RLA. Revista de Lingüística Teórica y Aplicada
Concepción (Chile), 44 (2), II Sem. 2006, pp. 47-58.

CL ISSN 0033 - 698X

VELARIZATION OF LABIAL, CODA STOPS IN SPANISH: A FREQUENCY ACCOUNT

VELARIZACION DE OCLUSIVAS LABIALES POSNUCLEARES: UN ANALISIS DE FRECUENCIA

ESTHER L. BROWN
University of Colorado Boulder, EE.UU.
Esther.Brown@colorado.edu

ABSTRACT

In several varieties of spoken Spanish, word-medial, labial stops are articulated as velar stops (*pepsi* > *pe*[k]*si*). This work summarizes some previous attempts to explain this abrupt sound substitution. Then, building upon advances in phonotactic theory (e.g., Pierrehumbert, 1994) and patterns emergent from lexical representations (Bybee, 2001), this work presents a new theoretical perspective from which to examine the p > k phenomenon. Syllable-final, word-medial, velar stops (/g, k/) have a significantly higher token and type frequency than syllable-final, word-medial labial stops (/b, p/) in Spanish. As a result, the schema [..$C_{VELAR}$$C..], and not [..$C_{LABIAL}$$C..], emerges as a stronger, more productive schema, promoting the abrupt sound substitution LABIAL > VELAR.

Keywords: Stops, Spanish, velarization, frequency, schemas.

RESUMEN

En algunas variedades del español hablado, las oclusivas labiales en medio de palabra se realizan con una articulación velar (*pepsi* > *peksi*). Este trabajo provee un resumen de estudios previos que intentan explicar esta sustitución fonológica abrupta e incorpora avances teóricos de la fonotáctica (e.g., Pierrehumbert, 1994) y de los patrones que surgen de las representaciones léxicas (Bybee, 2001) para explicar desde una perspectiva teórica nueva el fenómeno p > k en español. Las oclusivas velares, posnucleares (/g, k/) tienen una frecuencia de uso y una frecuencia de categoría significativamente más alta que las oclusivas labiales (/b, p/) en la misma posición. Como resultado, el esquema [..$C_{VELAR}$$C..], y no [..$C_{LABIAL}$$C..], surge como el esquema más fuerte y productivo, dando motivación al cambio fonológico LABIAL > VELAR.

Palabras claves: Oclusivas, español, velarización, frecuencia, esquema.

Recibido: 01-08-2006. Aceptado: 13-11-2006.

1. INTRODUCTION

IN SEVERAL varieties of spoken Spanish today, particularly in (although not limited to) Caribbean dialects, there is noted variation in the realizations of word-medial, syllable-final consonants (Canfield, 1981; Mora de González, 1989; Quilis, 1993). Many of these variants can easily be described as assimilation (assimilation of voicing *absoluto* > *apsoluto*), retiming of gestures (*arde* > *adde*), or as generally reductive in nature (*admitir* > *amitir*) and as a result do not appear to be exceptions to what is known about sound change patterns. One widespread sound change, however, that does not seem to follow any commonly found pattern is the backing of postnuclear, labial obstruents (*pepsi* > *peksi*).

Sound changes, generally arising from the reduction and/or retiming of gestures, tend to be phonetically gradual (Mowrey & Pagliuca, 1995; Bybee 2001a). We would not expect, therefore, a systematic change of syllable-final Spanish /p/ to [k]. As has been noted, "although we expect abrupt substitution of one sound for another in cases of language contact, such finer-grained data as we possess point to the phonetic gradualness of internal changes" (Mowrey & Pagliuca, 1995: 43). It is difficult to explain, therefore, the backing of labial consonants occurring in words such as *séptimo* > *sé[k]timo* in a variety of styles (Chela-Flores, 1981: 658) and in such a vast geographic area (Canfield, 1981).

Researchers have attempted to explain the backing of Spanish word-medial consonants from a variety of perspectives (Chela-Flores, 1980; Chela-Flores, 1981; Guitart, 1981; González, 1991; D'Introno *et al.*, 1995). This current work will summarize some of these previous works, and using what is known of phonotactics and patterns emergent from lexical representations, will present a new theoretical perspective from which to examine the p > k phenomenon. It will be suggested that due to the high token and type frequency of syllable-final [k], and the very low token and type frequency of syllable-final /p/, the schema [..$C_{VELAR}$$C..], and not [..$C_{LABIAL}$$C..], emerges as a stronger, more productive schema, promoting the abrupt sound substitution p > k.

This stance that frequency acts as a factor in language processing and that there is a connection between phonology and the lexicon finds support in child language acquisition research (e.g.: Gierut & Morrisette, 1998), psycholinguistic experimentation (e.g.: Luce & Pisoni, 1998; Vitevitch & Rodríguez, 2005), speech error analyses (e.g.: Levitt & Healy, 1985), and quantitative approaches to language variation (e.g.: studies summarized in Eddington, 2004: 60-66), with robust results all pointing in the same direction.

2. CODA CONSONANTS IN SPANISH

It is important to note that in spoken Spanish, obstruents in syllable-final position are variable (Mora de González, 1989; Quilis, 1993; Navarro Tomás, 1985; D'Introno *et al.*, 1995; Antón, 1998). Quilis (1993: 218), for example, lists nine different variants as the most frequent realizations of the phoneme /p/ in syllable-final position. D'Introno *et al.* (1995: 265) list five primary allophones for the occlusive stops in syllable-final position (voiceless stop, slightly voiced, lax stop, voiced fricative, geminate, and zero). For the voiced and voiceless stops in coda position (/p, b, t, d, k, g/), therefore, many different realizations are possible; deletion, lenition, assimilation, etc.

Curiously, postnuclear, labial obstruent /p/ is realized as [k] quite commonly according to Canfield (1981). This phonetic variant is frequent in the casual speech style of Venezuela, Colombia, Central America (Canfield, 1981: 11) and is also found in the Caribbean islands and other areas of the Spanish speaking world (Zamora Munné & Guitart, 1982; Betancourt Arango & García Zapata, 1998; Fraca de Barrera & Obregón Muñoz, 1985; Quilis, 1993; Salvador, 1987). Examples can be seen in (1).

(1)					
Zamora Munné & Guitart (1982)	*concepto*	'concept'	➔	conce[k]to
	séptimo	'seventh'	➔	sé[k]timo
Mora de González (1989)	*opción*	'option'	➔	o[k]ción
	receptor	'receptor'	➔	rece[k]tor
	pepsi	'Pepsi'	➔	pe[k]si
González and Pereda (1998)	*captando*	'grasping'	➔	ca[k]tando

This change of labials to velars is proceeding despite the loss of phonemic distinctions in the coda position. For example, the phonemic distinction in the coda position is obliterated in the minimal pairs listed in examples (2).

(2)							
Chela-Flores (1981)	*apto*	'apt'	➔	a[k]to	←	*acto*	'act'
	aptitud	'aptitude'	➔	a[k]titud	←	*actitud*	'attitude'
Quilis (1993)	*opto-*	'opto-'	➔	o[k]to-	←	*octo-*	'octo-'

However, as Quilis notes (1993:204-206), the neutralization of /p, t, k, b, d, g/ in word-internal coda position affects very few minimal pairs. These include those listed in examples (2) and few more (*acta* 'record' ~ *apta* 'competent'*)*.

In addition to backing, the opposite phenomenon, fronting, is also attested.

Although this fronting phenomenon is known to occur, labial-stop realizations are exceedingly rare and essentially are not realized by speakers (Chela-Flores, 1981:657). In fact, a quantitative analysis conducted on men and women from Mérida, Venezuela (Mora de González, 1989) reveals that labial realizations of velar obstruents account for less than 1% of the occurrences. Table 1 summarizes these data.

Table 1. Velar and Labial Coda Consonant Realizations in Mérida, Venezuela.

Coda phone	% velar	% labial	Other
/k/ (N = 874)	99	< 1	< 1
/g/ (N = 466)	99	< 1	< 1
/p/ (N = 439)	53	46	1
/b/ (N = 410)	37	48	15

Adapted from Mora de González (1989).

Certainly, diachronically in Spanish, backing of coda consonants is much more frequent than fronting (Penny, 1991). And although [k] > [p] is attested in other Romance languages such as Romanian (Avram, 1981), there is no pattern of consonant substitution of this type (labial > velar or velar > labial) historically in Spanish. How, then, can we account for the p > k that occurs more commonly?

3. PREVIOUS ACCOUNTS OF LABIAL > VELAR IN SPANISH

This type of sound change has been addressed from a variety of perspectives. Chela-Flores (1980), for example, proposes that the realization of labials as velars follows from a “principle of least effort”. This hypothesis suggests that posterior consonants are less taxing on the oral muscles than anterior ones. Therefore, velarization is seen as a step in the weakening process towards elimination of the consonant. A hypothetical evolution of the word *apto*, therefore, would be [apto] > [akto] > [a?to] > [ato] (labial stop > velar stop > glottal stop > deletion) (Zamora Munné & Guitart, 1982).

Utilizing the same poligestural theories, Guitart (1981) examines the same problem from an autosegmental perspective. The author states that there is a suppression of the oral gestures in the production of the labial consonants, which leaves just the glottal stop, which is then later perceived by the listener to be velar consonant who in turn pronounces it as such. This suggests a different order of variants within the hypothetical sound change mentioned above. The process might be, instead, [apto] > [a?to] > [akto] (Zamora Munné & Guitart, 1982).

In neither of the previously described studies (Chela-Flores, 1980; Guitart, 1981) is it demonstrated that the sound changes outlined for syllable-final, word-medial consonants (non-velar > velar > glottal > elision or non-velar > glottal > velar) are actually attested stages along a sound change cline. Mora de González (1989: 163) maintains that Guitart's (1981) autosegmental analysis does not account for many of the variants and Zamora Munné & Guitart (1982) state, "No existe...hasta la fecha evidencia empírica concluyente de que la articulación velar involucre menor esfuerzo muscular que las articulaciones más anteriores" (1982: 114), ["to date, there does not exist conclusive empirical evidence that the velar articulations involve less muscular exertion than more anterior articulations'; translation mine"]. It has been suggested, therefore, that neither of the previously summarized studies achieves explanatory adequacy.

Chela-Flores in a later work approaches the problem from a different perspective and proposes "una fonología natural polisistemática" ["a polisystematic natural phonology"] (1981: 655). She describes three, autonomous phonetic systems (prenuclear, nuclear and postnuclear) each with their own metaconditions. Based on the velar articulations of labial coda consonants, the author states,

> se deduce la existencia de una amplia metacondición que exige la máxima diferenciación entre el sistema prenuclear y el postnuclear. Esta condición se traduce a otro nivel en, por ejemplo, una subcondición de anteriorización para el sistema prenuclear y una de posteriorización para el postnuclear (1981: 656).

The process of labial > velar, in other words, is described by this author as the motivation to achieve maximum differentiation between the pre- and post-nuclear consonants. This theory, however, does more to describe the backing phenomenon than it does to explain it.

The change of labials to velars, therefore, is a widespread change found in several Spanish speaking dialect zones about which very little consensus has been reached. What, then, explains this sound change? It is proposed here that what drives this change is an extension based on existing words in the lexicon. The highly infrequent syllable-final labial consonant is patterning itself off of the far more frequent syllable coda velar consonant, as will be explained in the following section.

4. THEORETICAL BACKGROUND

The search for an explanation for the labial > velar phenomenon has typically been described in the form of external rules. Recent advances in phonotactic theories (Pierrehumbert, 1994; Vitevitch *et al.*, 1997; Bybee, 2001b), however, enable us

to re-visit and shed new light on this sound change; an apparent linguistic anomaly not only for Romance linguistics, but also for diachronic sound change theories.

Vitevitch *et al.* (1997) have shown that speakers possess a fine-grained knowledge of phonotactic probabilities within their language based on existing forms, as opposed to simply an understanding of either possible or impossible word and syllable structures. The authors state that, "it seems certain that information regarding the probability –and not simply the legality or illegality– of a given phonetic sequence is, in one form or another, represented in memory" (1997: 60). This gradient information suggests that speakers do not utilize abstract rules in the forming of syllable types, but rather make generalizations from existing patterns in the lexicon.

Similarly in an analysis of child language acquisition, Gierut & Morrisette note that like adults, children not only "have knowledge of the phonological properties of language, but also how these properties are distributed, in terms of frequency of occurrence and phonotactic structure, across words of the ambient language" (1998: 264). The effects of this knowledge might be evidenced in the labial variation under investigation here, or, in terms of phone frequency, in linguistic experiments. In speech error research, Levitt & Healy (1985), for example, find that in slips-of-the-tongue, the tendency is also for a low frequency phoneme to be replaced with a high frequency phoneme. This bias towards frequent sounds and patterns is true not only in production, but in perception, as well. For example, Newman, Sawusch & Luce state that "listeners may be biased toward labeling ambiguous stimuli as more common phonemes" (2000: 300). Patterns revealed in these and other experiments are similar to the substitution of the labial stop for the velar stop in word-medial position in Spanish, and this may suggest similar underlying mechanisms are at work.

Frequency is a clear factor in language processing and use, and there is a connection between phonology and the lexicon. As Gierut & Morrisette note for children's developing phonological systems, there is an "intimate relationship between phonological and lexical properties of words" (1998: 264). Likewise, Pierrehumbert (1994) finds that acceptability judgments about phonotactic sequences are based on connections to other words represented in the lexicon. Furthermore, this author's study determines that to understand phonotactic structure in a language it is necessary to consider the frequency with which certain syllable onsets and codas occur in the lexicon.

Type frequency, which refers to the dictionary frequency of a particular pattern, has been shown to be paramount in determining productivity of phonotactic patterns or schemas (Bybee, 2001b). Schemas with a higher type frequency (those that apply to a greater number of lexical items) have a greater likelihood to apply to new items (Bybee, 2001a).

It is proposed in this study, therefore, that what is occurring in the labial > velar development is not due to the application of an abstract rule (or the failure of some such rule to apply). Rather, based on the assumption that phonotactic knowledge and structure derive from actually occurring words in the lexicon, it is hypothesized that the paucity of Spanish words occurring with syllable-final labial stop coupled with the frequently occurring syllable-final velar stop motivates the production of forms such as *Pepsi* > *Pe[k]si*.

5. STUDY

Methods: In order to substantiate this claim, a quantitative analysis was conducted using approximately 6,800,000 words in a compilation[1] of oral Spanish corpora from the 1900's. For quantification purposes, the following graphemes were considered to contribute to the velar schema [..$C_{VELAR}$$C..] when they represented word-medial, syllable-final consonants; *c, g, x*[2] . Similarly, when the following graphemes represented a word-medial, syllable-final consonant, they were counted as contributing to the labial schema [..$C_{LABIAL}$$C..]; *p, b*.

5.1. Token frequency: For the purposes of this study, all word-medial <-bC-> and <-pC->combinations were calculated. In these corpora, the labial consonant clusters included the following series of graphemes -bb- (*hobby* 'hobby'), -bc- (*subcomisión* 'sub-commission'), -bd- (*abdomen* 'abdomen'), -bg- (*subgénero* 'sub-genre'), -bm- (*submarino* 'submarine'), -bn- (*abnegación* 'abnegation'), -bs- (*absolutamente* 'absolutely'), -bt- (*obtener* 'to obtain'), -bv- (*obviamente* 'obviously'), -pc- (*excepción* 'exception'), -pt- (*óptico* 'optic'), and -ps- (*lapsus* 'lapse, mistake'). The total number of tokens for [..$C_{LABIAL}$$C..] were tabulated individually, as well as added together to provide the total number of syllables in the text with labial stops in word-medial coda position.

The token frequency of word-medial syllables with velar stops in the coda was also calculated in order to make a comparison with the number of labial stop codas. First, in order to determine the relative frequency of the [..$C_{VELAR}$$C..] in relation to the labials, the following word-internal graphemes were tabulated: -cc- (*acción* 'action'), -cd- (*anécdota* 'anecdote'), -cm- (*dracma* 'drachma'), -cn- (*técnico* 'technical'), -cs- (*picnic* 'picnic'), -ct- (*proyecto* 'project'), -gb- (*rugby* 'rugby'), -gm- (*fragmento* 'fragment'), -gn- (*significar* 'to mean'), and -gz- (*zigzaguear* 'to zigzag').

[1] See www.corpusdelespanol.org a searchable online corpora created by Prof. Mark Davies of Brigham Young University, in Povo, Utah (2001-02).

[2] Phonemic distinctions exist in syllable-initial position between the voiceless and voiced labial and velar stops in Spanish (/p/, /b/; /k/, /g/). However, the phonemic distinction is neutralized in syllable-final position (D'Introno *et al.*, 1995: 277).

The grapheme -x- (*contexto* 'context') is also included (except in words like *México*). Realizations of -x- in spoken Spanish are highly variable. However, just like labial and velar stops in coda position, deletion is possible. While not all speakers will enunciate [ks] in all cases (just as not all will pronounce [p] or [k] in words such as *septiembre* or *doctor* respectively), this combination is common (Betancourt Arango *et al.,* 1998; Mora de González, 1989). For this reason, -x- is included in the analysis. However, alternate calculations were made including just intervocalic cases (*exigir* 'to require, to demand') where reduction of the stop may be less likely (Navarro Tomás, 1985), as well as comparisons in which no cases of orthographic -x- are included. Proper nouns were excluded from the token count in this study (names such as Magdalena) as well words where the <-xi-> combination could not represent the [-ks-] pronunciation (*mexicano*).

5.2. Type frequency: The distribution of the different codas within words was examined in order to determine the number of lexical items participating in the [..$C_{LABIAL}$$C..] schema compared to the number of lexical items participating in the [..$C_{VELAR}$$C..] schema. In this analysis, lemmas were tabulated in the corpora and not individual forms. For example, the word-internal consonant cluster "-bt-" included 644 occurrences of the verb *obtener*. Each individual form was not listed as separate lexical entries (*obtener* 'to obtain' N = 291, *obtenido* 'obtained (PP)' N = 90, *obtuvo* '3rd person singular obtained' N = 76, *obtiene* '3rd person singular obtains' N = 75, *obtienen* '3rd person plural obtains' N = 36, etc.), but rather as one lexical form *obtener*.

6. RESULTS

6.1. Token frequency results: The token frequency of the /-LABIALC-/ word-medially in Spanish is extraordinarily low. In the analysis of approximately 6,800,000 words spoken in Spanish, the /-pC-/ and /-bC-/ occurs just 13,230 times.

Syllable-final velar stops, on the other hand, are shown to be much more frequent than the postnuclear labials previously described. The /-VELARC-/ combination occurs a total of 91,999 times in the corpora. It is shown that syllable-final velar stop in Spanish is more than seven times more frequent than syllable-final labial stop ($p = 0.0000$)[3]. The results of the analysis can be seen summarized in Table 2.

[3] If just intervocalic instances of -x- are included in the analysis, the number of /-VELARC-/ cases is 76,867 [roughly six times more frequent ($p = 0.0000$)]. If no tokens of -x- are included, the total for /-VELARC-/ is 63,995 [roughly 5 times more frequent than the labial stops ($p – 0.0000$)].

Table 2. Token frequencies of labial and velar word-medial coda consonants.

	-bC-	-pC-	-gC-	-kC-
Token frequency	5,895	7,335	4,537	87,462
Total	13,230		91,999	

6.2. Type frequency results: It was hypothesized in this study that syllables with a velar stop in the coda, as opposed to labial, not only have a higher token frequency (occur within the text more often), but that their type frequency was also higher (that there are more lexical items containing syllable-final velar than syllable-final labial word-internally). The schema or phonotactic structure that applies to more forms, recall, would be expected to be more productive and to apply to new forms.

The consonant cluster with the lowest type frequency was /-bC-/, applying to just 112 different lexical items in the corpus of 6,800,000 words. The most frequent word with a medial -bC- cluster was *absolutamente* 'absolutely' (926 tokens). The /-pC-/ syllable structure had a slightly higher type frequency, applying to 148 forms, the most frequently occurring of which was *aceptar* 'to accept' (1218 tokens). In total, therefore, a schema for a /p/ final syllable type [..$C_{LABIAL}$$C..], only applies to 260 lexical items in the entire corpus, thus making it a relatively weak schema when compared to the [..$C_{VELAR}$$C..] phonotactic structure.

Words with a medial /-gC-/ and /-kC-/ far outnumber the previously discussed forms. The [-gC-] combination applied to 112 different words within the corpus (with *significar* 'to mean' having the highest token frequency of 1017). The [-kC-] sequence had the highest type frequency, with that syllable structure being found in 875 different lexical items. Together, therefore, the type frequency for syllables with a velar stop in the coda, forming part of the schema [...Vk$C...], totals 987, as compared to the 260 lexical items containing /p/ in the coda. Approximately 4 times as many lexical items share the velar coda as compared to the less frequent labial ($p = 0.0000$)[4], and as a result, the emergent schema [...Vk$C...] is considerably stronger than the schema [...Vp$C...]. These results can be seen summarized in Table 3.

[4] If just intervocalic instances of -x- are included, 682 types contribute to the velar schema [roughly six times as frequent ($p = 0.0000$)]. If no tokens of -x- are included in the analysis, 518 types contribute to the velar schema [roughly five times more types ($p = 0.0000$)].

Table 3. Type frequency for each syllable type.

	-bC-	-pC-	-gC-	-kC-
Type frequency	112	148	112	875
Total	260		987	

As is evident from Table 3, /LABIAL/ in the coda word-medially is rare in this corpus which supports the statement by Mowrey and Pagliuca that, "the rate of occurrence of syllable-final /p/ in Spanish is vanishingly small" (1995: 69). However, based on the results of this study, their subsequent statement may be too strong. The authors state, that since the occurrence of syllable-final /p/ is so rare in Spanish, it is in effect, "absent from the core lexicon of Spanish" (1995: 69) and therefore, "it is likely that many speakers never encounter, and hence never lay down motor patterns for, syllable-final /p/" (1995: 69).

It is true, as seen in this study, that /p/ does occur infrequently in the coda and that it has a significantly lower type frequency, but words such as *aceptar* 'to accept' and *concepto* 'concept' do seem to have a significant token frequency (1218 and 644 respectively). Of the 1247 word types extracted from the corpora in this analysis, only 11 words had a higher token frequency than *concepto*, putting it within the top 1% of the most frequent lexical items. It is apparent, consequently, that the type frequency of the syllable structure must be taken into account when examining this labial > velar phenomenon.

7. CONCLUSION

As discussed at the onset of this paper, the backing of coda labial stops in Spanish is a linguistic phenomenon occurring in several non-geographically contiguous dialects. This study, building upon recent advances in phonotactic theory (Pierrehumbert, 1994; Vitevitch *et al.*, 1997; Bybee, 2001b) as well as phonological and lexical representation (Bybee, 2001b), has provided a new explanation for this sound change.

The analysis conducted for this study has shown that in Spanish there is considerably higher token frequency for coda velar stops than for syllable-final labial consonants. In addition to the higher token frequency, the frequent syllable-final velar consonant also has a significantly higher type frequency. It has been shown that markedly more lexical items contribute to the [..$C_{VELAR}$$C..] schema than to the less common [..LABIALC$C..] schema. As a result, the former schema is stron-

ger and thus more accessible. The extremely low token frequency for coda labials, therefore, combined with the notably higher type frequency and thus stronger, more productive schema of the velar coda explains the tendency for words such as *Pepsi* to be produced as *Pe[k]si*.

REFERENCES

Antón, Marta. 1998. "Del uso sociolingüístico de las oclusivas posnucleares en el español peninsular norteño", *Hispania* 81.4: 949-958.

Avram, Andrei. 1981. "Fluctuatia po- ~ co- i limba romana si unele probleme de etimologie", *Studii si cercetari lingvistice* 32.3, May-June: 247-259.

Betancourt Arango, Amanda y Carlos García Zapata (1998). "Fonética en Antioquia", *Thesaurus* 53.1: 1-59.

Bybee, Joan. 2001a. "Lexicalization of Sound Change and Alternating Environments". *Laboratory V. Language Acquisition and the Lexicon.* Eds. Michael Broe & Janet Pierrehumbert. Cambridge: Cambridge University Press: 250-268.

Bybee, Joan. 2001b. *Phonology and Language Use.* Cambridge: Cambridge University Press.

Canfield, D. Lincoln. 1981. *Spanish Pronunciation in the Americas.* University of Chicago Press: Chicago.

Chela-Flores, Godsuno. 1980. Las teorías fonológicas y los dialectos del Caribe Hispánico. Paper presented at *El V Simposio de Dialectología del Caribe Hispánico,* Caracas.

Chela-Flores, Godsuno. 1981. Consonantes mínimas y metacondiciones en el Caribe hispánico. *Actas del VI Congreso Internacional de la Asociación de Lingüística y Filología de la América Latina.* Phoenix, Arizona.

Davies, Mark. 2001-02. *Corpus del español.* [On-line]. Available at http://corpusdel espanol.org/. [Last search: july, 2005]

D'Introno, Francesco; Enrique Del Teso and Rosemary Weston. 1995. *Fonética y fonología actual del español.* Madrid: Ediciones Cátedra, S.A.

Eddington, David. 2004. *Spanish Phonology and Morphology: Experimental and quantitative perspectives.* Amsterdam: John Benjamins.

Fraca de Barrera, Lucia and Hugo Obregón Muñoz. 1985. "Fenómenos fonéticos segmentales del español de la zona costera de Venezuela", *Letras* 43: 101-137.

Gierut, Judith and Michele Morrisette, 1998. Lexical properties in implementation of sound change. *Proceedings of the 22nd Annual Boston University Conference on Language Development.* Eds. A. Greenhill and M. Huges and H. Littlefield and H. Walsh. Somerville, MA: Cascadilla Press: 257-268.

González, Jorge. 1991. "Análisis fonológico de algunos procesos que intervienen en la producción de las consonantes obstruyentes en posición postnuclear del español venezolano", *Letras,* 48: 133-152.

González, Jorge and María Helena Pereda. 1998. "Procesos postnucleares de las obstruyentes oclusivas en el habla caraqueña", *Letras,* 56: 53-64.

Guitart, Jorge M. 1981. "Sobre la posteriorización de las consonantes posnucleares en

el español antillano: Reexamen teórico-descriptivo". *VI Simposio de Dialectología del Caribe Hispánico*. Universidad Católica Madre y Maestra. Santiago, República Dominicana.

Levitt, A.G. & A.F. Healy. 1985. "The roles of phoneme frequency, similarity, and availability in the experimental elicitation of speech errors". *Journal of Memory and Language* 24: 717-733.

Luce, Paul & David Pisoni. 1998. "Recognizing spoken words: The neighborhood activation model", *Ear & Hearing*, 19: 1-36.

Mora de González, E. 1989. "Las obstruyentes implosivas: un proceso de variabilidad", *Revue de Phonetique Appliquee*, 91-93: 161-175.

Mowrey, Richard and William Pagliuca. 1995. "The reductive character of articulatory evolution", *Rivista de Linguistica*, 7.1: 37-124.

Newman, Rochelle; James Sawusch and Paul Luce. 2000. "Underspecification and phoneme frequency in speech perception", *Papers in Laboratory Phonology V: Acquisition and the Lexicon*. Eds. M. B. Broe and J. Pierrehumbert. Cambridge: Cambridge University Press: 299-312.

Navarro Tomás, T. 1985. *Manual de pronunciación española*. Madrid: Gredos.

Penny, Ralph. 1991. *A History of the Spanish Language*. Cambridge: Cambridge University Press.

Pierrehumbert, Janet. 1994. "Syllable structure and word structure; a study of triconsonantal clusters in English", *Phonological Structure and Phonetic Form: Papers in Laboratory Phonology III*. Ed. Patricia Keating. Cambridge: Cambridge University Press: 168-190.

Quilis, Antonio. 1993. *Tratado de fonología y fonética españolas*. Madrid: Editorial Gredos.

Salvador, Gregorio. 1987. *Estudios dialectológicos*. Madrid: Paraninfo.

Vitevitch, Michael S.; Paul A. Luce, Jan Charles-Luce and David Kemmerer. 1997. "Phonotactics and syllable stress: Implications for the processing of spoken nonsense words", *Language and Speech*, 40: 47-62.

Vitevitch, Michael S. and Eva Rodríguez. 2005. "Neighborhood density effects in spoken word recognition in Spanish", *Journal of Multilingual Communication Disorders*, 3.1: 64-73.

Zamora Munné, Juan and Jorge Guitart. 1982. *Dialectología Hispanoamericana: Teoría-Descripción-Historia*. Salamanca: Ediciones Alimar, SA.