

Multiple stem-final variants in Korean native nouns and loanwords^{*}

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Abstract. The stem-final variation patterns of Korean nouns have recently turned out to be very complicated. Most importantly, several obstruents are involved as free variants. To verify the variation patterns and check the validity of certain previous analyses relying on multiple stochastic rules and constraints, the present study provides an experimental investigation of Korean native nouns and loanword adaptations. The results mostly confirm the occurrence of multiple variants and many predictions which can be made in the previous approaches employing multiple rules and constraints. It is also found that English loanwords in Korean show stem-final variation which is not significantly different from the variation observed among native Korean nouns. Consequently, it is indicated that native Korean speakers are well aware of complicated variation patterns, and use the knowledge of the patterns when they deal with the novel forms.

Outline

1. Introduction
 - 1.1 Background information: Korean stem-final obstruents
 - 1.2 Variation in Korean nouns
2. Experiments
 - 2.1 Experiment 1
 - 2.2 Experiment 2
 - 2.3 Experiment 3
3. Results
 - 3.1 Experiment 1
 - 3.2 Experiment 2
 - 3.3 Experiment 3
4. Discussion

1. Introduction

In Korean, stem-final obstruents of nouns show free variation (Ko 1989; Martin 1992; Hayes 1998; Y. Kang 2003a,b; Albright 2005a,b; and others): for example, /pat^h-il/ ‘field, accusative’ [pat^h-il] ~ [pas-il]. Some recent studies on the realization of the stem-final obstruents of Korean nouns (Kim 2003; Choe 2004; E. Kang et al. 2004; Oh 2006; and Oh & Shin 2007) suggest that the variation patterns are more complicated than previously thought, and they are subject to several statistical tendencies. Most notably, a wide set of coronal obstruents [s, č^h, t^h, č, t] may be involved as free variants. Building on Albright (2005a,b), Jun (2007) provides a frequency-based account for the variation patterns, arguing that native Korean speakers are aware of such statistical patterns and use the knowledge in a wug-test. The frequency-based accounts typically employ multiple stochastic rules or constraints, each of which is responsible for the derivation of a single variant and their applicability is determined based on the lexical frequency. To check the validity of some crucial patterns, including the occurrence of multiple variants, and their stochastic analysis, this paper provides an experimental investigation

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of the variation in Korean native nouns and loanword adaptation. The results mostly confirm the occurrence of multiple variants and many predictions made from the frequency-based approaches employing multiple stochastic rules or constraints. It is also found that English loanwords in Korean show stem-final variation which is similar to the variation observed among native Korean nouns. This finding, which is consistent with the results of a wug-test by Jun (2007), suggests that native Korean speakers are well aware of complicated variation patterns, and use the knowledge of the patterns when they deal with the novel forms.

1.1 Background information: Korean stem-final obstruents

Korean obstruent phonemes may be classified into three series of consonants, lenis, aspirated and tense, as shown below:

(1) Three-way laryngeal distinction among obstruents in Korean

	<i>Labial</i>	<i>Coronal</i>			<i>Velar</i>
	Stop	Stop	Fricative	Affricate	Stop
Lenis	p	t	s	č	k
Aspirated	p ^h	t ^h		č ^h	k ^h
Tense	p'	t'	s'	č'	k'

These obstruents may be targeted in some phonological changes. Two of them are relevant to the data discussed in this paper. First, aspirated and tense obstruents in coda position become their homorganic lenis stop counterparts. This coda neutralization applies with no exception. In addition, coronal obstruents are palatalized before the high front vowel [i]. Specifically, alveolar stops [t, t^h] become palato-alveolar affricates [č, č^h], and alveolar fricatives [s, s'] become palato-alveolar counterparts [ʃ, ʃ'] in the palatalizing context. The former palatalization process applies only when a morpheme boundary intervenes, whereas the latter is an automatic process. Among the two palatalization processes, only the cross-morphemic palatalization will be reflected in the phonetic transcription of the data of this paper since the fricative palatalization is completely predictable and it is not relevant to any important part of this paper.

These phonological processes cause alternations in the noun paradigm. As shown in (2), Korean noun stems may appear with a variety of final obstruents when they combine with certain vowel-initial suffixes such as the locative case marker *-e*. However, isolation forms may end only with (unreleased) lenis stops, due to the coda neutralization. Also, before the nominative case marker *-i*, stem-final coronal obstruents are realized only as palato-alveolars such as [č, č^h], due to the coronal palatalization. As a result, noun stems ending with obstruents show stem-final alternations within the paradigm. For instance, the final consonant of the noun stem meaning 'field' appears as [t^h] before the locative case marker *-e*, [t] in the isolation form, and [č^h] before the nominative case marker *-i*.

(2) Alternations of stem-final obstruents in nouns

stem-final C	(i) locative (-e)	(ii) isolation form	(iii) nominative (-i)	gloss
<u>Coronal</u>	os-e	ot ^ɾ	os-i	‘clothes’
	pat ^h -e	pat ^ɾ	pač ^h -i	‘field’
	nač-e	nat ^ɾ	nač-i	‘day’
	pič ^h -e	pit ^ɾ	pič ^h -i	‘light’
<u>Labial</u>	pap-e	pap ^ɾ	pap-i	‘rice’
	ip ^h -e	ip ^ɾ	ip ^h -i	‘leaf’
<u>Dorsal</u>	kuk-e	kuk ^ɾ	kuk-i	‘soup’
	pak ^ʔ -e	pak ^ɾ	pak ^ʔ -i	‘outside’
	puək ^h -e	puək ^ɾ	puək ^h -i	‘kitchen’

In standard rule-based analysis of these stem-final alternations, the output form occurring before the vowel-initial suffixes (except for [i]-initial ones) is posited as the underlying form, (which is reflected in standard Korean orthography). The above mentioned phonological rules apply to the underlying form to produce unreleased lenis stops and palatalized consonants in the isolation and nominative forms respectively. This standard rule-based analysis can be illustrated by the following derivation of some allomorphic forms of the stem /pat^h/.

(3) Standard rule-based analysis of the alternations

	<u>locative</u>	<u>isolation form</u>	<u>nominative</u>
<u>Underlying form:</u>	/pat ^h +e/	/pat ^h /	/pat ^h +i/
<u>Coda neutralization</u>		t	
<u>Palatalization</u>			č ^h
<u>Surface form:</u>	pat ^h e	pat	pač ^h i

1.2 Variation in Korean nouns

It has been observed and discussed in the literature (Ko 1989; Martin 1992; Hayes 1998; Han 2002; Y. Kang 2003a,b; Albright 2005a,b; Kim 2005; and others) that pre-vocalic allomorphs of the noun stems, such as [pat^h-e] and [pač^h-i] in (3), show free variation of final obstruents.

The variation patterns were originally known as somewhat simple. When the stem-final obstruent is coronal, its variant is basically [s]: for example, /pat^h-e/ ‘field, locative’ [pat^h-e] ~ [pas-e]. In contrast, when the stem-final obstruent is noncoronal, the

noncoronal aspirated or tense stop is in variation with its homorganic lenis stop counterpart: for example, /puək^h-e/ ‘kitchen, locative’ [puək^h-e] ~ [puək-e].

However, results of the recent studies by Kim (2003), Choe (2004), E. Kang et al. (2004), Oh (2006), and Oh & Shin (2007) indicate that the variation patterns are a lot more complicated than previously thought. When the stem-final obstruent is underlyingly (or etymologically in theory-neutral terms) coronal, five coronal obstruents [s, t^h, č^h, č, t] have been observed as free variants, as is illustrated in the following data from Jun (2007) which are originally culled from Kim (2003), Choe (2004) and E. Kang et al. (2004).

(4) Noun variation: Stem-final obstruent = coronal (chosen from Kim 2003; Choe 2004; and E. Kang et al. 2004)

<u>Stem-final C</u>	<u>UR</u>	<u>Standard</u>	<u>Variants</u>	<u>gloss</u>
a. /t ^h /	(i) /pat ^h -i/	pac ^h -i	pas-i	‘field’
	(ii) /pat ^h -ilo/	pat ^h -ilo	pas-ilo ~ pač ^h -ilo	‘field’
	(iii) /sot ^h -e/	sot ^h -e	sos-e ~ soč ^h -e ~ sot-e	‘pot’
	(iv) /mit ^h -il/	mit ^h -il	mis-il ~ mič ^h -il ~ mit-il	‘bottom’
b. /č ^h /	(i) /k’oč ^h -ilo/	k’oč ^h -ilo	k’os-ilo ~ k’ot ^h -ilo	‘flower’
	(ii) /k’oč ^h -a/	k’oč ^h -a	k’os-a ~ k’ot ^h -a ~ k’oč-a ~ k’ot-a	‘flower’
	(iii) /nač ^h -ilo/	nač ^h -ilo	nas-ilo ~ nat ^h -ilo	‘face’
	(iv) /tač ^h -il/	tač ^h -il	tas-il ~ tat ^h -il ~ tač-il	‘anchor’
	(v) /toč ^h -e/	toč ^h -e	tos-e ~ tot ^h -e ~ toč-e ~ tot-e	‘sail’
	(vi) /pič ^h -il/	pič ^h -il	pis-il ~ pit ^h -il	‘light’
c. /č/	(i) /nač-ilo/	nač-ilo	nas-ilo ~ nač ^h -ilo	‘daytime’
	(ii) /pič-in/	pič-in	pis-in ~ pič ^h -in	‘debt’
	(iii) /mokčəč-e/	mokčəč-e	mokčəs-e ~ mokčəč ^h -e	‘uvula’

(Suffixes: /-i/ = nominative, /-il/ = accusative, /-ilo/ = locative/instrumental, /-in/ = topic, /-e/ = dative/locative, /-a/ = vocative)

In addition, several statistical patterns have been observed in the variation of stem-final coronal obstruents. First, among the five coronal obstruent variants, there is an order of usage preference: in general, s >> č^h >> t^h >> č, t. This relative preference may be different depending on the following suffix. In general, [s] is the most preferred as the stem-final obstruent variant whereas [č] and [t] are least preferred. But the relative preference between [č^h] and [t^h] depends on whether the following suffix is *i*-initial or *e*-initial. [č^h] is preferred before *i*-initial suffixes such as *-il*, *-in* and *-ilo* whereas [t^h] is preferred before *e*-initial suffixes such as *-e* ‘locative/dative’ and *-esə* ‘locative’.

Among these observations and patterns, we think the occurrence of a wide set of

variants is the most important one since it requires at least a drastic revision of most previous analyses of Korean noun variation which propose a single rule or constraint deriving [s]-final variants. Some relevant rules and constraints are shown below:

(5) Rules or constraints deriving the stem-final variant [s] of nouns

a. Intervocalic (optional) assibilation: /t, č^h, č/ → [s] / V__+V (Kim 2001; cf. Choi 2002)

b. Morphological rule: /t/ → [s] / __+V (noun paradigm) (trivially adapted from Ko 1989)

c. Anticorrespondence constraint: t/[__]_{noun}# → s/[__]_{noun}V

“If a noun ends in [t] in isolation form, change it to [s] before a vowel initial suffix.” (Y. Kang 2003b)

(5a) is proposed as a phonetically-natural rule which changes intervocalic coronal obstruents to [s]. (See Choi 2002 for the proposal of a constraint comparable to the rule in (5a).) (5b,c) are morphological rule and constraint, respectively, which require that prevocalic allomorphs of nouns should end in [s] if their corresponding isolation forms end in [t]. It is obvious that these rules and constraints say nothing about the occurrence of other coronal variants. More specifically, it is very difficult to explain the occurrence of those which cannot be derived through the application of those in (5) or the cross-morphemic palatalization. (6) lists such problematic forms chosen from (4).

(6) Problematic variants

<i>Stem-final C</i>	<i>UR</i>	<i>Variants</i>	<i>gloss</i>
a. /t ^h /	(i) /pat ^h -i/		‘field’
	(ii) /pat ^h -ilo/	pač ^h -ilo	‘field’
	(iii) /sot ^h -e/	soč ^h -e ~ sot-e	‘pot’
	(iv) /mit ^h -il/	mič ^h -il ~ mit-il	‘bottom’
b. /č ^h /	(i) /k’oč ^h -ilo/	k’ot ^h -ilo	‘flower’
	(ii) /k’oč ^h -a/	k’ot ^h -a ~ k’oč ^h -a ~ k’ot-a	‘flower’
	(iii) /nač ^h -ilo/	nat ^h -ilo	‘face’
	(iv) /tač ^h -il/	tat ^h -il ~ tač ^h -il	‘anchor’
	(v) /toč ^h -e/	tot ^h -e ~ toč ^h -e ~ tot-e	‘sail’
	(vi) /pič ^h -il/	pit ^h -il	‘light’
c. /č/	(i) /nač-ilo/	nač ^h -ilo	‘daytime’
	(ii) /pič-in/	pič ^h -in	‘debt’
	(iii) /mokčəč-e/	mokčəč ^h -e	‘uvula’

Notice that these variant forms are neither identical to their underlying forms nor the result of the rules or constraints mentioned above.

One might consider the possibility that different mechanisms derive different variants. For instance, [s] is derived by one of those in (5), and other variants shown in (6) are derived through independently motivated mechanisms. But, this seems implausible if we consider the finding that the usage preference among variants is in fact matched by the relative frequency of stem-final obstruents (Jun 2007; cf. Albright 2005a).¹ This finding may be confirmed by the distribution of final obstruents of nouns, shown below, which comes from Kang and Kim (2004) employing the 5.5 million word text corpus of Sejong Project as a database.²

(7) Distribution of final obstruents of nouns

<u>Labial</u>		<u>Coronal</u>		<u>Velar</u>	
p	2370	t	7	k	7274
p ^h	81	t ^h	141	k ^h	22
p'	0	t'	0	k'	9
		č	19		
		č ^h	227		
		č'	0		
		s	428		
		s'	0		

From this distribution data, the following hierarchy may fall out:

(8) Frequency hierarchies among final obstruents of nouns

- a. Coronal: s >> č^h >> t^h >> č, t
- b. Noncoronal: k >> k^h, k'
- p >> p^h

Notice, as pointed out by Ko (1989), Hayes (1998) and Albright (2005a,b), that the most preferred/frequent coronal variant [s] is matched by the highest type frequency of [s]-final noun stems. Likewise, the least preferred/frequent coronal variants [č, t] are matched by the lowest frequency of [č/t]-final stems. A similar frequency matching can be conceived for the variants ending in noncoronal lenis stops. The occurrence of lenis-

¹ See Jun (2007) for the criticism on previous explanations of some of the problematic variants.

² Kang and Kim's (2004) database includes not only mono-morphemic nouns but also compound nouns which are listed as separate entries in Standard Korean Dictionary (written in Korean [phyocwunkwuketaesaceon], published in 1999, Dusan Dong-A). For the distribution in (7), we have removed English loanwords from Kang and Kim's database by hand-checking.

final variant forms for stems ending in underlying noncoronal aspirated/tense stops may be motivated by the higher lexical frequency of the noun stems ending in noncoronal lenis stops /p, k/, compared to those ending in aspirated/tense stops, /p^h, k^h, k’/.

This frequency matching cannot be accidental since Jun (2007) shows that native Korean speakers use this knowledge of the lexical frequency in a wug-test on Korean stem-final variation. Thus, any reasonable analysis of Korean noun variation should provide a unified account for the occurrence of multiple variants, where the relative preference of the variants is determined by the lexical frequency.

One plausible direction for analysis would be that the occurrence of multiple variants is the result of the variable resolution of multiple competing rules/constraints, each of which requires a certain variant to occur before a vowel-initial suffix, and the applicability of the rules/constraints is determined in terms of the lexical frequency of the noun stems ending in the variant obstruent. To obtain such multiple rules/constraints, the morphological rule for the variant [s] in (5b) may be duplicated with different outputs as shown below:

(9) Morphological rules deriving the stem-final coronal variants of prevocalic allomorphs of a noun stem

- a. /t/ → [s] / __+V (“If the isolation form of a noun stem ends in [t], its prevocalic allomorph should end in [s].”)
- b. /t/ → [č^h] / __+V (... its prevocalic allomorph should end in [č^h])
- c. /t/ → [t^h] / __+V (... its prevocalic allomorph should end in [t^h])
- d. /t/ → [č] / __+V (... its prevocalic allomorph should end in [č])
- e. /t/ → [t] / __+V (... its prevocalic allomorph should end in [t])

Each of these rules, which derives a coronal variant, has different reliability depending on the type frequency of relevant stem-final obstruents of nouns (Albright 2002a,b, 2005a,b). The resulting hierarchy based on the relative lexical frequency, shown in (8a), would be the following:

(10) Reliability hierarchy of rules deriving coronal variants

$$/t/ \rightarrow [s] \gg /t/ \rightarrow [\check{c}^h] \gg /t/ \rightarrow [t^h] \gg /t/ \rightarrow [\check{c}], /t/ \rightarrow [t]$$

This hierarchy would explain the overall relative preference of the variants. In addition, from the assumption that the higher reliability a rule has, the more often it applies, it may fall out that all five obstruents occur as variants with different frequency. This rule-based analysis can be readily accommodated within the framework of Albright’s paradigm learning model (Albright 2002a,b, 2005a,b; and Albright & Hayes 2003).

A comparable constraint-based analysis would include multiple stochastic constraints, as opposed to rules, whose relative rankings are in principle variable

(Boersma and Hayes 2001; Zuraw 2002; and Hayes and Londe 2006). This type of analysis is in fact adopted by Jun (2007). The following language-specific constraints are proposed which are responsible for the output forms of stem-final coronal obstruents of Korean nouns.

(11) Constraints for coronal variants³

- a. [s/___noun+V]: the stem-final coronal obstruent of nouns must be [s] before a vowel-initial suffix.
- b. [č^h/___noun+V]: the stem-final coronal obstruent of nouns must be [č^h] before a vowel-initial suffix.
- c. [t^h/___noun+V]: the stem-final coronal obstruent of nouns must be [t^h] before a vowel-initial suffix.
- d. [č̣/___noun+V]: the stem-final coronal obstruent of nouns must be [č̣] before a vowel-initial suffix.
- e. [t/___noun+V]: the stem-final coronal obstruent of nouns must be [t] before a vowel-initial suffix.

The ranking of these constraints is determined by the type frequency of the forms in the constraint focus. From the hierarchy in lexical frequency of stem-final obstruents, shown in (8a), the following ranking falls out:

(12) Ranking of constraints for coronal variants

[s/___noun+V] >> [č^h/___noun+V] >> [t^h/___noun+V] >> [č̣/___noun+V] >> [t/___noun+V]

Following stochastic Optimality Theory (Boersma and Hayes 2001; Hayes and Londe 2006), it is assumed that the constraint ranking is variable in actual speech production and perception. Thus, the ranking given above may be considered as an average ranking in the sense that it is most often adopted. Thus, it is more likely (but not always the case) that constraints ranked higher in the average ranking outrank constraints ranked lower in actual speech production and perception. In summary, the ranking in (12) explains the general preference/frequency hierarchy among variants. And “variable” ranking explains free variation. Comparable constraints and rankings may be proposed for the analysis of the noncoronal stem-final variants, as shown below.

³ Jun (2007) proposes different constraints depending on the following suffix, and the constraints are not specific to the nouns. But, we here discuss a simpler form of Jun’s analysis for the expository purpose.

(13) Constraints for noncoronal variants and their internal ranking

- a. [lenis/___noun+V]: the stem-final noncoronal obstruent of nouns must be lenis before a vowel-initial suffix.
- b. [aspirated/___noun+V]: the stem-final noncoronal obstruent of nouns must be aspirated before a vowel-initial suffix.
- c. [tense/___noun+V]: the stem-final noncoronal obstruent of nouns must be tense before a vowel-initial suffix.
- d. Ranking: [lenis/___noun+V] >> [aspirated/___noun+V], [tense/___noun+V]

These constraints and ranking may explain why lenis stops occur as free variants of stem-final noncoronal aspirated and tense stops.

In the above, we have discussed two possible analyses of the expanded set of data. The two analyses are very similar to each other. They basically differ in whether variants are derived by a rule or a constraint. The rule-based analysis is based on Albright's model (2005a,b). The constraint-based one is mostly from Jun (2007).

One purpose of this paper is to check the validity of these frequency-based approaches employing multiple stochastic rules and constraints. To do so, we will now consider their predictions, ignoring the issue of which of the two is more appropriate for the analysis of Korean noun variation.⁴ As will be stated below, many such predictions are difficult to test with the results of previous studies. This is because in most previous studies (Kim 2003; Choe 2004; E. Kang et al. 2004; Oh 2006; and Oh & Shin 2007), both test stems and the range of response items are very much limited.

First, no previous studies investigate the question of whether [s]-final stems show variation.⁵ Notice that it is not even an option within previous studies in which [s] is almost the only coronal variant, and it is derived from other underlying coronal obstruents through the application of rules/constraints in (5). However, within the stochastic approaches discussed above, it would not be surprising if [s]-final stems show variation. For instance, there is no guarantee that even the constraint ranked highest in the average ranking in (12), i.e., [s/___noun+V], is always top-ranked at each point of actual speech production and perception. When stochastic constraints for other coronal obstruents are top-ranked, less preferred/frequent variants would be attested even for [s]-final stems. Similar predictions can be made with stems ending in noncoronals. Specifically, since any of the three constraints in (13) may outrank the other two constraints, it is possible that stems with an underlying final lenis stop surface with its aspirated or tense counterpart stem-finally, and that stems ending in either one of aspirated and tense stop in the underlying form surface with the other stop occurring stem-finally.

Second, it has been known that when English words ending in alveolar stops, [t, d],

⁴ See Jun (2007) for the discussion of why his output-oriented approach is more appropriate for the analysis of Korean stem-final variation than Albright's source-oriented approach.

⁵ We are indebted to Stuart Davis (personal communication) for bringing this point to our attention.

are adapted into Korean, the adapted loanwords end in [s] before vowel-initial suffixes: for example, the topic form of “good” is [kus-in]. It has been assumed that this is related to the predominant occurrence of [s]-final variants in Korean noun variation (Ko 1989; Sohn 2001; Choi 2002; Davis & Kang 2006). If English loanword adaptation is really related to native noun variation, it is predicted from the above discussion that other variants like [č^h]-final forms should be attested with English loan words ending in the alveolar stop.

In addition to these predictions, we may still need to investigate the validity of the variation patterns discussed in Jun (2007). This is because no previous survey studies adopt all potential variants as the response choices of equal importance. For instance, as shown below, Choe’s (2004) survey forms mostly include only two main response items for each test word, under the assumption that [s] is the canonical variant of the stem-final coronal obstruents, and thus what needs to be examined is the relative preference between the underlying stem-final obstruent and [s].

(14) An experimental sentence and response items (from Choe 2004)

i k’oč^h-esə talk^homhan nɛmsɛ-ka na.

‘this’ ‘flower, locative’ ‘sweet’ ‘smell, nominative’ ‘come’
 ‘This flower smells sweet’

(i) [k’osesə] (ii) [k’oč^hesə] (iii) don’t know (iv) other ()

Notice that when the subjects think they normally produce either the underlying obstruent in (ii) or [s] in (i), they may complete their task simply by marking the corresponding number. In contrast, other potential variants such as [č, t^h, t] are not shown on the survey form, and thus when the subjects think they produce one of them, they have to write down the entire form with the variant within parentheses in (iv). It is quite possible that the design of this survey encourages the participants to choose only among directly given variants.

To explore the predictions and the variation patterns, presented above, we performed three sets of experiments. The following section discusses the method of the experiments.

2. Experiments

The three sets of experiments are different with respect to the method or/and test words employed. The same group of subjects participates in all three experiments. Ten native Korean subjects (six male, four female), aged 20s, were recruited from the community at Yeungnam University, Daegu, Korea.

2.1 Experiment One

Thirteen native Korean noun stems, listed below and transcribed based on the Korean orthography, were employed in constructing target words of Experiment One.

(15) Test stems: native Korean nouns

Place of articulation	<u>final</u> <u>obstruent</u>	<u>test stems</u>	<u>gloss</u>
coronal (8 stems)	s	nas	'sickle'
		os	'clothes'
	č	nač	'day'
		čəč	'breast'
	č ^h	k' oč ^h	'flower'
		nač ^h	'face'
	t ^h	pat ^h	'field'
		p ^h at ^h	'red bean'
velar (3 stems)	k ^h	puək ^h	'kitchen'
	k'	pak'	'outside'
	k	pjak	'wall'
labial (2 stems)	p ^h	ip ^h	'leaf'
	p	pap	'rice'

These test stems were suffixed with three different case markers, *-i* 'nominative', *-il* 'accusative', and *-e* 'locative/dative'. Then, 39 target words (13 stems x 3 suffixes) should have been employed in the test, but a single word form [čəč-e] was not included by an experimenter's mistake. As a result 38 target words in total were employed. The subjects' productions of these target words were transcribed by the experimenter, the second author of this paper, during a pre-planned conversation between the experimenter and the subjects. The pre-planned conversation consists of two sentences, one question and its (expected) answer. The subjects were instructed to answer the experimenter's question using the test stems shown to them on a sheet of paper. An example question-answer pair, where an expected target word is marked with an underline, is shown below.

(16) Example question-answer pair⁶

a. Experimenter: halməni-nin əti-e kjese-jo?

grandma-Top where-Loc exist-Int

⁶ Abbreviations used in (16, 18, 20) are the following: Top = Topic marker, Loc = Locative case marker, Int = Interrogative, Decl = Declarative sentence ender, Dat = Dative case marker, Con = Converb, SE = Sentence Ender, Nom = Nominative case marker.

‘Where is the grandmother?’

b. Subject: pat^h-e kjese-jo.
field-Loc exist-Decl

‘She is in the field.’

([pat^h], written in Korean orthography, is shown on a sheet of paper.)

2.2 Experiment Two

The following six English words ending in alveolar stops, two *d*-final and four *t*-final, were employed as target words of Experiment Two.

(17) Test stems: English words

<u>final obstruent</u>	<u>test stems</u>
d	good
	David
t	cut
	Pat
	Matt
	meet

These test words were suffixed with three different case markers beginning with [i], [ɪ], and [e]. The resulting eighteen target stimuli (6 stems x 3 suffixes), written in English alphabets, were put in the context of sentences as shown below:

(18) Example experimental sentences

a. Matt-i David-ege jəŋə-lil pəu-nin tesin David-in Matt-ege kwahak-il pəu-əja han-ta
Matt-Nom David-Dat English-Acc learn-Con instead David-Top Matt-Dat science-Acc learn-should do-SE

‘Matt is going to learn English from David whereas David should learn science from Matt.’

b. Pat-i kačəŋ jəŋə-lil čal han-ta
Pat-Nom most English-Acc well do-SE

‘Pat studies English best.’

Above, underlines are added to highlight the target stimuli. The subjects were asked to read the experimental sentences in normal speed. As in Experiment One, the subjects’ productions of these target stimuli were transcribed by the experimenter.

2.3 Experiment Three

Four native Korean noun stems and four English words, listed below, were employed as target stems of Experiment Three.

(19) Test stems: native Korean nouns and English words

	<u>final obstruent</u>	<u>test stems</u>	<u>gloss</u>
native Korean	s	os	'clothes'
	č	pič	'debt'
	t ^h	p ^h at ^h	'red bean'
	č ^h	suč ^h	'charcoal'
English	t	Matt	
		cut	
	d	David	
		good	

As in the first two experiments, these test words were suffixed with three different case markers beginning with [i], [i], and [e] ((4+4) x 3 = 24 test forms in total). The resulting target stimuli, together with their possible phonetic forms, were put in the context of sentences in the format shown in (20). The phonetic forms of each target stimulus differ only in the stem-final obstruent. Five coronal obstruents [s, t^h, č^h, č, t] were employed as the stem-final obstruent.

(20) Example experimental sentences

os-i ip'ə
 'clothes'-Nom 'nice'
 'The clothes are nice.'

[osi] ()
 [ot^hi] ()
 [oč^hi] ()
 [oči] ()
 [oti] ()

The experimental sentences, randomly ordered, and phonetic forms were written on A4 size paper in standard Korean orthography. The subjects were asked to evaluate their degree of acceptability by rating 1 through 5 in the order of acceptability with 5 (perfect) and 1 (impossible). The subjects were allowed to provide the same rating for different phonetic stimuli of the same test form.

3. Results

3.1 Experiment One

Results of Experiment One may be divided into two parts depending on the place of articulation of the stem-final obstruents of the experimental stimuli, all of which are native Korean nouns. The table below shows the results of the experiment employing coronal-final stems. The numbers in the table indicate how many subjects produced the corresponding obstruent as a stem-final one in inflecting the corresponding stem with a given suffix. For instance, all ten subjects produced [nasi] for /nas-i/. None of them produced [nač^hi], [nat^hi], [nači] or [nati]. Some speakers produced more than one variant by correcting their first utterance. In such cases, we counted both variants, and thus the sum of the responses for some target words exceeds 10. There are three such cases, /nač^h-e/, /p^hat^h-i/ and /p^hat^h-e/. For the convenience of classifying the results, consider as standard output forms those ending in obstruents which are either underlying or the result of cross-morphemic palatalization, i.e., [č^h] before [i]-initial suffixes. Notice that the subjects produced mostly either standard output forms or those ending in [s]. But, there are some exceptions, marked with shading in the table. These exceptional forms are the problematic variants of the type listed in (6). Recall that these cannot be directly explained within most previous analyses of Korean noun variation.

(21) Results of Experiment 1: native Korean nouns ending in coronal obstruents

final C	stem	before [i]					before [il]					before [e]				
		s	č ^h	t ^h	č	t	s	č ^h	t ^h	č	t	s	č ^h	t ^h	č	t
s	nas	10					10					10				
	os	10					9	1				10				
č	nač	1			9		4			6					10	
	čəč	5			5		9			1		none				
č ^h	k'oč ^h	2	8				4	6				9	1			
	nač ^h	3	7				4	6			5	6				
t ^h	pat ^h	1	9				2	8					1	9		
	p ^h at ^h	5	6				6	3	1			5	1	4		1

Relatively more exceptions can be seen with [t^h]-final stems, compared with the stems ending in other coronal obstruents. When the stem-final obstruent is underlyingly [s], one speaker produced a [č^h]-final form before the *i*-initial suffix. When the stem-final obstruent is underlyingly [č^h], one speaker produced a [t^h]-final form before the *e*-initial suffix. When the stem-final obstruent is underlyingly [t^h], eleven [č^h]-final forms are produced before *i*-initial suffixes, and two [č^h]-final and one [t]-final forms are

produced before *e*-initial suffixes.

These results suggest several important points. First, even [s]-final stems may be involved in the stem-final variation although the supporting evidence is weak. Only one relevant case, where the stem-final [s] is replaced with some other coronal obstruent, is attested. Second, it is confirmed that a wide set of coronal obstruents participate in the stem-final variation, as discussed in Jun (2007). Not only non-standard [s]-final forms but also output forms ending in some other non-standard obstruents, which would be “problematic variants” for most previous analyses of Korean noun variation, are attested.

In addition, at least one of the two suffix-specific asymmetric tendencies, discussed in section 1.2, can be confirmed by the results in (21). Most non-standard [č^h]-final forms (12 out of 14) occur before *i*-initial suffixes, suggesting the preference of the variant [č^h] before *i*-initial suffixes. In contrast, it is hard to say anything about the preference of [t^h]-final forms before *e*-initial suffixes since the results include only a single non-standard [t^h]-final form which in fact occurs before *e*-initial suffixes.

Let us turn to the results of the experiment employing test stems ending in noncoronal obstruents. As above, the numbers in table (22) indicate how many subjects produced the corresponding obstruent as a stem-final one in inflecting the corresponding stem with a given suffix.

(22) Results of Experiment 1: native Korean words ending in noncoronal obstruents

final C	stem	before [i]			before [il]			before [e]		
		lenis	asp	tense	lenis	asp	tense	lenis	asp	tense
k ^h	puək ^h	8	2		9	1		6	4	
k'	pak'			10			10		1	9
k	pjək	10			10			10		
p ^h	ip ^h		10		3	7			10	
p	pap	9+1*			10			10		

Some variation can be seen with the production of the test stems ending in underlying aspirated stops. The stem ending in the velar stop, /puək^h/, is mostly produced as lenis-final forms, whereas the stem ending in the labial stop, /ip^h/, is mostly produced with the underlying aspirated stop in the stem-final position. This is consistent with the results of Choe (2004). In Choe’s survey, almost same words ending in aspirated stops were employed as test stems. The relevant part of her results is shown below:

(23) The percentage of noncoronal obstruents in a survey on the preferred stem-final obstruent (from Choe 2004):

	p^h	p		k^h	k
namuip ^h ‘leaf’	78.71	21.29	puək ^h ‘kitchen’	31.02	68.82

The test stem ending in the tense stop, i.e., [pak’], is produced as such except that one speaker produced the aspirated velar stop in the stem-final position. If this single exceptional instance is valid, it may be the case that lenis stops are not the only stem-final variants for the noun stems ending in noncoronal obstruents. Aspirated stops may also be stem-final variants of the noun stems ending in noncoronal obstruents. This may indicate that multiple variants may occur not only for the stems ending in coronal obstruents but also for those ending in noncoronals.

Finally, all the stems ending in the underlying lenis stops, i.e., [k, p], are realized as such with one exception marked with * in table (22). One speaker produced [papsi] for /pap-i/. It seems that the speaker mistook the stem for the one with the final cluster /ps/. As far as we know, it cannot be a dialectal output form.⁷ And so we consider it as a production mistake.

3.2 Experiment Two

Results of Experiment Two employing English words as test stems are shown in table (24). The numbers in the table indicate how many subjects produced the corresponding obstruent as a stem-final one in inflecting the corresponding test words with a given suffix. As in Experiment One, some subjects produced more than one variant by correcting their first utterance. In such cases, both variants are counted separately in (24), and thus the sum of the responses for some target forms exceeds 10. There are four such cases, /meet-i/, /Matt-il/, /good-e/, and /Matt-e/. Also, some subjects released word-final stops by inserting a vowel [i], and these cases are specified under x.

(24) Results of Experiment 2: English words

final C	word	before [i]					before [il]						before [e]					
		s	č ^h	t ^h	č	t	s	č ^h	t ^h	č	t	x	s	č ^h	t ^h	č	t	x
d	good	10					10						6					5
	David	10					8				2			1		8	1	
t	cut	10					10						8		1		1	
	Pat	9	1				10					9				1		
	Matt	8	2				8	1	2			4		2		4	2	
	meet	7	2	2		1	8				2	4		4		1	1	

⁷ Thanks to Ju-won Kim (personal communication) for confirming that [papsi] is not a possible output form in any dialects spoken around Daegu.

Although, as has been reported in the previous studies, the occurrence of [s] is predominant in stem-final position, [s] is not the only attested word-final obstruent before vowel-initial suffixes. Many output forms include other coronal variants (marked with shading). These results indicate that stem-final obstruent variation occurs with English loanwords, and the range of attested stem-final variants is quite wide just like native Korean nouns.

It is also notable that among twelve [t^h]-final forms, eight occur before *e*-initial suffixes. This seems to be the asymmetry reflecting the suffix-specific tendency among native Korean nouns, i.e., the preference of [t^h] before *e*-initial suffixes.

3.3 Experiment Three

Results of Experiment Three, a judgment survey, may be divided into two parts depending on whether the test stems are from native Korean or English. The table below shows the results of the survey employing coronal-final stems of native Korean nouns as the test words. The numbers in the table are the mean judgment scores for the form ending in the corresponding coronal obstruent when the corresponding stem is inflected with each vowel-initial suffix. “Higher” scores mean “preferred”. Some subjects did not respond to some test stimuli. Such cases are not counted in calculating the mean scores. Cells for the standard output forms are shaded in the table. Notice that the standard forms are mostly “most preferred”, except that [č^h]-final output forms of underlyingly [t^h]-final stems show the highest score, marked with a bold box. Overall, [s]-final and [č^h]-final forms are most preferred, regardless of the suffixes. [t^h]-final and [č]-final forms are in general next preferred except that [t^h]-final forms are clearly less preferred to [č]-final forms before *i*-initial suffixes which must be due to the cross-morphemic palatalization. [t]-final forms are least preferred. All this confirms the general usage preference among coronal variants discussed in Jun (2007).

Notice that even in the case of underlyingly [s]-final stems, the mean acceptability scores of [č^h]-final forms are relatively high regardless of the suffixes, even higher than that of the [s]-final form of the underlyingly [č^h]-final stem, i.e., 2.5, before *i*-initial suffixes. This may indicate that the single occurrence of the [č^h]-final variant of the [s]-final stem in Experiment 1 is not a mistake by one speaker.

(25) Mean acceptability scores (Experiment 3): native Korean nouns

	before [i]					before [il]					before [e]				
	s	č ^h	t ^h	č	t	s	č ^h	t ^h	č	t	s	č ^h	t ^h	č	t
os	5.0	2.6	1.2	2.3	1.5	4.9	2.9	1.8	1.4	1.1	5.0	2.7	2.0	2.6	1.7
pič	3.1	2.6	1.9	4.4	1.3	2.8	2.8	1.6	4.2	1.5	3.2	2.7	1.6	4.4	2.5
p ^h at ^h	3.6	3.6	2.4	2.6	1.7	3.6	3.8	3.6	2.4	1.6	3.1	3.4	4.1	1.9	2.0
suč ^h	2.5	5.0	2.2	2.3	1.2	2.3	4.9	2.8	1.9	1.3	3.0	4.9	3.0	1.5	2.0
mean	3.6	3.4	1.9	2.9	1.4	3.4	3.6	2.4	2.5	1.4	3.6	3.4	2.7	2.6	2.1

Results of the judgment survey employing English test words are shown below. As above, the numbers in the table are the mean judgment scores for the form ending in the corresponding coronal obstruent when the corresponding English word is inflected with each vowel-initial suffix. The test forms with the highest mean scores are marked with shading. [s]-final forms are the most preferred in eight out of twelve cases. The exceptional four cases include two [č^h]-final, one [t^h]-final and one [t]-final forms. Again, it is obvious that when English words ending in alveolar stops are adapted into Korean, [s] is neither the most preferred variant for all target words, nor the only attested variant.

(26) Mean acceptability scores (Experiment 3): English words

	before [i]					before [il]					before [e]				
	s	č ^h	t ^h	č	t	s	č ^h	t ^h	č	t	s	č ^h	t ^h	č	t
Matt	3.3	3.9	2.9	1.5	2.2	3.8	4.1	3.3	1.7	2.0	3.5	2.7	4.2	1.5	3.1
cut	4.5	3.5	2.7	2.1	1.7	4.7	3.9	3.0	1.6	1.6	4.1	3.5	3.1	1.8	3.1
David	4.9	2.6	1.6	3.1	2.2	4.4	3.0	1.6	2.5	2.8	3.9	2.7	2.0	2.1	4.4
good	4.7	2.9	1.3	2.7	2.1	4.4	2.3	1.8	2.6	2.4	4.7	2.5	2.0	2.3	2.4

Notice that one suffix-specific tendency with Korean noun stems, i.e., preference of [č^h] over [t^h] before *i*-initial suffixes, is clearly confirmed here. Before *i*-initial suffixes, [č^h]-final forms show higher scores than [t^h]-final forms. But, there is no indication about the other suffix-specific tendency, i.e., preference of [t^h] over [č^h] before *e*-initial suffixes since there is only one out of four words in which [t^h] shows higher scores than [č^h] before *e*-initial suffixes.

4. Discussion

This section discusses the theoretical implications of the experimental results. It will be shown that these results confirm many predictions of the frequency-based approaches employing multiple rules or constraints, causing serious problems for other alternative approaches. We will also discuss potential problems that the present study is subject to.

Several observations can be made from the results reported in the previous section. First, many non-standard variants, which are neither underlying one nor [s], have been attested. Among the results of Experiment One, as summarized in (21), fourteen [č^h]-final, one [t^h]-final, and one [t]-final forms can be considered as such non-standard cases. The occurrence of these forms clearly shows that stem-final coronal obstruents are not limited to [s], and a wide set of coronal consonants may be involved as free variants, confirming the occurrence of multiple coronal variants.

Second, in Experiment One, one subject produced the [č^h]-final form for an underlyingly /s/-final stem. This single occurrence does not seem to be very exceptional or a production mistake since the results of Experiment Three show that the subjects consider, on the average, [č^h] as the second best variant, regardless of the suffixes, even when the stem-final obstruent is underlyingly /s/. As shown in (25), the mean acceptability scores of [č^h]-final variants for the /s/-final stem range from 2.6 to 2.9 depending on the following suffix. Notice that some [s]-final forms, for instance one for /suč^h/, show lower scores than these. Thus, it seems that even /s/-final stems may show variation. This is consistent with the predictions of the stochastic approaches to Korean noun variation, discussed in section one. On the other hand, none of the stems with final noncoronal lenis obstruents show a clear case of variation, as summarized in (22). However, one speaker produced an aspirated variant for a stem ending in an underlying tense stop. If this single occurrence is not a production mistake, it may suggest that more consonants may be involved as free variants even in the case of noun stems with final noncoronal obstruents, supporting the approaches employing multiple stochastic rules or constraints.

Third, English words ending in /t, d/ are not always adapted into Korean as [s]-final forms before vowel-initial suffixes. As shown in (24), many output forms produced by native Korean subjects end in [č^h], [t^h] and [t]. Moreover, results of Experiment Three, summarized in (26), show that [s]-final forms are not always the best option, and other variant forms may be either equally acceptable or even preferred to [s]-final forms, depending on the suffix. Consequently, English loanwords ending in the alveolar stops show the same type of variation as can be observed among native Korean nouns, confirming the predictions of the approaches employing multiple stochastic rules or constraints. All these results, which are consistent with those of Jun's (2007) wug-test, suggest that native Korean speakers are well aware of gradient variation patterns and use the knowledge of the patterns in dealing with the novel forms.

Let us now consider how these observations can be incorporated into the previous studies on Korean noun variation. Most previous approaches provide separate accounts for the occurrence of different variants. Two coronal variants other than [s], which are involved in the suffix-specific tendencies discussed in section 2.1, have been much

discussed in the literature. First, [č^h] occurs before *i*-initial suffixes. Most previous studies (Han 2002; Y. Kang 2003b; Choe 2004; Park 2006; and others) argue that this exceptional variant occurs due to Paradigm Uniformity to the palatalized allomorph of /t^h/-final stems. For instance, under the influence of the standard output form [pač^hi] of /pat^h-i/ ‘field, nominative’, /pat^h-il/ ‘field, accusative’ is realized as [pač^hil]. Second, [t^h] often occurs before *e*-initial suffixes. In the previous studies (Y. Kang 2003b; Choe 2004; and others), this suffix-specific fact is attributed to the high token frequency of the locative suffix *-e* which is never omitted even in conversational speech unlike suffixes such as *-i* ‘nominative’ and *-il* ‘accusative’. It has been claimed that high token frequency of noun forms suffixed with *-e* helps [t^h]-final stems to resist an analogical change to [s]-final forms or Paradigm Uniformity, and thus [t^h]-final stems are likely to surface as such before the suffix *-e*.

These previous accounts have been criticized by Jun (2007). Among others, one serious problem that Jun pointed out is that even noun stems, which underlyingly do not end in /t^h/ and thus are not eligible for palatalization, show the final variant [č^h]. For instance, as shown in (4c), underlyingly [č]-final stems such as /nač-ilo/ and /pič-in/ may have the final variant [č^h]. Among the results of the present study, [oč^h-il] for /os-il/ would be the same type of counter-example. Similarly, the occurrence of [t^h] before *e*-initial suffixes is not limited to the noun stems with the underlying final /t^h/. As shown in (4b), /toč^h-e/ may be realized as /tot^he/. The present study also reports production forms like [k’ot^he] for /k’oč^h-e/. These forms cannot be attributed to the analogy-resistance of /t^h/-final stems.

Previous studies also propose a separate explanation for the occurrence of the lenis-final variants of the stem-final noncoronal obstruents. Most of them (Ko 1989; Y. Kang 2003b; and others) rely on the effects of Paradigm Uniformity to the isolation form. For instance, under the influence of the frequent isolation form [ip] of /ip^h/ ‘leaf’, /ip^h-i/ may be realized as [ipi]. If, as mentioned in (22), the single occurrence of the aspirated variant [pak^he] for the tense-final stem /pak’-e/ is valid, it would indicate that the proposed Paradigm Uniformity accounts are not appropriate for the analysis of all the noncoronal variants.

As discussed above, most previous approaches to Korean noun variation propose separate explanations for the occurrence of different variants. Each of the previous explanations has its own problems, some of which are serious enough to reject the proposals, as mentioned above. What is worse is that the proposed explanations are often incompatible with each other. Most previous approaches argue that the isolation form is the base in deriving the variant [s]. Specifically, the alternation [t]~[s] is extended to the stems ending in underlying coronal obstruents other than [s] through the application of the rules and constraints in (5). However, the pre-[i] allomorph, not the isolation form, has been adopted as the base in the explanation of the variant [č^h] before *i*-initial suffixes. In addition, although the isolation form is adopted as the base in the explanation of the lenis variant of noncoronal stem-final obstruents, the effect involved is “paradigm uniformity”, not “alternation extension”. In summary, the assumptions that previous approaches make are conflicting with each other with respect either to the base

adopted or to the effect involved.

Consequently, it is very difficult to maintain the previous approaches which propose independent accounts for the occurrence of different variants. Recall that the frequency-based approach employing stochastic rules or constraints, illustrated in section 2.1, may provide a unified account for the occurrence of different variants, whether coronal or noncoronal.

At least some of the predictions which can be made from the frequency-based approaches employing multiple stochastic rules or constraints but cannot be consistent with other alternative approaches, are confirmed by the results of the present study. However, not all predictions were borne out.

First, in Experiment One, non-standard variants are not attested for /č/-final stems. However, as can be seen in (4c), previous studies in fact report many such cases, and thus we think this gap is simply due to the relatively small size of the test stems and experimental subjects employed in the experiments of the present study. Notice that we have employed only one or two native noun test stems for each final obstruent in the experiments. If we assume that lexical variation is also involved in the production of stem-final obstruents, and thus different stems may prefer to have different variants, the current size of the test stems and subjects of the present study may not be large enough to identify all possible variants. We think the same reason goes for why the variant [č] failed to be attested for English loanword adaptations in Experiment Two. Six test words and ten subjects employed in the experiment may not be sufficient to identify all potential variants.

Second, as mentioned above, the aspirated or tense variants are not attested for the stems ending in noncoronal lenis stops. This might be also attributed to the small size of the test stems and subjects. But, there is another possibility. As can be seen in (7), among noncoronal-final stems, lenis-final ones far exceed aspirated and tense-final ones in lexical frequency. If this large difference in the type frequency is reflected in the ranking or reliability of stochastic constraints or rules, the variants other than the lenis one would not have a chance to surface.⁸

There is another potential problem with this paper. All our subjects are native speakers of the Northern Kyungsang Korean (NKK) dialect, which is distinct from the standard Korean, i.e., Seoul dialect. They are relatively young, aged 20s, and it is known that young generation's language in Daegu area may not be much different from the Seoul dialect, mainly because they have been exposed to the mass media where the Seoul dialect is mostly spoken. Nonetheless, we think that it is a reasonable assumption that our speakers might have used the NKK accent during the experiments. However, as far as we know, no previous studies argue that the variation is limited to the Seoul dialect. Also, the fact that the results of the present study show the same type of variation as has been observed among Seoul dialect speakers suggest that the current findings may be adopted as criteria for evaluating the analyses of Korean noun variation in general.

Surely, a more elaborate and expanded set of experiments is needed to determine

⁸ But, then we need to know how the aspirated variant can occur for the stem ending in the underlying tense stop, as shown in (22).

the exact nature of the variation involved in native Korean nouns and loanword adaptations. But, we believe that the results of the present study are sufficient to reject most previous studies which propose a single rule or constraint for the occurrence of the variant [s] and separate explanations for the occurrence of other variants. The results at the same time provide evidence in favor of the frequency-based approaches employing multiple stochastic rules or constraints.

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