

Perceptual deletion of onset /n/ in Korean* **

Hyunsook Kang
(Hanyang University)

Kang, Hyunsook. (2016). Perceptual deletion of onset /n/ in Korean. *The Linguistic Association of Korea Journal*, 24(3), 1-16. This paper examines varying degrees of perceptibility of Korean /n/ in /nasal-nV/ contexts. Two perception tests were conducted and showed that onset /n/ was often confused to a null segment if the following vocoid is /j/ or /i/. Since it is the non-prominent segment that is often confused to a null value or to an adjacent segment (Cote, 2000), the findings in this paper support the suggestion in Jun (2015) who argues that Korean /n/ shows low perceptibility before /j/ or /i/ based on /n/-insertion in /C-j/ and /C-i/ that results in /nasal-nj/ and /nasal-ni/ sequences. That both /n/-insertion in Jun (2015) and /n/-confusion in this paper occur in the same contexts support P-map theory in Steriade (2009), namely that the segment with lowest perceptibility is more likely to be inserted or deleted.

Key Words: perceptual deletion, onset /n/ in Korean, P-map theory

1. Introduction

Korean linguists have long studied insertion and deletion rules with nasal /n/ (cf. Kim, 1970; Kim-Renaud, 1974; Ko, 1992; Jun, 2015 and many others). /n/-insertion has particularly attracted attention from many linguists as it is a rule that occurs in various morphological constructions including 'saisiot' construction. Some restrictions occur for the morphological environments of /n/-insertion but the phonological environment is quite clear: /n/ is optionally

* This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-2014S1A5A2A01014134).

** A part of this paper was presented at ICKL and Harvard-ISOKL 2015.

inserted after a syllable-final consonant and before high front vocoids /i j/.

(1) Native Korean

- a. nic-jəlɪm [nitʃəlɪm]~[niɲɲəlɪm] 'late summer'
 b. som-ilpul [somipul]~[sɒmɲipul] 'cotten-stuffed comforter'

(2) Sino-Korean

- a. sanəp-jɔŋ [sanəpjɔŋ]~[sanəmnjɔŋ] 'for industrial purpose'
 b. næŋtoŋ-jɔŋ [næŋtoŋjɔŋ]~[næŋtoŋnɔŋ] 'for freezing'

For example, in (2a), /n/ is inserted after a consonant-final Sino-Korean noun /sanəp/ and before a Sino-Korean dependent morpheme /jɔŋ/ that begins with a high front glide /j/ (e.g. /sanəp-jɔŋ/--> /sanəp-njɔŋ/). After /n/-insertion, the preceding obstruent /p/ is changed into /m/ by nasalization triggered by the following inserted /n/ (e.g. /sanəp-njɔŋ/--> /sanəmnjɔŋ/). The /n/-insertion rule is shown in (3).

(3) /n/-insertion in Seoul Korean

$\emptyset \rightarrow n / C] ___ [i/j$

/n/-insertion may apply across stems and affixes, in compounds or in phrases.

While discussing P-map theory, Steriade (2001, 2009) suggests that it is a segment with lowest perceptibility in a language that is likely to be inserted or deleted. That is, if a segment is non-prominent, it is confusable to nothing or to a nearby segment (Cote 2000), and thus, insertion or deletion of that segment would not affect the perception much. Based on P-map theory, Jun (2015) suggests that /n/-insertion in (3) is a case of insertion due to the low perceptibility of /n/ in Korean.

The suggestions by Steriade (2001, 2009) and Jun (2015) raise interesting questions concerning Korean /n/: first, why /n/ shows the lowest perceptibility in the context (3) and second, whether Korean phonology shows /n/-deletion in addition to /n/-insertion since /n/ has lowest perceptibility.

As for the first question why /n/ shows low perceptibility in the context (3), that is, why /n/ can be inserted into /næŋtoŋ-joŋ/ and become /næŋtoŋ-njoŋ/ in (2b), Jun (2015) explains it with flat formant transitions from /ɲ/ to high vocoids /i j/. Specifically, Jun assumes that /n/ becomes palatalized /ɲ/ before high front vocoids /i j/ in Korean (cf. Kang, 2003). Then, he suggests that due to flat formant transition from /ɲ/ to high vocoids /i j/, the input~output pairs such as i~ni and j~nj become perceptually more similar than other input~output pairs such as i~mi and j~mj that involve a different consonant, or other pairs like a~na, e~ne that involve a different vocoid like /a/ or /e/.

Though Jun's explanation of flat formant transitions from /ɲ/ to high vocoids /i j/ is somewhat unclear, we agree with him that the perceptual differences in input~output pairs like j~nj and i~ni are smaller than those in other pairs he mentioned. However, Jun (2015) only mentioned the importance of the segment that followed /n/. Note, however, that nasal /n/ is inserted in (3) only after a consonant, but not after a vowel, which argues that the preceding consonant (which becomes nasal) also contributes to inducing low perceptibility of /n/.

As for the second question, whether Korean has /n/-deletion in addition to /n/-insertion since /n/ has lowest perceptibility, Korean indeed shows /n/-deletion rule: Nasal /n/ is deleted before a high vocoid /i j/ at the word-initial position as in (4a, b). In (4a), /njə/ 'woman' appears as /jə/ at the word-initial position while surfacing as /njə/ in /canjə/ intervocalically.

- (4) a. njə-ca [jəca] 'woman' cf.) ca-njə [canjə] 'children'
 b. njən-to [jənto] 'year' cf.) o-njən [onjən] 'five years'

Though /n/-insertion rule and /n/-deletion rule seem closely related to each other, there are some important differences between them. Note that the phonological environments for each rule are different. /n/-insertion (3) occurs after a consonant but /n/-deletion occurs word-initially, though both rules require high vocoids /i j/ after /n/. Ko (1992) argued that historically /n/-deletion rule existed first and was inverted, becoming rule (3). Regardless of its historical development, however, /n/-deletion shows different phonological environments from rule (3) in Korean phonology (cf. Kim et al.,

2002; Jun, 2015).

Moreover, these two rules are different in their applicability: /n/-insertion is a productive rule while word-initial /n/-deletion is no longer productive: English words like 'New York' and 'news' are borrowed as /njujuk/ and /njus/, respectively, not as *[jujok] or *[jus]. Therefore, in contemporary Korean phonology, deletion of /n/ in the word-initial position cannot be evidence for the argument that /n/ is deleted due to low perceptibility.

Rather, a more plausible context where we can observe low perceptibility of /n/ in Korean would be the very contexts in which /n/ is inserted. Note that /n/ is inserted in /C-j/ and /C-i/, resulting in /nasal-nj/ and /nasal-ni/ sequences, respectively. Thus, these are the contexts where /n/ shows the low perceptibility.

The aim of this paper is then to explore this possibility by running perception experiments on the words in which /nasal-nj/ or /nasal-ni/ sequences occur. One morphological context in which /nasal-nj/ and /nasal-ni/ sequences are available is within Sino-Korean nouns. Sino-Korean nouns are formed by joining monosyllabic morphemes. Though few Sino-Korean morphemes begin with /nj/ and /ni/, many Sino-Korean morphemes begin with /lj/ and /li/ which will change into /nj/ and /ni/ in appropriate contexts as is shown in (5).

- (5) a. saŋ-lyu [saŋnju] 'upper class' cf. ha-lyu [harju] 'low class'
 b. kuk-lip [kuŋnip] 'national' cf. si-lip [sirip] 'municipal'

A Sino-Korean morpheme like /-lju/ in (5a) surfaces as /-rju/ after a vowel final morpheme as in /haryu/. When it is attached to a morpheme ending with a nasal or an obstruent, it surfaces as /-nju/ (e.g. /saŋ-lju/--> /saŋ-nju/) with initial /n/. If the preceding consonant is an obstruent, the changed /n/ nasalizes the preceding obstruent (e.g. /kuk-nip/ --> /kuŋnip/). The resulting forms contain /nasal-nj/ or /nasal-ni/ sequences. These /nasal-nj/ or /nasal-ni/ sequences are then possible candidates to test whether /n/ is confused as zero or to a nearby segment due to low perceptibility.

Therefore, in this paper we will examine whether we can observe the following /n/-confusion in the perception level.

- (6) Input ~ Output
- a. saŋ-lyu [saŋnju] ~ [saŋju] 'upper class'
- b. kuk-lip [kuknip] ~ [kukip] 'national'

If the confusion of /n/ may optionally occur to the input /saŋ-nju/ or /kuk-nip/ in (6), we can observe /saŋ-ju/ or /kuk-ip/ sequences, respectively. If so, the results will support the suggestion in Jun (2015) that Korean /n/ shows low perceptibility and the proposal in Steriade (2009) that a segment with low perceptibility can be inserted or deleted.

In the following sections, this paper will run a few perception experiments regarding how distinctive onset /n/ is in /nasal-nV/ contexts and will discuss the perception results in the Conclusion.

2. Experiment 1

In this section, we will test how similar the two stimuli in the input~output pairs such as /nasal-nj/~nasal-j/ and /nasal-ni/~nasal-i/ are compared to those in other input~output pairs such as /nasal-na/~nasal-a/, involving a different vocoid.

2.1. Stimuli

The stimuli for this experiment were made from the recordings of eleven university students in their twenties. The talkers were born and had spent most of their lives in Seoul or the nearby area. The talkers were asked to read a list of frame sentences 'əsə Palli 'target noun'-(i)lako malhæcuseyo' ("please say 'target noun' rapidly") in rapid speech style in which target nouns containing a /ŋ-n/ or /m-n/ sequence occur. Target nouns in the frame sentences are mostly Sino-Korean words. They were shown in Tables 1 and 2. The recording was done in a sound-attenuated booth.

Table 1, Words containing an /ŋ-n/ sequence

vocoid	UR	SR	gloss
a	mjəŋ-laŋ	mjəŋ-naŋ	cheerful
æ	mak-næ	maŋ-næ	the youngest
o	kjəŋ-lo-sək	kjəŋ-no-sək	seats for seniors
i	koŋ-lip-hak-kjo	koŋ-nip-hak-kjo	public school
jə	sək-ljək	səŋ-njək	speed
jə	kak-ljo	kaŋ-njo	cabinet
ju	saŋ-lju-sa-hwe	saŋ-nju-sa-hwe	upper class

Table 2, Words containing an /m-n/ sequence

vocoid	UR	SR	gloss
a	jəm-la-tæ-waŋ	jəm-na-tæ-waŋ	underworld king
æ	kam-næ	kam-næ	perseverance
o	kap-lon-il-pak	kam-non-il-pak	pros and cons
i	sim-li-hak-kwa	sim-ni-hak-kwa	psychology dept.
jə	jəm-ljə	jəm-njə	concern
jə	im-ljo	im-njo	drink
ju	sam-lju-in-sæŋ	sam-nju-in-sæŋ	lower class

2.2 Participants

Twenty participants in their twenties who were born and spent most of their lives in Seoul or a nearby province participated in the perception experiment.

2.3 Procedures

Each participant heard the fourteen frame sentences produced by each speaker that included a target word. A target word contains either /ŋ-n/ or /m-n/ as is shown in Tables 1 and 2. Participants were asked to judge how similar the words they hear (input) were to the words that appeared on the computer screen (output). On the computer screen, a word (e.g. /maŋ-æ/; 땅-애) without an onset /n/ appeared in Korean.

Participants were also informed how to interpret the form on the computer

screen: the form on the computer screen (e.g /maŋ-æ/) has a coda and no onset. After hearing the stimulus, participants were asked to judge the similarities between the word that they heard and the word that appeared on the screen, and choose a similarity score from 0 to 4 in a similarity ratings test. This scale has a progressive structure, so that Likert item 0 is very dissimilar, 2 is a midpoint, and 4 is very similar. Participants heard the sentence twice.

The perception test consisted of 2 sections, one with the words containing a /ŋ-n/ sequence and the other with the words containing a /m-n/ sequence. Participants first performed a practice test with 6 sentences before they began each main section. For each stimuli, there were 220 answers (11 speakers*20 listeners =220).

2.4 Results

Table 3 shows the mean scores of the answers for 220 tokens for each sequence involving /ŋ-n/ sequence.

Table 3. similarity ratings scores for an /ŋ-n/ sequence

pairs (Input ~ Output)	similarity mean	Std. Dev
/kaŋ-njo/~kaŋ-jo/	2.80	1.07
/saŋ-nju/~saŋ-ju/	2.78	1.06
/soŋ-njək/~soŋ-jək/	2.75	1.17
/koŋ-nip/~koŋ-ip/	1.79	1.20
/kjəŋ-no/~kjəŋ-o/	0.39	0.62
/mjəŋ-naŋ/~mjəŋ-aŋ/	0.25	0.45
/maŋ-næ/~maŋ-æ/	0.13	0.29

The results were submitted to a one-way repeated-measures ANOVA with following vocoids as a within-subject factor. The results showed that there was a significant main effect of vocoid, $F(3.05, 85.42) = 76.61, p < .001$. The stimuli, /-njo/, /-nju/ and /-njə/, were not significantly different from one another ($p > .05$) in similarity rating scores but significantly different from all the other vocoids ($p < .05$). Specifically, /-njo/, /-nju/ and /-njə/ are significantly different

from /-ni/ ($p < .002$, $p < .001$ and $p < .001$, respectively). /ni/ is significantly different from all the other vocoids ($p < .05$). Specifically, it is significantly different from /-no/, /-na/ and /næ/ ($p < .001$, $p < .001$ and $p < .001$, respectively). /-no/, /-na/ and /næ/ are not significantly different from one another ($p > .05$). Conclusively, the results showed that pairs njV~jV are perceptually most similar, a pair ni~i involving a high front vowel are next similar and pairs like no~o, na~a, and næ~æ involving a different vocoid are least similar.

Table 4. Similarity mean scores for an /m-n/ sequence

pairs (Input~Output)	similarity mean	Std. Dev
/sam-nju/~sam-ju/	2.70	1.20
/im-njo/~im-jo/	2.59	0.84
/jəm-njə/~jəm-jə/	2.09	0.77
/sim-ni/~sim-i/	1.05	1.20
/kam-næ/~kam-æ/	0.33	0.40
/kam-non/~kam-on/	0.23	0.41
/jəm-na/~jəm-a/	0.18	0.28

Table 4 shows another similarity mean scores for 220 tokens for each stimuli containing /m-n/. A one-way ANOVA with repeated measures was performed and the results showed that there was a significant main effect of a vocoid that follows the onset /n/ [$F(2.69, 51.01) = 64.41$, $p < .001$]. Specifically, /-nju/, /-njo/ and /-njə/ were not significantly different from one another ($p > .05$) but were significantly different from all the other stimuli ($p < .05$). Specifically, /-nju/, /-njo/ and /-njə/ were significantly different from /-ni/ ($p < .001$, $p < .001$ and $p < .004$, respectively). /-ni/ is significantly different from all the other stimuli ($p < .05$). Specifically, it was significantly different from /-næ/, /-no/ and /na/ ($p < .02$, $p < .002$ and $p < .004$, respectively). /-næ/, /-no/ and /na/ are not significantly different from one another ($p > .05$).

2.5 Discussion

The results in Experiment 1 showed that the vocoids after /n/ influenced

the perceptual similarity scores in pairs. For example, the input~output pair /saŋ-nju/~ /saŋ-ju/ shows higher similarity values than the other pair /koŋ-nip/~ /koŋ-ip/, which in turn shows higher similarity values than the pair /maŋ-næ/~ /maŋ-æ/. That is, the perceptual similarity values are higher if the vocoid following /n/ is in the order of /j/ > /i/ > other vowels, the order which was suggested by Jun (2015) for the frequency of /n/-insertion. Note that the results in this experiment show that /n/s in /nasal-nj/ and /nasal-ni/ contexts are not distinctively perceived and thus support Jun (2015) that Korean /n/ shows low perceptibility.

There are a few ways that /n/s in /nasal-nj/ and /nasal-ni/ are not distinctive. One way would be for /n/s in /nasal-nj/ and /nasal-ni/ to be confused to a null value so that they are perceptually similar to /nasal-j/ and /nasal-i/. Another way could be that onset /n/s in /nasal-nj/ and /nasal-ni/ become similar to the preceding nasals such that /n/s are no longer distinctively perceived: For example, /ŋ-nj/ and /m-nj/ could be perceived as /ŋ-(ŋ)j/ and /m-(m)j/ in which the preceding coda becomes a ambisyllabic segment or a geminate. These sequences would be also perceived as similar to /nasal-j/ and /nasal-i/ sequences. Either way, the results in these contexts support that /n/ in these contexts is a non-prominent segment with low perceptibility.

3. Experiment 2

In this experiment, we test whether the high similarity scores in pairs like /nasal-nj/~ /nasal-j/ and /nasal-ni/~ /nasal-i/ are due to the confusion of onset /n/ to a null value.

3.1 Participants

Another group of eighteen subjects participated in this experiment. Participants were also born and spent most of their lives in Seoul or a nearby province.

3.2 Procedures

For this experiment, the same stimuli used in Experiment 1 were employed. On the computer screen, frame sentences with a blank for the target noun appeared. Also on the computer screen were noun option pairs containing an empty onset option and an onset /n/ option (e.g. /maŋ-æ/ and /maŋ-næ/).

Participants were asked to listen to the word occurring in the blank of the frame sentence. They were instructed to pay attention to the onset of the second syllable of the noun and judge whether they heard an empty onset or not. If they hear an empty onset, they should choose the option with no onset like /maŋ-æ/. If they hear any onset, they should choose the option with an onset like /maŋ-næ/, regardless of the onset quality they perceived. Participants listened to the sentences twice.

This perception test consisted of 2 sections, one for the words containing /ŋ-n/ sequence and the other containing /m-n/ sequence. Participants performed a practice test with 6 sentences before they began each main section. For each word, there were 198 answers (11 tokens*18 listeners =198).

3.3. Results

Table 5 shows the number and percentages of response /ŋ-0/ for each stimulus presentation with a /ŋ-n/ sequence.

Table 5. responses as zero for /n/ in /ŋ-n/

token	Output(Input)	No of Answers	% for zero
/-nju/	/saŋ-ju/ (/saŋ-nju/)	93(198)	46.97
/-njo/	/kaŋ-jo/ (/kaŋ-njo/)	74(198)	37.37
/-njə/	/soŋ-ək/ (/soŋ-njək/)	71(198)	35.86
/-ni/	/koŋ-ip/ (/koŋ-nip/)	33(198)	16.67
/-no/	/kjəŋ-o/ (/kjəŋ-no/)	10(198)	5.05
/-na/	/mjəŋ-aŋ/ (/mjəŋ-naŋ/)	6(198)	3.03
/-næ/	/maŋ-æ/ (/maŋ-næ/)	0(198)	0

The perception scores were submitted to a one-way repeated measures of

ANOVA in which the following vocoid was a within-subject factor. The results showed that there was a significant main effect of vocoid, $F(2.63, 44.67) = 26.27$, $p < .001$. Stimuli, /-njo/, /-nju/ and /-njə/, were not significantly different from one another ($p > .05$) but were significantly different from all the other stimuli ($p < .05$). Specifically, /-nju/, /-njo/ and /-njə/ were significantly different from /-ni/ ($p < .001$, $p < .001$ and $p < .005$, respectively). Stimulus /-ni/ was significantly different from all the other stimuli ($p < .05$). Specifically, it was significantly different from /-na/, /-no/ and /-næ/ ($p < .003$, $p < .005$ and $p < .007$, respectively). /-na/ was not significantly different from /-no/ ($p > .05$) but was significantly different from /-næ/ ($p < .03$). /no/ is not significantly different from /-na/ and /-næ/ ($p > .05$).

Table 6. responses as zero for /n/ in /m-n/

token	Output(Input)	no of Answers	% for zero
/-njə/	/jəm-jə/ (/jəm-njə/)	56(198)	28.28
/-njo/	/im-jo/ (/im-njo/)	53(198)	26.77
/-nju/	/sam-ju/ (/sam-nju/)	51(198)	25.76
/-na/	/jəm-a/ (/jəm-na/)	15(198)	7.58
/-no/	/kam-on/(kam-non/)	10(198)	2.55
/-ni/	/sim-i/(/sim-ni/)	5(198)	2.52
/-næ/	/kam-æ/(/kam-næ/)	0(198)	0

Table 6 shows the number and percentages of response /m-0/ for stimulus presentations. A one-way ANOVA with repeated measures showed a significant main effect of a vocoid [$F(2.57, 43.61) = 11.47$, $p < .001$]. Stimuli /-njə/, /-njo/ and /-nju/ were not significantly different from one another ($p > .05$) but were significantly different from all the other stimuli ($p < .05$). Specifically, /-njə/ was significantly different from /-na/, /-no/, /-ni/ and /-næ/ ($p < .007$, $p < .004$, $p < .001$ and $p < .002$, respectively). /-njo/ was significantly different from /-na/, /-no/, /-ni/ and /-næ/ ($p < .017$, $p < .005$, $p < .001$ and $p < .001$, respectively). /-nju/ was significantly different from /-na/, /-no/, /-ni/ and /-næ/ ($p < .011$, $p < .005$, $p < .001$ and $p < .001$, respectively). Stimuli /-na/, /-no/, /-ni/ and /-næ/ are not significantly different from one another ($p > .05$).

3.4 Discussion

This section tested whether Korean listeners confused /n/ as a null value in /nasal-nj/ and /nasal-ni/. The results showed that when the preceding segment is /m/ or /ŋ/, a high front vocoid /j/ induced confusion of onset /n/ as a null value more frequently than any other vocoids. For example, 47% of /saŋ-nju/ were perceived as /saŋ-ju/ with an empty onset. If the preceding segment is /ŋ/, a high front vocoid /i/ also induced some confusion of onset /n/ as a null value. The results in this experiment support the suggestion that Korean /n/ is a non-salient segment in /nasal-nj/ and /nasal-ni/ (cf. Jun 2015) and that the non-salient segment /n/ in these contexts is often misidentified as a null value (cf. Cote, 2000; Steriade, 2001, 2009).

The results are particularly interesting in that some differences are observed from those in Experiment 1. In Experiment 1, the input~output pair /nasal-ni/~nasal-i/ involving a high front vowel showed lower similarity values than a pair /nasal-nj/~nasal-j/ containing a high front glide but higher similarity values than a pair like /nasal-na/~nasal-a/ involving a different vocoid, regardless of the preceding nasal, /m/ or /ŋ/. However, the results in this section showed that when the preceding segment was /m/, participants did not perceive a null value in /n/ of the onset position any differently when the following segment was /i/ from when it was a non-high front vocoid like /a/. Thus, the higher similarity values for a pair /m-ni/~m-i/ than a pair /m-na/~m-a/ in Experiment 1 might not be due to the confusion of /n/ as a null value before a high front vocoid /i/. More research is needed to determine this issue.

4. Conclusion

This paper examined the perceptibility of Korean /n/ in /nasal-nV/ sequences and showed that /n/ was not salient in the tokens containing /nasal-njV/ and /nasal-ni/. Specifically, in Experiment 1, it was shown that when the preceding consonant is /ŋ/ or /m/, the perceptual similarity scores in an input~output pair /nasal-njV/~nasal-jV/ were higher than those in a pair

/nasal-ni/~nasal-i/, which were in turn higher than those in a pair like /nasal-na/~nasal-a/ involving a different vocoid.

In Experiment 2, it was shown that the frequency of onset /n/ being confused as zero depended on the following vocoid: if the preceding nasal was /ŋ/, /n/ was confused as zero more frequently in the order of /j/ > /i/ > other vocoid and if the preceding segment was /m/, in the order /j/ > /i/, other vocoid. Based on these results, we suggested that /n/ had low perceptibility in /nasal-njV/ and /nasal-ni/ in Korean.

These results support for Jun (2015) who has argued that Korean /n/ has low perceptibility before high front vocoids than before other vocoids. His suggestion is based on the /n/-insertion in /C-jV/ and /C-i/ which results in /nasal-njV/ and /nasal-ni/, respectively.

Though both /n/-insertion in Jun (2015) and /n/-confusion which we discussed in this paper argue for the perceptual non-prominence of /n/ in Korean, the important environments for inducing perceptual non-prominence of /n/ seem different between the two proposals. Unlike Jun (2015) who emphasized the following high vocoids /i j/ as important contexts, this paper has argued that not only the following high vocoids /i j/ but also the preceding nasals are important.

Note that we follow Jun (2015) and suggest that /n/ is perceptually less salient before high front vocoids than before other vocoids. We offer some more details why high vocoids are important in inducing perceptual non-prominence of /n/. First, /n/ murmur (derived from /n/ before high vocoids) does not have prominent cues of place of articulation compared to other nasal murmurs: Recasens (1983) showed that [ɲ] murmur is not perceptually salient in Cantonese. In Polish, isolated palatal /ɲ/ murmurs are mainly identified as velar /ŋ/, not /ɲ/ (cf. Recasens, 1983 citing Dukiewicz, 1967). In Hakka Chinese, palatal /ɲ/ and a velar nasal /ŋ/ before a high front vocoid /i/ showed identical acoustic characteristics (Zee & Lee, 2008). All these research findings show that palatal murmur /ɲ/ has relatively weak cues for place of articulation and is often confused to /ŋ/. Rather, the transition of a palatal segment /ɲ/ is argued to have salient cues of place of articulation in Recasens (1983).

Therefore, input~output pairs like /ɲjV/~jV/ and /ɲi/~i/ may not show

much perceptual difference in the cues of place of articulation at the beginning of the stimuli, respectively, since /j/ and /i/ are palatal segments showing palatal transitions just like transitions from /n/ to the following vocoids in /n(j)V/ and /ni/.

However, this does not mean that there is little perceptual difference in input~output pairs of j~nj and i~ni: The second stimulus in each pair begins with a nasal consonant, perceptually distinct from the first stimulus in the pair that begins with a vocoid. We would like to suggest that this is why the preceding environment is important. With the preceding nasal, in the input~output pairs like /ŋj/~ŋnj/ and /ŋi/~ŋni/, for instance, the vocoid in the first stimuli of each pair is preceded by a coda nasal consonant such that the perceptual differences between the two stimuli in each pair would be smaller than those between two stimuli in a pair like /jV/~njV/ in which the first stimulus in the pair is not preceded by a nasal consonant. Therefore, the preceding environment is important in perceptual confusion.

This paper has attempted to support the proposal in Steriade (2009) that the same segment is likely to be inserted and deleted since it has low perceptibility. Jun (2015) has argued that /n/ is inserted in certain environment due to its low perceptibility. This paper showed that /n/ is confused in the same contexts due to its low perceptibility. With /n/-insertion and /n/-confusion in the same contexts, the proposal in Steriade (2009) is well supported.

This paper has some limitations. First, the data we examined included only a small set of /ŋn/ and /m-n/ sequences (7 sequences each), though they were produced by eleven speakers. More extensive data with /ŋn/ and /m-n/ sequences need to be investigated to show how extensive this phenomenon is. However, this paper at least showed that there is such tendency of /n/-confusion in /nasal-nj/ and /nasal-ni/. In addition, the author would like to note that in the author's speech the perceptual confusion this paper discussed frequently occurs. Moreover, in Korean portal sites, words like /saŋ-lyu/ and /jəm-lyə/ often appear as /saŋ-yu/ and /jəm-yə/ without /n/, not the expected forms /saŋ-nyu/ and /jəm-nyə/. We suggest that these misspellings represent the speech habits of speakers.

In future studies, extensive data with /nasal-nj/ and /nasal-ni/ including many other morphological contexts need to be tested.

References

- Cote, M. (2000). *Consonant cluster phonotactics: a perceptual approach*. Unpublished doctoral dissertation. MIT. Boston, MA.
- Jun, J.-H. (2015) Korean n-insertion: a mismatch between data and learning. *Phonology*, 32, 417-458.
- Kang, O.-M. (2003). *Korean phonology*. [Hankwuke umwunlon.] Seoul: Thaeaksa.
- Kim, C.-W. (1970). Boundary phenomena in Korean. *Papers in Linguistics*, 2, 1-26.
- Kim-Renaud, Y.-K. (1974). *Korean consonantal phonology*. Doctoral dissertation. University of Hawaii. Published 1991, Seoul: Hanshin.
- Kim, Y.-P., Park, S., Ahn, B. & Lee, B. (2002). An overview of studies of Korean /n/-insertion. [Niun sapiphyensanguy yenkwusacek kemtho.] *Emwunnoncip*, 46, 43-71.
- Ko, K.-M. (1992). n-epenthesis and sai-sios in Korean. [Niun chemkawa saisioseytayhanyenkwu.] *Eoneohak*, 14, 31-51.
- Recasens, D. (1983). Place cues for nasal consonants with special reference to Catalan. *Journal of the Acoustical Society of America*, 73, 1346-1353.
- Steriade, D. (2001). Directional asymmetries in place assimilation: a perceptual account. In E. Hume & K. Johnson (Eds.), *The role of speech perception in phonology* (pp. 219 – 250). San Diego, CA: Academic Press.
- Steriade, D. (2009). The phonology of perceptibility effects: the P-map and its consequences for constraint organization. In K. Hanson & S. Inkelas (Eds.), *The nature of the word: studies in honor of Paul Kiparsky* (pp. 151-179). Cambridge, Mass.: MIT Press.
- Zee, E & Lee, W. (2008). The articulatory characteristics of the palatals, palatalized velars and velars in Hakka Chinese. In *8th International Seminar on Speech Production ISSP*.

Hyunsook Kang

Department of English Language and Culture

College of Languages and Cultures, Hanyang University

55 Hanyang Daehak-ro, Sangrok-gu

Ansan, Gyeonggi-do, 15588, Korea

Phone: 82-31-400-5348

Email: hskang@hanyang.ac.kr

Received on April 13, 2016

Revised version received on August 26, 2016

Accepted on September 30, 2016