The liquid lexicalization and nativization
in Sino-Korean and English loans∗

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Lee, Borim. 2001. The liquid lexicalization and nativization in Sino-Korean and English loans. *Studies in Phonetics, Phonology and Morphology* 7.1. 101-124. In this paper I examine the two processes of loanword phonology, a lexicalization process and a nativization process, with a special focus on the loanwords with liquids in Korean. It will be argued that the input words from source languages are evaluated by the constraint ranking specific to loanwords to make them fit the phonemic inventory and the syllable structure of the native language. It will be claimed that once the loanwords are stored phonemically in the lexicon they participate in the native language morpho-phonology with no distinctions regarding their origin. It will be shown that the so-called 'Du-im constraint', which played a crucial role in the lexicalization process of Sino-Korean vocabulary, affects neither English loanwords nor recently developing native words. I conclude then that this constraint is not an active phonotactic constraint in the modern Korean and that the relevant ranked constraints within the framework of Optimality Theory provide a unified account of the alternations among /l/, /ɾ/, and /n/. **(Wonkwang University)**

Keywords: liquid, loanword, English loans, Sino-Korean, lexicalization, nativization, /l/-/ɾ/-/n/ alternations, 'Du-im constraint'

1. Introduction

Researches on loanword phonology have mostly focused on how loanwords are formed (Yip 1993, Silverman 1992, Ito and Mester 1995). There have also been many studies on the process of how English words are adopted into Korean (Hirano 1994; Lee 1995; Oh 1996; Kang 1996, 1999; Lee et al 1999 among others). Most studies are built onto Silverman's proposal, accounting for the processes that English words undergo to be adopted into Korean within the framework of Optimality Theory proposed by Smolensky and Prince (1993) and implemented by McCarthy and Prince (1993, 1995).

In this paper I will focus on how liquids in Sino-Korean and English loans are stored in the native lexicon and used in Korean morpho-phonology. The lexicalization process of English liquids will be compared to that of Sino-Korean liquids. I will argue that Silverman's model accounts for only a part of loanword phonology, i.e., the process of

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loanword adaptation to the native lexicon. Following Optimality Theory, I will assume that the input words from source languages will be evaluated by the constraint ranking specific to the loanwords. It will be shown furthermore that the constraint ranking that was applied to the existing Sino-Korean words is different from the ranking that applies to English loans, especially in regard with the so-called 'Du-im constraint' concerning the word initial /l/. It will then be proposed that once the loanwords go through the adaptation process the outputs are stored in the Korean lexicon in the same pool as that for the native vocabulary. It will also be argued that when the loanwords are actually used in Korean morpho-phonology in combination with other native words and the loanwords from different source languages, they will be evaluated by the one and the same Korean phonotactic and phonological constraints with no discriminations as to their origin. Additionally, it will be shown that 'Du-im constraint' is no longer an active constraint in the modern Korean.

The organization of this paper is as follows. In section 2, I will compare the liquid inventories between English and Korea and then illustrate relevant data regarding liquids from English loanwords and native Korean (including Sino-Korean). In section 3, I will first discuss in detail the process of adaptation that the English words containing liquids undergo before they are stored in the Korean lexicon. I will then show that both native words and loanwords in the lexicon are evaluated by the one and the same constraint ranking when they participate in the Korean morpho-phonology.

2. The Liquid Distribution in English and Korean

In this section I will present the liquid sounds and their phonological distributions contrasting English to Korean. The phonemic status and the distribution of the liquid sounds are quite different in the two languages. I will briefly present the phonemic status of English liquids. Then, I will concentrate on liquid distribution in Korean within the framework of Optimality Theory and propose relevant constraints to account for the alternations. Interactions among the formulated constraints will be illustrated in a few sample constraint tableaux.

2.1. The liquid sounds in English

English has two separate phonemes, /l/ and /r/[1], in the category of the sounds described by the cover term 'liquid'. Minimal pairs containing /l/ and /r/ in various positions of the word can be easily found.

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[1] The IPA symbol for retroflex is /ɹ/, but in this paper I will use /r/ for convenience.

(1) a. light   b. right
        collect   correct
        play   pray
        file   fire

/l/ is a lateral sound produced by lowering the mid section of the tongue at both sides or at only one side, thereby allowing the air to flow out of the mouth in the vicinity of the molar teeth (Chomsky and Halle 1968:317). The phoneme /l/ has two allophones in English: a clear 'l' [l] and a dark 'l' [ɫ].

(2) a. clear 'l'
          leaf , lie, late…
     b. dark 'l'
          feel, call, pool…

A clear [l] is made when /l/ precedes a vowel sound as in (2a). When the /l/ follows a vowel as in (2b), the movement becomes more extensive and this type of /l/ is called a dark 'l'. The tongue tip still touches the alveolar ridge for most speakers, but the back of the tongue is considerably raised toward the soft palate giving the sound the secondary articulation called velarization, hence [ɫ]. Ladefoged (1982:62) notes that in the speech of some English speakers, the dark 'l' is not an alveolar consonant but more like some kind of back vowel.

For the /r/-sound, however, the tongue tip does not touch anything. It is pronounced by a large majority of English-speaking people with both sides of the tongue touching the back part of the alveolar ridge and the back teeth. The American English /r/ always begins by a motion toward the back of the mouth, giving it its typical character of a retroflex (Prator and Robinett 1985:114). In American English, the sound /r/, when preceded by a vowel, adds a feature called rhotacization to the vowel, which is described as an auditory property, the /r/-coloring, of a vowel. The rhotacization of the vowel is most evident when the affected vowel is a schwa as follows:

(3) the rhotacized vowel [ɚ] (Ladefoged 1982:78)
        sir, her, fur…

Some East Coast Americans and speakers of British English, on the other hand, do not pronounce the /r/ sound after a vowel.

2.2. The liquids in Korean

Korean has only one phonemic liquid that has two phonologically conditioned allophones. One of the allophones occurring in coda is

realized as a dental lateral, whose manner of articulation is very close to a clear 'l' in English. Examples are as follows:

(4) a. [tal]   'moon'
    b. [kalt'ε]   'reed'
    c. [nalgε]   'wing'

The other allophone is a flap or tap, in which the tongue tip makes a single tap against the alveolar ridge. When a singleton liquid occurs inter-vocalically in Korean, it is realized as an onset flap.

(5) a. [pʰaɾi]   'fly'
    b. [uɾi]   'we'
    c. [kaɾu]   'powder'

I will assume that in Korean [l] and [ɾ] are liquid consonants that share all the features except laterality, i.e., [l] is [+lat] but [ɾ] is [-lat], to account for the allophonic relationship between the two sounds.

   Some dialects of American English also have a flap as an allophone of /t/ or /d/ as in 'city', 'better', 'writer', and 'rider', neutralizing the distinction between 'writer' and 'rider'. Although both English and Korean have the same phonetic sound, a flap, many Koreans identify their flap with an English /r/, a retroflex, which is a common source of foreign accent.

   In Korean, a geminate /l/ can occur inter-vocalically when a liquid in coda is followed by another in onset of the next syllable and in this case the liquid is realized as a dental lateral. This intervocalic contrast of a liquid is illustrated in the following data.

(6) a. geminate liquid
        [talli]   'differently'
        [kəlləɾa]   'Filter (a thing)!'
    b. singleton liquid
        [taɾi]   'bridge'
        [kəɾəɾa]   'Walk!'

 Presence of the apparent minimal pairs in (6) involving a geminate and a singleton liquid may suggest that the two sounds are separate phonemes in Korean. Huh (1979:145) claims that the intervocalic geminate liquid is an allophone, a cluster allophone of the same phoneme /l/. He notes that length of the geminate is identical to that of a genuine cluster such as [ca*nn*amu] 'pine tree'. Although they may be allophones, it is clearly needed to differentiate the two instances of the intervocalic liquid in representation. I assume that the geminate liquid is a liquid melody attached to the two skeletal slots. For notational convenience, however, I will use the linked notation and the cluster notation as in (7a) interchangeably to indicate the geminate liquid.

(7)   The representation of intervocalic liquids
       a. a geminate liquid   b. a singleton liquid
            l   or   ll   l
             $\wedge$ |
            C C   C

Summarizing the liquid distribution discussed so far, I will present the relevant constraints to account for the allophonic alternations of the Korean liquid.

(8)   a. Coda liquid constraint (CLC): a liquid in coda cannot be a non-lateral.

$$*C]_\sigma$$
$$|$$
$$[\text{-lat}]$$

       b. Onset liquid constraint (OLC): a liquid in onset cannot be a lateral.

$$*_\sigma[C$$
$$|$$
$$[\text{+lat}]$$

I will assume that an inter-vocalic geminate liquid with the representation in (7a) does not violate the coda liquid constraint in (8a) or the onset liquid constraint in (8b) because the association lines in the representation are interpreted exhaustively (Hayes 1986). Given a representation as in (7a), the feature [+lateral] of a geminate liquid is licensed by its association to the coda consonant in the preceding syllable.

Assuming that the lateral liquid is the phonemic form of the liquids in Korean, I will now consider a case of a flap surfacing in an intervocalic onset position. The optimal output [taɾi] in (6b) must be obtained from the underlying form /tali/, at the expense of violating the relevant faithfulness constraint, which is in this case IDENT(lat). Another output candidate that does not violate the constraints in (8) will be [talli] with a geminate liquid. To prevent that from being chosen as optimal, we need another faithfulness constraint, namely DEP(C). The constraints in (8) can also be satisfied by deleting the final vowel, making the lateral stand in coda. That is not an optimal output either, and MAX(V) can take care of that. Maintaining the manner of a liquid is also important to prevent a liquid from turning into something else, e.g., [n]. I suggest that IDENT (approximant) take care of it, where [approximant] covers both liquids and glides.[2] However, the ranking between the two IDENT constraints doesn't seem to matter: the sub-optimal candidate makes an additional violation on

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[2] Since [approximant] covers both liquids and glides, the proposed ranking will give an equally high evaluation to a candidate with a glide instead of a flap, e.g., [tayi] or [tawi]. Some other constraint such as IDENT(consonantal) or IDENT(place) can easily take care of the matter.

IDENT(approximant). All other constraints must dominate IDENT(lat) that is violated by the optimal candidate. IDENT(app) should also be dominated: its motivation will become clear when a post-consonantal nasalization of a lateral is discussed as shown in (15) below.

(9) a. CLC, OLC, MAX(V), DEP(C) » IDENT(app), IDENT(lat)

(10) /tali/ → [taɾi] 'bridge' (6b)

/tali/	CLC	OLC	MAX(V)	DEP(C)	ID(ap)	ID(lat)
a. tali		*!				
b. talli				*!		
☞c. taɾi						*
d. tani					*	*
e. tal			*!			
f. taɾ	*!		*			*

The most faithful candidate in (10a) fails because it violates OLC stating that a lateral liquid cannot occur in onset. The candidate (10b) can avoid OLC by sharing the lateral feature with the preceding coda, but it still fails because it has an additional consonantal slot that was not in the input to accommodate a geminate. The candidate (10c), which changes its lateral feature from [+lat] to [-lat], becomes an optimal output by satisfying OLC. (10d), as discussed above, loses the input liquid identity and thus makes an additional violation compared with the optimal candidate (10c). The remaining candidates commit fatal violations by deleting an input vowel. The last candidate (10f) violates two additional constraints, i.e., IDENT(lat) by changing the value of laterality and CLC by having a non-lateral liquid in coda.

Now that the phonemic status of Korean liquids has been identified, let us examine the distribution of liquids in the word-initial onset position, which is more complicated. No native Korean words have a liquid in the word initial position, whether it is a lateral or a flap, which seems to be a morpheme structure constraint of native Korean.

The words originated from the Korean reading of the Chinese letters, namely Sino-Korean, were affected by this constraint. If a word begins with a lateral, it becomes a nasal: [l] becomes [n]. Additionally, a word-initial [n], whether underlying or derived from /l/, is deleted before /i/ or /y/.[3]

(11) a. kə-*lɛ*   [kəɾɛ]   'trade'
          lɛ-il   [nɛil]   'tomorrow'
       b. co-*li*   [coɾi]   'cooking'

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[3] In Korean, lenis obstruents become voiced between voiced segments.

      li-pal   [ibal]   'haircut'
    c. ca-*nyə*   [canyə]   'child'
      nyə-ca   [yəja]   'woman'

I argue that this constraint is an old phonotactic constraint in native Korean that was still active at the time Korean was borrowing a massive quantity of words from Chinese based on its letters, not actual pronunciations. In the next section, I will show that this constraint does not apply to the recent loanwords including English loanwords. It is not documented in North Korean dialect and does not apply to recently developing native vocabulary. Therefore I will argue that it is no longer an active constraint in modern Korean. I will call it 'Du-ɨm constraint' following the traditional Korean grammarians.

(12) Du-ɨm constraint (word-initial constraint)
      *$_{pw}$(l
      *$_{pw}$(ni, ny

/l/ also alternates with /n/ word internally in Korean. An underlying liquid in Sino-Korean becomes [n] after a consonant other than /n/ or /l/.[4] When a lateral precedes, a geminate lateral surfaces. It will be assumed that a geminate lateral with a representation in (7a) surfaces from a cluster of two laterals by an OCP triggered merger. What happens when /l/ is preceded by /n/ will be discussed shortly.

(13) a. waŋ-*lɛ*   [waŋnɛ]   'comings and goings'
      kə-*lɛ*   [kəɾɛ]   'trade'
    b. hap-*li*   [hamni]   'reasonableness'
      co-*li*   [coɾi]   'cooking'
    c. pak-*lyək* [paŋnyək] 'power, drive'
      hap-*lyək* [hamnyək] 'joining forces'
      ma-*lyək*   [maɾyək] 'magical power'
      hwal-*lyək* [hwallyək] 'vitality'

Since /l/ changes into [n] word initially and after a consonant, Kim (1987) proposes that these two environments can be collapsed into one as syllable initial. However, Du-ɨm constraint does not apply to North Korean dialect and recent loanwords including English in South Korean. It does not apply even to a newly produced form of a native Korean pronominal, /ni-(ka)/ 'you (nominative)'. On the other hand, the post-consonantal /l/-/n/ alternation is observed with no exceptions in all areas of Korean phonology, from Sino-Korean to English loanwords and even to the actual nativization of loanwords in combination with native morphemes.

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[4] A syllable-final obstruent in Korean, when followed by a sonorant consonant in the next syllable, changes into a homorganic nasal.

In this paper, I will argue that the word-initial Du-im constraint should be treated differently from the /l/-/n/ alternation in the word-medial position, as was originally proposed by Kang and Lee (1997). The post-consonantal /l/-/n/ alternation should be understood as phrasal level phenomenon which applies across the board. The onset liquid constraint in (8b), which is repeated in (14a) for convenience, is not enough to take care of the post-consonantal alternation since it will permit a post-consonantal flap. Because neither a lateral nor a flap can occur after a consonant, I propose an additional constraint as in (14b).

(14) a. Onset liquid constraint (OLC): a liquid in onset cannot be a lateral. (8b)

$$*_\sigma[C$$
$$|$$
$$[+lat]$$

   b. Post-consonantal liquid constraint (PCLC): a liquid cannot occur if preceded by another consonant.

$$* \; C \quad C$$
$$|$$
$$/l/$$

If a liquid occurs syllable-initially, it should either surface as a flap when it is preceded by a vowel to avoid OLC or change into something else when preceded by another consonant. However, if the preceding consonant is not a lateral, the onset-initial liquid surfaces as an /n/. I agree with Kim (1987) and Lee (1995) in that the change of /l/ to [n] is very natural when the composition of their features is considered: /l/ and /n/ are the only coronal sonorant consonants in Korean. When faithfulness of the corresponding input and output is at stake, the minimal feature change is the natural result. Therefore, the optimal form violates a low-ranking IDENT constraint. A representative example of [l]-[n] alternation is illustrated in the following constraint tableau.

(15) / waŋ-lɛ/ → [waŋnɛ]

/ waŋ-lɛ/	OLC	PCLC	ID(app)	ID(lat)
a. waŋlɛ	*!			
b. waŋɾɛ		*!		*
☞c. waŋnɛ			*	*

The undominated onset constraint rules out the most faithful candidate in (15a). The candidate in (15b) has a legitimate onset, a flap, but it also fails because of the constraint ruling out *any* liquid after a consonant. The last candidate (15c) turns out optimal at the expense of violating lower ranked IDENT constraints. The ranking between the two IDENT

constraints is not still decisive, but IDENT(app) should at least be lower ranked than other undominated phonotactic constraints.

/l/ and /n/ in sequence also behave in the unique fashion in Korean. When a liquid and a nasal are juxtaposed word internally in Sino-Korean, it changes into an intervocalic geminate lateral. /l/-/n/ alternations above are documented in Sino-Korean vocabulary only. In native Korean, morpheme structure constraints already have taken effect in the lexicon and the /l/-/n/ combination does not occur word internally.

(16) a. an-lyək   [allyək]   'power of observation'
      b. kɨn-lyək   [kɨllyək]   'muscular power'
(17) a. pul-nɨŋ   [pullɨŋ]   'incapability'
      b. pʰal-nyən   [pʰallyən]   'eight years'
      c. pul-no   [pullo]   'not getting annoyed'

Non-existence of word internal /l/-/n/ clusters in Korean can be captured by the following phonotactic constraint.[5]

(18) Nasal-Liquid sequencing constraint
      *n l or *l n

In addition, to account for the fact that the above sequences are always resolved by turning into a geminate lateral, not a geminate nasal,[6] I suggest that the maintenance of liquidity or laterality is more important than that of nasality.[7] If we treat this with IDENT(feat) constraints, both /l/ to /n/ and /n/ to /l/ would violate the same sets of IDENT constraints, i.e., IDENT(lat) and IDENT(nas). I propose instead that the correspondence relation be extended from segments to features, which McCarthy and Prince (1995) said should be possible. I propose that MAX(lat) constraint dominates MAX(nas).

(19) MAX(lat) » MAX(nas)

Now consider the examples of the two opposite cases of /l/ and /n/ juxtaposition at the morpheme boundary.

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[5] One of the reviewers noted that the constraints in (18) are descriptive and that the first case is subsumed under PCLC. I absolutely agree with the reviewer. To mention only the latter case of the constraints, however, may lose the generalization of the constraints. The major role of the constraints should be understood as prohibiting a sequence of two coronal sonorants with distinct manner specifications.

[6] This is true word internally. Alternations at the phrasal level will be discussed in section 3.

[7] MAX(lat) constraint works under the present analysis that assumes a lateral as the underlying phoneme of Korean liquids. If one chooses an alternative underlying phoneme, small modifications on the constraints will be needed.

(20) /an-*lyək*/ → [allyək]

/an-*lyək*/	OLC	PCLC	*nl, *ln	MAX(lat)	MAX(nas)
a. anlyək	*!	*	*		
ɛb. allyək					*
c. annyək				*!	
d. anɾyək		*!	*	*	

   The phonotactic constraint against the /n/-/l/ sequences rules out the candidates in (20a) and (20d). These two candidates violate additional phonotactic constraints by retaining a liquid in the post-consonantal onset position. The remaining two candidates fare equally well with all phonotactic constraints discussed so far. According to the ranking in (19) between the two MAX(feat) constraint, however, the candidate with a geminate lateral wins over that with a geminate nasal, i.e., preserving laterality of the input is more important that preserving nasality.
   Let us now consider a case where the order of /l/-/n/ sequence is reversed.

(21) / pul-no /   → [pullo]

/ pul-no/	OLC	CLC	*nl,*ln	MAX(lat)	MAX(nas)
a. pulno			*!		
ɛb. pullo					*
c. punno				*!	
d. puɾɾo				*!	*

As before, the most faithful candidate in (21a) fatally violates the phonotactic constraint on the /l/-/n/ sequence. All remaining candidates have a geminate sonorant. The candidate with a geminate nasal fails by losing its input lateral feature. The candidate in (21d) with a geminate flap may not violate the coda constraint for the same reason that the optimal candidate in (21b) does not violate the onset constraint, i.e., by having a linked association. The optimal output is chosen when the two candidates are evaluated against MAX constraint on the feature [lateral].
   In this section, I have examined [l]-[ɾ]-[n] alternations in Korean, referring mostly to Sino-Korean vocabulary. To summarize the discussion, the ranking among the constraints proposed so far is given as follows:

(22) Constraint ranking for Korean
    CLC, OLC, PCLC
    *nl/*ln   » ID(app), MAX(lat) » MAX(nas)
    MAX(V), DEP(C)

All the proposed phonotactic constraints are undominated. Du-ɨm constraint, if active, will be also included among the undominated

constraints. It will be shown below that Du-ɨm constraint is no longer an active constraint in Korean phonology. In the next section, I will examine [l]-[ɾ]-[n] alternations in English loanword phonology.

3. Liquid Alternations in English Loanword Phonology

In loanword phonology, the adaptation process and the actual nativization process are two separate processes that should be treated accordingly. I will first discuss the adaptation process of English liquids into Korean lexicon. At the stage of loanword adaptation, the discussion will be focused on [l] (or [ll]) and [ɾ] alternation. It will be argued that the incoming loanwords go through the adaptation process to make the representations fit the Korean syllable structure and phonemic inventories, not the actual Korean pronunciations. The adapted loanwords then will then be stored in the lexicon in phonemic representations. Then I will shift the focus onto the discussion of the actual nativization of English loanwords in combination with native and Sino-Korean vocabulary and show that loanwords stored in the lexicon are not distinguished from other words in the nativization.

3.1. The Loanword Adaptation Process

Silverman (1992) proposes two levels for loanword phonology where he discusses only the process of adaptation. At the first level, the perceptual level, the input signals of the source language are substituted as the native segments. Perceived segments may then undergo phonological operations at the operative level, the second level, triggered by native phonotactic constraints.

It will be argued in this paper that the two levels in Silverman's model deal with part of loanword phonology, i.e., the adaptation process. The output in his model will then be interpreted as the input to the native language lexicon, i.e., the underlying representation of the loanword. It will be proposed that what happens in the adaptation process to the native lexicon is mainly the interpretation or transformation of the source sounds to the native phonemes and the necessary modifications to fit the native syllable structure by inserting a neutral vowel of the native language whenever needed.[8] Vowel epenthesis never happens outside the loanword adaptation process in Korean, which supports the present analysis treating the adaptation and nativization processes separately.

Let us consider how English liquids in loanwords are adapted to enter

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[8] Though interesting, I will not discuss vowel insertion phenomena in loanword adaptation in this paper since it is not relevant to the topic of the paper.

Korean lexicon according to their phonological environments.[9] First, I will consider word initial liquids in English loanwords. In a loanword list, underlying representations for English loans that are assumed in this paper to be stored in Korean lexicon are provided in the first column between slashes, and the actual pronunciations of loanwords in the middle column.

(23) a. /lɛmpʰɨ/   [ɾɛmpʰɨ]   'lamp'
    b. /lait/   [ɾait]   'light'
    c. /lɛmpʰɨ/   [ɾɛmpʰɨ]   'ramp'
    d. /leil/   [ɾeil]   'rail'

Both English /l/ and /r/ change to a flap, an allophone of /l/ in Korean, in the actual pronunciations. This is a natural consequence of OLC proposed in (8b) for Korean, which states that a lateral cannot occur as an only member of an onset. Du-ɨm constraint, which specifically bans word-initial /l/ in Sino-Korean (and in native Korean as a morpheme structure constraint), does not apply to English loanwords. A subset of Du-ɨm constraint banning /n/ before /i/ or /y/ also doesn't apply. A word initial /n/ always stays the same. In Sino-Korean, a word-initial liquid deleted before /i/ as in [ibal] from /ɾibal/, but in English loanword, it remains after a slight modification into a flap as in [ɾibon] in (24c).

(24) a. /nikʰel/   [nikʰel]   'nickel'
    b. /nyusɨ/   [nyusɨ]   'news'
    c. /lipon/   [ɾibon]   'ribbon'

It is interesting to note that Du-ɨm constraint has not affected North Korean dialect either. In North Korean, a word initial liquid in Sino-Korean words surfaces as a flap as is a word-medial onset liquid in South Korean. A word initial nasal /n/ before /i, y/ does not go through any modifications and surfaces as [n].

(25) North Korean dialect
    a. /lɛ-il/   [ɾɛil]   'tomorrow'
    b. /li-pal/   [ɾibal]   'haircut'
    c. /nyə-ca/   [nyəja]   'woman'

It may not be too surprising to note that we have a counter-example to Du-ɨm constraint in the recent development of native Korean vocabulary. Deletion of a nasal /n/ before /i/ or /y/ is not observed in a newly formed pronominal /ni-(ka)/ 'you (nominative)', which is an altered form of /ne-(ka)/. In modern Korean, /ɛ/ and /e/ have been merged in most dialects

neutralizing the contrast in many words which were previously distinguished by the different vowels as in (26).

(26) a. /nɛ-(ka)/ 'I'   /ne-(ka)/ 'you'   cf. /ni-(ka)/
     b. /kɛ/   'dog'   /ke/   'crab'
     c. /pɛ/   'pear'   /pe/   'hemp cloth'

Among many other cases of neutralization, a critical problem occurs with the two personal pronouns, the confusion of which can result in serious problems in communication. Therefore, in many dialects of modern Korean, /ne-(ka)/ has been substituted by /ni-(ka)/ via vowel raising. If Du-ɨm constraint had still been active in Korean, /ni-(ka)/ would have changed into */i-(ka)/, but this is not the case. So I claim that Du-ɨm constraint is no longer an active constraint in Korean phonology.[10]

I argue instead that Du-ɨm constraint was a native morpheme structure constraint that was still active when Korean was borrowing the massive quantity of Sino-Korean vocabulary based on the pronunciation of the Chinese letters. It is assumed that those Sino-Korean words beginning with a liquid underwent changes to fit the Korean morpheme structure condition and have been lexicalized as such.

On the other hand, it is assumed that English loanwords beginning with a liquid, both [l] and [r], are stored into the Korean lexicon with a Korean liquid phoneme /l/, e.g., /lipon/ for 'ribbon', since Du-ɨm constraint was not active by then. Therefore, at the stage of the actual nativization of those loanwords in Korean phonology, Sino-Korean vocabulary will not go through any additional changes whereas in English loanwords the phonemic liquid will be changed into a flap, which is a natural consequence of the general constraint on syllable initial liquid, OLC in (8b). I will illustrate the contrast between the Sino-Korean and English loanword adaptation processes to the Korean lexicon in the tableaux below.

(27) Sino-Korean: Du-ɨm constraint » IDENT(approximant)

(28) /lo-toŋ/ → /no-toŋ/

/lo-toŋ/	Du-ɨm	ID(app)
a. /lo-toŋ/	*!	
☞b. /no-toŋ/		*

(29) English loan: IDENT(approximant) » Du-ɨm constraint

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[10] A reviewer noted that it is an overgeneralization to argue, on the basis of a piece of evidence in the pronominal system, that Du-ɨm constraint is no longer an active constraint in modern Korean. However, the case of the newly developing pronominal form can be a strong argument for the proposal in that it adds support to the more prevailing phenomenon of the violation of the constraints in all the recent loanwords.

(30) /libon/ → /lipon/

/lipon/	ID(app)	Du-im
a. /lipon/		*
b. /nipon/	*!	*
c. /ipon/	*!	

The crucial difference in the adaptation processes of Sino-Korean and English loanwords is the relative ranking of Du-im constraint against a faithfulness constraint on the input and output. As in Ito and Mester's (1995) model on Japanese lexicon, Korean also shows the contrast between the nativized loans and the more recent non-nativized loans. In the case of nativized loans, Sino-Korean, the native phonotactic constraint such as Du-im constraint is higher ranked than a relevant faithfulness constraint. In contrast, more recent loans such as English loans maintain faithfulness constraint in the higher rank.

Within an Optimality theoretic framework, I argue that Du-im constraint is the lowest ranked constraint in modern Korean phonology with no active influences. It is argued that the loanword output obtained through the adaptation processes in accordance with different constraint rankings above is stored in the Korean lexicon. Therefore, the underlying or lexicalized representation for /lo-toŋ/ in the Korean lexicon will be /no-toŋ/, not /lo-toŋ/ or /ɾo-toŋ/. The underlying representation for the English loanword for 'ribbon' will be /lipon/. Other detailed morpho-phonological and phonetic alternations will be taken care of in Korean morpho-phonology with interactions with native and Sino-Korean vocabulary. I will provide supporting evidence for this proposal below when the actual nativization process of loanword phonology is discussed.

Let us now move on to the treatment of word medial liquids in English loanwords. /l/ and /r/ contrast in the middle of a word in English, and the contrast is maintained in most loanwords by being replaced by /ll/ and /l/ respectively.[11]

(31) a. / kʰollela /   [kʰolleɾa]   'cholera'
     b. / kʰalloli /   [kʰalloɾi]   'calorie'
     c. / kʰəllə /   [kʰəllə]   'color'
     d. / milə /   [miɾə]   'mirror'

In the word medial position, the phonemic difference between /l/ and /r/ in English should be perceived and maintained in Korean, where liquids

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[11] Alternating forms are sometimes found for English loans with medial liquids, e.g., [tʰel.le.bi.jən]/[tʰe.ɾe.bi] 'television'; [sɛllədɨ]/[saɾada] 'salad'. Substituting both /l/ and /r/ in English with a singleton liquid resulting in a flap is the influence of Japanese, which has no phonemic distinction in liquid in any positions of a word (Tranter 1997). Recent loans Korean borrowed directly from English all distinguish word medial /l/ from /r/.

are in allophonic relationship. It may be evidence that in the perceptual level in Silverman's model acoustic signals that do not have phonemic distinctions in the native language should be somehow perceived distinctively. A word medial /l/ is perceived as a geminate liquid /ll/, and /r/ as a singleton liquid /l/ when borrowed into Korean. When the loanwords are actually pronounced in Korean phonology, a geminate liquid will be realized as a coda [l] immediately followed by an onset [l] in the next syllable whereas a singleton liquid will be realized as an onset [ɾ].

   Let us now consider /l/ and /r/ in the clusters. Korean does not permit /C+liquid/ clusters in the onset and English loans with such clusters are usually resyllabified by means of vowel insertion.

   (32) a. / pɨllɛk /   [pɨllɛk]   'black'
        b. / pɨlokʰə /   [pɨɾokʰə]   'broker'

Once resyllabification applies, the situation becomes identical to the original word medial intervocalic liquids: /l/ as a geminate liquid and /r/ as a singleton liquid which will eventually surface as a flap.

   Finally, various proposals have been made regarding the treatment of a post-vocalic /r/ in English loans (Hirano 1994, Lee 1995, Kang 1996 among others). A post-vocalic /l/ is uniformed interpreted as coda, [l] being one of the seven legitimate consonants that can occur in coda.

   (33) a. / pətʰə /   [pətʰə]   'butter'
        b. / seil /   [seil]   'sale'

In this paper, I will treat a vowel and /r/ sequence as a case of rhotacized, or /r/-colored vowel in accordance with Ladefoged (1982) that was mentioned above. An /r/-colored vowel will then be substituted with just one vowel in loanwords.

   I'd like to note that there are alternations regarding post-vocalic /r/ and that there is a recent tendency to substitute post-vocalic /r/ with a singleton liquid which will then surface as coda as illustrated below.[12]

   (34) a. [kʰoɾɨset] / [kʰolset]   'corset'
        b. [hoɾɨmon] / [holmon] 'hormone'

The maintenance of post-vocalic /r/ in English seems to be a matter of its perceptual salience. When it is perceived as /r/-colored vowel, no independent consonant for /r/ will be matched. When it is more strongly perceived, probably due to the recent tendency for Korean to borrow

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[12] I think that the pronunciations in the left column represent Japanese influence and those in the right more recent tendency. Children's preference for realizing English post-vocalic /r/ as Korean /l/ reflects this tendency: [kʰaɾ-i] for 'car +nom suffix' (an example obtained from the author's son).

words directly from American English, it will be matched to a singleton liquid. The liquid will surface either as a flap or a lateral depending on its position in the resulting syllable.

To summarize, I have argued that Silverman's model accounts for only half of loanword phonology: the adaptation process. I have claimed that in the adaptation process occur relevant sound substitutions to the native phonemes and necessary syllabifications to fit the native syllable structure. The loanword output that has gone through the adaptation process is stored in the lexicon phonemically. Supporting evidence for this proposal, i.e., phonemic or abstract lexicalization of loanwords, can be found from the alternation between /t/ and /s/ in English loanwords ending in an unreleased /t/, e.g., [ɾobot] 'robot' but [ɾobos-i] with a Korean nominative suffixation. The alternation between /t/ and /s/ can be accounted for by assuming that those words are stored in the lexicon as words ending with /s/, just like other native Korean vocabulary with /s/ ending, e.g., /bəs/ 'friend' (Sohn 1999, Kang 1999). Below I will examine the nativization process of loanwords contrasting Sino-Korean and English loans when they are used in combination with native vocabulary in Korean phonology.

3.2. The Loanword Nativization Process

The analysis that loanwords are stored in phonemic forms in the native lexicon is well supported by the fact that loanwords participate in /l/-/ɾ/-/n/ alternations in compounds and affixed forms containing other loans and native words. Consider the following examples of the native Korean and English loan compounding.

(35) a. /kʰo-lain/   [kʰoɾain]   'nose line'
     b. /əlgul-lain/   [əlgullain]   'face line'

The liquid in the English loan, /lain/, surfaces as either a flap or a lateral depending on its context. The phonological conditioning for this allomorphy is identical to that illustrated for the native Korean (and Sino-Korean) in section 2, i.e., a flap inter-vocalically and a lateral as part of a geminate lateral. In the following tableaux, allophonic variations of /l/ in an English loan are illustrated using the proposed constraint ranking above.

(36) CLC, OLC, PCLC
     *nl/*ln   » ID(app), MAX(lat) » MAX(nas) » Du-ɨm C.
     MAX(V), DEP(C)

(37) /kʰo-lain/   → [kʰoɾain]

/kʰo-lain/	OLC	DEP(C)	ID(app)	MAX(lat)
a. kʰolain	*!			
ɛb. kʰoɾain				*
c. kʰonain			*	*
d. kʰollain		*!		

(38) /əlgul-lain/ → [əlgullain]

/əlgul-lain /	PCLC	*nl / *ln
ɛa. əlgullain		
b. əlgulɾain	*!	
c. əlgulnain		*!

Once the underlying representation for the English loanword is assumed as
/lain/, it is the result of the proposed constraint ranking that /lain/ surfaces
as [ɾain] when preceded by a word ending with a vowel and as [lain] when
preceded by a word ending with a lateral. In the latter case, a geminate
lateral surfaces from a lateral cluster as a result of the OCP triggered
merger of the two lateral liquid consonants.

When the same English loanword is compounded with a Korean word
ending in a consonant other than a lateral, the expected alternation occurs,
i.e., /l/ becomes [n].

(39) a. /s'aŋ-lain/   [s'aŋnain]   'double line'
     b. /kyəp-lain/   [kyəmnain]   'double line'

When an /l/ initial loanword is compounded with another ending in a
voiceless stop, however, we see examples of alternating forms.

(40) a. / kʰətʰɨ-lain/   [kʰətʰɨɾain]   'cutline'
     b. / has-lain/   [hannain]   'hotline'[13]
     c. /lip-lain/   [ɾimnain]   'lip line'
     d. /nekʰɨ-lain/   [nekʰɨɾain]   'neck line'

Alternating forms with final voiceless stops result from alternating input
forms in the loanword adaptation process (Lee et al 1999). Words ending
in a voiceless stop have been adopted into Korean lexicon either with an
epenthetic vowel (if perceived as a released stop) or without it (if
perceived as an unreleased stop). Once epenthesis applies to a loanword to
preserve the release feature, the word will be stored as such in the lexicon
and behave in the same way as other vowel final Korean words in the
lexicon. On the other hand, when the word is lexicalized with a coda

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[13] As suggested above, a word ending with an unreleased /t/ as in (40b) is assumed to be
lexicalized as a word ending in /s/.

consonant /p, t-s, k/, it will cause nasalization on the following liquid and change itself to a homorganic nasal like other stop final Korean morphemes. The following tableau will show how an optimal output is chosen for /lip-lain/ in (40c):

(41) /lip-lain/ → [limnain]¹⁴

/ lip-lain/	OLC	PCLC	MAX(C)	ID(app)	Du-im
a. limlain	*!*	*			*
b. ɾimɾain		*!			
☞c. ɾimnain				*	*
d. nimnain				*!*	*
e. imnain			*!	*	

The optimal output in (41c) is chosen in the same way as that for a Sino-Korean word, [hamnyək] from /hap-lyək/ in (13c). The more faithful candidate in (41a) and (41b) violate an undominated phonotactic constraint preventing [l] or [ɾ] from occurring after a consonant. (41c) is chosen optimal because it satisfies all the undominated constraints. (41d) also satisfies every undominated contraint, but it commits an additional violation on the constraint requiring a liquid to remain a liquid. Both (41c) and (41d) violate a once active phonotactic constraint, Du-im constraint. Each violates a component of Du-im constraint which consists of two parts, i.e., no word initial /l/ and no word initial /n/ before /i, y/. However, violating the constraint is not fatal since it is ranked in the lowest stratum. The last candidate in (41e) satisfies Du-im constraint by deleting /l/ before /i/, which ends up violating a higher ranked faithfulness constraint forbidding a consonant to delete.

In recent years there is a tendency for the voiceless stop final English loanwords to be adopted with unreleased coda stops. This tendency has been accelerated by the recent spelling reform for loanwords preferring less number of syllables. This assumed, it will not be surprising to document alternating forms of English loans in (40a) and (40d), namely [kʰənnain] from / kʰəs-lain/ and [neŋnain] from /nek-lain/. It is interesting to note that this tendency of liquid nasalization and the concomitant nasalization of the preceding obstruent is prevalent in the transfer errors in pronunciation made by Korean learners learning English as a second or foreign language. For instance, the English word 'application' is used as [ɛpʰ*ill*ikʰeišən] when adopted as a loanword, but the same word may be mispronounced [ɛ*mn*ikʰeišən] when considered as pure English.

The case of /n/-/l/ cluster behaves in the same way as that in Korean: the cluster turns into a geminate lateral.   Recall that in Sino-Korean

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¹⁴ The change of /p/ to [m] mentioned in the footnote 4 above is not considered in this tableau. To account for that, another phonotactic constraint such as *[-son][+son] will have to be ranked higher than a faithfulness constraint such as IDENT(son).

lateralization applies irrespective of the order of /n/ and /l/ as repeated in (43).

(42) /on-lain/   [ollain]   'on-line'
(43) a. /an-lyək/   [allyəɾ]   'power of observation'
    b. /pul-niŋ/   [pulliŋ]   'incapability'

Lateralization in English loan results from the identical constraint ranking that was proposed for Korean.

(44) /on-lain/ → [ollain]

/on-lain /	OLC	PCLC	*nl, *ln	MAX(lat)	MAX(nas)
a. onlain	*!	*	*		
ɛb. ollain					*
c. onnain				*!	
d. onɾain		*!	*	*	

Some speakers, however, prefer an alternative pronunciation for the above loanword, i.e., [onnain]. This should not be treated by a handy repair strategy that is ordinarily invoked to account for optionality, i.e., reranking of the two MAX(feat) constraints. Instead, I claim that the alternative form is only reflecting a more extensive progressive assimilation between /n/ and /l/ that occurs at the phrasal level in Korean. Consider the following alternations:

(45) a. /kʰal-nal/   [kʰallal]   'knife blade'
    b. /tal-nala/   [tallaɾa]   'moon world'
    c. /tol-noli/   [tolloɾI]   'playing with stones'

(46) a. /sinmun-lo/   [sinmunno]   'Sinmun street'
    b. /ɨmun-lon/   [ɨmunnon]   'phonology'

It was proposed in Kang and Lee (1997) that there should be two lateralization rules. Lateralization of a nasal adjacent to a lateral always applies stem (or word) internally whose effect is manifested in Sino-Korean vocabulary (See the data in (16) and (17) above.). Progressive lateralization, on the other hand, was proposed to be a phrase internal rule that applies whenever its environment is met.

In this paper, I suggest that the progressive lateralization be modified and extended to include progressive nasalization illustrated in the data in (46). What is common in the apparently contrasting alternations in (45) and (46) is a preservation of the manner feature of the sonorant sounds, /l/

120   Borim Lee

or /n/, at the prosodic word final position. This analysis is well supported
by the pronunciations of the following hybrids of native and loan words.

(47) a. /pal-neil/   [palleil]   'toe nail'
     b. /pal-lain/   [pallain]   'foot line'
(48) a. /son-neil/   [sonneil]   'hand nail'
     b. /son-lain/   [sonnain]   'hand line'
     c. /sin-lamyən/ [sinnamyən]   (a brand name for instant noodle)

To account for the progressive assimilation at the phrasal level, I suggest
the following constraint ensuring the preservation of the manner feature of
the sonorant at the rightmost prosodic word boundary among other
undominated constraints. A tableau illustrating the function of the new
constraint is provided below, followed by another tableau for a Sino-
Korean word repeated from (20) with the new constraint in (49) added.

(49) IDENT([sonorant manner]$_{pw}$)

(50) /sin-lamyən/ → [sinnamyən]

/sin)$_{pw}$-lamyən/	OLC	PCLC	ID([man]$_{pw}$)	*nl, *ln	M(lat)	M(nas)
a. sinlamyən	*!	*		*		
b. sillamyən			*!			*
☞c. sinnamyən					*	
d. sinɾamyən		*!		*	*	

(51) /an-lyək/ → [allyək]

/an-lyək/	OLC	PCLC	ID([man]$_{pw}$)	*nl,*ln	M(lat)	M(nas)
a. anlyək	*!	*		*		
☞b. allyək						*
c. annyək					*!	
d. anɾyək		*!		*	*	

The seemingly identical input clusters of /n/ and /l/ are resolved in the
exactly opposite manners due to the distinct characterization of the
boundaries. Since the two prosodic words are concatenated in (50), the
IDENT constraint in (49) is at work preventing a candidate with a
geminate lateral from being chosen optimal. The word in (51), on the other
hand, is a prosodic word composed of two bound Sino-Korean morphemes,
where the constraint applying to prosodic word boundary does not apply.
The crucial decision in this case is made by the two IDENT manner

constraints: since MAX(lat) dominates MAX(nas), the candidate with a geminate lateral is chosen optimal.[15]

The above analysis works very nicely in accounting for the alternate pronunciations of the words containing /l/-/n/ clusters that are documented by a small number of speakers. The prosodic word in this analysis refers to a constituent that is considered to have its own content meaning by the speakers. Since the speakers may vary in their intuition on whether a specific constituent is a prosodic word or not, depending on their intuition, alternate forms can surface. For example, someone who considers /ɨmun-lon/ in (46b) to be one prosodic word will pronounce it [ɨmullon], which is indeed documented sporadically.[16] A parallel explanation can be provided about an alternate surface form for an English loanword, [onnain]. Speakers who prefer [onnain] to [ollain] seem to regard 'on' as an independent prosodic word. This analysis also accounts for an additional fact. A speaker can choose to pause between prosodic words. In the case of /sin-lamyən/ illustrated in (50), therefore, the candidate in (50d) will be chosen as optimal if a speaker makes a sufficient pause between the two prosodic words since the constraint prohibiting a liquid and a nasal cluster will not apply.

Before I conclude this paper, let me discuss Du-ɨm constraint and the lexical representation of the relevant Sino-Korean vocabulary such as [nodoŋ]. Traditionally, it has been assumed that the underlying representation for the word is /lo-toŋ/, where Du-ɨm constraint triggers the nasalization of the initial liquid. In this paper, I have argued that Du-ɨm constraint has no effect in modern Korean phonology due to its lowest position in the constraint ranking and that it was only active in the adaptation process for Sino-Korean vocabulary. There is no evidence against the claim that the word [nodoŋ] is stored in the lexicon as /no-toŋ/ not as /lo-toŋ/. This word behaves in exactly same way as native words beginning with a coronal nasal.

(52) a. /no-toŋ/   [nodoŋ]   'labor'
     b. /mak-no-toŋ/   [maŋnodoŋ] 'rough work'
     c. /pal-no-toŋ/   [pallodoŋ]   'foot labor'

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[15] The domination of MAX(lat) over MAX(nas) in Korean phonology is supported by transfer errors made by Korean learners of English. I found that in the analysis of a set of experiments (done by Hee-Chun Lee for his forthcoming dissertation) on the pronunciations of /n/-/l/ clusters in English that the subjects (Korean high school students) made a significantly higher percentage of errors involving [-ll-] from both /-n#l-/ and /-l#n-/ clusters given in English compounds or phrases. In a follow-up experiment done after a period of intensive training on the pronunciation of the clusters, it was found that /-ll-/ errors were more difficult to be corrected than /-nn-/ errors. I argue that these reflect the relative ranking of the two constraints on sonorant manner: MAX(lat) » MAX(nas).

[16] The geminate lateral pronunciation of the name of a mountain pass, [tɛgwallyəŋ] from an underlying form /tɛkwan-lyəŋ/, can be explained similarly. Although /-lyəŋ/ is a Sino-Korean suffix meaning a mountain pass, /tɛkwan/ is never used independently of this suffix. /tɛkwan-lyəŋ/ is regarded as one prosodic word and therefore [tɛgwallyəŋ].

d. /son-no-toŋ/   [sonnodoŋ]   'hand labor'

(53) a. /nolɛ/   [norɛ]   'song'
    b. /mak-nolɛ/   [maŋnorɛ]   'rough song'
    c. /pyəl-nolɛ/   [pyəllorɛ]   'star song'
    d. /son-nolɛ/   [sonnorɛ]   'hand song'

Without any evidence to the contrary, an input form most transparent to the optimal output should be chosen as underlying form in terms of lexicon optimization (Prince and Smolensky 1993:192).

If a more abstract form such as /lo-toŋ/ was chosen as underlying, additional complication might arise. Let us consider a case where a prefix /mu-/ meaning 'no ~' is attached to the relevant words.

(54) a. /mu-no-toŋ/   [munodoŋ]   'no work'
    (/mu-lo-toŋ/   *[murodoŋ])
    b. /mu-nolɛ/   [munorɛ]   'no song'
    c. /mu-leil/   [mureil]   'no rail'

If one wants to maintain the underlying form with liquid initial Sino-Korean vocabulary as that in parentheses in (54a), at least two additional assumptions should be made to explain the apparent effect of Du-ɨm constraint in the word medial inter-vocalic position in (54a). First, it should be assumed that Du-ɨm constraint is still an active constraint in modern Korean phonology that applies only to Sino-Korean since it does not apply even to newly developing native vocabulary. Second, it should also be assumed that what comes after the prefix /mu-/ is a constituent at the beginning of which Du-ɨm constraint applies. Kang and Lee (1997) proposed that /mu-/ behaves like a prefix which is subcategorized for prosodic word, i.e., what comes after /mu-/ is a prosodic word and therefore Du-ɨm constraint applies to /l/ following the prefix. The current analysis claiming that Du-ɨm constraint only applied actively during the adaptation process in the loanword phonology involves no further complications.

The analysis in Kang and Lee (1997) may entail another problem: this prefix /mu-/ behaves differently from the other /mu-/ in a disyllabic Sino-Korean word such as [munyəm] derived from /mu-nyəm/ meaning 'no thoughts'. In this example, 'nyəm' is not a free morpheme and (the second constituent of) Du-ɨm constraint has not applied to this. Although the current analysis is free from complications with Du-ɨm constraint, it still has to recognize the existence of Sino-Korean monosyllabic bound morphemes in the lexicon. Those morphemes such as /mu/ 'no', /lo/ 'street', and /lyək/ 'ability' participate in modern Korean morphology still very productively. They can even make new words combining with

English loans, e.g., [mukʰapʰein] 'no caffeine', [teheɾanno] 'Teheran street', and [ɾidɨɾyək] 'leadership'.

4. Conclusion

I have shown in this paper that loanword phonology should be discussed in two separate processes: the adaptation process and the actual nativization process where loanwords are used in combination with native and other loanword vocabulary in the lexicon. It was argued that input words from foreign languages are adapted to the native lexicon by an evaluation through a specific constraint ranking for the loanwords. During the period of Sino-Korean adaptation, Du-im constraint had taken an undominated position in the constraint ranking. It was assumed therefore that the Sino-Korean vocabulary had been stored in the lexicon with no violations against the constraint. On the other hand, English loanwords that entered the Korean lexicon more recently have not been affected by the constraint. This analysis has been supported by a variety of phenomena in the actual nativization process of loanword phonology where the data were drawn from all possible combinations of native and Sino-Korean vocabulary as well as English loans. It was concluded that Du-im constraint is no longer an active constraint in Korean phonology and that proposing a relevant constraint ranking within the framework of Optimality Theory provides a unified account of alternations among /l/, /ɾ/ and /n/ in Korean phonology.

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