violate Ident-IO(lateral).

Likewise, this ranking also explains the adaptation of intervocalic [r], which is always realized as [r], not as [rr] or [ll]. The higher ranked Ident-IO(lateral) ensures the faithful adaptation of [r], and Dep-μ rules out the geminated candidate.

(17)   Loan

	'orange' [ɔrindʒ]	*Non-moraic -l	Ident-IO(lateral)	Dep-μ	*r	*l
a.	o.len.ci	*!	*			*
b.	ol.len.ci		*!	*		*
c. ☞	o.ren.ci				*	
d.	or.renci			*!	*	

The change of input [r] to [l] is fatal in candidate (a) and (b), although candidate (a) violates *Non-moraic -l as well. Candidate (d) violates Dep-μ, thus is ruled out. Candidate (c) becomes the winner.

5. Variation within Loanwords

The discussion in the previous section is based on the generalization that intervocalic [l] is always accompanied by gemination. While this is true in most cases, it is worth to note that intervocalic [l] is adapted as [r] in quite a few cases, thus allowing variation between geminate [l] and singleton [r]. And this variation is attested within the same speakers. The following items illustrate the case, where two variants in (I) and (II) are interchangeably used.

(18) Variation of intervocalic [l] adaptation:

English | Korean
| | (I) | (II)
'kilo' | [kil.lo] | [ki.ro]
'jelly' | [cel.li] | [ce.ri]
'melon' | [mel.lon] | [me.ron]
'blouse' | [bɨl.la.u.sɨ] | [bɨ.ra.u.sɨ]
'chocolate' | [cʰo.kʰol.let] | [cʰo.kʰo.ret]
'ambulance' | [ɛm.bul.lan.s'ɨ] | [ɛm.bu.ran.s'ɨ]

The variation above presents a contrast to other cases where such variation is not allowed. For example, [kʰol.la] 'cola' does not allow a variant *[kʰo.ra], and neither does [tal.la] 'dollar' (*[ta.ra]). This contrast suggests a division within loanwords, whereby one group has one coherent ranking of constraints, and the other is subject to two co-existing ranking systems. What is interesting here is that given the same input, the forms in (I) result from the loanword ranking, whereas the forms in (II) result from the native ranking.

Let us see one case of this. When 'kilo' follows the ranking of the loanword system, it is adapted as [kil.lo]. When it is subject to the native ranking, we get [ki.ro]. The tableaux (19) and (20) illustrate each case.

(19)   Intervocalic [l] with the loanword ranking

	'kilo' [kilou]	*Non-moraic -l	Ident-IO(lateral)	Dep-µ	*r	*l
a.	kʰi.lo	*!				*
b. ☞	kʰil.lo			*		*
c.	kʰi.ro		*!		*	
d.	kʰir.ro		*!	*	*	

(20)   Intervocalic [l] with the native ranking

	'kilo' [kilou]	*Non-moraic -l	Dep-µ	*r	Ident-IO(lateral)	*l
a.	kʰi.lo	*!				*
b.	kʰil.lo		*!			*
c. ☞	kʰi.ro			*	*	
d.	kʰir.ro		*!	*	*	

The ranking between Dep-µ and Ident-IO(lateral) is reversed in loanword and native grammars. In the loanword case, Ident-IO(lateral) dominates

Dep-μ. In (19) the input follows this ranking, whereby input [l] is faithfully adapted as [l] via gemination. On the other hand, in the native case, Dep-μ is ranked higher than Ident-IO(lateral). In (20) candidate (b) has a geminated [l], a fatal violation of Dep-μ. Candidate (c) becomes the winner although [l] is adapted as [r].

As can be seen here, different adaptations arise depending on the ranking. I propose that this stratification *within* loanwords supports the core-periphery organization of the lexicon (Ito & Mester 1995). Less nativized items strictly follow the loanword ranking, thus showing no variation, while more nativized ones are sometimes subject to the native ranking. While native vocabulary and loanwords form different strata, it is not a clear-cut division. More nativized loanwords move towards the core of the lexicon and follow the ranking of the core-native system. [6]

6. Conclusion

In this paper, I proposed a new generalization on liquid alternation in Korean whereby lateral [l] is licensed in moraic positions (*Non-moraic-l), whereas flap [r] appears in non-moraic positions. This new generalization explains why the coda and geminate, but not the onset, license the laterality, and why liquid geminate is [ll], not [rr], an otherwise puzzling restriction. I also proposed that a Moraic Faithfulness constraint, Dep-μ in particular, works in liquid alternation in Korean. The contrast between native and loanword is attributed to the different positions of Dep-μ and Ident-IO(lateral) in the ranking, as summarized below.

(21) Native vs. Loan
    a. Native: *Non-moraic-l, Dep-μ >> *r >> **Ident-IO(lateral)**, *l
    b. Loan: *Non-moraic-l >> **Ident-IO(lateral)** >> Dep-μ >> *r >> *l

Finally, I presented several loanwords showing variation, and argued that these items are subject to two co-existing rankings.

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[6] Other possible accounts for this division were suggested while presenting this paper: the influence of Japanese which adapts [l] as [r] in every case, and sociolinguistic factors such as education level. However, as far as the variation is attested, the speaker should have two ranking systems depending upon the social setting, e.g. to whom she is talking to.

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