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A study of /l̪/- and /t/-irregular stems in Korean: Focusing on their regularity and underlying unity*

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Lee, Sechang. 2026. A study of /l̪/- and /t/-irregular stems in Korean: Focusing on their regularity and underlying unity. *Linguistic Research* 43(1): 163-183. This article aims to offer some unified analysis of a couple of irregular stems in Korean. The *l*-gemination attested in /l̪/-irregular stems turns out to be compensatory in nature, and so the phenomenon comes under the purview of moraic theory. The /t/-irregular stems are basically shown to be conditioned in the lexicon. But it is argued that their allomorphic choice becomes phonologically natural once the stem is assumed to carry two underlying allomorphic variants in the lexicon. Those two allomorphs are closely related in that they have the feature value of [voice] unspecified in the input. The value will be filled in with the help of a universal constraint in charge of agreement. Then, what appears to be irregular in the allomorphy of /t/-irregular stems in question is not a phonological irregularity at all, but rather results from a different match between morphemes that under more normal circumstances would not be expected to happen. On the other hand, emergence of nondistinctive [d] and [ɾ] in the conjugation of regular as well as irregular stems should not be something that happens within phonology. It must be an allophonic process taking place in the environment of intervocalic position, so it stands reason to treat it in terms of phonetic implementation. **(Sookmyung Women's University)**

Keywords /l̪/-irregular stems, /t/-irregular stems, allomorphy, voice assimilation, phonetic implementation, multiple inputs

1. Introduction

There is a long-standing issue in Korean phonology that some stem-final consonants show *l*-gemination or [t]~[ɾ] alternation, both of which involve liquids. They are 'irregular' in that their alternations are not predictable on purely phonological

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grounds. They are dubbed as /l̪/-irregular and /t/-irregular stems in the literature. As far as they are concerned, one allophone is required in a specific phonological context, and the other appears everywhere else. Like all allophonic alternations, the phonological behavior of such irregular stems could be captured by markedness constraints. In terms of Optimality Theory (McCarthy and Prince 1993, 1995; Prince and Smolensky 1993, 2004, OT henceforth), that sort of an account would result in putting most of the burden of determining allomorphy solely on the operation of a set of language-specific markedness constraints against some relevant faithfulness constraints. That would be cheap for the data at hand, but costly for the phonology as a whole. The intuition to be captured in this work is this: since an underlying lateral approximant is involved as a common denominator in the alternations of both types of irregular stems, there must be a direct and cost-free link between them, which will become apparent when we examine them in terms of the interaction of ranked universal constraints.

The remainder of this paper is organized as follows. The next section (§2) furnishes crucial data and paradigm bearing on current issue. Then, the following section (§3) provides the necessary theoretical background and proposal for the analyses that follow. We will introduce and discuss the notion of multiple inputs, on which our work on stem selection rests. In the following section (§4) we motivate the proposal in some depth within optimality-theoretic architecture. The final section (§5) concludes the analyses.

2. Paradigm

There is a systematic dual behavior of the underlying representation of lateral approximant in Korean. Some stems ending in either /l/ or /l̪/ behave differently before a Stative marker. To be more specific, they show different alternations when they are found before a vowel-initial suffix. The data in (1) illustrate:

(1) Paradigms of /l/-regular and /lɨ/-irregular stems

a. /l/-final regular stem[1]

Declarative	Connective	Gloss
/mol-/ + /ta/	/mol-/ + /ko/	'to drive'
↓	↓	
[mol.da]	[mol.go]	

Stative	Conditional
/mol-/ + /a/	/mol-/ + /mjən/
↓	↓
[mo.ɹa]	[mol.mjən]

b. /lɨ/-irregular stem[2]

Declarative	Connective	Gloss
/molɨ-/ + /ta/	/molɨ-/ + /ko/	'to be ignorant'
↓	↓	
[mo.ɹɨ.da]	[moɹɨ.go]	

Stative	Conditional
/molɨ-/ + /a/	/molɨ-/ + /mjən/
↓	↓
[mol.la]	[mo.ɹɨ.mjən]

Admitting that the underlying /l/ is typically weakened to [ɹ] in intervocalic position,[3] the paradigm in (1a) should be an automatic consequence of syllabification. Apparently, appealing to this line of account could seem reasonable in this case. But it makes a prediction that can be easily falsified in such cases as (1b). Before a

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1 Additional /l/-final regular stems include /kəl-/ 'to hang (on)', /bul-/ 'to blow', /sal-/ 'to live', etc.

2 Other examples of the same sort are /kolɨ-/ 'to choose', /hilɨ-/ 'to flow', /nalɨ-/ 'to transport', etc.

3 The allophonic implication of this fact was pointed out by Kim-Renaud (1974, and references therein). She formulates the phenomenon as follows:

l-weakening (ibid.,69)
l → r / [+syll] ____ [-cons]
(l becomes r between a vowel and a vowel or a glide.)

vowel-initial Stative suffix /a/, the stem /molɨ-/ undergoes the deletion of /ɨ/ and gemination of /l/. We would not be able to account for this allomorphy without some additional stipulation.

Related to this point is the important fact that /t/-final stems in Korean show a dual behavior, too. Those /t/-final forms such as in (2a) are perfectly regular, just like in (1a). An unexpected complication is raised by contrasts such cases as Stative and Conditional in (2b):

(2) Paradigms of /t/-final regular and /t/-irregular stems

a. /t/-final regular stem[4]

Declarative	Connective	Gloss
/kət-/ + /ta/	/kət-/ + /ko/	'to roll up'
↓	↓	
[kət͈.t'a]	[kət͈.k'o]	

Stative	Conditional
/kət-/ + /ə/	/kət-/ + /ɨmjən/
↓	↓
[kə.də]	[kə.dɨ.mjən]

b. /t/-irregular stem[5]

Declarative	Connective	Gloss
/kət-/ + /ta/	/kət-/ + /ko/	'to walk'
↓	↓	
[kət͈.t'a]	[kət͈.k'o]	

Stative	Conditional
/kət-/ + /ə/	/kət-/ + /ɨmjən/
↓	↓
[kə.ɾə]	[kə.ɾɨ.mjən]

4 Such /t/-final stems as /pat-/ 'to receive', /kut-/ 'to harden', and /tat-/ 'to close' etc. show the same regular alternation.

5 The following stems have the same irregular alternation: /tit-/ 'to hear', /mut-/ 'to ask', /sit-/ 'to load', etc.

As for the alternations in (2b), those in Declarative and Connective are quite normal.[6] Something unexpected happens before Stative and Conditional markers: the stem-final /t/ is realized as [ɹ], as you can verify in the last two examples in (2b). A retroflex [ɹ] just appeared from nowhere.[7] Note that the intervocalic [ɹ] in (2b) reminds us of that in (1). Since the intervocalic [ɹ] in (2b) should be the surface manifestation of an underlying /l/, it seems that there must also be a possibility of some kind of relationship holding between underlying /t/ and /l/ in the case of /t/-irregular stems. This notwithstanding, traditional ways of treating the /t/-irregular stems have failed to deliver sufficiently motivated feature specification or feature geometry that are needed to encode the relationship between phonological representations of /t/ and /l/ in such irregular stems. The task of current work is to seek links among all these seemingly unrelated irregular alternations. It will be argued in the next section that the whole picture is a part of a larger generalization that assimilation affects mostly segments lacking values for the spreading feature.

3. Theoretical background and proposal

There are two types of phonological alternations. When the phonetic shape of a morpheme can be traced back to a single underlying form, the single input form has to be posited underlyingly. Other than this sort of case, two or more input forms or allomorphs need to be posited. The former is a regular type which is conditioned by phonology. The latter is conditioned in the lexicon where the idiosyncratic conditions determine the choice of one allomorph rather than the other one. Of course,

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6 In Korean, syllable-final obstruents get unreleased (C˭) and the immediately following syllable-initial ones undergo tensification (C'). We will not deal with these phenomena since they are not directly relevant to our discussion at hand.

7 Just as the case of *l*-weakening described in footnote 3, Kim-Renaud views this as a kind of weakening process which should be the synchronic residue of a series of diachronic changes in Korean phonology (i.e.,t→d→l). The rule is formulated as follows:

t-Extreme Weakening (ibid., 31)
t → l / V: ____ & V
(A verb stem final /t/ is weakened to [l] in intervocalic position when the preceding vowel is long.)

However, we suspect that she is, in so doing, reenacting in the minds of modern Korean speakers the rule of t-Extreme Weakening dating back hundreds of years, which is certainly very unlikely.

the latter is supposed to put some burden on phonology overall.

The main claim of the present work is two-fold. Firstly, the intervocalic realization of [ɹ] from /l/ in (1b) constitutes phonetic implementation which is to be handled under moraic analysis. On the other hand, the kind of opaque stem selection such as [kət-] or [kəɹ-] in (2b) is to be handled lexically, which means that constraint satisfaction in terms of OT should also be used in a component other than phonology, that is, in the lexicon (Lapointe 1999; Mascaró 2007; Mester 1994, among others). As for the /t/-irregular stems in (2b), faithfulness of stem can be assumed to be partially suspended in allomorphy. That is, the feature value of the stem-final consonant in question may not be specified in the input forms.

Let us begin with the story of /l/-regular and /lɨ/-irregular stems. The [l]/[ɹ] alternation is completely allophonic, predictable on purely phonological grounds, as mentioned earlier in footnote 3. One of the allophones is required in a specific phonological context, and the other appears everywhere else: [ɹ] appears in intervocalic position while [l] surfaces elsewhere. Like all allophonic alternations, the [l]/[ɹ] alternation could be fully determined by a markedness constraints forbidding [l] intervocalically.[8] However, this conception of the problem, as simply a matter of allophonic variation, leads to another major problem for this theory. When the stem /molɨ-/ 'to be ignorant' is combined with Stative ending /a/, a gemination of *l* occurs, resulting in [mol.la], as in (1b). Contrary to a geminate [l.l], however, a plain [l] is witnessed in intervocalic position instead. This is a phenomenon which appears to contradict our expectation based on what happens in (1a).

Hayes (1989) was influential in establishing a perspective that many of the phonological cases of what had seemed like strange behavior could be accounted for under his representational proposal for the treatment of moras. The mora represents

8 Let us cite some previous OT treatments. In Choi's (2004: 180) analysis of /l/-final stems, she posits an undominated constraint such as the following:

*l-ɨ: The sequence of *lɨ* is not allowed.

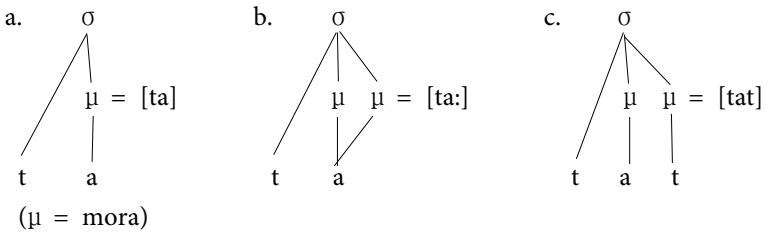
Kim (2003: 24) also adopts a similar constraint to the effect that the sequence of *lɨ* is prohibited:

No-*r]VSɨ*(**rɨ*): The sequence of [*rɨ*] is not allowed with a verb stem boundary inside.

However, these constraints are far from having any universal property from the perspective of OT. In other words, they are definitely language-specific statements that describe the very phenomenon that has to be explained in phonological theory. As we proceed, it will become clear that our analysis of irregular stems differs in this very important respect from previous treatments.

a well-known contrast between light syllables and heavy syllables: the former has one mora while the latter has two:

(3) Syllable weight in moraic theory (Hayes 1989: 254)

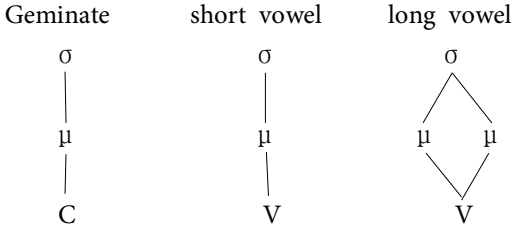


(μ = mora)

The general picture that is emerging from (3) is that many phonological processes count moras or syllables.

In line with Hayes' work and other traditional treatments (Hyman 1984, 1985; McCarthy and Prince 1995), it is also noteworthy in moraic theory that geminates and vowels have distinctive weight by being inherently moraic:

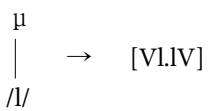
(4) Distinctive segment weight in moraic theory



In order to account for the above facts of irregular stems, we shall assume that there are two types of lateral approximant, based on the framework of moraic theory. That is, a moraic *l* in (5a) constitutes a geminate structure whereas non-moraic *l* in (5b) is not:

(5) Two types of an intervocalic /l/

a. Mora-carrying *l*



b. Moraless *l*

/VlV/ → [V.lV] → (phonetic implementation) [V.ɹV]

In case the mora is assigned underlyingly as in (5a), *l*-gemination takes place to preserve the mora in the output. Otherwise, a non-moraic *l* in (5b) is to be realized or interpreted as nondistinctive [ɹ]. Such a variant (allophone) of the same underlying sound (phoneme) in (5b) is the product of phonetic implementation that modifies the segment depending on the presence or absence of a mora in intervocalic context. In a nutshell, what is being claimed is that the idea of attributing the gemination to the moraic status of *l* can provide a plausible motivation of the facts at hand.

As is demonstrated below in (6), flaps and laterals collectively are close to vowels and occupy a relatively high position in sonority scale. According to the scale, both flaps and laterals occupy a relatively high position right next to vowels. So, there is reason to believe that they could be moraic and are inclined to induce gemination:

(6) Sonority scale (Hogg and McCully 1987: 33)

Sounds	Sonority values	Examples
low vowels	10	/a, ɑ/
mid vowels	9	/e, o/
high vowels	8	/i, u/
flaps	7	/r/
laterals	6	/l/
nasals	5	/n, m, ŋ/
voiced fricatives	4	/v, ð, z/
voiceless fricatives	3	/f, ɵ, s/
voiced stops	2	/b, d, g/
voiceless stops	1	/p, t, k/

Now let us turn to the /t/-irregular stems in (2b), whose alternation seems worse yet. Here, an important question immediately arises as to exactly how the stem /kət-/ 'to walk' seems to be chosen over /kəɹ-/ before a consonant-initial suffix, and the other way around before a vowel-initial one. No such prediction could be made by any adequate model of feature representation. That line of analysis could only stipulate, and not explain, why the stem-final /t/ shows the alternation between [t] and [ɹ] before certain suffixes. Allomorphic choice in that case is arbitrary and does not

improve the resulting structure in terms of markednesss.[9]

In order to understand better what is going on in /t/-irregular stems, we must take a step further. Such stems as /kət-/ 'to walk' form their Stative by realizing the underlying /t/ into [ɹ] before the suffix. In contrast, regular stems like /kət-/ 'to roll up' behave transparently in this respect. The /t/-irregular stems are questionable in that speakers simply pronounce the stem-final /t/ in the /t/-regular stems in the ordinary way. The irregular stem-final /t/ might go through some sort of intermediate stage. But we ignore this and other complications and argue that the irregular alternation follows from multiple inputs in OT. That is, we offer a story that some stems have two forms, one for 'before a vowel', another for 'before a consonant', and that they are tagged incomplete without a suffix.[10] The regular conjugation suffixation then applies, generating the surface form without further ado.

We assume here then that both /kət-/ and /kəl-/ appear in the candidate set for the /t/-irregular stems of concern in the present discussion. Then, a set of relevant OT universal constraints comes into play in the evaluation of competing output forms, selecting one of them as the optimal output. In order to make this work for our purposes, we need a condition on the operation of the GEN along the following lines:

(7) *Multiple Inputs* (*MI*, Lapointe 1999: 267)
The GEN function operates in such a way as to contribute to the candidate set all prosodic parses based on all of the forms listed as possible phonological representations for a morpheme or lexeme.

9 As we noted in footnote 7, the traditional approaches to the /t/-irregular stems have typically been just descriptive rather than explanatory, and then their phonological behavior must be regarded as having quite exceptional nature. As a matter of fact, even until recent years, we have tried in vain searching out any attempts in OT literature to provide an understanding of the phonologically-predictable behavior of the Korean /t/-irregular stems. In addition, this work could be safely regarded as the first approach to the regularity of /t/-irregular stems,s and also the first unified approach to /li/- and /t/-irregular stems in Korean.

10 The rationale behind this is the following. In English plurals, in a similar vein, there are two types of voice assimilation. A class of nouns takes a regular *–s* plural ending but changes its final consonant from voiceless to voiced: *knife-knives*, *calf-calves*, *leaf-leaves*, *life-lives*, *wolf-wolves*, etc. On the other hand, there is another class of nouns in which the noun keeps its voicing and the plural suffix *–s* surrenders it: *dogs* and *cats*. Pinker (1999: 53) asks, if such English suffixes as *-s*, *-ed*, and *–ing* are tagged as suffixes that cannot be pronounced unless they are attached to a stem, why can't there be stems that cannot be pronounced unless they have a suffix attached to them?

To the extent that allomorphic variants are not predictable on a phonetic basis, we adopt *MI* as a natural assumption to make, taking the rest of the assumptions in OT for granted. Due to *MI*, possible output candidates based on the multiple inputs are contributed by GEN to our candidate set. Cases where the margin of a morpheme alternates are not uncommon in Korean. In such cases, the particular part of the alternating morpheme has to be listed in the lexicon, as the part of the form of the morpheme.[11] As a result, allomorphic choice becomes phonologically natural since a less-marked structure is chosen in terms of the interaction of a given set of constraints.

In cases where the most common sorts of alternation involve some predictable variation in the phonetic shape of a stem-final consonant, the stem can be traced to a single input form. Otherwise, at least two input forms (or allomorphs) have to be posited. As far as /t/-irregular stems are concerned, the [t]-final form occurs before consonant-initial suffixes, while [ɹ]-final one appears before vowel-initial ones. The point we are building up to is the proper underlying representation for the forms in §2 that show [t]~[ɹ] alternation. The form of the stem depends solely on the immediately following suffix and nothing else. We therefore propose that the lexical entries for the /t/-irregular stems be schematic so that the last segment of the stem are listed as unspecified with respect to the feature value of [voice] and they are fleshed out into full consonants by voice assimilation:

11 Lapointe (1999: 267-268) points out two simple instances of such alternations. There are long or short versions of topic or focal suffixes and accusative ones in Korean. Their manifestation depends on the presence vs. absence of the stem-final consonant. That is, we witness a long version after vowel-final stems while we find a short version after consonant-final ones. Lapointe (ibid., 269) expresses those suffixes as following representations:

(a) Korean TOP/FOC — + / (n) In /
(b) Korean Acc — + / (l) Il /

Under the influence of *MI*, GEN unpacks each representation in (a, b) and interprets them as if each suffix consists of a couple of distinct input forms.

(8) Right-edge consonants of /t/-irregular stems

a. ⓣ

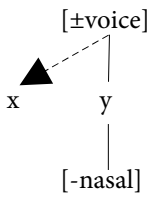
+anterior
+coronal
-continuant
⋮
Ovoice

b. ⓛ

+anterior
+coronal
+lateral
⋮
Ovoice

As shown above, both (8a) and (8b) include zero-valued [voice] and are almost the same as feature matrices of /t/ and /l/, respectively. This schematic feature is the very place where the irregularity of the stems comes from. The feature value will be filled in by the immediately following segment. Then, the /t/-irregular stems carry a couple of allomorphs in the input. That is, either (8a) or (8b) will constitute each of the right-edge consonant of the stem. The feature-value of [voice] is supposed to be filled in, depending on the voicing status of the immediately following segment. The filling of feature value then falls out from a universal principle. This is a consequence of the tendency that if a segment (syllable, or other unit) bears some feature value, then the immediately preceding (or following) segment must also bear the same value (Eisner 1999; Lombardi 1999; Bakovic 2000; Lombardi 2001; Pulleyblank 2004). The constraint we are giving in (9) constitutes a typical example of the feature agreement:

(9) AGREE-LEFT(±voice)
In a sequence of adjacent segments *xy*, if *x* is associated with [0voice] and *y* is with [±voice] and [-nasal] (i.e., oral consonants or vowels), then *x* is also associated with [±voice]. I.e.,



AGREE-LEFT(±voice) is violated if the feature value of [voice] is not filled in by the

immediately following oral consonants or vowels (but not nasals).[12] In §4, we will discuss consequences of this proposal outlined so far.

In addition, we will assume that the basic alternations at hand are enforced by the constraints listed in (10). Each of those markedness constraints is independently motivated and arguably universal—if not in the exact formulation proposed here, then at least in spirit:

(10) Universal constraints
  a. *VOWELCLASH: Vowel adjacency across a morpheme boundary is not allowed.
  b. *LONGVOWEL: Long vowels are not allowed.
  c. *ONSET-μ: Syllable onsets do no dominate mora.
  d. *GEMINATE: Geminates are not allowed.
  e. CONTRASTPRESERVATION: Nondistinctive segments are not introduced in output.
  f. MAX-IO(μ): Input moras must have output correspondents. (No deletion of moras)
  g. DEP-IO(μ): Output moras must have input correspondents. (No epenthesis of moras)
  h. DEP-IO(±voice): [±voice] in the output must have input correspondents. (No epenthesis of [±voice])

Regarding (10e) CONTRASTPRESERVATION, a piece of clarification is in order before we leave this section. Segmental inventories across diverse languages emerge from interactions of markedness constraints with faithfulness constraints. Those interactions serve to preserve input segmental contrasts in the output (Kager 1999: 44). In a related vein, it stands to reason to assume that nondistinctive segments should not be introduced in the output of phonology.[13] This is where the CONTRASTPRESERVATION

12 A remark on the presence of [-nasal] in the AGREE-LEFT(±voice) is in order. It is specified to express the universal tendency in phonology that nasals are not capable of inducing voice assimilation.

13 For the readers' convenience, the consonantal phonemes and their components of Korean are displayed below in a tabular form:

in (5e) steps in.[14] The interactions of all these proposed constraints are rendered somewhat clearer when full tableaux are considered in the next section.

4. Analysis

We begin our investigation with some of relatively elementary facts encountered in Korean phonology. An acceptable theory must be capable of handling the facts simply and perspicuously. The *l*-gemination pattern is analyzed in (11), where the Stative output [mo$^{\mu}$l$^{\mu}$.la$^{\mu}$] shows the elimination of stem-final /i/ and the retention of underlying mora:

(11) /li/-irregular: /mo$^{\mu}$li$^{\mu}$/ 'to be ignorant' + /a$^{\mu}$/ 'Stative' → [mo$^{\mu}$l$^{\mu}$.la$^{\mu}$]

/mo$^{\mu}$li$^{\mu}$/+/a$^{\mu}$/	*VOCL	*LOVO	*ONSET-μ	FAITH(μ)	*GEMINATE
a. mo$^{\mu}$.li$^{\mu}$.a$^{\mu}$	*!				
b. mo$^{\mu\mu}$.la$^{\mu}$		*!			
☞c. mo$^{\mu}$l$^{\mu}$.la$^{\mu}$					*
d. mo$^{\mu}$.l$^{\mu}$a$^{\mu}$			*!		
e. mo$^{\mu}$.la$^{\mu}$				*!	

Below in (12), we provide the syllabifications of each major candidate. But we will

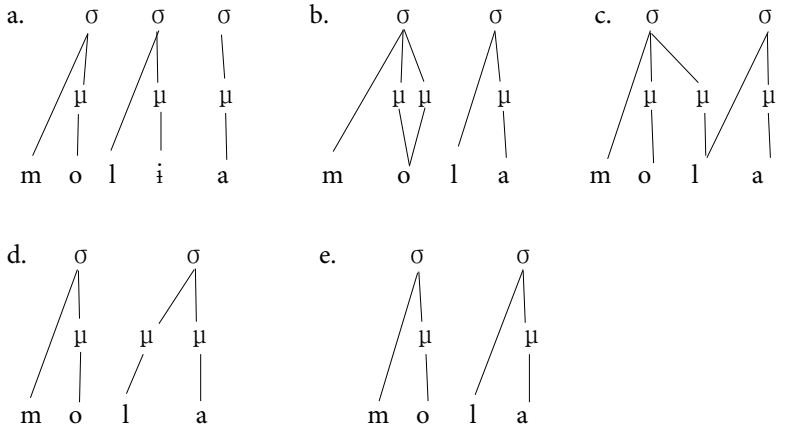
	Lax	Tense	Aspirated	Nasal	Liquid
Labial stop	p	p'	p^{h}	m	
Dental stop	t	t'	t^{h}	n	l
Palatal affricate	c	c'	c^{h}		
Velar stop	k	k'	k^{h}	ŋ	
Fricative	s	s'	h		

Crucially, there are three series of stops in Korean. Weakly articulated are the lax consonants in the second column. They are all lax articulation, released with a slight puff of local breath syllable-initially. The tense consonants in the third column are pronounced with great muscular tension, locally as well as through the entire vocal tract. The aspirated consonants in the fourth column begin with a lax articulation which is immediately followed by heavy aspiration. Nasals and liquid should be familiar enough.

14 This is reminiscent of the notion of *Structure Preservation* (Kiparsky 1982a, 1982b), which is the observation that a large class of phonological rules apply in such a way that their output conforms to certain well-formedness conditions. As a special case of this, phonological rules do not create any segment types which do not already exist underlyingly. As will be shown later in the next section, due to CONTRASTPRESERVATION, neither [d] nor [ɹ] will be allowed to appear in the output of phonology.

omit the drawing hereafter because most of the structures should be the same. We thereby simplify exposition and display only tableaux directly relevant to the discussion at hand.

(12) Syllabifications of the five candidates in the tableau (11)



The concatenation of stem-final /i̵/ and a vowel-initial suffix /a/ (11a=12a) suffers from a vowel clash, which results in a crucial violation of *VOWELCLASH. The (11b) deletes the stem-final vowel and the stranded mora contributes to the lengthening of the preceding vowel, which is penalized by *LONGVOWEL. The (11d) has a configuration in which the stray mora is rescued exclusively by [l] in syllable onset position. That is forbidden by *ONSET-μ. The candidate (11e) is out because it violates the faithfulness of mora. But there is another candidate available in (11c) that does not violate FAITH(μ) and turns out to be the optimal output.

We can also account for the lack of *l*-gemination which is observed in the alternations of *l*-final regular stems. The following tableau (13) shows how the correct result devolves from the given ranking, assuming a couple of competing candidates where the candidates exactly match the segmental template:

(13) /l/-regular: /mo$^{\mu}$l-/ 'to drive' + /a$^{\mu}$/ Stative → [mo$^{\mu}$.la$^{\mu}$]

/mo$^{\mu}$l/+/a$^{\mu}$/	*VOCL	*LOVO	*ONSET-μ	FAITH(μ)	*GEMINATE
a. mo$^{\mu}$l$^{\mu}$.la$^{\mu}$				*!	*
☞b. mo$^{\mu}$.la$^{\mu}$					

Unlike the winning candidate in (11c), the geminate output in (13a) incurs a crucial violation of FAITH(μ) because of the insertion of an extra mora. Thus, all else being equal, FAITH(μ) makes the choice in favor of the candidate (13b) that remains faithful to the input. According to (5b) in §3, the moraless [l] in (13b) will be realized as [ɹ] through phonetic implementation in the end.

The following tableau in (14) lays out the more complex interaction of those constraints that have been employed thus far, involving the full hierarchy plus AGREE-LEFT(±voice), CONTRASTPRESERVATION, and DEP-IO(±voice). It is necessary that the /t/-irregular stems are assumed to be given allomorphic variants underlyingly in the first place, i.e., /kəᵘⓣ-/ and /kəᵘⓛ-/. Consider some major output candidates along the following lines:

(14) /t/-irregular: /kəᵘt-/ 'to walk' + /əᵘ/ Stative → [kəᵘ.ɹəᵘ][15]

/{kəᵘⓣ-, kəᵘⓛ-} + əᵘ/	AGR (±voice)	CONPRE	*VOCL	⋯	DEP (±voice)
a. kəᵘ.ⓣəᵘ	*!	*			
b. kəᵘ.təᵘ	*!				*
c. kəᵘ.dəᵘ		*!			*
d. kəᵘ.ⓛəᵘ	*!	*			
e. kəᵘ.l̥əᵘ	*!	*			*
☞f. kəᵘ.ləᵘ					*
g. kəᵘ.ɹəᵘ		*!			*

The tableau illustrates all the combinations of stem /kəᵘⓣ-/ or /kəᵘⓛ-/ with Stative /ə/.[16] Candidates (14a) and (14d) are faithful to their inputs, failing to fill in the feature value of ⓣ and ⓛ respectively, and thus they violate AGREE-LEFT(±voice). On top of this, the presence of such nondistinctive segments as ⓣ and ⓛ in the

15 There is an apparently confusing alternation of a regular stem: /kəᵘl-/ 'to hang (on)' + /əᵘ/ Stative → [kəᵘ.ɹəᵘ]. Such an *l*-final stems are not carrying ⓛ but a fully-specified *l* in the input. The allomorphically variant inputs will never be posited for this regular form by Korean speakers. So, it is expected to receive the same analysis as (13).

16 We have prevented three constrains from being seen on the fifth column since they are irrelevant in candidate evaluation: *LONGVOWEL, *ONSET-μ, and FAITH(μ). This is a practice we will follow throughout to save space. It is also important to bear in mind that the presence of such constraints as AGREE-LEFT(±voice), CONTRASTPRESERVATION, and DEP-IO(±voice) would not affect the evaluation in the tableaux (11) and (12). That is because they would be irrelevant in the evaluation there. So, we will omit these three constraints when space does not permit.

output violates CONTRASTPRESERVATION, too. In (14b) and (14e), those schematic segments are avoided. In so doing, however, AGREE-LEFT(±voice) is violated since voiceless consonants appear in the voiced context. That is, the top-ranked AGREE-LEFT(±voice) demands that the following vowel be only capable of providing the immediately preceding segment with the plus value of [voice]. The voiceless lateral approximant [l̥] in (14e) is also in violation of CONTRASTPRESERVATION in the output. Both (14c: [kəᵘ.dəᵘ]) and (14g: kəᵘ.ɹəᵘ]) are introducing the nondistinctive [d] and [ɹ] respectively, which is in crucial violation of CONTRASTPRESERVATION.[17] The (14f: [kəᵘ.ləᵘ]), on the other hand, successfully avoids all the dominating constraints, at the expense of only one violation of low-ranked DEP-IO(+voice), and turns out to be the ultimate winner which will be realized as [kəᵘ.ɹəᵘ] in the end through phonetic implementation.[18]

Now consider what happens to /t/-irregular stems before other suffixes. As to the same stem /kəᵘt-/ as in (14) combining with an obstruent-initial Connective ending, an illustrative tableau is given below, where diverse candidates for a schematic underlying concatenation of /{kəᵘⓣ-, kəᵘⓛ-} + koᵘ/ are evaluated:

(15) /t/-irregular: /kəᵘt-/ 'to walk' + /koᵘ/ Connective → [kəᵘt.koᵘ]

/{kəᵘⓣ-, kəᵘⓛ-} + koᵘ/	AGR (±voice)	CONPRE	*VOCL	⋯	DEP(±voice)
a. kəᵘⓣ.koᵘ	*!	*			
☞b. kəᵘt.koᵘ					*
c. kəᵘd.koᵘ	*!	*			*
d. kəᵘⓛ.koᵘ	*!	*			
e. kəᵘl̥.koᵘ		*!			*
f. kəᵘl.koᵘ	*!				*

17 Voiced alveolar stop [d] and retroflex [ɹ] appear intervocalically and are nondistinctive in Korean phonology (cf. footnote 13).

18 A principle of learning called *lexicon optimization* is proposed in Prince and Smolensky (1993/2004: 225). The principle reassures learners that the familiar underlying forms are still identifiable in spite of the richness of the base. In other words, it is decisive as a learning strategy and tells learners what to do when they cannot find any independent evidence for the underlying representation. Our current analysis should support the idea that when there is an alternation within a paradigm, learners must regard the alternation as a piece of crucial evidence, and in that case *lexicon optimization* is ignored. Simply put, the Korean paradigm tells learners that they should posit such schematic segments as ⓣ or ⓛ, and then the surface form [kə.ɹə] comes from /{kəᵘⓣ-, kəᵘⓛ-} + ə/ mainly by a process of voice assimilation.

Almost the same explanation would hold for the tableau in (15). The stem has to be /kəᵘⓉ-/ since the suffix /koᵘ/ is only capable of providing minus value of [voice].[19] The fully faithful candidate (15a) and (15d), which preserve the schematic segments Ⓣ and ①, fatally violate AGREE-LEFT(±voice) by failing to fill in the feature value from the immediately following /k/. To avoid such a violation, two strategies are considered, as represented by the rest of the candidates. Candidates (15c) and (15f) fill in the plus value of [voice], resulting in nondistinctive voiced alveolar stop [d] and distinctive (voiced) lateral approximant [l], respectively. The former still violates AGREE-LEFT(±voice), however, because of the immediately following /k/ which is voiceless, incurring a violation of the prohibition against introducing nondistinctive segment (i.e., [d]) in the output. The latter, (15f: [kəᵘl.koᵘ]) also has a violation of AGREE-LEFT(±voice) due to the sequence of [+voice] and [-voice] across the syllable boundary. The candidate (15e: [kəᵘl̥.koᵘ]) satisfies AGREE-LEFT(±voice) but crucially violates the next-lower constraint due to the presence of a voiceless lateral approximant [l̥]. The voice-assimilated candidate (15b) emerges as optimal--though violating low-ranked DEP-IO(-voice)--since it satisfies both higher-ranked constraints.[20]

The situation becomes somewhat more complicated when both stem and suffix have allomorphic variation. There is a two-way variation in the form of Conditional marker in Korean: /-mjəᵘᵘn/ and /-ɨᵘmjəᵘᵘn/. Generally speaking, when these markers are attached to vowel-final stems, the consonant-initial /-mjəᵘᵘn/ occurs as in (16a), but when they are attached to consonant-final stems, the vowel-initial /-ɨᵘmjəᵘᵘn/ appears as in (16b). For such alternations, a straightforward OT analysis can be offered such that prosodic constraint ONSET(= syllables have legal onsets) dominates NOCODA(= syllables have no codas). There is, however, one class of exceptions to this generalization: /l/-final stems take /-mjəᵘᵘn/ rather than /-ɨᵘmjəᵘᵘn/, as shown in (16c):

19 In tableau (14) previously, learners had no alternative but to choose /kəᵘ①-/ as the stem because the following vowel-initial suffix can only offer [+voice] to the preceding schematic ①.

20 The discussion in this paragraph does not apply to such /l/-regular stems as /moᵘl-/ 'to drive' in (1): /moᵘl-/ + /koᵘ/ → [moᵘl.goᵘ]. The /l/-regular stems are literally regular in that (i) they do not carry any schematic segments and (ii) they have a single form in the input.

(16) Alternation of Conditional marker: /-mjəᵘᵘn/ vs. /-iᵘmjəᵘᵘn/

a.	/oᵘ-/ 'to come'	+	/-mjəᵘᵘn/	→ [oᵘ.mjəᵘᵘn]
	/kaᵘ-/ 'to go'	+	/-mjəᵘᵘn/	→ [kaᵘ.mjəᵘᵘn]
	/kʰiːᵘ-/ 'to grow'	+	/-mjəᵘᵘn/	→ [kʰiːᵘ.mjəᵘᵘn]
b.	/məᵘk-/ 'to eat'	+	/-iᵘmjəᵘᵘn/	→ [məᵘ.kiᵘ.mjəᵘᵘn]
	/kuᵘp-/ 'to bend'	+	/-iᵘmjəᵘᵘn/	→ [kuᵘ.biᵘ.mjəᵘᵘn]
	/kəᵘt-/ 'to roll up'	+	/-iᵘmjəᵘᵘn/	→ [kəᵘ.diᵘ.mjəᵘᵘn]
c.	/saᵘl-/ 'to live'	+	/-mjəᵘᵘn/	→ [saᵘl.mjəᵘᵘn]
	/coᵘl-/ 'to doze off'	+	/-mjəᵘᵘn/	→ [coᵘl.mjəᵘᵘn]
	/maᵘndiᵘl-/ 'to make'	+	/-mjəᵘᵘn/	→ [maᵘn.diᵘl.mjəᵘᵘn]

This three-way contrast tells us something very significant about the status of the stem-final consonant in /t/-irregular stems—namely, that they are not like other consonant-final stems in taking Conditional marker. Our /t/-irregular stems at hand take /-iᵘmjəᵘᵘn/ not /-mjəᵘᵘn/, unlike in (16b). An illustration of it is offered in the following tableau (17):

(17) /t/-irregular: /{kəᵘⓣ-, kəᵘⓛ-}/ 'to walk' + /{-mjəᵘᵘn, -iᵘmjəᵘᵘn}/ Conditional → [kəᵘ.ɹiᵘ.mjəᵘᵘn]

/{kəᵘⓣ-, kəᵘⓛ-} + {-mjəᵘᵘn, -iᵘmjəᵘᵘn}/	AGR (±voice)	CONPRE	*VOCL	…	DEP (±voice)
a. kəᵘⓣ.mjəᵘᵘn	*!	*			
b. kəᵘ.ⓣiᵘ.mjəᵘᵘn	*!	*			
c. kəᵘ.tiᵘ.mjəᵘᵘn	*!				*
d. kəᵘ.diᵘ.mjəᵘᵘn		*!			*
e. kəᵘⓛ.mjəᵘᵘn	*!	*			
f. kəᵘ.ⓛiᵘ.mjəᵘᵘn	*!	*			
☞g. kəᵘ.liᵘ.mjəᵘᵘn					*
h. kəᵘl.mjəᵘᵘn	*!				*
i. kəᵘl.mjəᵘᵘn	*!	*			*

The most of the account of selecting the optimal output form will proceed as before. If a candidate contains a schematic segment in the output, it forces violations of the markedness constraint responsible for voice assimilation as well as preservation of contrast (e.g., (17a, b, e, f, i)). Candidate (17c) is out owing to the fact that [tiᵘ] is

not a result of voice assimilation which would force it into [di]. The candidate (17d) fatally violates CONTRASTPRESERVATION because the voice assimilation generated [d] which is nondistinctive in Korean phonology. We must take precaution to drive out (17h: [kəᵘl.mjəᵘᵘn]). Here, the schematic segment ① in the input gets its plus value of [voice] from the following nasal, which is prohibited by AGREE-LEFT(±voice) as formulated in (9) in §3. At the expense of a violation in low-ranking DEP-IO(+voice), the remaining candidate (17g) is decided as the optimal form.

Taken as a whole, the analysis in tableau (17) lends a new perspective on the data it confronts in (16): it explains at least why the /t/-irregular stems take /-iᵘmjəᵘᵘn/ rather than /-mjəᵘᵘn/ as Conditional marker, unlike the case of other regular stems in (16b) which is the other way around.[21] This crucial piece of evidence suggests that the stem-final segment in the /t/-irregular stems is not like that in other regular ones, which means that the stem-final segment in /t/-irregular stems cannot be a normal consonant. From this, we conclude that the stem-final segment in question cannot be a true consonant but could be a schematic one.

5. Summery and outlook

As has been made clear, an apparent irregularity attested in a gemination of /l/ in /li/-irregular stems can be understood as a regular process under the proposed OT constraint interaction in terms of moraic theory. The emergence of nondistinctive allophones is commonly attested intervocalically in /li/- and /t/-irregular stems. Their unity is captured through phonetic implementation. The situation becomes somewhat complicated when /t/-irregular stem-final consonant shows [t]~[ɾ] alternation. If the allomorphy of /t/-irregular stems is simply treated lexically, we lose a significant generalization inherent in their paradigms. So, we have proposed a solution to this complication in the way certain stems consist of a set of allomorphs. Lapointe's *MI* turned out to have a crucial role to play in our current OT account, which relies on stem-final schematic segments. Although our analysis still remains a lexical approach, it captures a regularity in the lexicon. The two allomorphs of /t/-irregular stems differ minimally. Such schematic segments as ⓣ and ① are almost identical

21 The /t/-regular stem /molᵘ-/ takes /-mjəᵘᵘn/ as Connective marker, as we have shown in (1a).

with /t/ and /l/ respectively, with the feature value of [voice] unspecified. The proper value of [voice] is to be filled in through the universal constraint in charge of assimilation. All the possible combinations of allomorphic stems and suffixes are considered and evaluated in the tableaux. Correct allomorphic candidate is selected according to the satisfaction of our arguably universal constraints of OT, especially the right-to-left assimilation of [±voice]. It is therefore important to emphasize that it is feasible to construct an OT account for the kinds of apparently lexically-restricted allomorphy in some of the irregular stems of Korean. We thus have every reason to believe that the sorts of mechanism adopted in the present work can be expanded to handle lexically-restricted other 'irregular' alternations of Korean stems in general.

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