The behavior of velar nasal and syllabification*

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Chung, Chin Wan. 2001. The behavior of velar nasal and syllabification. *Studies in Phonetics, Phonology and Morphology* 7.1, 177-189. This study provides a Correspondence-Theoretic analysis for the behavior of velar nasal [ŋ], which normally occurs after the alveolar nasal /n/ is inserted, a variant realization in Korean, with respect to syllabification and related phenomena in Korean and Japanese. Normally syllable internal consonants are syllabified as the onset of the following syllable, but the velar nasal does not follow this normal syllabification. We analyze this peculiar behavior by using Onset Condition constraint plus other relevant constraints. The velar nasal also shows other different acts than the other consonants in that it shows intraspeaker variation and interdialectal variation between SD and KD. These are rather readily analyzed by reranking the constraints offered in this analysis. The analysis of Korean case may be extended to Japanese case where it shows variation between young and old Japanese speakers regarding [g] and [ŋ] variation. This paper illuminates the specific behaviors of the velar nasal in syllabification in general**.(Hannam University)**

Keywords: Syllabification, velar nasal, variation, Correspondence Theory

1. Introduction

Across languages including Korean, a string $C_1V_1C_2V_2C_3$ is generally syllabified as $C_1V_1.C_2V_2C_3$ but not as $C_1V_1C_2.V_2C_3$.[1] This is largely due to the fact that languages prefer a syllable with an onset, which is explained by Itô (1986) as a Universal Core Syllable Condition or by Prince and Smolenky (1993) as an optimality-theoretic constraint 'Onset'. In Korean, a $C_1V_1C_2V_2C_3$ string is generally syllabified as $C_1V_1.C_2V_2C_3$. However,

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[1] In a language such as Barra Gaelic (Bosch 1991, originally due to BorgstrØm 1937), every intervocalic consonant is syllabified as coda of the preceding syllable, which is opposite to what many languages syllabify in such an environment. Syllabification of an intervocalic consonant in Barra Gaelic is shown by the following data. In the following data the mid back round vowel (open 'o') is indicated by 'ō'.

bōd.ōx	'old man'
ar.an	'bread'
faL.u	'empty'

when the velar nasal /ŋ/ is C_2, it is not syllabified as the onset of the second syllable but rather as the coda of the preceding syllable.

The main purpose of this paper is twofold. On the one hand, we investigate the behavior of the velar nasal with respect to syllabification in syllable coda position. On the other hand, we also investigate the variation among speakers regarding strategies to avoid an onsetless syllable over a morpheme boundary in which the second morpheme begins with the glide /y/ in Korean, as well as the variation between Seoul dialect (SD) and Kyungsang dialect (KD) with respect to ways to deal with the velar nasal in the syllable coda position. We provide an analysis within Optimality Theory (Prince and Smolensky 1993), particularly the more enhanced version called Correspondence Theory (McCarthy and Prince 1995). This paper tries to shed more light on various cases of syllabification in Korean.

The organization of this paper is as follows. In section 2, we present the data. In section 3, we propose optimality-theoretic constraints and their interaction and provide an analysis based on the constraints and their ranking. Finally, we sum up the paper in section 4.

2. Data

In this section we present the data. First we present data for normal syllabification, syllabification involving the velar nasal, syllabification over a morpheme boundary when the second morpheme begins with the glide /y/and the high front vowel /i/, and the data for variation between SD and KD.

The data for normal syllabification in Korean are given in (1) in which a $C_1V_1C_2V_2C_3$ string is syllabified as $C_1V_1.C_2V_2C_3$. The data are from M-S. Kim et al. (1997). In (1), we indicate a boundary by a dot between syllables but not the edges of the syllable. In (1), barred-i is indicated by 'ï'.

(1) Normal syllabification

a. /kako/	→	[ka.go]	'resolution'
b. /kani/	→	[ka.ni]	'simplicity'
c. /kat^{h}i/	→	[ka.c^{h}i]	'together'[2]
d. /talin/	→	[ta.rin]	'master'
e. /camos/	→	[ca.mot]	'pajamas'
f. /c∂py∂ŋ/	→	[c∂.by∂ŋ]	'butterfly stroke'
g. /kucïnil/	→	[ku.cïn.nil]	'an untoward event'

[2] In Korean, the coronal stop /t/ is typically palatalized when it is followed by the high front vowel /i/ over a syllable boundary.

As seen in (1), Korean prefers a syllable with an onset to an onsetless syllable. However, when C_2 is the velar nasal, it is not syllabified as onset of the second syllable, but is syllabified as coda of the preceding syllable as shown by the data given in (2).

(2) Syllabification involving the velar nasal

a. /saŋo/	→	[sa ŋ.o]	*[sa.ŋo]	'morning'
b. /mɔ̂ŋe/	→	[mɔ̂ŋ.e]	*[mɔ̂.ŋe]	'a yoke'
c. /kaŋaci/	→	[kaŋ.a.ci]	*[ka.ŋa.ci]	'a puppy'
d. /cuŋyo/	→	[cuŋ.yo]	*[cu.ŋyo]	'importance'
e. /toŋan/	→	[toŋ.an]	*[to.ŋan]	'an interval'
f. /toŋyo/	→	[toŋ.yo]	*[to.ŋyo]	'a children's song'
g. /noŋɔ̂p/	→	[noŋ.ɔ̂p]	*[no.ŋɔ̂p]	'farming'
h. /paŋul/	→	[paŋ.ul]	*[pa.ŋul]	'a small bell'

The velar nasal is not syllabified as onset of the second syllable because it is not a possible onset constituent in Korean. This could be explained by an onset condition prohibiting the occurrence of the velar nasal as an onset constituent.

In another case of syllabification in Korean, when a morpheme ending with a velar stop /k/ is followed by a morpheme beginning with a glide /y/, there are two possible output forms. One possible form is to syllabify the velar stop /k/ as onset of the second syllable (morpheme) through normal syllabification. The other possible form is to insert an alveolar nasal [n] before the glide /y/ and the high front vowel /i/. The inserted [n], in turn, triggers the alternation of /k/ to [ŋ], which is enhanced by syllable contact (Vennemann 1988, Davis 1998, Davis and Shin 1999) prohibiting rising sonority over a syllable boundary. This is shown by the data in (3). In (3), the morpheme boundary is indicated by '+'.

(3) Syllabification: variation among speakers[3]

a. /sæk +yuli/	→	[sæ.gyu.ri] or [sæŋ.nyu.ri]	'colored glass'
b. /puɔ̂k^h	→	[pu.ɔ̂.gil]	'kitchen

[3]We view that the [n] insertion occurs over a morpheme boundary in compounding both in native Korean and Sino-Korean words. However, it does not occur in monomorphemic words as in following words:

/hwakin/	[hwa.gin] *[hwaŋ.nin]	'confirmation'
/sɔ̂kyu/	[sɔ̂.gyu] *[sɔ̂ŋ.nyu]	'petroleum'
/kukyɔ̂ŋ/	[ku.gyɔ̂ŋ] *[kuŋ.nyɔ̂ŋ]	'state-run'
/tokil/	[do.gil] *[doŋ.nil]	'German'
/mokyok/	[mo.gyok] *[moŋ.nyok]	'bath'

However, in monomorpemic word in Korean ideophones the base form /yoŋyoŋ/ 'teasing' is realized [yoŋ.yoŋ] and [yoŋ.nyoŋ].

+il/		or [pu.∂ŋ.nil]	work’
c. /hwesæk +y∂nki/	→	[hwe.sæ.gy∂n.gi] or [hwe.sæŋ.ny∂n.gi]	‘gray smoke’
d. /hankuk +y∂ŋhwa/	→	[han.gu.gy∂ŋ.hwa] or [han.guŋ.ny∂ŋ.hwa]	‘Korean movie’

Furthermore, there is variation between SD and KD with respect to strategies used for the velar nasal in the syllable coda position. In SD, the velar nasal remains in the syllable coda tolerating an onsetless syllable; it also triggers nasalization of neighboring vowels. On the other hand, in KD the velar nasal in syllable coda position is deleted, but the neighboring vowels are still nasalized. The data for different strategies between SD and KD are given in (4). In (4), nasalization of an onglide /w/ is indicated by ‘ŵ’.

(4) Variation between SD and KD[4]

Input		SD	KD	Gloss
a. /talp^{h}eŋi/	→	[tal.p^{h}ẽŋ.ĩ]	[tal.pẽ.ĩ]	‘snail’
b. /paŋ+i/	→	[pãŋ.ĩ]	[pẽ.ĩ]	‘room+Nom.Marker’
c. /yoŋwaŋ/	→	[yõŋ.ŵãŋ]	[yõ. ŵãŋ]	‘king of sea’
d. /toŋyaŋ/	→	[tõŋ.ỹãŋ]	[tõ.ỹãŋ]	‘east’

In the next section, we will analyze the different data with respect to syllabification in Korean within the framework of Correspondence Theory (McCarthy and Prince 1995).

3. Analysis: constraints and their interaction

In this section, we first discuss the normal syllabification of Korean where C_2 of a $C_1V_1C_2V_2C_3$ string is syllabified as the onset of the second syllable. Since in normal syllabification every segment in the input is faithfully realized in the output, Max-Seg, which requires a perfect corresponding relation between the input and the output, is ranked high. In normal syllabification, not only is deletion banned but any insertion is also highly prohibited. This is regulated by Dep-IO, which militates against insertion of any segment in the output.

While deletion and insertion of segmental content are controlled by faithfulness constraints, the actual syllabification of C_2 of a $C_1V_1C_2V_2C_3$

[4] The data given in (4) are the typical examples of a counterbleeding case because the nasal segment that triggers the nasalization but it does not appear in the surface representation. In this analysis, we do not provide an account for this. In the Optimality-Theoretic approach it has been a controversial problem until “Sympathy approach” was proposed. We can explain typical a coundterbleeding case with Sympathy approach (McCarthy 1997, Davis 1997 and 2000)

string as onset of the second syllable is enhanced by constraints such as Onset and Syll(able) Con(tact). The former requires that syllables should have an onset (Prince and Smolensky 1993). The latter calls for a ban on rising sonority over a syllable boundary (Vennemann 1988, Davis 1998, Davis and Shin 1999). The Optimality-Theoretic constraints that we employ for the normal syllabification in Korean are presented in (5).

(5) Constraints for normal syllabification
   a. Max-Seg: Every segment in the input has its correspondent in the output.
   b. Dep-IO: Every segment in the output has its correspondent in the input.
   c. Onset: Syllables should have an onset.
   d. Syll Con: Rising sonority is prohibited over a syllable boundary.

The constraints given in (5) are not in conflict. That is, they do not show any particular ranking among themselves for normal syllabification. This is illustrated in tableau (6).

(6) /kani/ → [ka.ni] 'simplicity'

/kani/	Max-Seg	Dep-IO	Syll Con	Onset
a. kan	*!			
b. kan.ni		*!		
c. kan.i			*!	*!
d. ☞ ka.ni				

As seen in (6), the second consonant of the input should be syllabified as onset of the second syllable. Such normal syllabification is observed only in (6d), which is the optimal form. (6a), (6b), and (6c) are all suboptimal due to a violation of faithfulness constraints in (a) and (b), and of Syll Con and Onset in (c). Thus, these four unranked constraints can account for normal syllabification in Korean.

However, the proposed constraints cannot account for the syllabification reflected in the data given in (2), in which an intervocalic consonant is the velar nasal. As observed in (2), in such cases the velar nasal is, rather, syllabified as the coda of the preceding syllable leaving the following syllable without an onset. This does not observe the Universal Core Syllable Condition (Itô 1986) or the optimality-theoretic constraint Onset (Prince and Smolensky 1993).

A word-medial onsetless syllable occurs in the syllabification of Korean only when C_2 of $C_1V_1C_2V_2C_3$ is the velar nasal. The Onset

Cond(ition) is responsible for this. It prohibits the occurrence of the velar nasal in syllable onset position. This constraint is presented in (7).

(7) Onset Cond: The velar nasal /ŋ/ is not allowed as an onset element in Korean.

This constraint is ranked very high in Korean. It does not show any specific ranking with faithfulness constraints such as Max-Seg and Dep-IO in SD. However, it crucially ranks higher than Syll Con and Onset which compel the syllabification of the intervocalic consonant as the onset of the following syllable. Since (7) is ranked higher, intervocalic /ŋ/ should be syllabified as the coda of the preceding syllable, unlike other consonants. This is illustrated in tableau (8).

(8) /paŋul/ → [paŋ.ul] 'a small bell'

/paŋul/	Onset Cond	Max-Seg	Dep-IO	Syll Con	Onset
a. pa.ŋul	*!				
b. pa.ul		*!			*
c. paŋ.nul			*!		
d. ☞ paŋ.ul				*	*

As seen in (8), (b) and (c) are eliminated because of their violation of the faithfulness constraints. (a) loses to (d) because of the non-proper syllabification in (a), which is regulated by Onset Con. Ranking Onset Cond over Syll Con and Onset implies that rising sonority over a syllable boundary and an onsetless syllable, which are ranked high in Korean phonology, are tolerated in order to satisfy the high ranking Onset Cond. The constraint ranking revealed in tableau (8) is given in (9). For our purposes here, we rank the faithfulness constraints higher than Syll Con and Onset.

(9) Onset Cond, Max-Seg, Dep-IO » Syll Con, Onset

The constraint ranking in (9) also can be applied to the data in (3), which show intraspeaker variation with respect to syllabification. One strategy used to treat a velar stop consonant /k/ that is followed by a morpheme (syllable) beginning with an on-glide /y/, is to syllabify the velar stop as onset of the following syllable (morpheme) through normal syllabification. Since this strategy reflects normal syllabification, the constraint ranking given in (9) can account for the syllabification shown by the data in (3). The other variant form, in which the alveolar nasal /n/ is

inserted before a y-initial morpheme, also can be accounted for if we include one additional constraint.

The additional constraint is *g proposed by Itô and Mester (1997), which prohibits the occurrence of /g/. This constraint is relevant to Korean syllabification since we are focusing on the behavior of the velar nasal in syllable coda position. There are two possible velar nasals in Korean. One is an underlyingly present /ŋ/ and the other is a derived one, which results from an [n] inserted before a y-initial or i-initial morpheme. The inserted [n] affects the preceding velar stop /k/ to change it into [ŋ] through Syll Con. Thus, in such case the appearance of /k/ as [g] is prohibited because of the inserted [n]; if /k/ is realized as [g], then it creates a syllable boundary which has a less sonorous coda followed by a high sonorous, a highly undesirable syllable boundary by Vennemann (1988). Taking these together, we argue that generally *g is ranked very low in Korean, however when the [n] is inserted in syllabification, *g is at least ranked higher than Dep-IO to prevent [g] appearing in such syllabification. The relevant constraint *g constraint is given in (10).

(10) *g: Voiced dorsal obstruents are prohibited
(Itô and Mester 1997).

The tableau presented in (11) shows the normal syllabification of the data given in (3) which exhibits the constraint ranking established for the normal syllabification in (9) plus the additional constraint given in (10).

(11) /sæk+yuli/ → [sæ.gyuri] ‘colored glass’[5]

/sæk+yuli/	Onset Cond	Max-Seg	Dep-IO	Syll Con	Onset	*g
a. sæk.yu.ri				*!	*!	
b. ☞ sæ.gyu.ri						*
c. sæk.nyu.ri			*!	*		
d. sæŋ.nyu.ri			*!			

(a) is not the optimal form due to its violation of Syll Con and Onset. (c) is not the optimal form either because of its violation of high ranking Dep-IO. The comparison between (b) and (d) shows that the candidate with normal syllabification is selected as the optimal form rather than (d) in which /n/ is inserted before a y-initial morpheme.

[5] We assume in this paper that all output forms observe such undominated constraints as *VCV where a consonant is –voice or *VlV, which prohibits an intervocalic –voice consonant or an intervocalic [l].

The variant output form of the data given in (3) can be accounted for if we rerank the relevant constraints for such cases of syllabification. Since the variant form involves the alveolar /n/ insertion before a y-initial morpheme, the relevant constraints are Dep-IO and *g. If we rank *g over Dep-IO in the constraint ranking shown in the tableau (11), then the resulting constraint ranking will select an output with /n/ insertion over a morpheme boundary. This is illustrated in tableau (12).

(12) /sæk+yuli/ → [sæŋ.nyuri] 'colored glass'

/sæk+yuli/	Onset Cond	Max -Seg	*g	Dep-IO	Syll Con	Onset
a. sæk.yu.ri					*	*!
b. sæ.gyu.ri			*!			
c. sæk.nyu.ri				*	*!	
d. ☞ sæŋ.nyu.ri[6]				*		

As seen in (12), ranking *g over Dep-IO properly selects the optimal output form for the variant realization of the data given in (3). Recall that Dep-IO is violated only before a y-initial morpheme or i-initial morpheme. The overall rankings for normal syllabification, including syllabification with the velar nasal in the syllable coda position and the variant realization among the speakers in Korean, are given in (13) and (14).

(13) Normal syllabification
Onset Cond, Max-Seg, Dep-IO » Syll Con, Onset, *g

(14) Syllabification with /n/ insertion
Onset Cond, Max-Seg, *g » Dep-IO, Syll Con, Onset

With respect to the interdialectal variation between SD and KD for the velar nasal in syllable coda position, in SD an onsetless syllable is tolerated when the following syllable is a vowel initial syllable and the neighboring vowels are affected by the nasal undergoing nasalization. On the other hand, in KD not only is an onsetless syllable tolerated, but the velar nasal in the syllable coda is deleted. Interestingly, the neighboring vowels are still nasalized even though the velar nasal is deleted in KD.

[6]For this data, it could be viewed as the case of n-insertion and an ensuing nasalization by the inserted [n]. In this analysis we consider this a case of Syllable Contact constraint violation, which prohibits rising sonority over a syllable boundary. Using Syll Con instead of employing nasalization is more generally applicable to other phenomena over a syllable boundary such as various assimilation processes could be accounted for more comprehensively by using Syll Con (Shin 1997, Davis and Shin 1999)

We can account for the syllabification of SD by applying the constraint ranking given in (13) plus one additional constraint since SD reflects normal syllabification. The additional constraint is Max-nas(al), which requires faithful realization of the nasal feature of the input on the output. This constraint does not show any particular ranking with the other constraints in (13). We rank this constraint along with Syll Con and Onset. The constraint is presented in (15).

(15) Max-nas: The nasal feature of the input should faithfully be realized on the output.

The normal syllabification involving nasalization in SD is illustrated in (16).

(16) SD: /talp^{h}eŋi/ →[tal.p^{h}ẽŋ.ĩ] 'snail'

/tal.p^{h}eŋi/	Onset Cond	Max-Seg	Dep-IO	Syll Con	Max -nas	Onset
a. tal.p^{h}e.i		*!			*	*
b. tal.p^{h}ẽŋ.nĩ			*!			
c. ☞ tal.p^{h}ẽŋ.ĩ				*		*

The normal syllabification in SD is accounted for by the constraint ranking given in (13). The additional constraint Max-nas is ranked low and does not play an important role in tableau (16). But its effect is crucial in KD where the nasalization still occurs even though the trigger velar nasal is deleted.

The syllabification in KD could be accounted for by reranking Max-Seg and Syll Con. In KD, Syll Con should be ranked higher than Max-Seg since in this dialect the velar nasal in syllable coda position is deleted to satisfy Syll Con. The other important constraint is Max-nas. The satisfaction of this is crucial since in this dialect the neighboring vowels are nasalized despite the fact that the trigger is not present in the output. This is displayed in tableau (17).

(17) KD: /talp^{h}eŋi/ →[tal.p^{h}.ĩ] 'snail'

/talp^{h}eŋi/	Onset Cond	Dep-IO	Syll Con	Max -Seg	Max -nas	Onset
a. tal.p^{h}e.i				*	*!	*
b. tal.p^{h}ẽŋ.nĩ		*!				
c. tal.p^{h}ẽŋ.ĩ			*!			*
d. ☞ tal.p^{h}ẽ.ĩ				*		*

Candidate (b) is not the optimal form because of the violation of Dep-IO. The optimal output form for SD (c) loses to (d) since in KD Syll Con outranks Max-Seg. That is, to observe Syll Con the coda consonant, which is not a possible onset element in Korean, is deleted. The interesting comparison in (17) is between (a) and (d). (a) succumbs to (d) since the nasal feature of the input consonant is not realized on the output. Thus, (d) emerges as the optimal form.

The ranking of Syll Con over Max-Seg and the important role by Max-nas can successfully explain the dialectal variation of syllabification shown in KD. The overall constraint rankings for syllabification in SD and KD are presented in (18) and (19).

(18) Normal syllabification in SD
Onset Cond, Max-Seg, Dep-IO » Syll Con, Onset, Max-nas

(19) Syllabification of KD
Onset Cond, Dep-IO, Syll Con » Max-Seg, Max-nas, Onset

So far we have discussed the behavior of the velar nasal with respect to syllabification. It shows a different behavior than other consonants when it is in intervocalic position. Interestingly, a similar phoenomenon is found in Japanese, as discussed by Itô and Mester (1997) and Kager (1999). In Japanese, a velar stop /g/ is realized as [g] word initially or is realized as [ŋ] syllable internally as shown by the data in (20). The velar stop is in boldface.

(20) Japanese velar stop /g/

a. /**g**akuša/	→	[**g**ak.ša]	‘scholar’
b. /**g**eki/	→	[**g**e.ki]	‘drama’
c. /ka**g**ami/	→	[kaŋ.a.mi]	‘mirror’
d. /ka**g**i/	→	[kaŋ.i]	‘key’

However, there is variation in phonetic realization between young speakers and old speakers of Japanese when it occurs syllable internally as seen in (21).

(21) Variation between young sp(eakers) and old sp(eakers)

		Young Sp.	Old Sp.	
a. /ka**g**ami/	→	[ka.**g**a.mi]	[kaŋ.a.mi]	‘mirror’
b. /ka**g**i/	→	[ka.**g**i]	[kaŋ.i]	‘key’

As seen in (21), young speakers syllabify the velar stop as onset of the following syllable while old speakers syllabify it as coda of the preceding syllable tolerating an onsetless syllable. For the anaysis, Itô and Mester (1997) propose three constraints which are given in (22).

(22) a. *PWd[ŋ : ŋ is prohibited PrWd-initially.
b. *g: Voiced dorsal obstruents are prohibited.
c. Ident-IO (nas): Corresponding segments in the input and the output are identical in the nasal feature specification.

The constraint ranking for old speakers is *PWd[ŋ » *g » Ident-IO (nas). *g is ranked higher than Ident-IO (nas) since the velar stop is realized as [ŋ] but not as [g] for old speakers of Japanese while this ranking is reversed for young speakers of Japanese due to a different realization of the velar stop. The variation of the velar stop syllable internally between two groups of speakers is illustrated in the tableaux (23) and (24).

(23) Old speakers of Japanese

/kagi/	*PWd[ŋ	*g	Ident-IO (nas)
a. ka.gi		*!	
b. ☞ kaŋ.i			*

(24) Young speakers of Japanese

/kagi/	*PWd[ŋ	Ident-IO (nas)	*g
a. ☞ ka.gi			*
b. kaŋ.i		*!	*

The similaritiy between Japanese and Korean regarding the syllabification of the velar nasal is interesting and suggests that Korean is not unique with respect to the phonology of its velar nasal.

4. Conclusion

In this paper we examined the behavior of the velar nasal with respect to syllabification in Korean when it occurs syllable internally. The velar nasal behaves differently from other consonants in syllabification in that it does not syllabified as the onset of the following syllable while most other consonants are normally syllabified as the onset of the next syllable in $C_1V_1\underline{C_2}V_2C_3$ string. Thus velar nasal does not follow the normal syllabification because it is not licensed as an onset segment in languages

such as Korean and Japan (cf. Barra Gaelic). Furthermore, it shows allophonic behavor with [g] in Korean when it is followed by the on-glide /y/ over morpheme boundary. The allophone [g] is syllabified either as the onset of the next syllable (or morpheme) or the coda of the preceding syllable realizing as [ŋ] along with the insertion of [n] as the onset of the following syllable. We analyze it with the ranking of Onset Cond over Syll Con and Onset. Variational behavior between [g] and [ŋ] is analyzed by reanking Dep-IO and *g. A similar behavior between [g] and [ŋ] is also observed in Japanes in which *g is ranked higher than Ident-IO (nas) for old speaker of Japanese while it is ranked lower than Ident-IO (nas) for young speaker of Japanese.

Concering intraspeaker variation and interdialectal variation in syllabification in SD and KD in Korean are accounted for by reranking relevant constraints such as Max-Seg and Syll Con. Thus, the optimality-theoretic account provided in this paper sheds more light on syllabification with respect to pecular behavior of velar nasal in Korean and Japanese.

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