"¿Tomas [pepsi], [peksi] or [pesi]?": A variationist sociolinguistic analysis of Spanish syllable coda stops

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Abstract

This study analyzes deletion and velarization of word-internal syllable coda /p b t d k g/ by native speakers of Spanish. A total of 945 tokens were analyzed from speech samples of 36 speakers from the corpus *Estudio Sociolingüístico del Habla de Caracas* (Bentivoglio & Sedano, 1987), with equal representation of socioeconomic levels, ages and sex. The results of the present study show that labial, dental and velar coda stops have different linguistic distributions and that they retain, velarize, and delete at different rates. The analysis reveals that deletion of velars is favored by the working class, younger speakers, males, and high frequency lexical items. Deletion of labial and dentals, on the other hand, is favored by dental stops, the younger age group, and the working class. With regards to velarization, the results of the current study contrast with research by González & Pereda (1998) in that the present study reveals that while all social classes velarize, it is only significant for the middle and working classes. Taken together, the analysis of deletion and velarization shows that the two processes have different sociolinguistic distributions. Additionally, the present study offers a discussion for the role of lexical frequency in the realization of coda stops.

Keywords: Stops, Spanish, velarization, deletion, phonological variation.

1. Introduction

In syllable-final position, Spanish stops are highly variable. Their realizations range from full stops to complete deletion. For example, for *aceptar* [a.sep.táɾ] "to accept", possible realizations are [a.sep.táɾ], [a.seb.táɾ], [a.seβ.táɾ] and [a.se.táɾ] (Hualde, 2005). Another possible realization for stops in the syllable coda across many Spanish dialects is the backing of post-nuclear obstruents. It is not uncommon for word-medial syllable-final consonants to be articulated as [k], such that *aceptar* can also be realized as [a.sek.táɾ].

Previous research on stop consonants in coda position has documented all of the realizations previously mentioned, though, some realizations have received more attention than others. For example, Lipski (2011: 79) mentions that in informal speech, most Spanish dialects delete voiceless coda stops, but that research has yet to investigate this phenomenon in more detail. On the other hand, several researchers have attempted different explanations to account for velarization (Chela-Flores, 1986, 1988; Díaz-Campos, 1999; González, 1991; Guitart, 1981). Recent work analyzing velarization of labial coda stops in Spanish by Brown (2006) indicates that syllable-final, word-medial, velar stops have significantly higher token and type frequency than word-medial coda labial stops. As a result, the […$C_{VELAR}$$C] schema and not […$C_{LABIAL}$$C] emerges as a stronger, more productive schema, promoting the sound substitution labial > velar.

Quantitative studies on the realization of word-internal coda stops (Anton, 1998; González & Pereda, 1998) show that deletion is the most frequent phonological process. On the other hand, the results in Brown (2006) suggest that the frequency of the […$C_{VELAR}$$C] schema favors velarization, and should favor as well retention of /k/ and /g/. Nevertheless, the author only considers bilabial stops. The present study builds on these findings to provide a variationist analysis of the realization of Spanish word-internal coda stops. Specifically, it analyzes the social distribution of and the effect of lexical frequency on retention, deletion, and velarization of word-internal syllable-coda stops in Caracas Spanish. Previous studies (Díaz-Campos, 1999; González, 1991; González & Pereda, 1998) argue that velarization is a common process in Caracas Spanish. In the words of González (1991: 140), "it is the most generalized process in Venezuelan speakers, especially among lower and middle socioeconomic levels[1]" (my translation). However, previous studies do not include lexical frequency as a factor in their analyses.

The present paper is organized as follows. Section 2 reviews previous literature on deletion and velarization. Section 3 addresses the research questions and methodology. The results are presented in Section 4 and discussed in Section 5. Finally, the conclusions are presented in Section 6.

[1] "Este es el proceso más generalizado en los hablantes venezolanos especialmente en los niveles medio y bajo".

2. Previous literature

This section presents an overview of the previous research on deletion and verlarization of syllable coda stops. For clarity purposes, the literature presented in this section is organized based on the theoretical framework adopted.

2.1 Prescriptive and descriptive grammar perspectives

Traditional approaches to the study of syllable coda stops provide descriptions of phonological processes. In his classic Spanish phonetics study, *Manual de Pronunciación Española*, Navarro Tomás (1980 [1918]) contrasts syllable-final stops in careful and relaxed (conversational) speech. He explains that /p b t d k g/ in syllable-final position, in spoken Spanish, can undergo several phonological processes such as lenition, voicing and devoicing. Even when bearing stress, Navarro Tomás highlights that stops are produced as fricatives. Consider the examples in (1):

(1)

inepto "unfit" realized as [i.né.βto]	*subterráneo* "underground" realized as [suβ.te.rá.ne.o]
étnico "ethnic" realized as [éð.ni.co]	*admirable* "remarkable" realized as [að.mi.ɾá.βle]
actor "actor" realized as [áɣ.toɾ]	*digno* "worthy" realized as [díɣ.no]

However, the aim of this work was to provide descriptions that would aide in the teaching of Spanish, both as a first and a second language. For this reason, Navarro Tomas' efforts focus on comparing conversational speech to normative Spanish.

Quilis (1993), on the other hand, points out that in syllable-final position stops cease to contrast in voicing and manner of articulation. This neutralization results in varied realizations for these phonemes. For example, *absoluto* "absolute" will show variation between [absolúto], [aβsolúto] and [apsolúto], depending both on the speakers' habits and emphasis, and on the regional norm. To explain this variation, Quilis posits three archiphonemes: /B/, /D/ and /K/, that only retain place of articulation features. That is, these archiphonemes do not specify voice or manner of articulation. They have the advantage of accounting for retention, voicing, devoicing and spirantization of syllable coda stops. However, cases where there is a change in place of articulation, as is the case with velarization, or cases of deletion, are not accounted for by this explanation.

These traditional accounts offer a description of some of the variation in the realization of syllable coda stops. Nevertheless, they do not provide explanatory principles, as this would fall outside of the scope of their aims. The studies in the next section put forth formal explanations for deletion and velarization of Spanish syllable coda stops.

2.2 Theoretical perspectives

The goal of the studies in this section is to provide the formal mechanisms that account for deletion and velarization in the realization of stop consonants. For example, Chela-Flores (1986, 1988) argues that velarization is a step previous to deletion of the consonant. The sequence for sound change would be non-velar stop > velar stop > glottal stop > deletion. From an autosegmental perspective, Guitart (1981) argues for a different sequence due to suppression of the oral gestures and retention of laryngeal ones in the production of the labial consonants. As a result, a glottal stop is produced, which is perceived by listeners as a velar consonant who in turn pronounce it as such. Guitart posits the sequence non-velar stop > glottal stop > velar stop. Therefore, velarization is a result of perception.

González (1991) explains velarization of obstruents in syllable-final position as a weakening process, following Chomsky and Halle's *Sound Patterns of English*. He offers a formal descriptive model for deletion, assimilation, aspiration, compensatory vowel lengthening and velarization. According to the author, these phonological processes exhibit a similar pattern: in all cases the post-nuclear obstruent presents loss or omission of place of articulation features. Under this account, velarization is explained as a two-step process, in which the syllable coda stop first loses place of articulation features and later adopts an unmarked place of articulation, velar.

Díaz-Campos (1999) analyzes velarization of /p b t d k g/ within the framework of Feature Geometry. For the author, velarization is best explained by means of three phonological rules: i) a delinking rule, that disassociates the obstruent segments from their place of articulation specifications, ii) a place of articulation and continuity assignment rule, which assigns dorsal place of articulation by default, and iii) a following consonant voicing assimilation rule, to account for cases such as *admirable* "remarkable" [ag.mi.ɾá.βle].

These studies offer theoretical explanations for velarization and deletion of post-nuclear stops. However, given that they do not include production data, the question remains how frequent these processes are and how they are distributed. The studies in the following section address these questions.

2.3 Quantitative research

Quantitative studies that analyze the realization of syllable-coda stops can be divided in two groups: those that include several phonological processes and those that analyze velarization exclusively. I will first address the former group of studies, and then I will comment on the latter group.

González and Pereda (1998) examine how the phonological processes described in González (1991) are distributed among speakers of different social classes in the Spanish of Caracas, Venezuela. For this purpose, they analyze the frequency of occurrence of deletion, assimilation, and velarization in speech samples of 20 speakers randomly selected from the 14-29 age group in the corpus *Estudio sociolingüístico de Caracas* (Bentivoglio & Sedano, 1993). The results show that lower social classes favor deletion and assimilation. With regards to

velarization, though it was less common than deletion and assimilation, they found that it was registered in all socioeconomic groups.

Antón (1998) also provides a sociolinguistic account of syllable-coda stops. She examines five variants of post-nuclear stops, in Northern Iberian Spanish: stop (/áktoɾ/ "actor" as [áktoɾ]), voiced fricative (/tékniko/ "technical" as [téɣniko]), interdental (/absuɾdo/ "absurd" as [aθsuɾdo]), glide (/kaɾácteɾ/ "character" as [kaɾájteɾ]) and deleted (/dóktoɾ/ "doctor" as [dótoɾ]). In her study, she incorporates three independent variables: socioeconomic level, sex, and age. The sample consists of 60 speakers evenly stratified by age (14-17, 18-45, 26-35, 36-50 and 51 and over), gender (male and female), and socioeconomic group (upper-middle, lower-middle, and lower). Additionally, the sample also considers origin of the speakers. Half of the speakers in the sample were native to the region. In order to elicit different speech styles, the sample includes, for each speaker, a 30-45 minute interview, reading of a news article, and reading of a list of words.

The analysis reveals that the realization of post-nuclear obstruents indexes social meanings, as the data show patterns according to socioeconomic group, age and style. Antón finds that speakers in the upper middle-class, younger generations, men and formal styles of speech favor spirantization and voicing. In addition, she observes that the interdental realization is more frequent in lower-middle and lower socioeconomic groups, and women. Furthermore, deletion is favored by an informal speech style, older generations, and speakers in lower middle and lower socioeconomic groups. Origin of the speakers was not found to be significant. Thus, it is evident that the variants under study are socially distributed.

These previous studies show that syllable-final stops can undergo different phonological processes. Brown (2006) offers a frequency account for velarization of labial coda stops in Spanish that provides insights as to why this might occur. Her hypothesis is that the labial > velar substitution is not due to the (failure of) application of an abstract rule. Instead, based on the assumption that phonotactic knowledge and structure derive from occurring words in the lexicon, Brown claims that Spanish words with syllable-final labial stops together with the frequently occurring syllable-final velar stop motivates the labial > velar substitution.

Brown conducted a quantitative analysis using approximately 6,800,000 words from a compilation of oral Spanish corpora from the 1900s available online. For that purpose, she determined type and token frequency. Token frequency allows for comparing the number of velar and bilabial stops in the syllable coda. On the other hand, by considering type frequency Brown accounted for the number of lexical items that participate in each of the syllabic schemas. In order to establish token frequency, all word medial <-bC->, <-pC->, <-gC-> and <-kC-> combinations were calculated. The series of graphemes included were *bb, bc, bm, bn, bs, bt, bv, pc, pt*, *ps*, *cc, cd, cm, cn, cs, ct, gb, gn, gz* and *x* (except in words such as *México*). As for type frequency, Brown determined the number of lexical items that participate in [$C_{LABIAL}$$C] and [$C_{VELAR}$$C] schemas by tabulating lemmas instead of individual words. For example, *absolutamente*

(absolutely) and *absoluto* (absolute) were not listed as separate lexical items, but rather considered under the same lexical entry '*absoluto*'.

The results show that, in terms of token frequency, velar consonants in syllable-coda position are seven times more frequent than labials. With regards to type frequency, [-gC-] and [-kC-] are also more frequent. Brown concludes that since more lexical items contribute to the [$C_{VELAR}$$C] schema than to the [$C_{LABIAL}$$C] schema, the former is stronger, more accessible and more productive. Therefore, the labial > velar substitution is favored.

The study by Brown provides a theoretical account for velarization of coda stops. It shows how a stronger and more accessible schema contributes to language change. However, it only comments on the case of labial obstruents and leaves aside other stops. Furthermore, a stronger and more accessible [$C_{VELAR}$$C] predicts that syllable-coda stops will undergo velarization more often than other phonological processes, but studies such as González & Pereda (1998) contradict this claim.

On the other hand, the frequency analysis in Brown (2006) shows which stops are more common in the coda, but does not show if lexical frequency triggers higher rates of velarization. The analysis shows that a lexical item, such as *absolutamente* (absolutely) is frequent, but not if this item is velarized more frequently. That is, the study provides frequency counts but does not address the question if token frequency is correlated with velarization. Additionally, the account of type frequency is incomplete, as it only considers the first member in a hetero-syllabic consonant cluster. If the analysis contemplates type frequency, it is important not only to investigate the role of the place of articulation of the consonant in the syllable coda, but also that of the consonant in the contiguous syllable onset.

The cumulative message of the studies in this section, as well as the studies in the previous ones, is that the realization of word-internal syllable coda stops is variable and that this variation is patterned. The articles that explore the locus and the degree of variation offer evidence for a social distribution of deletion and velarization of word-internal coda stops. The current study builds upon this previous literature by analyzing deletion and velarization of word-internal syllable-coda stops in a corpus of sociolinguistic interviews of Caracas Spanish.

3. The current study

The present study analyzes deletion and velarization, non-standard realizations of word internal syllable-coda /p b t d k g/. The aim of the current study is twofold. First, the goal is to add to the findings in the previous literature. This study expands upon Brown (2006) by incorporating dental coda stops and the consonant in the contiguous syllable onset (i.e. the following consonant), and by including lexical frequency in the analysis. Additionally, I expand the research by Gonzalez and Pereda (1998), who only included one age group in their analysis. Thus, the current study incorporates extralinguistic factors to the analysis, including sex, age group, and socioeconomic class.

The research questions that guide the present study are the following:

RQ1 What is the frequency with which speakers retain, velarize, and delete word-internal coda stops in Spanish?
RQ2 What are the independent variables that affect deletion of word-internal bilabial, dental, and velar coda stops in Spanish?
RQ3 Which are the independent variables that affect velarization of word-internal bilabial and dental stops in Spanish?
RQ4 What is the role of lexical frequency in the deletion and velarization of word-internal coda stops in Spanish?

3.1 Methodology

The data in the current study comes from the corpus *Estudio sociolingüístico de Caracas* (Bentivoglio & Sedano, 1993). This corpus is comprised of 160 semi-directed sociolinguistic interviews, conducted between 1987 and 1988. All participants in the corpus were born and raised in Caracas, as were their parents. The speakers are evenly stratified by age (14-29, 30-45, 46-60, 61 and over), gender (male, and female), and socio-economic group (upper, upper-middle, lower-middle, and working). The current study analyzes data from 36 participants in this corpus.

The dependent variable under study is realization of word-internal syllable coda /p b t d k g/. This dependent variable has three levels: retention, velarization, and deletion. For this study, any realization that maintained place of articulation was considered an instance of retention. This includes stop-like realizations, as well as cases of voicing and spirantization, as long as place of articulation remained faithful. Any bilabial or dental stop realized as a voiced or voiceless velar stop or a velar approximant, that is [g], [k] or [ɣ], was considered an instance of velarization. An absence of a coda stop was coded as deletion. Determining whether each token of syllable-final stop is retained, deleted or velarized was accomplished by impressionistic, auditory coding. No tokens were removed from the analysis.

After extracting each token of stops in the syllable coda, and based on the previous literature presented in Section 2, each token was coded for the independent linguistic and social variables in (2). The present study does not include instances of coda stops represented by the grapheme <x>, as in the word *contexto* "context", which can be transcribed as /kónteksto/. In some cases, [ks] constitutes a complex cluster, as in the word *contexto* above, where we have three contiguous consonants; for this reason <x> was left aside in the analysis.

(2) Independent variables
a) Place of articulation of the coda stop (labial / dental / velar)
b) Place of articulation of the following consonant (labial / coronal / dorsal)
c) Manner of articulation of following consonant (stop / fricative / nasal)
d) Sex (male / female)
e) Social class (working / middle / high)

f) Age (14-29, 30-45, 61+)[2]
g) Lexical frequency of the word (high / medium / low)

To establish lexical frequency, the data was coded for corpus frequency by counting the number of occurrences of lexical entries used from the actual corpus of *Estudio Sociolingüístico de Caracas*. Each word was counted was individually. The criteria for the definition of frequency were based on the nature of the data coded. Words that occurred 20 times or more in the corpus were considered high-frequency items; words that had an occurrence in between 10 and 19 were considered medium-frequency items, and the rest were coded as low-frequency words.

The data were statistically analyzed with Goldvarb X (Sankoff, Tagliamonte & Smith, 2005), to determine which of the independent variables contribute significantly to velarization and deletion. Based on previous findings (González & Pereda, 1998; Brown, 2006; Díaz-Campos, 1994), the [$C_{VELAR}$$C] schema was expected to be more frequent than [$C_{LABIAL}$$C] and [$C_{DENTAL}$$C]. Additionally, deletion was expected to be more frequent than velarization. Finally, with regards to sociolinguistic variation, velarization was hypothesized to be favored by all social classes, while deletion was expected to be favored by the working class.

4. Results

In this section, we present the results. Tokens of retained, deleted and velarized realizations of /p b t d k g/ in the syllable coda were exhaustively extracted from speech samples of 36 speakers of the corpus *Estudio sociolingüístico de Caracas*. A total of 945 tokens of word-internal coda stops were found in the data. Figures 1, 2, and 3 below present the distribution of the data. Figure 1 presents the distribution of syllable coda stops according to their place of articulation. Figure 2 shows the distribution of each phonological process. For these two figures, the number in the second line represents the number of tokens, and the number in the third line represents the percentage. Finally, Figure 3 summarizes the distribution of each phonological process per place of articulation. Velar stops do not show instances of velarization as this would constitute the retained variants.

[2] As stated at the beginning of the section, the corpus *Estudio sociolingüístico de Caracas* includes four age groups and four socio-economic classes. However, the speech samples under study do not include speakers in the 46-60 age group, or speakers in the upper-middle and lower-middle socio-economic classes. Thus, in the present study, speakers are evenly distributed among three age groups (14-29, 30-45, 61+) and three socio-economic classes (working / middle / high), as indicated in (2).

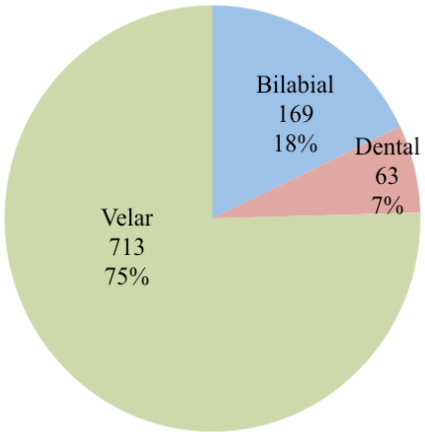

Figure 1. Distribution of tokens per place of articulation of the stop in the word-internal syllable coda

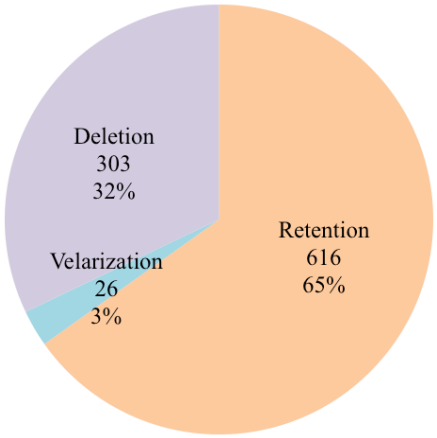

Figure 2. Distribution of tokens per phonological process

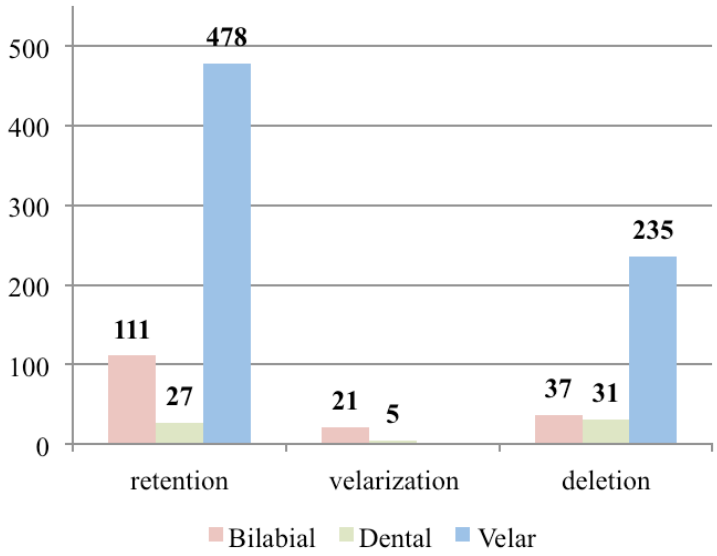

Figure 3. Distribution of tokens of phonological process per place of articulation of the stop in the word-internal syllable coda

As expected from Brown (2006), velars are more frequent in the syllable coda than labials and dentals. The data in Figure 1 shows 713 tokens of coda velars, 169 of coda bilabials, and 63 of coda dentals. These represent 75%, 18% and 7% of the data, respectively. Additionally, Figure 2 shows that retention is more frequent than deletion and velarization, as there are 616 tokens of retained coda stops, 303 of deleted coda stops, and 26 velarized coda stops. However, the patterns of deletion and velarization vary according to the coda stop, as shown in Figure 3. I will elaborate on this later in the paper.

Given that in order to carry out logistic regression in GoldVarb dependent variables must be binary, the research questions will be addressed by separate GoldVarb runs. Section 4.1 presents results on deletion, and Section 4.2 reports on velarization. For all reported results, factor weights above .5 are to be interpreted as significantly favoring the application of the linguistic rule (deletion in Section 4.1, and velarization in Section 4.2). For example, if a factor has a factor weight of .6, this means that it favors the application of the rule (deletion or velarization, in the case at hand), whereas a factor weight of .3 disfavors it. Given that setting significance at .5 is a convention, factor weights approaching this benchmark, whether above or below, should be interpreted with caution.

4.1 Deletion

In order to perform the GoldVarb runs for deletion, cases of velarization and retention were collapsed as cases of non-deletion. The data is distributed unequally across coda stops (i.e., coda velars account for 75% of the data). For this reason, velars were run separate from labials and dentals. Given that coda

velar stops are only followed by coronal consonants, the independent variable for place of articulation of the consonant in the contiguous syllable onset was excluded from the analysis. Furthermore, because this first run only includes one type of coda stop, the independent variable for place of articulation for the first consonant in the cluster was excluded as well. Table 1 presents the results for the logistic regression on word-internal syllable coda velar stops. In this and future tables, factor weights that favor the application of the rule (deletion in the case of Table 1) are presented in bold to aid visualization.

Table 1. Logistic regression on deletion of word-internal velar coda stops

Input	0.308		
Total N	616		
	Factor weight	%	N
Lexical Frequency			
High	**.751**	50	44/88
Low	.468	30.7	172/561
Median	.399	29.7	19/64
Range	35		
Social class			
Working	**.764**	60.5	72/119
Middle	.460	30.5	78/256
High	.428	25.1	85/338
Range	33		
Age group			
14-29	**.613**	42.4	112/264
61+	.478	31.4	61/194
30-45	.398	24.3	62/255
Range	21.5		
Manner of articulation of following consonant			
Nasal	**.722**	50	36/72
Fricative	**.541**	34.9	38/109
Stop	.459	30.3	161/532
Range	18		
Sex			
Males	**.541**	37.9	158/417
Females	.443	26	77/296
Range	9		
Log likelihood: -399.771			
Significance: 0.037			

The results in Table 1 show that lexical frequency, social class, age group, manner of articulation of the following consonant, and sex of the speaker are factors that significantly influence the deletion of velar stops. Based on the ranges, the most significant independent factor is lexical frequency, which has a range of 35. High frequency items favor deletion (.751), whereas intermediate and low frequency items disfavor it (.468 and .399, respectively). The second most

important factor is social class. The working class favors deletion, with a factor weight of .764. Middle and high social groups appear to disfavor deletion, as their factor weights are slightly below .500 (.460 and .428, respectively). The following factor group in significance is age group. Speakers in the first age group, 14 to 29 years old, favor deletion, as their factor weight is .613. As for manner of articulation of the following consonant, nasal, and fricative following consonants favor deletion of velar coda stops, with factor weights of .722 and .541, respectively. Finally, sex of the speaker is also a significant group. Male speakers favor deletion, as the factor weight is .541.

We now turn to the analysis of deletion of labial and dental coda stops. Because of the number of tokens, it was decided to run labial and dental stops together. For this reason, this analysis incorporates place of articulation of the stop in the coda into the analysis. Thus, this factor allows for examining if the presence of a labial or a dental stop conditions deletion. Table 2 presents the results for the logistic regression on deletion of word-internal labial and dental coda stops.

The results in Table 2 in the next page show that age group, place of articulation of the coda stop, social class, and manner of articulation of the following consonant are significant factor groups. The most significant factor was age group, as indicated by the higher range value of 46. Speakers in the first age group, i.e. the 14-29 years old group, favor deletion of labial and dental stops, with a factor weight of .726. The following factor group in significance is that of the place of articulation of the coda stop. Dental stops favor deletion (factor weight .786), while labial stops disfavor it (factor weight .381). Next, the social class of the speaker predicts deletion of dental and labial coda stops. Speakers in the working class favor deletion, with a factor weight of .797. The factor weights for middle and higher class show that they do not favor deletion. However, the middle class is approaching significance, with a factor weight of .492. Finally, manner of articulation of the following consonant is a significant factor. Fricatives and nasals favor deletion, with factor weights of .645 and .549 respectively.

There is a mismatch between factor weights and the rate of application of deletion, which suggests that there is an interaction. A following nasal consonant results in a 50% rate of deletion. Further investigation reveals that while both labial and dental stops can be followed by a nasal consonant, only dental coda stops delete in this context. In other words, with labial coda stops, deletion does not apply when the following consonant is a nasal. With a following fricative, both dental and labial stops exhibit deletion, with rates of 25% and 35% respectively. Thus, there is an interaction between the coda stops (labial or dental) and the manner of articulation of the following consonant. Dental coda stops favor deletion, especially when followed by a nasal consonant.

Table 2. Logistic regression on deletion of word-internal labial/dental coda stops

Input	0.228		
Total N	232		
	Factor weight	%	N
Age group			
14-29	**.726**	46	46/100
61+	.434	22.9	11/48
30-45	.268	13.1	11/84
Range	46		
Place of articulation of coda stop			
Dental	**.786**	49.2	31/63
Labial	.381	21.9	37/169
Range	40.5		
Social class			
Working	**.797**	60.7	17/28
Middle	.492	24.8	26/105
High	.412	25.3	25/99
Range	38.5		
Manner of articulation of following consonant			
Fricative	**.645**	33.7	33/98
Nasal	**.549**	50	15/30
Stop	.350	19.2	20/104
Range	29.5		
Log Likelihood	-106.779		
Significance	0.201		

4.2 Velarization

As was the case with deletion of labials and dentals, a single run that combined labial and dental coda stops was performed. Thus, for velarization the analysis presents the results of only one run.

As with the analysis of deletion, the factor group of place of articulation of the coda stop was included in the analysis, as this model incorporates labial and dental stops. This factor group explores if the presence of a labial or a dental stop has an effect on velarization. Additionally, given that the factor groups for manner and place of articulation of the following consonant, and age group presented knock-outs, factor groups were recoded to allow the binomial up/down analysis. For manner of articulation, nasals were collapsed with stops. Place of articulation was excluded from the analysis. Finally, speakers in the third age group, 61+, were collapsed with speakers in the second age group. As a result, we now have two age groups: younger and older speakers. Table 3 below shows the results of this run.

Table 3. Logistic regression on velarization of word-internal labial/dental coda stops

Input	0.077		
Total N	232		
	Factor weight	%	N
Social class			
Middle	**.723**	19	20/105
Working	**.636**	10.7	3/28
High	.236	3	3/99
Range	49		
Age group			
Older	**.609**	14.4	19/132
Younger	.358	7	7/100
Range	25		
Log likelihood	-71.655		
Significance	0.596		

Only two factors were significant: socioeconomic class and age group. Based on range values, social class is the most significant factor. Middle and working classes favor velarization with factor weights of .723 and .636, respectively. As for age group, the older age group favors velarization, as its factor weight is .609.

5. Discussion

The findings of the present study confirm the observations by Brown (2006) that velars are the most frequent plosives in the word-internal syllable coda in Spanish. The results show that velars are almost twice as frequent as labials and dentals. Additionally, we see that labials are more frequent than dentals. Taking the results from this study together with those in Brown (2006), we observe a hierarchy in the distribution of Spanish coda stops: velars are more frequent than labials, which in turn are more frequent than dentals.

The present study shows some similarities and some differences with the previous research on deletion and velarization of syllable coda stops (Antón, 1998; González & Pereda, 1998). One major difference has to do with the type of quantitative analysis. First, the previous literature reports the results of descriptive statistics. In other words, the previous studies describe distributions present in the data. However, these patterns cannot be generalized to a larger population. The present study incorporates inferential statistics, as the data are analyzed by means of a logistic regression. Inferential statistics have the advantage of making predictions about the variation in the data that can be extended to a larger sample. Thus, the present study builds on previous findings and goes a step further by providing an additional view of how the data may be generalized. In what follows, I will discuss the research questions and will draw comparisons with the previous research.

The first research question asked about the frequency with which speakers of Caracas Spanish retained, velarized and deleted word-internal syllable coda stops. The present study shows that retention is the most common variant for labial and velar stops, but not for dentals. In the case of dentals, deletion is the most frequent variant. Dentals delete at a rate of 49.2% rate and are retained

42.8% of the time. Additionally, for dental and labial coda stops, deletion is more frequent than velarization. However, labials velarize at a higher rate than dentals, 12.4% versus 8%, respectively. Thus, it seems that while dentals delete, labials velarize. These trends can be summarized as in (3). The symbol ">" is used here as in mathematics to mean "greater than", whereby the item on the left is greater than the item on the right. Thus, items on the left are ranked higher than items to the right.

(3) Velars: retention > deletion
Bilabials: retention > deletion > velarization
Dentals: deletion > retention > velarization

The results of this study show that velarization has a narrower scope than suggested by the previous literature (Chela-Flores, 1988; Díaz-Campos, 1999; González, 1991; González & Pereda, 1998; Guitart, 1981). For example, Chela Flores (1988: 656) and González (1991: 140) state that velarization is a highly generalized process among Venezuelan speakers. However, In a corpus of 232 tokens of dental and labial coda stops, only 26 (11.2%) of them were velarized.

The second research question asked which independent variables affected deletion of word-internal coda stops. Given that the data was not evenly distributed among coda stops, velars were run separately from dentals and labials. The first GoldVarb run, which explored deletion of velar syllable coda stops, revealed that all three social variables were significant factors. The working class, the younger age group, and men favored deletion of velar coda stops. Additionally, when the role of the following consonant was explored, it was found that a following nasal or fricative favored deletion as well.

The second run on GoldVarb explored deletion of dental and labial stops. The stop in the coda was incorporated as an independent variable to account for potential differences between labial and dentals. The results showed that a dental stop predicts deletion of word-internal syllable coda stops. Additionally, in line with velar coda stops, we see that the working class and speakers in the 14-29 age group favored deletion. Sex of the speakers, however, was not a significant factor for labial and dental syllable coda stops. The manner of articulation of following consonant was also a significant factor, with nasals and fricatives favoring deletion in this case as well.

Additionally, the results for deletion in this study partially confirm the findings in González & Pereda (1998) and Antón (1998). Table 4 summarizes differences between this study and previous quantitative research. Italics indicate factor groups that do not overlap between studies. In the column for the present study, Table 4 does not include lexical frequency and sex of the speakers, given that they were only significant for velar coda stops.

Table 4. Comparison between the present study and previous quantitative research on deletion of syllable coda stops

	González & Pereda (1998)	Antón (1998)	Present study
Location	Caracas, Venezuela	Langreo, España	Caracas, Venezuela
Significant factors	+ working class	+ middle-working class / working class + older speakers *+ informal speech style*	+ working class + younger speakers *+ following nasal or fricative*
Statistical Analysis	Descriptive statistics	Descriptive statistics	Inferential statistics

In all three studies, the working class favors deletion of syllable coda stops. However, the age group that favors deletion varies. In Antón (1998) it is older speakers who delete at higher rates. The present study, however, shows a different pattern: younger speakers favor deletion.

The third research question asked which independent variables affected velarization of word-internal labial and dental syllable coda stops. The results showed that velarization was favored by middle and working classes, and older speakers. Interestingly, even though labials accounted for 80% if the velarized tokens (*n*= 21), point of articulation of the consonant in the coda was not a significant factor.

The results for velarization contrast with the results in González & Pereda (1998), who find that all social classes in the one age group they examine exhibit instances of velarization, which leads them to conclude that it is not socially stratified. The present study analyzes speech samples from the same sociolinguistic corpus, but it incorporates more than one age group. In doing so, we can explore differences among age groups and social class. The results of the logistic regression showed that, while all social classes velarize, it was only significant for the middle and working classes.

In the analysis of velarization, no linguistic or extra-linguistic factors other than age group and social class were significant. It should be noted that the sample under examination includes only 26 tokens of velarization. Thus, these results should be taken with caution. It is possible that other independent variables did not reach significance due to size of the data set, such as point of articulation of the consonant in the coda. For this reason, future research should explore velarization further.

The results of the present study also contrast with Brown (2006). In the corpus under analysis, deletion is more frequent than velarization. Brown posited that a more frequent [C_{VELAR}\$C] schema leads to the labial>velar alternation. However, this explanation does not explain why deletion is more frequent than velarization. We can address this question by considering the role of the independent variables. The present study shows that deletion and velarization have different social and linguistic distributions. While deletion is favored by younger speakers and the working class, velarization is favored by older speakers and the middle class. In this sense, velarization can be interpreted as a form of resistance to the linguistic change lead by the younger generations. By resorting to

velarization, older speakers maintain the CVC syllable structure and avoid CV syllables. Speakers who preserve a CVC structure retain the coda stop by selecting the most frequent schema, [$C_{VELAR}$$C].

However, the data presented in this study only partially support the last statement. Brown (2006) explains the direction of the distribution, from labial to velar. However, if speakers who retain choose the most frequent variant, [k], the data for labials and dentals should show higher rates of velarization than retention, but this is not the case. Bilabials show a retention rate of 65%, while they velarize at a 12% rate. Dentals, on the other hand, are retained 43% of the times, and are velarized 8% of the time. A possible interpretation of this distribution is that velarization is a form of hypercorrection, as speakers exaggerate the use of a prestigious variant. If the higher social classes favor retention, and the velar stop is most frequent in the coda domain, the middle class extends its use and replaces other stops in the coda with [k]. However, as mentioned above, our analysis of velarization is based on 26 tokens. At this juncture, these are plausible speculations.

Additionally, we see a split between dental and labial stops. The data show only 5 tokens of velarized dental coda stops, which represent a 20% of the tokens of velarization. That is, 80% of the velarized tokens are labials. The question that remains unanswered is why are mostly labials replaced, as opposed to dentals? One possible answer has to do with the lower type frequency of dentals in comparison to labials. The data show 63 tokens of coda dentals as opposed to 169 tokens of coda labials. Future analyses with a larger corpus would allow exploring this issue in greater detail.

Moreover, not all speakers velarize, and when they do, they do it very at different rates. That is, some speakers velarize across the board, and some speakers do not velarize at all. Speakers range from no velarization (n = 20) to 89% rate of velarization. Thus, future analyses could examine data exclusively from speakers that do velarize to explore further the issues presented above. Additionally, as an anonymous reviewer pointed out, another issue to explore at the individual level is whether speakers are consistent in their retention and deletion patterns. That is, does a speaker who retains (or deletes) velars, also retains (or deletes) the labial and dental stops at the same rate? For these reasons, a larger corpus is also recommended.

The fourth research question investigated the role of lexical frequency in the deletion and velarization of word-internal coda stops in Spanish. Lexical frequency was significant for the deletion of velar coda stops, but not for labials and dentals. For velars, high frequency lexical items favored deletion. Thus, the present study offers some evidence in support of a frequency effect in the deletion of word-internal syllable coda stops in Spanish.

The fact that lexical frequency was not a significant factor with labial and dental coda stops could be due to several reasons. First, it is possible that lexical frequency did not reach significance due to the lower number of tokens with labial and dental coda stops in the corpus. The data set under analysis includes 713 velar tokens, whereas only 169 labials and 63 dentals were analyzed.

Another possibility to explain why lexical frequency was not significant with labial and dental coda stops has to do with the structure of the Spanish

lexicon. The present corpus does not include high frequency lexical items with labial or dental syllable coda stops. The most frequent words in the data set have velars in the syllable coda. In fact, the category of high frequency lexical items only includes three lexical items: *prácticamente* "practically", *actualmente* "nowadays", and *doctor* "doctor". The first two are discourse markers. That is, they establish textual coherence and cohesion, and contextualize an utterance in a communicative situation (Silva-Corvalán, 2001: 214). Higher rates of use lead to semantic bleaching, which in turn leads to a more efficient neuromotor sequences and greater overlap and reduction of the articulatory gestures involved (Bybee, 2003).

However, it is also possible that only one of the variants of the dependent variable exhibits a frequency effect. Coda stop deletion is a likely candidate for phonetic reduction as a function of higher rate lexical items, given that higher frequencies result in greater articulatory efficiency and gestural reduction. However, velarization is a different phonological process in nature. In this case, we do not observe a decrease in the magnitude of the articulatory gesture, but rather a change in place of articulation (from labial to velar), and even devoicing. Thus, lexical frequency could have different effects on deletion and velarization. This is a question to be addressed by future research.

6. Final remarks

The present study offers a variationist analysis of word-internal coda stops. In doing so, it confirms that velar stops are more frequent in the syllable coda than bilabial and dental stops, which confirms previous findings by Brown (2006). For velars, retention is more common than deletion. Labials and dentals include a third variant, velarization, but the distribution of deletion and velarization is unequal. With labials, retention is more common than velarization, which in turn is more common than deletion. Dentals, on the other hand, show that deletion is more common than retention, which is followed by velarization. Thus, this suggests that velarization is more specific to bilabial stops, and deletion to dentals.

The results of the logistic regression show that velarization and deletion have different social distributions. Deletion is favored by the working class and the younger age group. Velarization, on the other hand, is favored by the middle and working classes. These results contrast with previous research by González & Pereda (1998). In their study, they analyzed one age group and found speakers of all social classes velarized. However, the present study, by including more than one age group, revealed that velarization is statistically significant for some social groups, and not others.

This patterns found in this study suggests that deletion, unlike velarization, is a stigmatized variant. A potential interpretation for velarization is that it is a form of hypercorrection. When speakers wish to maintain the CVC structure, they opt for the most frequent variant, [k].

Additionally, the study examined the role of lexical frequency and found some evidence for a frequency effect. Deletion of velar coda stops, and not labial and dental stops, was favored by high frequency lexical items. Lexical frequency was not a significant factor for velarization. It could be due to the size of the

corpus, but it could be that lexical frequency has different effects for two variants of the same variable. Thus, future research in this direction would shed light on the effect of lexical frequency on phonological variation.

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