Accounting for Variation of Diminutive Formation in Porteño Spanish

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1. Introduction

Diminutive formation is a highly productive derivational process in Spanish, and it is commonly used to express the little and/or endearing form of the word being derived (Colina, 2003; Harris, 1969; Jaeggli, 1980). Diminutives can be derived from nouns, adjectives, and adverbs, as shown in example (1).[1]

(1)

nouns	[ˈpes]	'fish'	→	[pes**e**ˈ**sit**o]	'little fish'
adjectives	[aɾaˈɣan]	'lazy'	→	[aɾaɣanˈ**sit**o]	'lazy (endearing form)'
adverbs	[temˈpɾano]	'early'	→	[tempɾaˈn**it**o]	'early (endearing form)'

As shown in the previous example, the Spanish speaker has different allomorphs available for this process: *-it*, *-sit*, *-esit*.[2] This paper analyzes the puzzle that arises when the speaker decides which allomorph to use, taking into consideration that sometimes the speaker himself is ambivalent as to which one to affix, as in example (2):

(2) [ˈbɾokoli] 'broccoli' [bɾokoˈl**it**o] vs. [bɾokoliˈ**sit**o]

To account for this ambivalence, this paper uses a Maximum Entropy Model (Hayes and Wilson, 2008), a probabilistic theory that captures this free variation.

In addition to the choice of allomorphy shown in (1), for words ending in vowels, the speaker has the option of deleting or not deleting this vowel, shown in (3):

(3)

[ˈkasa]	'house'	[kaˈsita]
[ˈbeɾðe]	'green'	[beɾð**e**ˈsito]

This expands even more the possible number of outputs per input and the free variation found amongst speakers. Thus, although participants in this study agreed in the formation of diminutives for words ending in /é/ by 94% (X'e → Xe+'sit; e.g. [ka'fe] 'coffee' → [kafe'sito]), most generalizations are imperfect. Such is the case of words with three or more syllables ending in /i/, where 55% retained the final vowel and affixed *-sit* (e.g. ['taksi] 'taxi cab'→ [taksi'sito]) and 44% deleted the final vowel and affixed *-it* (e.g. ['taksi] → [ta'ksito]).[3]

1.1 Spanish Word Structure

1.1.1 Terminal Elements and Base Elements

Final segments of non-inflected words in Spanish can be divided into *terminal elements* (hereafter, TEs) and *base elements*. Harris (1994) states that terminal elements are suffixes with "no 'meaning' or 'function' in the ordinary sense; they serve only as overt phonological identifiers of several lexically arbitrary form classes into which all Spanish nouns, adjectives and adverb stems and derivational affixes are partitioned" (185). The norm in Spanish is for this TE to match in gender with the word (i.e., words ending in /a/ are normally feminine and words ending in /o/ are normally masculine). To this, Colina (2003) adds that TEs cannot be stressed; therefore according to her definition the final /á/ in [mam'a] 'mom' is not a terminal element (thus a base element), whereas final /a/ in ['kama] 'bed' is a terminal element because it is unstressed.

Regarding final /e/, different scholars have made different proposals; however, Colina (2003) claims it is also a TE. This is a controversial statement as the data is not entirely clear. Based on other derivational processes, final /e/ can either follow the pattern of TEs (i.e., deleting before affixation) or not (i.e., not deleting before affixation) as shown in example (4).

(4)	[a'lambɾ**e**]	'wire'	→	[alambɾ'aðo]	'wire fence'
	['kaβl**e**]	'cable'	→	[kaβl**e**'aðo]	'group of cables'

However, this deletion process could also be attributed to a phonological process that occurs in specific environments, but a deeper analysis of this issue is beyond the scope of this work. In addition, following the class analysis proposed by Harris (1992), this paper assumes classes I and II (i.e., words with final /a/ and /o/) to be the only TEs in Spanish, leaving final /e/ as a base element. According to the data, /e/ follows the same patterns as final /u/ and /i/ with regard to diminutive formation. By considering final /e/ to be part of the base, the inclusion of unmotivated constraints can be avoided, thereby yielding a simpler grammar. Thus, this paper considers final stressless /a/ or /o/ (as in example 5) to be the only two TEs in Spanish.

(5)	/a/	['kam-a]	'bed'
	/o/	['liβɾ-o]	'book'

Therefore, *base elements* include all consonants and the remaining vowels. The examples below illustrate final stressed /á/ and /ó/ (example 6), all final /i/ and /u/ (example 7), and all final /e/ as base elements (example 8).

(6)	/á/	[t͡ʃiɾi'pa]	'cloth diaper'
	/ó/	[boŋ'go]	'bongo'
(7)	/i/	['bondi]	'bus'
	/í/	[ma'ni]	'peanut'
	/u/	['tɾiβu]	'tribe'
	/ú/	[ɲan'du]	'rhea'
(8)	/e/	['kaβle]	'cable'
	/é/	[be'βe]	'baby'

1.1.2 Terminal Elements in Diminutive Formation

In diminutive formation, TEs are deleted before affixation (9a); as opposed to base elements which, as Colina (2003) points out, are retained (9c). As previously argued, final /e/ behaves as a base element (9d) rather than a TE (i.e., it is not deleted before the diminutive allomorph is affixed).

In Spanish, all diminutives have a final /a/ and /o/ affixed to the diminutive allomorph. For words that do not have a TE, this final segment agrees with the gender of the word: final /a/ for feminine and final /o/ for masculine. However, words that do have a TE do not follow this pattern; rather they attach to the allomorph the same TE that was previously attached to the stem, regardless of the gender of the word (Colina, 2003; Harris, 1969), as seen in (9b).

(9)	(a)	['kas-a]	'house'	→	[ka'sita]	
	(b)	['map-a]	'map, masc.'	→	[ma'pita]	*[ma'pito]
	(c)	[ma'ni]	'peanut, masc.'	→	[mani'sito]	
	(d)	['kaβle]	'cable, masc'	→	[kaβle'sito]	

1.2 Target Dialect

Although diminutive formation is highly productive in Spanish, it is not a uniform process across all dialects. Prieto (1992) points this out in her analysis where she compares diminutives from Bolivian and Peninsular Spanish (e.g. [o'tel] 'hotel' → [otel'sito] (Bolivia) vs. [ote'lito] (Peninsular)). She adds that "other diminutive forms such as *-ill*, *-cill*, *-ecill*, *-in*, *-cin*, *-ecin*, and *-ic*, *-cic*, *-ecic* are generally used in the same manner" (171), as *-it*, *-cit*, *-ecit* are used in the dialect used in the present study. To obtain a clear picture, this paper focuses only on one dialect, Porteño Spanish, and consequently on only one set of diminutive forms: *-it*, *-cit*, and *-ecit*.

Porteño Spanish is the dialect spoken mainly in the capital of Argentina, Buenos Aires. Approximately 20,000,000 inhabitants of Buenos Aires and Greater Buenos Aires as well as from a few neighboring cities in Uruguay across the De la Plata River speak this dialect.

1.3 Maximum Entropy Model

A Maximum Entropy (hereafter, MaxEnt) grammar consists of a set of numerically weighted constraints calculated based on the percentage of occurrence of each output for a specific input (Martin, 2007). The goal of this model is not only to account for the favorite candidate, but also to express the ambivalence that exists in a set of candidates or outputs. The method has been previously applied by Goldwater and Johnson (2003), and Hayes and Wilson (2008). Goldwater and Johnson (2003) explain that "[t]his model is probabilistic, making it resistant to noise, and seeks to reproduce the distribution of output forms in a training corpus, thus modeling free variation. Like Optimality Theory, the MaxEnt model treats constraints as additive, thus accounting for cumulativity effects" (2).[4] The constraints' weights are assigned based on the Real Frequency (i.e., the number of occurrences of the candidates of a particular input) and the Real Proportion (i.e., its percentage of occurrence within each input), which in turn yields a predicted percentage of occurrence (Predicted Proportion).[5]

The goal is to generate a grammar whose weighted constraints yield a Predicted Proportion as close as possible to the Real Proportion; thus, accounting for as much variation found in the data as possible. Appendix B illustrates how the model calculates the Predicted Proportion.

The software used in this project was OTsoft version 2.3 (Hayes et al., 2008), which was developed in the Linguistics Department at UCLA. This software uses the statistical method of maximum entropy to develop a grammar based on constraints that receive a specific weight which accounts for frequencies of variants.

2. Methodology

2.1 Participants

The test subjects for this study consisted of three male and three female native speakers of Porteño Spanish from Buenos Aires, Argentina. Their ages ranged between 28 and 62 years old. To ensure there would be little or no dialectal variation among them, the speakers chosen had similar level of education (at least some college or graduated from college), had similar socioeconomic status (upper middle class), and grew up and resided in the same area of the city (Northern Buenos Aires). Thus, their speech can be considered characteristic of an educated Porteño speaker.

2.2 Stimuli

The stimuli consisted of approximately 650 words including nouns, adjectives, and adverbs, with all the possible phonemic endings: the five vowel phonemes (both stressed and unstressed) and the thirteen consonant phonemes present in word-final position according to Spanish phonotactics (Harris, 1969).[6] The words were collected from two reverse Spanish dictionaries, Stahl and Scavnicky (1973) and Bosque and Pérez Fernández (1987). The list had the words in random order to obtain a more natural production and to avoid the recognition of patterns that could lead the consultants to follow a pattern as opposed to their own instinct.

2.3 Procedure

Participants were involved in one production task. A native speaker of their same dialect produced the non-diminutive form of each word and they were asked to produce the diminutive form of the word once. As previously mentioned, words were given in random order, and all participants were exposed to the same ordering. The entire experiment lasted approximately sixty minutes per participant, and they were recorded in Buenos Aires, Argentina, in September 2007, using an iPod 4th generation.

After the data was gathered, the words were entered into a spreadsheet to facilitate sorting according to: (1) last phoneme, (2) last two phonemes, (3) number of syllables in casual or formal speech, and (4) allomorph used in each case. A second spreadsheet grouped all of the outputs for each input by candidates. Each candidate's absolute value of occurrence was reflected as the "Real Frequency," and its percentage of occurrence in relation to the other candidates of the same input was noted as the "Real Proportion." There was also a large number of "no response" answers that were not taken into consideration when analyzing the percentage of occurrence of each allomorph.

3. Results

3.1 Final Vowels

After analyzing vowel-final words preceded by a consonant and by another vowel or a glide, it was found that although the treatment of the segment preceding the allomorph might be different in each case (deletion or retention), the allomorphs are selected based on the final segment, and sometimes on the number of syllables; thus, the second to last segment has no influence on the allomorph selection. To account for the difference between deletion or retention of the last segment, when this segment is not a TE, phonological processes re-apply after the morphological process has been completed. This paper assumes that the input is morphologically treated, which yields an output that in turn becomes the input for the phonological process, which is what ultimately becomes the surface representation as illustrated in figure 1 (Kiparsky, 1982, p. 132).

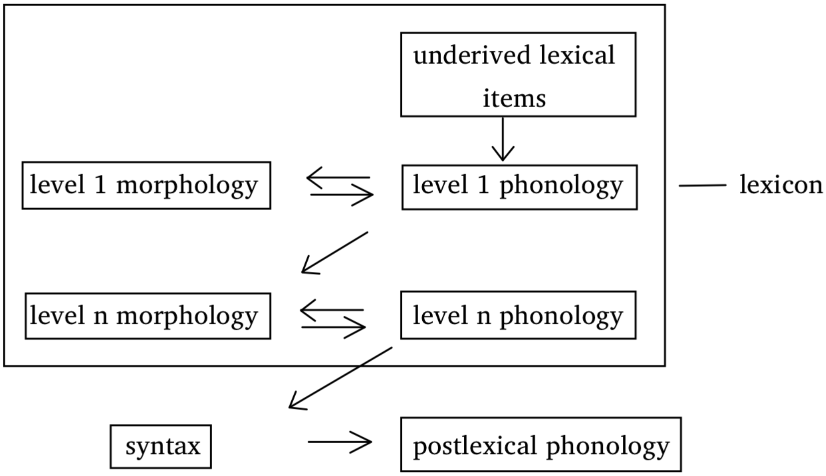

Figure 1. Lexical Phonology Model

The following table shows an overview of all the possible final segments and the allomorph most frequently selected by each one in Spanish diminutives.[7]

TABLE 1. **Overview of Final Vowels and the Allomorph Most Frequently Selected**

- it				***- sit***			
Phoneme	Word	Diminutive	Gloss	Phoneme	Word	Diminutive	Gloss
/a/	['maɾka]	[maɾ'kita]	mark	/e/	['kaβle]	[kaβle'sito]	cable
/o/	['fweɣo]	[fwe'ɣito]	fire	/i/	['bondi]	[bondi'sito]	bus
				/á/	[t͡ʃiɾi'pa]	[t͡ʃiɾipa'sito]	diaper
				/ó/	[boŋ'go]	[bongo'sito]	bongo
				/é/	[ka'fe]	[kafe'sito]	coffee
				/í/	[ma'ni]	[mani'sito]	peanut
				/ú/	[ɲan'du]	[ɲandu'sito]	rhea

The final segments from the previous table can be regrouped into three categories for a clear analysis of the results: final terminal elements (i.e., /a/ and /o/), final unstressed base elements (i.e., /e/ and /i/), and final stressed base elements (i.e., /á/, /ó/, /é/, /í/, and /ú/).

3.1.1 Final Terminal Elements

When analyzing TEs, the most frequently used or *winning* candidate, with 90% occurrence, is that which deletes the TE and attaches the allomorph *-it* (e.g. ['maɾka] 'mark' → [maɾ'kita]).[8] Jaeggli (1980) shows in his work reflecting the Paraguayan Spanish dialect that final /a/ and /o/ take *-it*; however, he mentions that this occurs only for words with three or more syllables, and shorter words take *-esit* (e.g. ['sawɾjo] 'saurian' → [sawɾje'sito]), which is not the case in Porteño Spanish, where ['sawɾjo] → [saw'ɾito].

3.1.2 Final Unstressed Base Elements

In table 1, final /e/ and /i/ take *-sit* as the main allomorph; however, the generalization for these endings is imperfect since not all the consultants agreed as to which allomorph to affix. Moreover, it is possible to observe a difference in the percentage of generalizations between words with two or fewer syllables and those with three or more syllables. As Jaeggli (1980) points out, "the syllable length of the base is undoubtedly one of the determining factors" in selecting the allomorph (143).

3.1.2.1 Mono or Disyllabic Words

For base elements in words with two or fewer syllables, the winning candidate, with approximately 85% occurrence, is that which retains the base element and attaches the allomorph *-sit* (e.g. ['kaβle] 'cable'→ [kaβle'sito]). In addition, both inputs (i.e. X+/e/ and X+/i/) have a second candidate with an approximate 10% occurrence, where the base element is deleted and *-it* is affixed (e.g. ['ʃeɾsei] 'jersey' → [ʃeɾse'ito]). Prieto (1992) observes in her work that disyllabic words ending in unstressed /e/ take *-it* as the allomorph; however, for final /i/ (regardless of the number of syllables in the word), she states that "the possible diminutive forms are very inconsistent across speakers" (174).

3.1.2.2 Trisyllabic or Longer Words

For base elements in words with three or more syllables, the winning candidate is that which retains the base element and attaches the allomorph *-sit*, just as for words with two or less syllables. However, here the winner obtains only an average of 60% of occurrence (e.g. [pexe'rej] 'mackrel' → [pexerej'sito]), with second place for deleted final vowel with attachment of *-it* allomorph at 40% occurrence (e.g. [de'saɣwe] 'drainpipe' → [desa'ɣwito]).[9]

3.1.3 Final Stressed Vowel

Fluctuating between 76% and 94% of occurrence, the most frequent winning candidate for all final stressed vowels is that which does not delete the base element and attaches *-sit* as the allomorph (e.g. [ka'fe] 'coffee' → [kafe'sito], with 94.1%); the selection of this allomorph has been previously indicated by Prieto (1992).

Within this category of final stressed vowel, a peculiar phenomenon was observed. Words that are common amongst speakers and evoke certain endearment (shown in 10) do not always follow the general pattern of attaching *-sit*, and they affix the "simpler" form *-it*. When the consultants were asked to give the diminutive form of words and probably not thinking about their meaning, but rather thinking of them as a string of sounds, they would follow the general pattern and attach *-sit*. However, when they used the same words in casual speech, when they were not aware they were forming diminutives, the informants would use the form with *-it*.[10]

(10)		Casual Form	Elicited Form
[be'βe]	'baby'	[be'βito]	[beβe'sito]
[ma'ma]	'mom'	[ma'mita]	[mama'sita]
[pa'pa]	'dad'	[pa'pito]	[papa'sito]

3.2 Final Consonants

The following table gives an overview of all of the possible final segments and the allomorph selected by each one.[11]

Table 2. **Overview of Final Consonants and the Allomorph Most Frequently Selected**

- it					***- sit***		
Phoneme	Word	Diminutive	Gloss	Phoneme	Word	Diminutive	Gloss
x	[re'lox]	[relo'xito]	watch	b	[bao'βaβ]	[baoβaβ'sito]	tree
l	[pin'sel]	[pinse'lito]	brush	d	[beɾ'ðað]	[beɾðað'sita]	truth
				k	[bis'tek]	[bistek'sito]	steak
				m	['alβum]	[alβum'sito]	album
				n	[xa'βon]	[xaβon'sito]	soap
				ɾ	[ta'ʃeɾ]	[taʃeɾ'sito]	workshop
				s	[in'gles]	[ingles-'sito][12]	English

The output given here for final /s/ is an intermediate step between the underlying representation (UR) and the surface representation (SR) because the phonological processes of /e/ epenthesis or /s/ deletion will modify this output before it becomes the SR that a speaker normally outputs (where, [ingles-'sito] → [ingle-'sito]), as figure 1 previously showed. This process is later analyzed in the Phonology section of this paper. Furthermore, the consonants from the previous table will be grouped into two categories for a clear analysis of the results: consonants that normally attach *-sit* and consonants that normally attach *-it*.

3.2.1 Final Consonants that Normally Attach -sit

The percentage of occurrence of *-sit* for words ending in /b/, /d/, /k/, /m/, /n/, and /r/ fluctuates between 71% and 95%. The highest percentages (i.e., /n/ and /r/ with over 90%) agree with the data presented by Jaeggli (1980) and Prieto (1992). Jaeggli (1980) also states that final /d/ takes *-sit*; however, when he presents the data, he is not certain of that diminutive formation:

"ciudad ?ciudadsita 'city'" (Jaeggli, 1980, 144)

This uncertainty is reflected in the data presented here by a lower percentage of occurrence of that allomorph (71%). On the other hand, the previous works on diminutives (Jaeggli, 1980; Crowhurst, 1992; Harris, 1992 & 1994; Prieto,1992; and Colina, 2003) do not account for final /b/, /k/ or /m/.

3.2.1.1 Final /s/

A first glance at the examples, (11) and (12a), shows that words with final /s/ take both *–sit* and *–esit* as the allomorph.

(11)		[in'gles]	'English'	[ingle'sito]
(12)	(a)	['lus]	'light'	[luse'sita]
	(b)	[traɣa'lus]	'skylight'	[traɣaluse'sita]

However, the analysis for this case is much deeper as phonology plays an important role in the formation of diminutives for words ending in /s/.

As previously mentioned in the introduction of this paper, *-esit* is not considered an allomorph on its own; rather it is the *-sit* allomorph with an epenthesized /e/, thus yielding all the allomorphs for the phoneme /s/ to be *-sit*, which is indeed what the data in this study showed (e.g. [in'gles] 'English' → [ingles'sito]).

After the allomorph *-sit* is affixed, an intermediate output is formed which has two options. If the word's stem has two or more syllables, it undergoes /s/ deletion (example 11). If the word's stem is monosyllabic, then /e/ is epenthesized (example 12a). Note that the number of syllables corresponds to the stem of the word. In compounded words, the length of the base stem is what counts; therefore, when a compounded word with a monosyllabic base forms a diminutive, an /e/ is epenthesized just as with monosyllabic words (example 12b).

One could argue that final /s/ takes two different allomorphs according to the length of the stem (*-it* and *-esit*); however, it is a much simpler approach to select only one allomorph for the /s/ final phoneme, and to follow this by the application of phonological rules that comply with the phonotactics of Spanish that prevent *[ss] from of occurring.

3.2.1.2 Consonant Deletion or Lenition

As mentioned earlier, consonants do not get deleted because they form part of the base. However, examples where the final consonant was deleted were actually found in the data:

(13)	[bao'βaβ]	'type of tree'	[baoβa'sito]
	[e'ðað]	'age'	[eða'sita]
	[ko'ɲak]	'cognac'	[koɲa'sito]

This deletion was consistent with a dialectal deletion or lenition that is applied across the board to final stops in Porteño Spanish (and other Spanish dialects). Furthermore, this deletion takes place after the morphological process has occurred because the allomorph chosen correlates to the one normally chosen by the given consonant, as opposed to the one that the segment preceding the final stop would choose. Thus,

(14)	[bao'βaβ]	'type of tree'	[baoβa**β**'sito]	→	[baoβa'sito]
	[e'ðað]	'age'	[eðað'sita]	→	[eða'sita]
	[ko'ɲak]	'cognac'	[koɲa**k**'sito]	→	[koɲa'sito]

These outputs constrast with the ones that would have resulted from having the deletion process occur before the affixation (i.e., instead of attaching the allomorph to a final consonant, /a/ would have been the final phoneme the allomorph would have been attached to, resulting in a deletion of the /a/ after the attachment of the allomorph *-it*):

(15)	[bao'βaβ]	'type of tree'	[bao'βa]	→	*[bao'βito]
	[e'ðað]	'age'	[e'ða]	→	*[e'ðita]
	[ko'ɲak]	'cognac'	[ko'ɲa]	→	*[ko'ɲito]

3.2.2 Final Consonants that Normally Attach -it

The only two final consonants that select *-it* as their allomorph instead of *-sit* are /x/ and /l/. Final /x/ was not discussed in the literature analyzed. On the other hand, Jaeggli (1980) does examine final /l/ and he comes to a different conclusion. He proposes that final /l/ takes *-sit* for monosyllables and *-it* for words with two or more syllables (16). However, the data obtained from Porteño Spanish does not follow this pattern or any other particular pattern of distinction between *-sit* and *-it*. Thus, the data collected in some cases follows Jaeggli's (1980) proposal (as in example 16 [kana'lito] and example 17 [mjel'sita]), but not consistently (as in example 16 [ma'lito]).

(16)			Jaeggli's proposal	Porteño Spanish
	['mal]	'bad'	[mal'sito]	[ma'lito]
	[ka'nal]	'channel'	[kana'lito]	[kana'lito]

(17)			Jaeggli's proposal	Porteño Spanish
	['mjel]	'honey'	[mjel'sita]	[mjel'sita]

3.3 Phonology

The following phonological processes account for the treatment of stem final diphthongs and final /s/ after morphology has applied. They are evaluated using Maximum Entropy as the previous morphology sections.

3.3.1 Diphthong Phonology

3.3.1.1 Secondary Stress

The process of secondary stress formation is summarized in table 3. The two constraints involved in the process are:

1) **Max-'σ** prevents complete deletion of stress from a syllable. This does not imply changing the stress from primary to secondary. This constraint is violated when a syllable is deleted or when stress is removed from a syllable.

2) ***'σ-'σ** implies that it is illegal to have two contiguous primary stresses in a word. This constraint is violated when a morpheme that carries primary stress is affixed in a word next to the primary stressed syllable without altering the value of this stress to secondary stress; thus making the change from primary to secondary stress on the unaffixed word, the best candidate (e.g. [[kan'sjon] 'song' → [kansjon'sita]).

TABLE 3. **Insertion of *'σ-'σ Constraint**

Input	Candidate	Real Freq.	Real prop.	Pred. prop.	Max-'σ	*'σ 'σ
				Weights:	3.587	18.28
'σ 'σ	ˌσ 'σ	289	0.973	0.973		
'σ 'σ	Ø 'σ	8	0.027	0.027	1	
'σ 'σ	'σ 'σ	0	0	0		1

3.3.1.2 GLIDE MERGE

The data collected showed that when the *-it* suffix was attached to a word ending in a front glide, both sounds would merge into one instead of remaining as a diphthong. To account for this process, a new constraint was created:

***Merge GV** prevents assimilation and merge of a glide and a contiguous vowel when both have the same backness. The environment that triggers such a merge is generated every time the allomorph *-it* is attached to a word that ends in diphthong formed with a front glide and a terminal element, because once the TE drops, the glide will tend to merge with the attached vowel. In Porteño Spanish, such is the case of:

(18) ['tapja] 'wall' [ta'pjita] → [ta'pita]

However, as Colina (2003) points out, other dialects do not undergo this merge:

(19) ['tapja] 'wall' [tapje'sita] (Peninsular Spanish)

3.3.2 Final /s/ Phonology

For the purposes of the phonological process, words ending in /s/ were separated into two subsets: monosyllables (e.g. ['lus] 'light') or compounds where the stems are monosyllables (e.g. [traɣa'lus] 'sky-light'), and words with two or more syllables.

Table 4. **Insertion of *Gem and Dep-V Constraints**

Input	Candidate	Real Freq.	Real prop.	Pred. prop.	*Gem	Dep-V	*5 + syll
				Weights:	5.62	0.155	2.279
Xssit (1 syll)	Xsesit	41	0.461	0.46		1	
Xssit (1 syll)	Xssit	0	0	0.002	1		
Xssit (1 syll)	Xsit	48	0.539	0.538			
Xssit (2+syll)	Xsesit	20	0.08	0.08		1	1
Xssit (2+syll)	Xssit	1	0.004	0.003	1		
Xssit (2+syll)	Xsit	228	0.916	0.916			

Table 4 illustrates the two processes that apply to final /s/: /e/ epenthesis, and /s/ deletion. The process of /e/ epenthesis applies to monosyllables (e.g. ['bals] 'waltz' → [bals**e**'sito]), and the /s/ deletion applies to words with two or more syllables (e.g. [in'gles] 'English' → [ingle**s**'sito] → [ingle'sito]). The two constraints involved in these processes are the following:

1) ***Gem** stands for ungrammatical geminate. Following Spanish phonotactics, this constraint does not allow consonant geminates; thus, marking as illegal the /ss/ sequence.

2) **Dep-V** states that every vowel in the output must have an input vowel. In this particular case, it is violated when /e/ is epenthesized to solve the geminate. However, this process is based on the fact that Spanish already shows a similar epenthesis process in the formation of plurals for final /s/ words:

(20)	['kos]	'kick, sg.'	['koses]	'kick, pl.'
	[aβes'tɾus]	'ostrich, sg.'	[aβes'tɾuses]	'ostrich, pl.'

4. Conclusion

Using a Maximum Entropy grammar, this paper shows a full account of the free variation found in the data set from the elicitation of diminutives from six native speakers of Porteño Spanish. A set of ten constraints (explained in detail in Appendix A) was developed in order to restrict the diminutive formation process. Additionally, the interaction of this process with phonological processes was drawn for the particular case of words ending in /s/. Furthermore, the proposed constraints and interaction with phonology achieved on average 90% accuracy when comparing the real proportion and the predicted proportion of occurrence for every candidate; thus yielding a very significant account for the variation of diminutive formation in Porteño Spanish.

Neveretheless, although it seems that all of the candidates were treated in this analysis, there is one more output that has not been studied in this paper: no response. During the elicitation process, two types of no-response were encountered: "I don't know how to form the diminutive of that word" and "That word doesn't have a diminutive." Considering the productivity of this process and that all of the words from the list could form diminutives, the next step in the analysis of diminutives would be to evaluate if speakers follow any pattern in stating which words do not allow diminutive formation; are words marked for diminutive formation? If not, how do speakers know when a noun, adjective or adverb can form a diminutive or not?

Appendix A: Constraints

The following ten constraints were used to generate a Maximum Entropy grammar. Extensive informal experimentation with a variety of different constraints gave this somewhat intuitive explanation of what they do.

Co-Co (i.e., coda stays coda) prevents a coda from becoming an onset in a following syllable (e.g. [bao'βaβ] 'baobab tree' → [baoβaβ'sito]). Considering that final consonants do not delete, every time the allomorph *-it* is attached, this constraint is violated (e.g. ['kluβ] 'club' → [klu'βito]). This constraint is based on Stephenson's proposal of a constraint for classical OT that she calls *Ident (Base –* dim*) Syl-Pos* where "segments in the diminutive must have the same syllable position (onset or rhyme) as their corresponding segments in the base" (21).

Max-baseV states that every base-vowel input must have an output correspondent (i.e., do not delete a vowel that is a base element). As mentioned in the first section of this paper, TEs do not form part of the base, and they delete when an allomorph is affixed. Therefore, rather than having a constraint such as Max-V that would be violated every time a vowel is deleted, to simplify the number of violations, this narrower constraint is used instead, which is violated only when a base element vowel is deleted (e.g. ['nene] 'kid' → [ne'nito]).

***Hiatus** is violated every time the allomorph *-it* is attached next to a vowel, requiring a separate pronunciation of the two adjacet vowels. Hiatuses are legal sound sequences in Spanish; however, the dialect prefers not to form additional ones when attaching a suffix (e.g. [baka'lao] 'cod' → [bakalao'ito]).

***FrV-FrV** (i.e., *FrontV-FrontV) prevents from having two adjacent front vowels. It targets a subset of the candidates that violate ***Hiatus**. The use of this constraint becomes apparent when looking at all final vowels together, since the percentage that final /é/ and /í/ attach *-it* to the base without final vowel deletion is much smaller than final /á/, /ó/ or /ú/ (1.5% and 0% vs. 2.3% and 15% respectively).[13]

***Stop coda** prevents having a stop as a coda. Although this constraint seems to contradict Co-Co, its purpose is to differentiate between any consonant in the coda position (e.g. [kan'sjon] 'song' → [kansjon'sita]) and a stop in the coda position (e.g. [beɾ'ðað] 'truth' → [beɾðað'sita]) and account for the difference in frequency between a stop coda and a non-stop coda.

***Phon** (i.e., *Phonotactics) is violated any time an illegal segment sequence is triggered. For the purposes of diminutive formation, the possible illegal sequences violated are /ds/, /ms/ and /xs/ since these sequences do not normally occur in Spanish. Its effects can be seen in the analysis of nasals, given that the candidate that violates this constraint (Xm-sit; e.g. ['alβum] 'album' → [alβum'sito]) occurs 12% less than the one that does not violate it (Xn-sit; e.g. [kan'sjon] 'song' → [kansjon'sita]), and in turn the predicted proportion of the first one is smaller than the latter. Although /ss/ is also an illegal sequence, it is not considered illegal here because the output of the morphological process still has to undergo the phonological process which remedies for that.

***5 + syll** is violated when a word has five or more syllables as a consequence of suffixation. The candidates that violate it are those whose input are stems with three or more syllables with final BE and attach the allomorph *–sit*, which adds two more syllables to the stem (e.g. [pexe'rej] 'mackrel' → [pexerej'sito]). Here again there is a difference in frequency between the candidates that do not violate this constraint and those that do; for example, disyllabic words ending in /i/ that take *-sit* (e.g. ['bondi] 'bus' (slang) → [bondi'sito]) have a real proportion of occurrence of approximately 88%, as opposed to trisyllabic ones with a proportion of ocurrence of approximately 55%.

No sit is violated every time the allomorph *-sit* is attached to the stem (e.g. ['laktea] 'milky' → [laktea'sita]). Although it might seem logical to add the counterpart **No it**, when this constraint was added and run through the program, its weight was 0.00, meaning it had no influence in the grammar. On the other hand, if **No sit** were to be taken off of the grammar, all of the inputs would lose some degree of accuracy; in addition, there would be no differentiation for final {a,o} between the following three candidates: X{a/o}-sit, X-it (e.g. ['maɾka] 'mark' → [maɾ'kita]), and X-sit (e.g. ['boa] 'boa' → [bo'sita]) since aside from **No sit** they do not violate any other constraint.

***ls** targets the sequence /ls/. Candidates for final /l/ behave different than candidates for other inputs that, besides ***ls,** violate the same constraints (i.e., final /n/, /ɾ/ and /s/). However, final /l/ takes *-it* as the primary allomorph (e.g. ['gol] 'goal' → [go'lito]) as opposed to the other three inputs which select *-sit* (e.g. [ta'ʃeɾ] 'workshop' → [taʃeɾ'sito]).

***xs** takes care specifically of the violation of the sequence /xs/, previously violated by ***Phon**. However, ***Phon** alone does not account for the difference in frequency between candidates that include /xs/ and those that do not (e.g. [re'lox] 'watch' → [relox'sito], with 23.3% real proportion of occurrence). After experimenting with different more general constraints, no other constraint was found that would reflect this difference which is specifically seen when comparing final /m/ (that takes *-sit* as the allomorph, e.g. ['alβum] 'album' → [alβum'sito]) and final /x/ (that takes *-it*; e.g. [re'lox] 'watch' → [relo'xito], with 76.7% real proportion of occurrence).

Appendix B: Candidates and Inputs

The following tables combine all of the inputs and candidates with the constraints that apply in each particular case. Notice that the constraints obtain their weights as a result of the analysis of all the inputs, their respective candidates and their frequencies; thus interacting with each other even if they do not affect the same candidate. Phonological constraints are not included since they are applied after the morphological process that involves these constraints, and only to a subset of the inputs.

TABLE B.1. **Final Unstressed Vowels**

Input	Candidate	Real Freq.	Real prop.	Pred. prop.	Co-Co	Max-baseV	*Hiatus	*ls	*xs	No sit	*FrV FrV	*Stop coda	*5+syll	*Phonotactics	Example
				Weights:	6.41	4.88	4.52	3.81	3.60	3.17	3.17	1.76	1.28	0.85	
X{a/o}	X-it	836	0.908	0.913											['maɾka] → [maɾ'kita] 'mark'
X{a/o}	X{a/o}-sit	49	0.053	0.039						1					['laktea] → [laktea'sita] 'milky'
X{a/o}	X{a/o}-it	24	0.026	0.010			1								[baka'lao] → [bakalao'ito] 'cod'
X{a/o}	X-sit	12	0.013	0.039						1					['boa] → [bo'sita] 'boa'
Xe2	Xe-sit	68	0.840	0.834						1					['kaβle] → [kaβle'sito] 'cable'
Xe2	X-it	13	0.160	0.150		1									['nene] → [ne'nito] 'kid'
Xe2	Xe-it	0	0	0.009			1				1				
Xe2	X-sit	0	0	0.006		1				1					
Xi2	Xi-sit	88	0.880	0.834						1					['bondi] → [bondi'sito] 'bus'
Xi2	X-it	11	0.110	0.150		1									['ʃersei] → [ʃerse'ito] 'jersey'
Xi2	Xi-it	1	0.010	0.009			1				1				['kaði] → [kaði'ito] 'caddy'
Xi2	X-sit	0	0	0.006		1				1					
Xe3	Xe-sit	29	0.630	0.584						1			1		['eɾoe] → [eɾoe'sito] 'hero'
Xe3	X-it	17	0.370	0.377		1									[de'saɣwe] → [desa'ɣwito] 'drainpipe'
Xe3	Xe-it	0	0	0.023			1				1				
Xe3	X-sit	0	0	0.016		1				1					
Xi3	Xi-sit	37	0.552	0.584						1			1		[pexe'rej] → [pexerej'sito] 'mackrel'
Xi3	X-it	30	0.448	0.377		1									['bɾokoli] → [bɾoko'lito] 'broccoli'
Xi3	Xi-it	0	0	0.023			1				1				
Xi3	X-sit	0	0	0.016		1				1					

TABLE B.2. Final Stressed Vowels

Input	Candidate	Real Freq.	Real prop.	Pred. prop.	Co-Co	Max-baseV	*Hiatus	*ls	*xs	No sit	*FrV FrV	*Stop coda	*5+syll	*Phonotactics	Example
X{á/ó}	X{á/ó}-sit	68	0.773	0.692						1					[t͡ʃiɾi'pa] → [t͡ʃiɾipa'sito] ‘cloth diaper’
X{á/ó}	X-it	18	0.205	0.124		1									[ma'ma] → [ma'mita] ‘mom’
X{á/ó}	X{á/ó}-it	2	0.023	0.178			1								[no'ʃo] → [noʃo'ito] ‘type of liqueur’
X{á/ó}	X-sit	0	0	0.005		1				1					
Xé	Xé-sit	64	0.941	0.834						1					[ka'fe] → [kafe'sito] ‘coffee’
Xé	X-it	3	0.044	0.150		1									[be'βe] → [be'βito] ‘baby’
Xé	Xé-it	1	0.015	0.009			1				1				[ki't͡ʃe] → [kit͡ʃe'ito] ‘Guatemalan indians’
Xé	X-sit	0	0	0.006		1				1					
Xí	Xí-sit	97	0.758	0.834						1					[ma'ni] → [mani'sito] ‘peanut’
Xí	X-it	27	0.211	0.150		1									[kaɾme'si] → [kaɾme'sito] ‘crimson’
Xí	Xí-it	4	0.031	0.009			1				1				[es'ki] → [eski'ito] ‘ski’
Xí	X-sit	0	0	0.006		1				1					
Xú	Xú-sit	33	0.825	0.692						1					[ɲan'du] → [ɲandu'sito] ‘rhea’
Xú	Xú-it	6	0.150	0.178			1								[ala'xu] → [alaxu'ito] ‘type of candy’
Xú	X-it	1	0.025	0.124		1									[fu'fu] → [fu'fito] ‘type of dish’
Xú	X-sit	0	0	0.005		1				1					

Table B.3. Final Consonants

Input	Candidate	Real Freq.	Real prop.	Pred. prop.	Co-Co	Max-baseV	*Hiatus	*ls	*xs	No sit	*FrV FrV	*Stop coda	*5+syll	*Phonotactics	Example
Xb	Xb-sit	14	0.737	0.815						1		1			[bao'βaβ] → [baoβaβ'sito] 'type of tree'
Xb	Xb-it	5	0.263	0.185	1										['kluβ] → [klu'βito] 'gym'
Xd	Xd-sit	63	0.708	0.654						1		1		1	[beɾ'ðað] → [beɾðað'sita] 'truth'
Xd	Xd-it	26	0.292	0.346	1										[e'ðað] → [eða'ðita] 'age'
Xk	Xk-sit	22	0.710	0.815						1		1			['kaʃak] → [kaʃak'sito] 'kayak'
Xk	Xk-it	9	0.290	0.185	1										[bis'tek] → [biste'kito] 'steak'
Xm	Xm-sit	42	0.824	0.917						1				1	['alβum] → [alβum'sito] 'album'
Xm	Xm-it	9	0.176	0.083	1										[is'lam] → [isla'mito] 'islam'
Xn	Xn-sit	157	0.946	0.963						1					[kan'sjon] → [kansjon'sita] 'song'
Xn	Xn-it	9	0.054	0.037	1										['bwen] → [bwe'nito] 'good, masc'
Xr	Xr-sit	121	0.924	0.963						1					'[ta'ʃeɾ] → [taʃeɾ'sito] 'workshop'
Xr	Xr-it	10	0.076	0.037	1										[se'ɲoɾ] → [seɲo'ɾito] 'gentleman'
Xs	Xs-sit	338	1.000	0.963						1					[in'gles] → [ingles'sito] 'English'
Xs	Xs-it	0	0	0.037	1										
Xl	Xl-it	139	0.638	0.638	1										['gol] → [go'lito] 'goal'
Xl	Xl-sit	79	0.362	0.362				1		1					[alβa'ɲil] → [alβaɲil'sito] 'construction worker'
Xx	Xx-it	33	0.767	0.767	1										[re'lox] → [relo'xito] 'watch'
Xx	Xx-sit	10	0.233	0.233					1	1				1	[re'lox] → [relox'sito] 'watch'

Appendix C: Maximum Entropy Model

The following tables illustrate how the Maximum Entropy model calculates the Predicted Proportion.

Table 1 shows the outputs for a specific input and the constraints they violate. As in classic Optimality Theory (OT) (Prince & Smolensky, 1993), one must indicate the number of times that each constraint is violated (i.e., "1" in this table corresponds to one ungrammatical * in OT). A crucial element in this model is the Real Frequency, which is the number of times that each output happens per input for a specific set of data; this is the main difference between this model and classic OT, since here free variation is accounted for. After learning, the program assigns a number (weight) to each constraint (Cons.).

Table 1. **Outputs and violations per constraint**

			Cons. 1	Cons. 2	Cons. 3	Cons. 4
		Weights:	5.08	3.22	1.02	3.68
Input	Output 1		1	1		
	Output 2				1	1
	Output 3		1		1	

Table 2 shows the first step of the process, which is to multiply each weight by the number of violations per output.

Table 2. **Weighted violations**

		Cons. 1	Cons. 2	Cons. 3	Cons. 4
Input	Output 1	5.08	3.22		
	Output 2			1.02	3.68
	Output 3	5.08		1.02	

Table 3 shows, in the column on the far right, the sum of the penalties for each output.

Table 3. Penalties per input

		Cons. 1	Cons. 2	Cons. 3	Cons. 4	SUM
Input	Output 1	5.08	3.22			8.30
	Output 2			1.02	3.68	4.70
	Output 3	5.08		1.02		6.10

Table 4 shows the result of taking the number *e* to the minus sum previously calculated in the right column.

Table 4. **e to the minus sum**

		Cons. 1	Cons. 2	Cons. 3	Cons. 4	e - SUM
Input	Output 1	5.08	3.22			2.485E-04
	Output 2			1.02	3.68	9.095E-03
	Output 3	5.08		1.02		2.243E-03

Table 5 shows (at the bottom of the right column) the result of adding the values calculated in table 4.

TABLE 5. **Addition of Table 4**

		Cons. 1	Cons. 2	Cons. 3	Cons. 4	e - SUM
Input	Output 1	5.08	3.22			2.485E-04
	Output 2			1.02	3.68	9.095E-03
	Output 3	5.08		1.02		2.243E-03
					TOTAL	1.159E-02

Finally, table 6 shows, in the right column, the computation of the proportional share of each output compared against the real frequency (Real Fr.) on the third column from the left.

TABLE 6. **Proportional Share**

		Real Fr.	Cons. 1	Cons. 2	Cons. 3	Cons. 4	e - SUM	PROP.
Input	Output 1	5	5.08	3.22			2.485E-04	2.144
	Output 2	195			1.02	3.68	9.095E-03	78.473
	Output 3	51	5.08		1.02		2.243E-03	19.353
						TOTAL	1.159E-02	

The proportion obtained in the last table is the "Predicted Proportion" based on the real frequency, the violations and the weight of each constraint.

Once the Predicted Proportion (Pred. Prop.) has been calculated, the Real Frequency percentage can be compared with the Predicted Proportion percentage to determine the accuracy of the predicted values. When looking at table 7 below, output 2 was predicted to occur 79% of the time and it occurred 78% of the time, yielding a 98.7% accuracy.

TABLE 7. **Comparison of Real Frequencies and Predicted Proportion**

		Real Fr.	Real Fr. (%)	Pred. Prop.	Pred. Prop. (%)
Input	Output 1	5	2	2.144	2
	Output 2	195	78	78.473	79
	Output 3	51	20	19.353	19

Notes

1. Although Spanish is commonly known as a "phonetic language," meaning that the spelling reflects the phonemes in the language, there are some phonemes that can be represented by more than one character (e.g. <casa> 'house' IPA ['kasa] and <caza> 'hunt' IPA ['kasa]), and some characters represent different phonemes according to the environment (e.g. <cara> 'face' IPA ['kaɾa] and <cera> 'wax' IPA ['seɾa]). Thus, in this paper all the phonetic transcriptions will be shown in IPA, abstracting away from the language's allophones.

2. However, as Jaeggli (1980) argues, and it is shown here, *-esit* is not a separate allomorph, rather the allomorph *-sit* that undergoes epenthesis of /e/. This paper further argues that the morphological process of diminutive formation interacts with the phonological process of epenthesis in specific environments.

3. Where X'e stands for any word that finishes in a stressed [e].

4. Optimality Theory is a linguistic model of how grammars are constructed. It proposes that observed forms of language arise from the interaction between conflicting constraints; thus modeling grammars as systems that provide mappings from inputs (underlying representations) to outputs (surface representations). For a more detailed explanation, see Prince & Smolensky (1993).

5. For a full explanation of how the Maximum Entropy Model calculates the Predicted Proportion, see Appendix C.

6. Words ending in /p/, /t/, /f/ and /g/ are not included in the analysis in this paper because they occur only in loan words that have not yet been adapted to follow Spanish phonotactics; and they do not follow any specific pattern for diminutive formation.

7. Final unstressed /u/ is not shown because there are not enough words in Spanish with this ending to be able to make a generalization based solely on the data. However, based on the behavior of final stressed /u/, which follows a similar pattern of the other two final base elements, this paper assumes that this behavior parallels for unstressed final vowels.

8. For a full account of inputs, candidates, and their interaction with constraints, see Appendix A.

9. For purposes of diminutive formation, glides /j/ and /w/ behave as the vowels /i/ and /u/.

10. Although studying diminutive formation in casual speech was not part of this project, in casual non-research related conversations the author noted these instances of diminutive formation as illustrated in example 10, which were quite salient as unnatural Porteño Spanish during the elicitation process.

11. As mentioned earlier, words ending in /p/, /t/, /f/ and /g/ are not analyzed in this paper. (See Endnote 5)

12. Following Kiparsky's model previously discussed, this paper assumes that the input is morphologically treated, which yields an output that in turn becomes the input for the phonological process, which is what ultimately becomes the surface representation. Therefore, the case of final /s/ will be first analyzed in terms of the morphological process and a phonological process will later account for the degemination process (see section 3.3.2).

13. See Appendix B, Table B.2 for final stressed vowels.

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