Preliquid Nasalization*

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Jun, Jongho. 2000. **Preliquid Nasalization.** *Korean Journal of Linguistics,* Traditionally, the Korean preliquid nasalization (e.g. kl → ŋn) has been analyzed by a feeding order of L-nasalization (kl → kn) and prenasal nasalization (kn → ŋn). It is thus predicted that if L-nasalization is blocked, prenasal nasalization will not occur. To test this prediction, we performed experiments in which audio recordings of tokens with an underlying stop-liquid sequence (e.g. /kl/) were analyzed by the author and two other trained phoneticians relying on the spectrographic display and perception. Ten native Korean speakers were requested to pronounce the spelling pronunciation of a post-stop liquid, while reading ten real words (e.g. /tɛ hak-lo/). Since the Korean spelling system is phonemic, spellings directly reflect the underlying segments. The results are not compatible with the prediction of the traditional analysis. Finally, we discuss why the synchronic preliquid nasalization, which is an unnatural process, becomes active in Korean. We claim that it is due to a historical reanalysis of the triggering segment of prenasal nasalization. **(Yeungnam University)**

0. Introduction

Two types of obstruent nasalization are attested in Korean. As shown

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in (1), syllable final obstruents assimilate in nasality to a following nasal.

(1) Korean prenasal nasalization[1]

Native Korean

a. /mək-ne/ [məŋne] 'I see he is eating'
b. /ip-mɛ/ [immɛ] 'shape of the mouth' (Kim-Renaud 1974:219)
c. /pap-mul/ [pammul] 'water for rice cooking'
d. /mit-ne/ [minne] 'I see (s)he is believing'

Sino-Korea

e. /kuk-min/ [kuŋmin] 'a people'
f. /tok-njə/ [toŋnjə] 'the only daughter'

This type of obstruent nasalization can be seen not only in native Korean words but also in Sino-Korean words. The other type of obstruent nasalization is preliquid nasalization. As shown in (2), obstruents become nasalized before a liquid /l/ which surfaces as an alveolar nasal [n].

(2) Korean preliquid nasalization

Sino-Korean

a. /pəp-ljəŋ/ [pəmnjəŋ] 'statute'
b. /p^{h}ok-lak/ [p^{h}oŋnak] 'slump' (Kim-Renaud 1974:227)
c. /tɛhak-lo/ [tɛhaŋno] 'university street'
d. /kuk-lip/ [kuŋnip] 'national'

Native-Korean

No morphemes beginning with a liquid
No word internal obstruent-liquid sequences

This nasalization can be observed only in Sino-Korean words since in native Korean no morphemes begin with a liquid and no word-internal obstruent-liquid sequences exist. Traditionally, this type of preliquid nasalization has been analyzed by a feeding order of prenasal nasalization and L-nasalization in which a lateral becomes a nasal after

[1] "-" is adopted to indicate a morpheme boundary.

a consonant (Huh 1965, Kim-Renaud 1974):

(3) Traditional analysis

	/tɛhak-lo/
L-nasalization	[tɛhak-no]
Prenasal nasalization	[tɛhaŋ-no]

From this analysis, the following prediction is necessary.

(4) A prediction of traditional analysis
If L-nasalization is blocked, prenasal nasalization will not occur.

In other words, if a liquid does not become a nasal, its preceding obstruent must remain as an oral consonant. A nasal-liquid sequence is not a possible surface option. However, according to our informal observation, some Korean speakers sometimes produce forms like [tɛ haŋro] besides [tɛhaŋno] for /tɛhak-lo/; thus, a surface nasal-liquid sequence is attested.[2] Motivated by this informal observation, we performed two experiments to test the prediction in (4). The first experiment is concerned with the spelling pronunciation of a liquid in an underlying obstruent-liquid cluster whereas the second experiment with natural speech. It will be shown that results are not compatible with the prediction (4).

1. Experiment 1: Forced Speech (spelling pronunciation)

The purpose of the present study is to find out whether or not a preliquid obstruent is nasalized when the liquid surfaces as such. In other words, the nasalization of the liquid is not crucial. We want to find out whether an obstruent is nasalized or not under the condition that the liquid after it is not nasalized. In this experiment, to provide the condition for blocking of L-nasalization, we requested subjects to produce the spelling pronunciation of the liquid. Since the Korean spelling system is phonemic, spellings directly reflect the underlying

[2]The exact phonetic nature of [r] will be discussed below.

segments. The following ten real (Sino-)Korean words with an underlying stop-liquid sequence were employed:

(5) Experimental Tokens (Crucial clusters are underlined.)

a. /toklip/	'independence'	b. /tɛhaklo/	'university street'
c. /kukljək/	'national power'	d./munhaklon/	'literature theory'
e. /paklamhwɛ/	'exposition'	f./kuklip/	'national'
g. /čoksəklu/	'the name of a kiosk'	h./hakljək/	'academic career'
i. /phalsipli/	'80 li'	j./hapličuii/	'rationalism'

(li = a unit of length)

Subjects included ten native Korean speakers (aged from early 20 to mid 40): three Seoul dialect speakers (all female) and seven Kyungsang dialect speakers (two male, five female). All subjects were not aware of the purpose of the present experiment. Audio recordings were made while subjects were reading each word twice in a casual way. Subjects were allowed to skip a word if the spelling pronunciation of its medial liquid is too awkward. Nonetheless, no subjects skipped any one token.

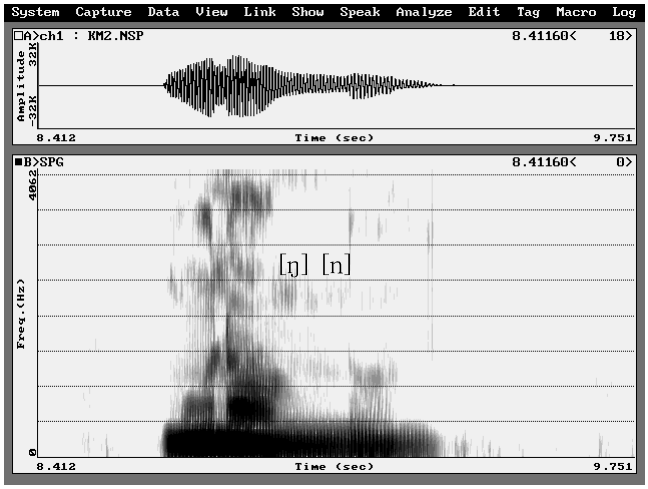
Based on the perception and a spectrographic display on a Kay Elemetrics' CSL system, we may categorize experimental results into the following four different patterns depending on the phonetic realization of the crucial cluster:

(6)

	C1	*C2*
a.	nasal	alveolar nasal
b.	nasal	lateral
c.	nasal	tap
d.	oral stop	tap

A spectrogram of an utterance belonging to the first pattern (nasal-nasal) is shown in (7).

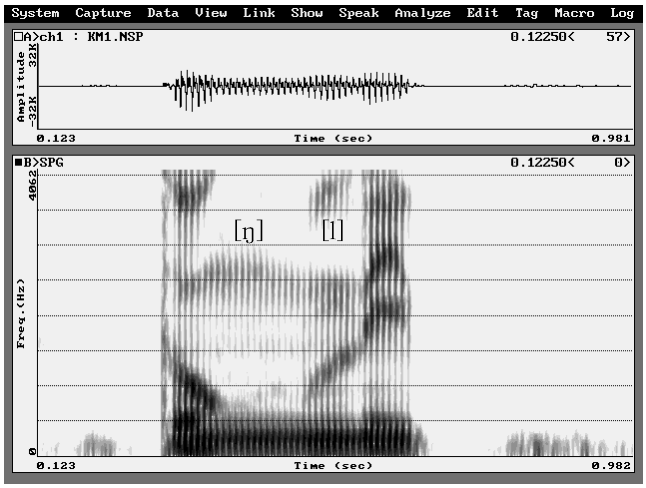
(7) /munhaklon/ [ŋn]



Notice that a low frequency prominence, which is a characteristic of nasal consonants, dominates through the crucial cluster. In the production of this type of tokens, subjects failed to follow the instruction for the spelling pronunciation of the word-medial liquid. Thus, these tokens say nothing about the prediction of the traditional analysis (4).

The second pattern (nasal-lateral) may be illustrated by the following spectrogram:

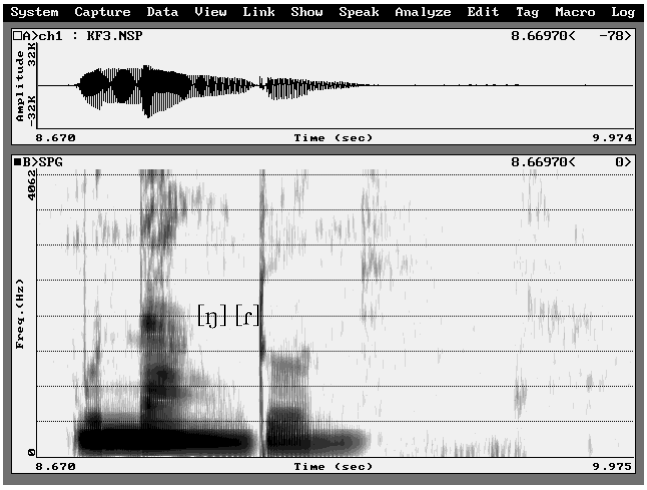
(8) /tokl<u>i</u>p/ [ŋl]



In this spectrogram, it can be seen that after a velar nasal, F2 changes in a gradual way and F3 stays high, which are characteristics of a lateral. In the production of this type of tokens, subjects followed the instruction, producing a lateral for C2. Notice that this pattern is not compatible with the prediction of the traditional analysis (4): C1 stop becomes a nasal even when C2 liquid does not.

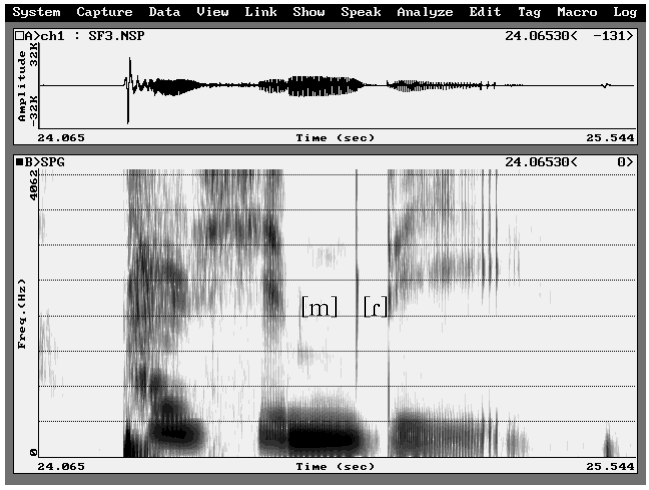
Spectrograms of utterances belonging to the third pattern (nasal-tap) are shown in (9) and (10). An abrupt spectral gap between a nasal and a following vowel indicates the presence of a tap.

(9) /munhaklon/ [ŋɾ]



This spectral gap is more obvious in (10). Notice that a tap, which is characterized by the spectral gap, is almost a voiceless stop since it has a release burst while lacking voice bar.

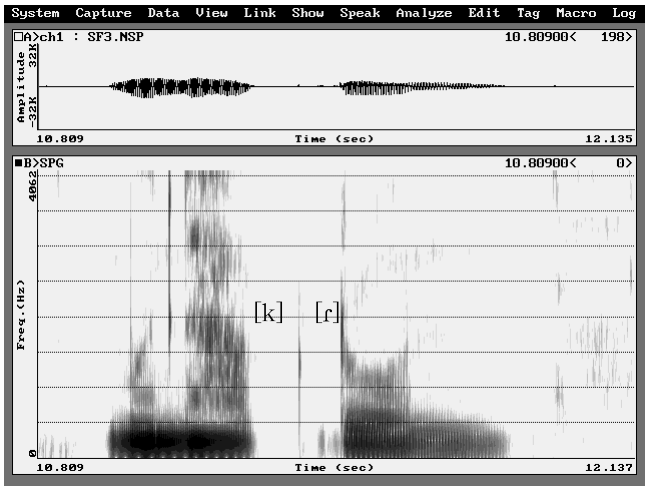
(10) /pʰalsipli/ [mɾ]



Along with the second pattern (nasal-lateral), this pattern is not compatible with the prediction (4).

Finally, the fourth pattern (stop-tap) can be seen in the following spectrogram:

(11) /munhaklon/ [kɾ]



Voicelessness of C1 stop is obvious: there is no voice bar at the bottom of the spectrogram. This pattern is compatible with the prediction (4): C1 stop does not become a nasal when C2 liquid does not.

Although many results may be categorized into the above four basic patterns, the precise phonetic nature of some tokens is difficult to determine mainly due to the nasalization factor. In the experimental tokens, laterals and taps are often nasalized. For instance, the distinction between an alveolar nasal and a nasalized lateral is usually unclear not only in a spectrogram but also in perception. For a precise phonetic interpretation of experimental results, two trained phoneticians were employed. They judged separately, relying on the spectrographic display and perception.

In the judgement of C1, the two phoneticians agreed for 198 out of 200 tokens (10 subjects x 10 test words x repeated productions): 194 full nasal ([ŋ] or [m]) and 4 oral stop (3 voiceless stop and 1 voiced stop). For the remaining two tokens, the phoneticians agreed in that a

voiced velar stop is involved whereas they are different in the decision of whether or not the voiced velar stop is nasalized:

(12) Different judgments (P1, P2 = phoneticians)

a.	P1: gk	P2: g̃k	(g̃ = nasalized g)
b.	P1: g	P2: g̃	

The following observations can be made. First, C1's phonetic form is mostly clear (198/200). Second, a full nasal is predominant: only 6 tokens were not considered as including a full nasal. Notice that although the phoneticians did not agree about C1's precise phonetic nature of two tokens, they both agreed that C1's of the two tokens are not a full nasal.

In the judgement of C2, the two phoneticians agreed for 102 out of 200 tokens. It thus seems that C2's phonetic nature is less clear than C1's. The distribution of tokens for which the phoneticians made an identical judgement is shown in (13).

(13)

a.	full nasal (n):	33		
b.	lateral:	14	c. nasalized lateral:	14
d.	tap:	37	e. nasalized tap:	4

The judgements may form a continuum from a fully oral liquid (l/r) to a full nasal (n).

If we consider the two phoneticians' judgements for C1 and C2 together, the generalization would be that C1 is consistently a nasal, regardless of how much nasalized C2 is and whether C2 is nasalized or not. This is not compatible with the prediction of the traditional analysis (4). Many tokens with a nasal C1 include a partially nasalized liquid C2. These tokens do not support a traditional analysis shown in (3) since it is hard to claim that a source segment, which itself is not fully nasalized, triggers complete nasalization of a target segment. More critically, as discussed with (10), at least some taps are clearly oral; nonetheless, C1 is still a nasal. In conclusion, the results of the present experiment suggests that in an obstruent-liquid sequence, L-nasalization is not a necessary condition for obstruent nasalization.

2. Experiment 2: Natural Speech

In this experiment, we relied on natural speech. As in the first experiment, the purpose of the experiment is to find out whether or not a preliquid obstruent is nasalized when the liquid is not nasalized. To prevent L-nasalization, we selected words with an obstruent-liquid sequence in which the liquid is not likely to be nasalized. Right after the audio recording was made in the first experiment, each subject was asked about how often s/he produces a liquid for each experimental token in an ordinary context. Three choices were given: *never, sometimes and always*. Two native Korean speakers who were not subjects of the first experiment additionally participated in this survey, making twelve in total. Results of the survey are shown in (14).

(14) A survey of liquid production

	Never	*Sometimes*	*Always*
a. toklip	6	4	2
b. **tɛhaklo**	1	8	3
c. kukljək	8	4	0
d. munhaklon	5	4	3
e. paklamhwɛ	6	3	3
f. kuklip	6	6	0
g. čoksəklu	5	3	4
h. hakljək	6	4	2
i. p^halsipli	5	7	0
j. hapličuii	8	2	2

Most subjects (11 out of 12) think they produce a liquid with /tɛhaklo/ at least *sometimes*. We thus think that if Korean speakers may produce a liquid in an ordinary context, /tɛhaklo/ is the best candidate for a liquid production. /kuklip/ is additionally chosen since it was relatively easy to make control tokens. These two selected words were put within sentential contexts:[3]

[3]Two types of control tokens with underlying /kn/ and /ŋn/ sequences were also recorded: /tɛhak-nolɛ/ 'university song', /waŋ-nolu/ 'king deer', /kuknɛ/ 'domestic', /kuŋnɛ/ 'inside a royal palace'. However, these control phrases have no importance in the present experiment since the phoneticians did not consider phonetic forms of these phrases when they determine the phonetic nature of experimental tokens.

(15) a. /uli-n tɛhaklo-esə čaču maču čʰi-əs′-ta/
we-Top university street-Loc often run into-Past-SE
"We often ran into each other in the unversity street."
b. /nali-ka kuklip-tosəkwan-e is′-ta/
Nali-Subj national-library-Loc present-SE
"Nali is at the national library."

(abbreviations: Top = topic marker, Loc = locative marker, Past = past tense marker, SE = sentence ender, Subj = subject marker)

Subjects included 5 native Korean speakers (age: early 20): all Seoul dialect speakers (2 female; 3 males). None of these subjects were employed in the first experiment. No subjects know the experimental purpose. Subjects read experimental sentences six times in a casual way.

For a precise phonetic interpretation of results, as in the first experiment, we employed two trained phoneticians; one of them was employed in the first experiment. In the judgement of C1, the two phoneticians agreed on 48 out of 60 tokens (5 subjects x 2 test words x 6 times production). One phonetician considered all of 60 tokens as having a full nasal ([ŋ]). The other phonetician concluded that 48 tokens have a full nasal and the remaining 12 tokens have a nasalized velar approximant. Thus, both phoneticians agree that C1 is always nasalized although their decision may be different in the exact aperture of C1. This is not surprising since the velar nasal is acoustically very similar to nasalized vocoids (Ohala 1975).

The two phoneticians′ judgements about C2 are much more complicated than those about C1, as shown in (16).

(16) Judgements on C2

phonetician	full nasal	lateral	nasalized lateral	tap	nasalized tap	total
P1	26	7	24	0	3	60
P2	30	18	7	0	5	60
Identical	17	5	3	0	0	25

There are only 25 tokens for which both phoneticians reached idential judgements. The following observations can be made. First, no results with a clear tap were observed. This is different from the first experiment in which many results contain a clear tap. We speculate that Korean speakers use different strategies for the production of a liquid in spelling pronunciation and natural speech. The second point which is more relevant to our purpose is that if we consider judgements for C1 and C2 together, as in the results of the first experiment, C1 is consistently fully nasalized, regardless of C2's nasalization degree. Notice that although more than a half of tokens have fully nasalized C2, at least some tokens were determined to include an oral liquid C2 by both phoneticians. These results are not compatible with the prediction of a traditional analysis (4). Therefore, the results of the present experiment with natural speech confirms the conclusion of the first experiment, i.e. that L-nasalization is not a necessary condition for the obstruent nasalization in an obstruent-liquid sequence.

3. Discussion

There are two findings from Experiments One and Two. The major finding is that Korean nasalization may be triggered by surface liquids as well as nasals. The minor one is that Korean postconsonantal onset /l/ may be realized as a lateral. It has been assumed in the literature on Korean phonology that an onset liquid is realized as a tap.

Let us focus on the discussion of the major finding. The major finding implies that Korean nasalization (at least the one triggered by liquids) is not an assimilation which has been described within Autosegmental Phonology in terms of simple spreading of an adjacent nasal feature. As mentioned in the previous sections, this finding is not compatible with serial analyses with a feeding relation of L-nasalization and obstruent nasalization (Huh 1965, Kim-Renaud 1974 among others). Also, it undermines the relatively recent analyses relying on Murray-Vennemann's (1983) Syllable Contact Law: the coda should not be less sonorous than the following onset. The claim made by Rice & Avery (1991) within Autosegmental Phonology, and Shin (1997) and

Davis (1997) within Optimality Theory is that /kl/ becomes [ŋn] in order to turn a heterosyllabic sequence of increasing sonority into a sequence of level sonority. In the present experimental results with a nasal-liquid sequence, the stop nasalization occurs but the surface sequence still violates the Syllable Contact Law; thus, the nasalization is not due to the Law. One might still argue that nasal-liquid clusters have improved with respect to Syllable Contact. There seems a more fundamental problem for the accounts relying on syllable contact. Syllable Contact Law is supposed to capture phonological naturalness which should be reflected in the typology. However, to the best of my knowledge, preliquid nasalization is so rarely attested. If this is correct, the nasalization cannot be attributed to any accounts emphasizing phonetic or phonological naturalness. An account relying on the assimilation, more formally spreading, of a feature [sonorant] (Kim 1987) may be subject to the same criticism since assimilation is the most natural process in phonology and phonetics.[4] In conclusion, none of previous approaches to Korean preliquid nasalization provide a convincing analysis.

We should now consider one possible objection to the finding of the present study: Sino-Korean words employed in the present experiment are lexicalized with a nasal-liquid sequence. If this objection is correct, preliquid nasalization is not a synchronic process. All the previous analyses that we have just discussed would be the description of a historical change. Specifically, as exemplified in (17), in an obstruent-liquid sequence C1C2, C1 was historically reanalyzed as a nasal (stage 2). In the next stage, even after speakers manage to produce a surface post-consonantal liquid, they still produce a nasal for its preceding consonant.

(17)	UR	SR
stage 1	/toklip/	[toŋnip]
stage 2	/toŋlip/	[toŋnip]
stage 3	/toŋlip/	[toŋlip]

[4]Notice that the [sonorant] spreading is not available in most theories of feature geometry in which [sonorant] is part of the root node (McCarthy 1988, Halle 1992 among others).

This objection might look plausible if we consider the fact that in many Sino-Korean words, each syllable is, in some sense, a bound morpheme. For instance, each syllable forming a word /tok-lip/ 'independence' (/tok/ means 'independent'; /lip/ means 'stand') can combine with some other morphemes to form other words: /tok-paŋ/ [tokpaŋ] 'room for a single person', /ki-lip/ [kiɾip] 'stand'. None of the component syllables can be independent words on their own.

However, there are several reasons for rejecting this objection. First, at least some test words are composed of morphemes which can occur as an independent word. In /tɛhak-lo/ 'university street', the first morpheme /tɛhak/ 'university' is an independent word. Thus, the underlying status of the word-final coda is justified although the morpheme /lo/ cannot be an independent word (it must combine only with other morphemes to form a word: e.g. /tɛ-lo/ [tɛɾo] 'main street'). For this purpose, /sipli/ 'ten li' is more convincing. /sip/ is a word meaning 'ten'. /li/ is a unit of length just like meter or yard; it always occurs immediately after some number: e.g. /ili/ [iɾi] 'two li' cf. /i/ 'two'. If /sipli/ 'ten li' is lexicalized as /simli/, the combination of each number and 'li' would be lexicalized, which is obviously impossible under the assumption that numbers are inherently infinite.

Second, according to our informal observation, Korean speakers frequently apply preliquid nasalization with recently borrowed English loan words beginning with a liquid. At least young Korean speakers may produce a word-initial liquid for /limok^{h}on/ 'remote control', regardless of its preceding segment class. For instance, if /limok^{h}on/ occurs after a word ending with an obstruent as shown in (18a), its possible pronunciations will be shown in (18b).

(18) a. /uli cip limok^{h}on/
our house remote control
'the remote control at our house'
b. possible pronunciations of /...p l.../
[..m ɾ/l..] ~ [..p ɾ/l..] ~ [..m n..]

It thus seems obvious that Korean preliquid nasalization is a productive

synchronic process.

4. Historical developments

In this section, instead of examining details of the analysis of the preliquid nasalization, we will be mainly concerned with the question of why such an unnatural process becomes active in Korean. We claim that the occurrence of the synchronic preliquid nasalization is the result of a historical reanalysis of the triggering segment of prenasal nasalization. Our claim is based on the following conjecture about historical developments of the Korean liquid.

In the first stage, there were no native morpheme-initial liquids. Foreign (Sino-Korean) morphemes with an initial liquid underwent L-nasalization (possibly to obey a constraint prohibiting an onset liquid) and then may trigger prenasal nasalization if a preceding morpheme ends with an obstruent. Thus, in this stage, two rules are active as shown in (19).

(19) Rules in Stage One

a. L-nasalization: L → [+nasal] in the onset.

More specifically, (i) L → [+nasal] / C__

(ii) L → [+nasal] / #__

b. Prenasal Nasalization: [-son] → [+nasal] / __ [+nasal]

In the second stage, massive foreign (mainly English) words with an initial liquid were borrowed into Korean. Speakers managed to produce word-initial liquids and thus one of two L-nasalization rules, i.e. word-initial liquid nasalization (19aii), is lost. Also, more occurrences of surface liquids in this stage may lead speakers to realize that some triggering segments of prenasal nasalization (19b) are originally liquids; thus speakers may reanalyze the triggering nasal as its corresponding underlying segments, i.e. nasals and liquids as shown in (20):

(20) Prenasal nasalization

[-son] → [+nasal] / __ [+nasal]

→ /n, m/

→ /l/

This reanalysis leads to the activation of the two nasalization rules in (21), more precisely, the addition of the preliquid nasalization rule (21b).

(21) Obstruent nasalization rules

a. [-son] → [+nasal] / __ [+nasal]

b. [-son] → [+nasal] / __ [+son, -nasal, -syllabic]

In the final stage, which is considered as the present stage by us, at least some speakers may produce post-consonantal liquids for some words and thus L-nasalization is totally lost for those words. The liquid may surface not only in word-initial but also in post-consonantal positions. Two obstruent nasalization rules in (21) which resulted from the reanalysis of the triggering segment of the prenasal nasalization in the previous stage are active in this stage. Thus, obstruent nasalization before a surface liquid which is the major finding of the present experiments is the result of applying the preliquid nasalization rule in (21b).

5. Conclusion

In the present study, we have performed two experiments to test the prediction of a traditional analysis for Korean preliquid nasalization: L-nasalization feeds prenasal nasalization and thus if L-nasalization is blocked, prenasal nasalization will not occur. Results of the present experiments are not compatible with the prediction: an obstruent becomes nasalized even when it occurs before a surface liquid. Also, we have shown that some other previous approaches cannot be considered as an optimal account for the preliquid nasalization. For the explanation

of how the preliquid nasalization becomes active in Korean, we have claimed that its occurrence is due to a historical reanalysis of the triggering segment of prenasal nasalization.

In addition to the major finding and its explanation in the present study there are two important points which need to be noticed. First, the present study employs the spelling pronunciation to test the prediction of a theory. To our knowledge, no previous studies use this methodology. Second, new findings which are relevant to the Korean phonetics/phonology are reported: a post-consonantal liquid may surface as such and, moreover, it may be realized as a lateral.

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