UNIVERSIDAD COMPLUTENSE DE MADRID

FACULTAD DE FILOLOGÍA
Departamento de Filología Románica, Filología Eslava y Lingüística General

FONOLOGÍA DEL ESPAÑOL: ENFOQUE DESDE LA TEORÍA DE OPTIMIDAD.

MEMORIA PARA OPTAR AL GRADO DE DOCTOR

PRESENTADA POR

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Bajo la dirección del doctor

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Madrid, 2010

ISBN: 978-84-693-7632-4

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Noviembre de 2009

ISSUES IN SPANISH PHONOLOGY FROM AN OPTIMALITY-THEORETIC APPROACH

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PREFACE

This work is a prosodic study of the phonology of the Spanish spoken in Madrid, Spain from an Optimality-Theoretic (OT) framework. As such, our study serves a dual purpose. On one hand, we offer a scrupulous examination of the phonology of this variety of Spanish, making amendments where necessary to previous works based on an exhaustive reanalysis of the data. Conversely, our study also provides an introductory survey of the theoretical architecture based on conflict resolution proposed by OT.

The initial chapter of this thesis is dedicated to defining and describing the phonological inventory of the Spanish of Madrid. Shortly after, we employ this taxonomic categorization to account for a few of the most common phonological generalizations which surface in this particular dialect. We demonstrate that OT analyses, by their nature, are more transparent than rule-based approaches because they oblige a more abundant quantity of phonological information in order to justify optimal forms while simultaneously explaining why sub-optimal forms are discarded. We discuss this, as well as other, advantages of the OT framework throughout the course of the first chapter.

In chapter two, we study the distribution of phonological segments across syllables. We entertain the idea that certain constraints can stipulate the phonological units which may occupy a determined syllabic position. Of course, this does not constitute any major discovery in theoretical phonology. Itô (1989), in fact, programs this generalization into his Syllabic Licensing hypothesis, providing a formal theory of the correlation between the permissible segments which may appear at syllable and word margins. We compare the salient points of Itô's argument with the facts from Spanish phonology and formalize the data in a constraint based framework. We go a step further and propose that syllabic structure in Spanish is dominated by principles of onset well-formedness, and that codas are only passively tolerated. The natural upshot of such a claim is that the inclusion of special constraints governing coda well-formedness becomes superfluous, and to a certain extent redundant.

Chapter three examines the empirical data from Spanish syllables, examining onsets and codas, both singleton and complex, at word edges and word-internally in order to test the veracity of our claim supposing onset pre-eminence in Spanish. We explore a bit further the implications of the Syllabic Licensing hypothesis and illustrate that Itô's assumptions are basically correct for Spanish.

Immediately following in chapter four, we address possible repair strategies that the Spanish grammar has on hand to treat marked inputs before they have a chance to surface. Specifically, we deal with segment insertion (prothesis and epenthesis) in three derived contexts. We demonstrate that OT's flexible constraint based framework grounded in conflict resolution is acutely capable of offering sound and superior explanations for these processes in Spanish.

The fifth chapter examines the application of primary stress and its correlation to foot structure. We provide a typology of Spanish stress which is based on the shape of the foot itself and its subsequent alignment to the appropriate syllable. We show that productive stress application can be reduced to a paradigm of conflict resolution involving three simple shape constraints and three alignment constraints. Crucially, we demonstrate that all stress patterns in Spanish can be abridged into two basic hierarchies. This model represents a major benefit with regard to acquisition since Spanish speakers in their formative years of phonological acquisition only need to learn two basic hierarchies in order to produce stress. Later in this same chapter, we demonstrate how the interaction of the constraints we introduce in the first sections can offer an accurate account of stress shifts in morphologically derived words.

Finally in chapter 6, we provide an exhaustive analysis of Spanish diminutive formation from a constraint-based framework. We ground our analysis heavily in the nominal stem categorization proposed in Bermúdez-Otero (2006, in Martínez-Gil & Colina, 2006). We will argue that optimal diminutive forms result from the appeasement of two principle types of constraints: phonological well-formedness and morphological alignment. We illustrate that all diminutive forms can be justified using a hierarchy of competing forces in which the propensity for nuclei to align to onsets dominates the proclivity to align the diminutive suffix to the right margin of the prosodic base.

On a final note, throughout the course of this thesis a special effort has been made to ground our theoretical justifications in concrete examples and concepts relating to language acquisition. We do this for pedagogical purposes and continuity, and to contextualize the constraints we depict with the intent of illustrating more profoundly the polysystemic character of natural language.

1

THE SOUNDS OF SPANISH

1.0 A BRIEF INTRODUCTION TO SOUNDS AND REPRESENTATIONS

This initial chapter defines and categorizes the phonological inventory of the standard Spanish spoken in Madrid, Spain. We will outline both the phonological and phonetic components of the Spanish phonological system and address their representations. Subsequently, these descriptions will serve as a base for the phonological analyses which follow. Throughout the course of this chapter, we will offer an introduction to the theoretic architecture proposed by Optimality Theory (Prince and Smolensky, 1993) (henceforth OT) which we will employ throughout the rest of this thesis.

The most basic components of speech are sounds. All speakers are aware, consciously or not, of the phonetic components which surface in their native language. These sounds form but one mechanism of the vehicle by which humans exchange thoughts, emotions and by which information is transmitted.

In the beginning stages of life, infants perceive the individual sounds to which they are exposed. Naturally, linguistic sounds made by the mother are among the first, and most important, of these primary sounds. In phonological terminology, the linguistic components the infant perceives are known as **allophones**. They are the material, observable constituents of the phonological system. At the same time, they are merely the final component of a larger cycle which begins with a lexical, or mental signal, which later becomes linked with abstract articulatory information before being carried out by the speech apparatus. Allophones themselves do not have any inherent lexical or mental **meaning**. They are simply sound waves carried out by the permutation of vocal chord vibration and varying grades of constriction or obstruction of the speech apparatus.

Let us brainstorm for a moment about how a human infant might observe speech in the beginning stages of phonological acquisition. For all intents and purposes, she will begin from zero. No sound, or string of sounds, is codified in the brain with a specific mental image. By virtue of the fact that humans are endowed with complex auditory systems, she will passively perceive the sounds to which she is most regularly exposed, usually those of her parents and close relatives. Of course, while these acoustic sequences make sense to the adult interlocutors, to the infant, they have no more meaning than, say, hearing the dog bark or a scream. Soon after, these sounds will eventually establish the body of input data by which the infant's grammar will be programmed.

That is not to say, however, that human infants lack the ability to think or even to express simple impulses. Much to the contrary. They simply have not yet learned that the sounds of their native language are connected in a sophisticated way to a more significant mental representation. Essentially, she has not learned that the sounds that she perceives are the final stop on a **meaning-to-sound mapping**.

If we imagine for a moment listening to a foreign language which we have never heard before, we can begin to contemplate what a baby might perceive in the beginning stages of phonological acquisition. We can ponder hearing sounds, some familiar and others not so familiar, as well as perceiving other paralinguistic information such as the tone of the speaker's voice, perhaps the interlocutor's body language and even pauses in conversation. All of this information would be stored in the short-term memory for later access. Studies show that this learning process occurs surprisingly fast in infants. With repetition, perception skills become increasingly honed. Eventually, individual sounds will be noticed, along with their distribution. In other words, the learner will be able to discern between which phonological components may associate with other elements in the language and which components never do.

Nevertheless, these sounds are still disassociated from any lexical meaning. The only way a child might extract some lexical expression, is by way of the extralinguistic information which accompanies the speech gesture; a caress, for example, or a soft caring tone of voice. By simultaneously hearing the speech sounds made by the speaker and interpreting the message of affection, the child begins to learn that the spectro-temporal features of the language that she has been perceiving for months linked to a deeper, emotional message. Although the infant is long from dominating her native language at this point, she is certainly on her way to making some critical discoveries regarding how raw sounds associate with meaning and how they are produced.

Allophones do not directly become encoded with lexical meaning, at least in traditional models of phonology. There are many intervening processes along the way, both linguistic and cognitive. First, the allophones that the infant has been hearing for many months must be categorized into abstract units called **phonemes**. Phonemes are not sounds, but the mental representation of sounds which serve a classificatory function later used for distribution.

To develop this concept, let us consider a concrete example from Spanish. Surely, a child being raised in a Spanish-speaking environment will perceive the consonants [g,ɣ], both spelled with the grapheme –g, in such words as –*gato* [g] (*cat*), *agua* [ɣ] (*water*), *algo* [ɣ] (*something*) and *tengo* [g] (*I have*). With repetition, the child can intuit that these sounds share certain qualities, like similar air-flow constriction, and the parts of the speech apparatus implicated in production. The child will simultaneously perceive that these sounds differ in their distribution; [g] never appears after the sounds [n], [m] or word-initially following a pause. On the other hand, [ɣ] always emerges following a vowel. The common aspects of these sounds are categorized and stored as archetypes, or bundles of non-redundant defining features. The following example illustrates how this categorization takes place:

(1)

Phonetic sounds:

[ɣ] [g]

Phonological categorization: /g/

Lexical Storage:

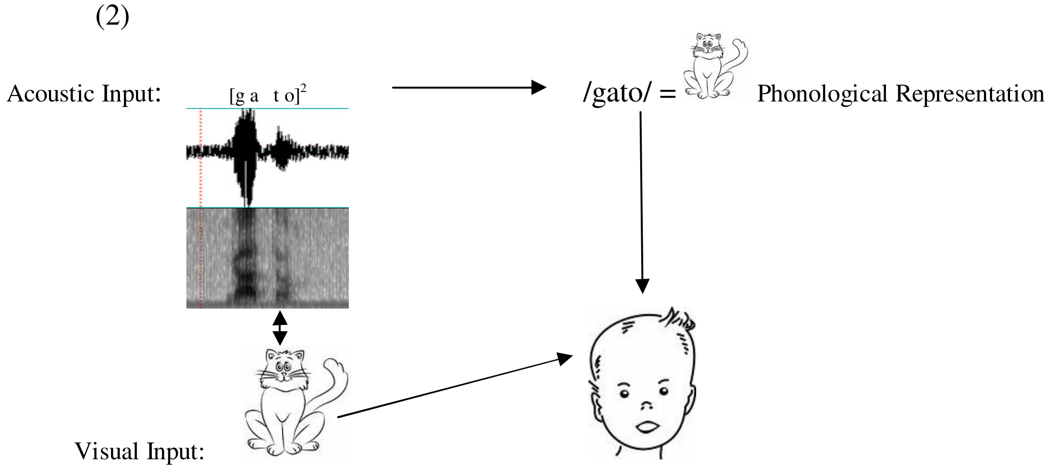
The defining, non-redundant phonetic information which is common to both the sounds in (1) is categorized phonologically as /g/, a phoneme[1]. Therefore, the crucial particles contained in /g/ can be stored in the lexicon without overtaxing the memory. In this way, phonological categorization is an economic way to store information since only the core information which defines /g/ is necessary. The contrary would imply that each segment were stored individually in memory. Obviously, this process would be highly redundant.

Phonemes themselves, like allophones, have no inherent meaning. They are yet another stepping-stone between meaning and sound. Before association with a lexical signal can take place, the child must first learn that strings, or sequences of sounds, can combine to form larger units which are capable of expressing more complex images.

[1] Special mention should be made here that /g/ should not be confused with the grapheme –g. We use /g/ as an abstract unit of classification to represent bundles of articulatory information.

Let us imagine the Spanish language learner seeing a cat. At the same time, she might hear her parent say -*gato* [gato]. The child now has solid proof that the object she sees has a name which is realized as an autonomous unit carried out by the conglomeration of individual sounds. Effectively, she has learned that concrete sound sequences have concrete lexical meaning. The following example (2) illustrates how this process occurs:

(2)



This last example illustrates an important point. Human speech is **categorical** in character and is distinguished by different levels. On one hand, the learner has perceived the sound sequence [gato], while simultaneously observing the animal called –*gato*. The sounds the child hears are allophones, recognizable at this point in the acquisition process.

Allophones exist at the **phonetic level,** or **surface level.** However, the diagram in (1) shows that allophones are categorized into phonemes before lexical storage occurs. Therefore, we see in (2) that the spectro-temporal information contained in the acoustic representation [gato] must be mapped onto a mental representation, /gato/, before the new lexical item, along with its meaning, can be stored to memory. That is

[2] This is a visual representation of the spectro-temporal information associated with the phoneme string /gato/, as spoken by a speaker of Madrid, Spain.

to say, the defining, non-redundant information contained in the allophones [gato] must be preserved while eliminating the redundant information. Seen in this way, we can say that the phoneme string /gato/ is simply a skeleton of basic articulatory information, containing only the most essential distinguishing features.

Conversely, phonemes exist at a stratum called the **phonological**, or **underlying level (UR).** This level is distinguished from the phonetic level in a number of ways. First, we have no physical proof of its existence. Remember, phonemes are not sounds themselves but serve as the mental, categorical representation of sounds. And whereas speech scientists are privy to the data contained at the surface, or phonetic level, the concept of an abstract UR is strictly theoretic and used for classification. It is supposed that from this level, strings of phonemes can associate with their respective mental, or lexical image.

This association is best contemplated as a two sided coin, which, on one side appears the phoneme sequence, and on the other, the mental image[3]. Just as a coin, the two are indissoluble. It is for this reason that when we hear a foreign language, the sounds we hear represent little more than the discernible features which compose the individual allophones. Effectively, there is no associated underlying meaning to accompany them.

The paradigm we have just described provides a very basic model of speech perception, which departs from the phonetic level. Models which describe speech **production**, logically, part from the phonological or underlying level. So, when the language learner wishes to repeat the new lexical item which she has just learned, she must find some way to organize the underlying information found in the phoneme string /gato/ into the phonetic or surface representation [gato] (instead of [γato] for example).

[3] See Saussure (1916).

This systematization is carried out by way of a **phonological generalization.** Basically, phonological generalizations are the bridge by which the underlying and phonetic levels of representation are connected. This point is shown in the following example (3):

(3)

Phonological level: /gato/

Phonological generalization

Phonetic level: [gato]

All the phonological analyses that we address throughout the course of this thesis can be reduced to this same central model involving two levels of representation. As we will show, phonological generalizations, and more importantly, how these generalizations are formally expressed will be a major part of this thesis. We will employ an Optimality-Theoretic (OT) framework to formalize the phonological generalizations treated in our analyses. When convenient, we will also make reference to certain aspects of the rule-based paradigms of classical Generative Phonology in order to illustrate the inherent benefits supplied by the OT framework.

The remainder of this chapter is organized as follows: §1.1 below, offers a thorough description of the individual sounds of Spanish, followed in §1.2 (page 24) by a brief introduction to the phonological generalizations which we will examine throughout the course of this initial chapter. Later in §1.3 (page 32), we address the various theoretical options we have at our disposal with which to formalize the data revealed in our phonological generalizations. §1.4 (page 35) offers a brief, yet exhaustive, presentation of OT's constraint based architecture, the predominant theoretical framework we employ in the subsequent sections 1.4.1-1.4.4 (pages 44-67). Finally, we summarize the results of our first chapter in §1.5 (page 78).

1.1 THE SOUNDS OF SPANISH

Spanish, like all languages, has a restricted repertoire of phonetic components. All words in the Spanish lexicon can be produced with a relatively small number of allophones. In this section, we offer an introduction to the phonetic and phonological components of the standard Peninsular Spanish spoken in Madrid, Spain. This last distinction is important since Spanish, like all languages, exhibits a vast dialectal assortment of less commonly used segments. This is the logical result of a dissemination that spans thousands of miles and four continents. The systematic classification of the speech sounds of Spanish we offer here will become a useful tool for the phonological analyses which follow in subsequent sections.

In recent years, the psychological and phonetic literature has criticized traditional phonetic and phonological classifications of allophones and phonemes[4]. Early transcriptions in phonetics and phonology depended to a great extent on the interpretation of the author. Naturally, a consistent classification of the sounds of a language is a difficult task since, not only do all speakers pronounce the sounds of their native language slightly differently, but all listeners perceive these sounds in a slightly different fashion. However, much work has been done in the speech sciences in recent years, especially in Spanish, to remedy this problem. Spectrographic equipment and computer based transcriptions now make classification of sound inventories more reliable and less biased than those of previous studies.

The classification we offer here, based in large part on Navarro Tomás' (1932) *Manual of Spanish pronunciation*, is a result of the efforts made to provide a more

[4] See Hawkins (2001).

consistent, accurate description of the Spanish inventory of sounds. Let us concentrate for a moment on the following list of Spanish consonants:

(4)
The consonantal allophones of Spanish as spoken in Madrid, Spain

[m]	mano	[n]	no	[ɲ]	leña	[k]	cama
[p]	pan	[t]	tú	[tʃ]	trucha	[g]	gama
[b]	beso	[d]	diciembre	[j]	tienes	[ɣ]	lago
[β]	lobo	[ð]	sed	[ʝ[5]/d͡ʝ]	pollo	[x]	Jimena
[f]	fonología	[θ]	zapato			[w]	huevo [we.βo]
		[s/s̺]	siempre/ des̺de			[ŋ]	tango
		[s̬]	mismo				
		[r]	rey				
		[ɾ]	pero				
		[l]	tela				

The consonants that appear in this chart represent those which emerge in the allophonic repertoire of the Spanish spoken in Madrid, Spain. That is not to say however that these consonants are exclusive to this dialect of Spanish. In fact, the great majority of these consonants appear in all dialects of Spanish. One of the more noticeable differences between the Spanish spoken in Madrid, as well as other regions of the Iberian Peninsula, and Spanish speaking America is the distinction between [s] and [θ]. In American dialects, [s] is used in all contexts corresponding to the graphemes –*z*, -*s*, and –*c*i/-*c*e, whereas –*z* and –*c*i/-*c*e in Madrid, and throughout Castilian speaking Spain, are realized as [θ].

Consonants in all languages may be distinguished using a set of predetermined criteria. **Place of articulation** describes the primary point of contact in the speech apparatus upon production. The physical parts of the speech apparatus involved in

[5] Throughout the course of this thesis we will use the alveolar-fricative [ʝ] instead of the palatal fricative [ʎ] used in previous analyses. This represents a minor difference between our descritpion and those of Navarro-Tomás (1932) and Alarcos Llorach (1964). The basis for our doing so lies in the fact that the palatal fricative is no longer present in the phonetic repertoire of the majority of Peninsular Spanish varieties.

producing speech signals are relatively few considering the amount of space and quantity of mechanisms available. The categorization we offer here involves three principal places of articulation: **Labial**, **Coronal** and **Dorsal**.

In addition, **manner features** describe the degree and type of constriction of the passing air flow required to produce each consonant. Here we employ the following manner features: **stop, fricative, affricate, nasal** and **lateral**.

Vocal chord vibration may play a crucial role in defining a given consonant, and oppositions between consonants. Those consonants which engage vocal chord vibration are known as **voiced** consonants while those which do not are called **voiceless** consonants. All manner features have both voiced and voiceless counterparts.[6]

Labial consonants involve the lips, either partially or wholly, as the primary articulator. These consonants are [m], [p], [b], [β], and [f]. The first, [m], is a **nasal** consonant since the velum is lowered to allow air to escape through the nasal cavity upon production. The next two, [b] and [p], entail full detainment of air flow. Consequently, these consonants are known as **stops** since the stream of air employed in their articulation is completely obstructed. The following, [β], is considered an **approximate**, or **fricative**, since the flow of air is only restricted and not fully obstructed. The last, [f], is considered **labial-dental** since both lips and teeth are required to produce this consonant.

Coronals comprise the largest group of consonants with regard to place of articulation in Spanish. Interestingly, coronals emerge in 99.7% of the world's languages (Hume, 2003). These consonants oblige the use of the tongue apex as the primary articulator in their production. In Spanish, they are unquestionably the most

[6] In Spanish, the only affricate is voiceless while all nasal consonants are voiced.

frequent of the major [place] classes (Alarcos Llorach, 1964). Alarcos Llorach offers the following frequency of occurrence for coronals in Spanish:

(5)

Frequency of coronals in Spanish

Coronal	% of total phonemes of which 52.70% are consonants
/t/	4.60%
/d/	4.00%
/s/	8.00%
/n/	2.70%
/θ/	1.70%
/l/	4.70%
/r/	7.60%

The segments [n] and [ɲ] are nasal coronals since a significant amount of air escapes from the nasal passage upon realization. They are distinguished in that [n] is considered an alveolar coronal, meaning primary contact involves the tongue apex and the alveolar ridge, while [ɲ] is palatal, meaning that primary contact is made with the tongue apex and hard palate. The segments [t], [tʃ] and [d] are dental stop coronals as the air flow is completely constricted for a determined time before release. Next, [θ], [ð], [s] and [s̬] are dental fricative coronals, meaning that air is still free to circumvent the obstruction and pass out of the mouth, even though there is partial constriction between the tongue tip and teeth. The Spanish of Madrid and other northern regions of the Iberian Peninsula also have one alveolar-palatal allophone [s], which is similar to dental [s̪] except that the tongue apex extends up toward the hard palate and alveolar, instead of making contact just behind the teeth. Additionally, [r] and [ɾ] are alveolar trill and tap coronals respectively. Finally, [l] is a lateral coronal.

Dorsal consonants are produced in the back part of the mouth near the throat and vocal tract. There are two dorsal stops, [k] and [g]. The distinguishing feature between these two consonants is **voice.** The segment [k] involves no vibration of the vocal chords while [g] is voiced. [x] is a fricative dorsal consonant since air is still free to pass even if significantly restricted.

Although we have organized the allophones according to their places of articulation, **labial, coronal,** and **dorsal**, other means of categorization are also possible, and sometimes desirable. For example, if we wanted to isolate **voiced** consonants our classification would involve all the nasals, [m], [n], and [ɲ], as well as [b], [d], [g], [β], [ð], [γ] [s̬], [r], [ɾ] and [l]. **Fricative** consonants too can be grouped in a separate category which contain the following sounds: [f], [s], [θ], [ð], [x] and [s̬].

A full chart of the consonant allophones of Spanish categorized according to their respective place and manner features is offered in the following example (6):

(6)

	LAB	COR	COR	COR DOR	DOR	LAB DOR
Stop						
Voiced	[b]		[d]		[g]	
Voiceless	[p]		[t]		[k]	
Fricative						
Voiced	[β]	[ð]	[s̬]	[j̞]	[ɣ]	[w]
Voiceless	[f]	[θ]	[s]			[x]
Affricate						
voiced				[d͡j̞]		
Voiceless				[t͡ʃ]		
Nasal						
Voiced	[m]		[n]	[ɲ]	[ŋ]	
Laterals						
Voiced			[l]	[ʎ][7]		
Voiced		[ɾ]	[r]			

Some of the consonants presented in (6) interact in a state of **complementary distribution**. Let us consider the sounds [d] and [ð]. Both are allophonic dependents of a phoneme /d/. However, the concept of complementary distribution implies that their allocation is exclusive and predictable in a given phonological context. For example, [d] always appears after a pause, nasal consonants and lateral [l]. Therefore a Spanish speaker says *el* [d]*edo* but never *el* [ð]*edo*. Conversely, [ð] surfaces after vowels and in all other contexts except following nasals, lateral [l] and a word-initial pause. Hence, a Spanish speaker says *el de*[ð]*o* and never *el de*[d]*o*. A partial list of the consonants that interact in a state of complementary distribution in Spanish can be observed in the following table (7):

[7] The voiced alveolar-palatal [ʎ] in the contemporary Spanish of Madrid exists exclusively at the phonetic level in contexts in which the lateral [l] precedes [j̞]: -el llavero (*-the keychain*), [el.j̞a.βe.ɾo] →[el.ʎa.βe.ɾo]. This differs with Alarcos Llorach (1950, 1964 edition) classification in which this author included /ʎ/ as part of the phonemic inventory of Spanish. We base our phonological reclassification on the fact that [ʎ] has become systematically neutralized with [j̞] in modern Spanish. We will discuss this more in depth later in this same chapter.

(7) Consonants in complementary distribution in Spanish

	contexto$_1$	contexto$_2$	contexto$_3$	contexto$_4$	contexto$_5$
	#___	n(asal)___	V___	___V	___#
[b]	✓	✓	—	—	—
[β]	—	—	✓	✓	✓
[d]	✓	✓	—	—	—
[ð]	—	—	✓	✓	✓
[g]	✓	✓	—	—	—
[γ]	—	—	✓	✓	✓

(Alonso-Cortés, 2003)

As we observe, the concept of complementary distribution entails that each consonant has a very specific context in which it systematically and predictably appears.

Other consonants from the chart in (6) represent **minimal pairs.** Contrary to complementary distribution, consonants that appear in minimal pairs do, in fact, occupy the same phonological context. In English, the words *–bed* and *–bet* are minimal pairs. That is they differ minimally in only one feature. In this case, [d] is a voiced consonant while [t] is voiceless. And although the distinction is discreet, it would be somewhat strange that a native speaker of English confuse the expression *-to make a bed* with *–to make a bet*. The following is a partial inventory of minimal pairs in Spanish in (8):

(8)

Pairs	Distinctive Components
pena/vena	[+voice] in [b], [-voice] in [p]
raba/Rafa	[+voice] in [β], [-voice] in [f]
pata/chata	labial [p], palatal [t͡ʃ]
vino/kilo	labial [b], dorsal [k]
vino/mino	[-nasal] [b], [+nasal] [m]

This table shows that two distinct mental images can be discerned by one aspect of the bundle of attributes which comprise a sound. Voicing in [b] is sufficient to distinguish the first two pairs. In the second two pairs, place of articulation renders the pairs distinguishable. The last pair illustrates that the nasal quality in [m] is responsible for distinguishing *–mino* from –[b]*ino*, even though all other features of the two words are identical.

The Spanish vowel system is much less cumbersome than its English counterpart. With the exception of a few dialectal variations, vowels in Spanish are relatively consistent throughout Spain and Spanish speaking America[8]. The following chart illustrates the vowel system of Spanish[9]:

(9)

	Front		Back
High	i		u
Middle	e		o
Low		a	

This chart highlights two principal articulatory characteristics. First, **front** expresses that the vowels which compose this category are realized along a horizontal plane in the front part of the mouth toward the teeth, while **back** expresses the fact that these vowels are produced toward the back of the mouth toward the throat. **High, medium** and **low** express the position on a vertical plain of the tongue at the time the vowels are articulated. Hence, [i] is considered a **front** vowel since the tongue is positioned toward the front of the mouth. Moreover, we can refine this description to include that [i] is a **high**-front vowel since the tongue body sits high toward the hard palate. Conversely, [u], is a high-**back** vowel since it proceeds from the back part of the speech apparatus toward the vocal tract. Both [e] and [o] are mid-vowels, the only difference being that [e] is a front-mid vowel and [o] is a back-mid vowel. The segment

[8] In some southern regions of Spain lax vowels emerge as a result of the erosion of word-final /s/.

[9] For ease, we use posterior and anterior instead of [+ATR] and [-ATR].

[a] is a low mid vowel, meaning that the position of the tongue sits low in the mouth and it is neither front nor back.

Vowels in all languages are characterized by their lack of air-flow constriction. All vowels inherently employ spontaneous vocal chord vibration due to this lack of constriction. As well, labial descriptions are often used to characterize certain vowels. **Round** describes the position of the lips upon realization. Back vowels in Spanish are always round, meaning that the lips are necessarily rounded. Spanish, unlike French, has no rounded front vowels.

Some languages make the distinction between **tense** and **lax** vowels. Predecessors to modern Spanish exhibited tense/lax alternations of the mid vowels. Therefore the tense mid-front vowel [e] had a lax mid-front counterpart [ɛ], and the tense mid-back [o] had the lax counterpart [ɔ] (Holt, 1997). This opposition has been neutralized in modern Spanish, although certain southern dialects of the Iberian Peninsula retain these allophones in specific phonological contexts.

Spanish vowels are all inherently **oral**. That is to say that they proceed from the oral cavity. Some languages exhibit contrasts between oral and nasal vowels but Spanish does not. However, in contexts in which the vowel comes into contact with a nasal consonant, nasal quality does extend beyond the nasal consonant and affect the preceding or following vowel, producing, in effect, a nasalized vowel. This is, however, a phonetic process which does not affect the underlying oral essence of vowels in Spanish.

All vowels may appear individually or as part of a **diphthong**. These are distinguished from **monopthongs** in that diphthongs imply an inherent movement of the tongue from one articulation to another upon production. As their name implies, diphthongs are composed of two vowel sounds pronounced concurrently. Spanish has six **falling diphthongs** and eight **rising diphthongs**. Falling diphthongs are composed of two vowels, the first one of which may be [e,a,o,u] and the second must be [j,w]. Rising diphthongs, on the other hand, all begin with a **semi-consonant** [j,w] and may end with [a,e,i,o,u]. A list of all possible diphthongs in Spanish is offered in example (10):

(10)

Diphthong	Example
Falling	
[ej]	rey
[aj]	aire
[oj]	hoy
[ew]	neutro
[aw]	pausa
[ow]	bou

Diphthong	Example
Rising	
[je]	tierra
[ja]	hacia
[jo]	radio
[ju]	viuda
[wi]	fuimos
[we]	fuego
[wa]	cuadro
[wo]	cuota

Triphthongs ([wej], [waj], [jej], [jaj]), a priori, are not forbidden in Spanish. They appear in the second person plural (*vosotros*) verb conjugation: -averig**uái**s, ampl**iái**s, ampl**iéi**s, etc. Rarely, they may appear in other lexical items: *buey*, *guay*. Nevertheless, we should consider their distribution to be quite limited.

In rapid speech, mid vowels [e,o] may diphthonguize with following vowels, although this trait is considered non-standard in most dialects: t**ea**tro→t**ja**tro.

Vowels in Spanish may appear word-initially and word-finally, stressed or unstressed. Certain vowels, however, show a lesser proclivity to emerge in word-final position. For example, both [i] and [u] may unquestionably appear word-finally, both stressed and unstressed, but a casual search through any Spanish text reveals that [o,a,e] are much more common in this position.

Now, in shifting our focus, we have mentioned that allophones exist at the phonetic or surface level whereas phonemes pertain to a more abstract underlying, or phonological level. We have seen that phonemes are not sounds, but mental representations of sounds, contained in economical bundles used for taxonomical purposes. The past examples have offered a preliminary look at the allophones of Spanish, but until now we have ignored the phonemic inventory of Spanish.

For anyone not accustomed to fine grained phonological analyses, the concept of the phoneme may be a confusing notion. Traditional analyses heavily burdened by philology gave the impression that the phonemes of a given language are an external entity of the language invented by language philosophers to explain processes we really do not understand. Afterall, a great deal of speculation regarding the phonological level was involved in early phonological methodology. Even in the contemporary literature, there is very little congruency among speech scientists as to whether or not the phoneme really exists, or if it does, what sort of information it should contain. Psychological and Phonetic studies in the past two decades have produced a copious amount of research addressing these exact points. However, for taxonomical and distributional purposes, the notion of the phoneme is a useful, but not perfect, tool for phonological analyses.

One can observe that some of the allophones of Spanish presented in table (6) have strikingly similar attributes. Let us consider the sounds [d] and [ð] for example. These allophones differ on one point; [ð] is a voiced fricative while [d] is a voiced stop. There distribution is strictly governed by the phonological context. A child learning Spanish has two options. She may lexicalize both forms [ð] and [d], in other words, store them to memory. The side effect of this strategy is that a large amount of redundant information is stored in memory. Perceptibly, this is neither economic nor efficient.

A viable alternative strategy would be that the language learner extracts all the non-redundant, distinguishing articulatory features of the two sounds and combine them into an archetype, or phoneme. When the child wishes to use one of the allophones, the defining traits for that sound are provided by the grammar. Of course, this strategy alleviates a rather cumbersome burden for the memory, but at the cost of an additional tax for the grammar. Now, the memory only needs to retain the necessary information which defines the archetype /d/, and the rest of the information is supplied post-lexically by the grammar. This system provides an efficient way to categorize the articulatory information needed for speech production.

A complete list of the phonemic inventory of Spanish is provided in the following example (11):

(11) Phonemes in Spanish

b	d	g
p	t	k
m	θ	x
f	s	
	r	
	l	
	n	
	ɲ	
	t͡ʃ	
	ʝ	
	d͡ʝ	

Roman Jakobson devised a system of abstract binary features based on articulation to describe and define phonemic segments and subsequently explain their interaction. Positive values for a given trait are denoted with a (+) while negative values are described using a (-). The features, along with their abbreviations, we will employ in our description of the phonemes of Spanish consist of the following:

(12) Distinctive features for phoneme description based on articulation

C = consonantal
S = sonorant
c = continuous
P = point of articulation (L = labial, C = coronal, D= dorsal)
a = back (+ = +ANT, - = -ANT, A = ANT)
d = spread
ret. = retracted
s = sonorous
N = nasal
L = lateral

Using this description, we can define any phoneme in our inventory. Let us consider the feature description of the phoneme /p/. We can start by specifying a positive value for consonantal, along with a negative value for sonant [+C, -S]. Since /p/ is a voiceless **stop**, logically, it cannot simultaneously receive a positive value for [continuous], which, by definition, contradicts full obstruction. A negative mark for [continuous], **[-continuous]**, will express this description. Incidentally, the segment /b/ is left **unspecified** for [continuous], since its allophonic correlate [β] acquires a positive value for this feature post-lexically. Since /p/ only has one allophonic correlate in Spanish, [p], which does not deviate with respect to the feature value for [continuous], there is no theoretic justification to leave /p/ unspecified. Accordingly, unlike /p/, specifying a feature value [-continuous] for /b/ would be superfluous. A negative value for sonorant illustrates the fact that /p/ is a **voiceless** consonant. Finally, by specifying that this consonant is **labial**, our description is complete. We can therefore classify /p/ according to the following description:

(13)

/p/ = [+C,-S,-cont. L(abial), -s]

Thus /p/ can be abstractly distinguished from /b/ by the marked negative value for [continuous]. In a similar way, /p/ can be differentiated from /t/ by the labial specification. A full description based on binary feature values of the phonemic inventory of Spanish is provided in the following chart:

(14)

	m	n	ɲ	l	ʝ	r	p	b	f	t	s	θ	d	t͡ʃ	d͡ʝ	k	g	x
C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
S	+	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-
c							-		+	-	+	+				-		+
P	L	C	C	C	C	C	L	L	L	C	C	C	C	C	C	D	D	D
a		+	-	+	-	+				A	+	A	A	-	-			
d											-	+						
ret																		
S					+		-	+	-	-	-	-	+	-	+	-	+	-
N	+	+	+															
L				+		-												

C = consonantal
S = sonorant
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P = point of articulation (L = labial, C = coronal, D = dorsal)
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d = spread
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s = sonorous
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L = lateral

(Alonso-Cortés, 2002)

The astute reader will notice that our table of phonemes includes three important points of distinction from the phonemic categorization first presented in Alarcos Llorach (1950, 1964 edition). We base the discrepancies we introduce here on the arguments presented in an important paper by Alonso-Cortés (*at press*), in which this author reexamines the contemporary phonetic data from standard Peninsular Spanish, illustrating a general tendency toward the reduction of the phonological inventory of this variety of Spanish.

The phonological reclassification mentioned above entails the restructuration of three natural place classes. First, we consider that /s/ in Spanish is a dental consonant. This represents a rupture from the classification as a palatal sibilant presented in Alarcos Llorach (1950). Aside from being corroborated by the morphophonological alternation /t/→/s/ in words that take the suffix *–ión*, of the type *-omiṯir*→*-omiṣión* (*-to omit/ -omission*), Alonso-Cortés' argument is also theoretically supported by Maddieson's (1984) claim which proposes that languages which only dispose of a single sibilant, by and large, prefer dental sibilants and not palatals. The predictable consequence of this argument is that palatal /s/ becomes an allophonic dependent of dental /s/, leaving the palatal class with only two phonological representatives: the affricates /t͡ʃ/ and /d͡ʝ/.

In addition, we will assume that the voiced palatal fricative, [ʝ], is an allophonic dependent of /d͡ʝ/. Of course, this argument differs from that of Alarcos Llorach, who understood [d͡ʝ] to be an allophonic dependent of underlying /ʝ/. The theoretical obstacle inherent to Alarcos Llorach's hypothesis is that the /ʝ/ → [d͡ʝ] conversion can only be justified then as a case of consonantal fortition, for which there is not an abundance of empirical evidence. Alonso-Cortés, citing Navarro Tomás (*Manual* '127), nevertheless, challenges the phonological classification of /ʝ/, offering in its stead the claim that /d͡ʝ/ is indeed the underlying unit and that the first element [d] can be precluded post-lexically by way of a phonological generalization. In this way, the /d͡ʝ/→[ʝ] transformation can easily be captured as a case of consonant lenition, effectively mirroring other cases of lenition such as the spirantization of the voiced stops /bdg/ to [β,ð,ɣ].

We also observe the neutralization of the alveolar-palatal /ʎ/ with the voiced palatal fricative /ʝ/, so consistently that we can state categorically that this former unit no longer forms part of the phonemic repertoire of standard Peninsular Spanish. In fact, save in the cases of a few rural pockets, [ʎ] has all but disappeared from Peninsular varieties of Spanish. Hence, whereas some eighty years ago there would have been a phonetic difference between -*pollo* /ʎ/ and -*poyo* /ʝ/ (-*chicken* and a -*type of stone seat*, respectively), in contemporary Peninsular Spanish there is no discernable distinction made between the two phonemes. Both are realized as the voiced palatal fricative /ʝ/, *systematically*.

Finally, the reclassification of the rhotic consonants also merits special attention here. We assume there to be one rhotic consonant /r/ which has two allophonic dependents, the multiple vibrant [r], along with the simple vibrant [ɾ]. Their distribution is considered complementary in accordance with the following criteria:

(15)

Distribution of the multiple vibrant [r]

-word-internal onset: *co - rro, mo - rro, po - rro* (-*ring of people, -pebble, -dull/-stupid*)
-word-initial onset: *ro-sa, re-ja, ra-mo,..* (-*rose, -grate, -branch*)
-word-internal onset following [n,s,l][10]: *en-redo, al-rededor, is-raelita.*
(-*tangle, -around, -Israeli*)

Distribution of the simple vibrant [ɾ]

-word-internal coda: *bur-la, cuer-no, per-sa,…* (-*mockery, -horn, -Persian*)
-word-final coda: *mar, a-mor, im-par, co-lor,…*(-*sea, -love, -odd, color*)
-word-internal coda followed by a vowel: *lor*-o, *mor-o*, *par-a…*(-*parrot, Moor, -for*)
(Alonso-Cortés, 1995)

To recapitulate then what we have examined up to this point, allophones are the material sounds of a language which are realized at the surface, or phonetic level. Phonemes are not sounds, but abstract units composed of binary values for a set of given features, employed for classificatory and distributional purposes. They are archetypes, or similar even to stereotypes, in that the binary values for a given feature set parameters by which the grammar defines and classifies the segments of its phonological inventory. Phonemes interact at a level called the underlying, or phonological, level of derivation. Deviations between the two levels of representation

[10] The behavior of the multiple vibrant [r] following /s/ proves the dental status of this latter consonant.

are the result of phonological generalizations. The way in which we engineer the data extracted from generalizations into formal computational models is known as phonological modeling and will be dealt with in the subsequent sections.

1.2 PHONOLOGICAL GENERALIZATIONS

In this section we present a set of phonological generalizations which we will analyze throughout the remainder of this chapter. Phonological generalizations, as we have mentioned previously, are the bridge between the underlying, or phonological and phonetic levels of representation.

1.2.1 Nasalization of Spanish vowels

Unlike French and Portuguese, there are no underlying, or phonological contrasts with regard to nasality in the Spanish vowel system. That is to say that all Spanish vowels are oral, meaning that air is released exclusively from the oral cavity:

(16)

Spanish oral vowels

	Front		Back
High	i		u
Mid	e		o
Low		a	

That does not imply, however, that nasalization of vowels cannot take place under certain phonological circumstances at the phonetic or surface level. Indeed, in certain contexts in which an underlying oral vowel precedes a nasal consonant, the nasal property of the consonant extends leftward, affecting the preceding vowel. Due to a slight opening between the velum and palate caused by the articulatory anticipation of the following nasal consonant, a small stream of air produced from the articulation of the vowel escapes through the nasal cavity (Alonso-Cortés, 2003). Interestingly, we see a certain proclivity toward spontaneous nasalization of [a] in certain cases attributable to the tongue position during the articulation of low vowels.

Let us observe the phonetic contrast between oral and nasalized vowels in Spanish:

(17)
Spanish vowel contrast at the phonetic level

	Oral vowels			Nasal vowels		
[a]	papa	[papa]	(*dad*)	pan	[pãn]	(*bread*)
[e]	ve te	[be te]	(*go*, command)	ven te	[bẽn te]	(*come,* command)
[i]	fiscal	[fiskal]	(*prosecutor*)	fin	[fĩn]	(*end*)
[u]	susto	[susto]	(*scare*)	asunto	[asũnto]	(*topic*)
[o]	mosto	[mosto]	(*must*, grape juice)	monton	[mõntõn]	(*a lot*)

It should be clear that oral and nasalized vowels coexist at the phonetic level in a state of complementary distribution. Nasalized vowels result from the dominance of a phonotactic constraint which systematically converts oral vowels into nasalized vowels when preceding nasal consonants. In this context, oral vowels do not emerge due to the slight aperture of the velum which allows air to pass through the nasal cavity. In contrast, nasal vowels in Spanish only appear in this context and, therefore, may not replace an oral vowel in contexts apart from the one previously outlined.

1.2.2 Spirantization of stop consonants

Spanish has three voiced stop consonants /b,d,g/. They are so called because the air flow produced by articulation is completely detained, or stopped. In certain phonological contexts, these consonants become marked for [+continuous], [β,ð,γ], meaning the stream of air required for their production escapes **continuous**ly, with no absolute obstruction. The process by which this occurs is called **spirantization**.

Spirantization is a form of **lenition**, or weakening. Lenition processes are motivated by phonotactic constraints which require a reduction in articulatory exertion (see Kirchner, 1998). In some cases, synchronic, or instantaneous weakening of consonants is altogether facultative, as in the weakening of /s/ to [h] in syllable-final position in Southern Peninsular and American varieties of Spanish. In other cases, the process is predictable and systematic and, therefore, constitutes a phonological generalization.

The spirantized allophones [β,ð,γ] appear in all contexts except when following nasal consonants or after a pause. Additionally, [d] remains [-continuous] when following [l]. The following chart provides examples:

(18)

	after a pause	after a vowel	after a nasal	after [l]
[b]	[b]eso	-	em[b]utido	-
[β]	-	lo[β]o	-	el [β]eso
[d]	[d]edo	-	duen[d]e	alcal[d]e
[ð]	-	de[ð]o	-	-
[g]	[g]uante	-	an[g]ula	-
[γ]	-	a[γ]ua	-	el [γ]amo

As we can observe, stop spirantization produces a perfect pattern with regard to the segments which appear in a determined context. The stops marked for [-continuous] never follow a vowel. Likewise, the lenited versions marked for [+continuous], [β, ð, γ], never appear word-initially following a pause or after a nasal. Additionally, the segment [ð] may not appear after lateral [l].

The surfacing of [d], and not [ð], following [l] stems primarily from the fact that /l/ is underspecified for [continuous], while /d/ is necessarily marked phonologically as [-continuous]. The logical consequence of the feature underspecification of /l/ for [continuous] implies that, phonetically, [l] can surface as both [+continuous] or [-continuous]. Preceding [-continuous] /d/, /l/ must surface as [-continuous], effectively blocking the transformation of [-continuous] to [+continuous] in /d/ to [ð]. Accordingly and most conveniently, this justification explains why sprirantization of /d/ is also blocked by nasals, since all nasals except for [ɲ] are also marked for [-continuous][11].

We should also mention that, in non-standard speech, it is not infrequent that other consonants undergo this same process[12]. Alarcos Llorach (1964) provides examples of spirantization of voiceless stops, /p,t,k/ in non-standard speech. It should be noted that, contrary to voiced stop spirantization, stop spirantization **neutralizes** surface forms of two distinct phonemes. That is to say, that the resulting allophone produced by spirantization is already a corresponding surface segment of another phoneme. **Neutralization**, in effect, is a process by which underlying contrasts between phonemes are lost, converging to identical allophones yet radiating from two distinct underlying segments. The examples in (19) provide examples of stop spirantization in common speech:

(19)

Spirantization of voiceless stops

cápsula	[káβsula]	*(capsule)*	atlas	[aðlas]	*(atlas)*
atleta	[aθleta]	*(athlete)*	ritmo	[riðmo]	*(rhythm)*
eclipse	[ekliβse]	*(eclipse)*	étnico	[éðniko]	*(ethnic)*
inepcia	[ineβθ̬ja]	*(ineptness)*	atmósfera	[aðmósfeɾa]	*(atmosphere)*
apto	[aβto]	*(apt)*	actor	[aɣtóɾ]	*(actor)*
acción	[aɣθ̬jón]	*(action)*			
examen	[eɣsámen]	*(exam)*			

(Alarcos Llorach, 1964)

[11] This argument is only viable for homorganic clusters. Afterall, /b/ and /g/ are also marked phonologically for [-continuous], but do not affect the surface level feature value of [continuous] in /l/.
[12] Especially in rapid, informal speech.

The examples in this chart show that in non-standard speech, the phonemes /p,t,k/ can take on surface features of the allophones, [β,ð,γ] which normally correlate to underlying /b,d,g/. We can say that the feature contrasts that exist at the underlying level between /p,t,k/ and /b,d,g/ have been lost, or neutralized at the surface level.

To conclude, we will assume both cases of spirantization to be motivated by the rightward spreading of the feature value [+continuous] of the preceding vowel. As we can observe, the only consistent regularity between the spirantization of voiced and voiceless stops is the systematic appearance of the preceding vowel. In addition, with regard to the examples in (19), the majority of the lenited consonants are modified to include the positive value [+voice]. We will not address this aspect in our analysis but suppose this be a simple case of feature spreading as well.

1.2.3 Sonorization and devoicing

Spanish has one underlying **sibilant**, /s/, in its phonemic inventory. Sibilants are realized by directing a stream of air through a constricted canal in the vocal tract which escapes through an aperture between the teeth and tongue. Furthermore, as we have observed in table (5), /s/ is a **voiceless** coronal fricative.

Sonorization is a lenition process by which voiceless consonants become voiced at the phonetic level due to some condition in its phonological environment. This contrast in voice is observed in the phonetic alternation of [s], unvoiced fricative sibilant, with [s̬], voiced fricative sibilant.

Sibilant sonorization occurs when the voiceless fricative /s/ directly precedes a voiced consonant. An aperture in the vocal tract prompted by the anticipation of the following voiced consonant motivates the transformation from /s/ to [s̬][13]. Examples of this process appear in the following:

(20)

Sonorization of /s/ before voiced consonants

/s/ before voiceless consonants			/s/ before voiced consonants		
susto	[sústo]	*(scare)*	desde	[des̬ðe]	*(since)*
atmósfera	[atmósfera]	*(atmosphere)*	mismo	[mís̬mo]	*(same)*
espejo	[espéxo]	*(mirror)*	cisne	[θís̬ne]	*(swan)*
escena	[esθéna]	*(scene)*	resbalar	[res̬βalár]	*(to slip)*
mosca	[móska]	*(fly)*	resguardar	[res̬γwárðaɾ]	*(to preserve)*
			más leve	[mas̬leβe]	*(more trivial)*
			Israel	[is̬rael]	*(Israel)*

In a similar way, the fricative non-sibilant /θ/ may become a voiced approximate [ð] in an identical phonological context:

(21)

Sonorization of /θ/ before voiced consonants

/θ/ before voiceless consonants			/θ/ before voiced consonants		
mízcalo	[míθkalo]	*(milk mushroom)*	gaznápiro	[gaðnápiɾo]	*(bumpkin)*
mezquita	[meθkita]	*(mosque)*	pazguato	[paðgwato]	*(dolt)*
izquierda	[iθkjerda]	*(left)*	jazmín	[xaðmín]	*(jazmine)*
mozcorra	[moθkorra]	*(harlot)*	juzgar	[juðγaɾ]	*(to judge)*
pizpireta	[piθpireta]	*(brisk)*	maznar	[maðnaɾ]	*(to knead)*
			lezna	[leðna]	*(awl)*

Conversely, **devoicing** or **desonorization** affects word-final voiced stops before a pause in casual speech. Contrary to sonorization, devoicing is a lenition process by which consonants marked for [+voice] convert to [-voice] at the phonetic or surface level. We have some intuitive evidence from orthographic representations that native Spanish speakers are aware of this devoicing process in word-final position.

[13] This process can be suppressed in careful speech styles, and therefore does not take effect in all cases as with the spirantization cases we saw earlier. However, we can generalize that when the process does occur, its contexts are predictable and restricted as in any other case of complementary distribution.

Commonly, in non-standard orthography, the name Madrid is spelled –*Madriz*[14], as in the –*Madriz Café*.[15]. Examples of this process can be observed in the following table:

(22)

Devoicing of word-final consonants in Spanish		
Madrid	[madriθ]	(*Madrid*)
libertad	[liβertáθ]	(*liberty*)
virtud	[birtúθ]	(*virtue*)
usted	[ustéθ]	(*you, 3rd person singular formal*)

These last examples represent a process of feature neutralization. At the underlying level, /d/ and /θ/ are distinguished by their feature value for [voice]. In most cases, this contrast is maintained in surface representations. In other words, under normal circumstances, both phonemes, [d,ð], remain voiced consonants, while [θ] remains voiceless.

1.2.4 Place assimilation

Spanish nasal consonants, [m,n,ɲ], contrast in intervocalic position, ca[m]a ca[n]a, and ca[ɲ]a. For this reason, nasals are phonologically categorized as three distinct phonemes, /m,n,ɲ/. Nevertheless, at the phonetic level, in sequences of [+nasal] + [+cons], Spanish nasals undergo a process of neutralization whereby they assimilate the place of articulation of the consonant which follows, both word internally and across prosodic boundaries:

[14] A coffee shop on Calle Costa Rica, Madrid

[15] This author has observed more than a casual trend in orthographic errors of this same nature made by children in their primary years of formal education.

(23) Place assimilation of Spanish nasals

un beso *(kiss)*	u[m] <u>b</u>eso	[n] becomes [m] preceding bilabial [b].
un peso *(weight)*	u[m] <u>p</u>eso	[n] becomes [m] preceding bilabial [p].
un faro *(streetlamp)*	u[ɱ] <u>f</u>aro	[n] becomes [ɱ] preceding labial-dental [f].
un tiro (gun *shot*)	u[n̪] tiro	[n] becomes dental before [t].
un yate *(yacht)*	u[ɲ] yate	[n] becomes [ɲ] before palatal [ʝ/d͡ʝ].
un gato *(cat)*	u[ŋ] gato	[n] becomes [ŋ] before velar [g].

The [m] to [n] conversion before coronal consonants is more infrequent since /m/ is an illicit word-final coda in patrimonial words in Spanish, and therefore cannot assimilate the following word-initial consonant. Often in diachronic cases, coda /m/ in word-internal syllable-final position appearing before coronals has undergone a phonological transformation such that /m/ is replaced by /n/ at the underlying level: *te<u>nt</u>ación* << *te<u>mpt</u>atĭo*, *rede<u>nc</u>ión* << *rede<u>mpt</u>ĭo*, *sí<u>nt</u>oma* << *sy<u>mpt</u>ōma*. Naturalized loan words ending in /m/ are realized as [n], the closest permissible word-final nasal; *maximum* [maksimu<u>n</u>], *álbum* [álbu<u>n</u>], *papel film* [filn], *Benidorm*[16] [benidorn] (Alarcos Llorach, 1964).

In a similar way, though not identical, lateral [l] in Spanish also assimilates place of articulation of the following consonant:

(24)

Place assimilation of [l]

el tío	*(tio)*	e[l̪] [t̪]ío	[l] becomes dental before [t̪].
el día	*(day)*	e[l̪] [d̪]ía	[l] becomes dental before [d].
el niño	*(boy)*	e[l] niño	[l] becomes alveolar before [n].
el llavero	*(keychain)*	e[λ] llavero	[l] becomes palatal before [ʝ].

This chart illustrates the phonetic level assimilation of [l] in Spanish. As can be observed, lateral place assimilation is significantly more restricted than nasal assimilation. Table (24) presents two interesting points for contemplation. First and

[16] Coastal city of Catalán origin.

more obvious, before [d] the lateral [l] assimilates the dental articulation of the voiced stop. Secondly, as we can recall from §1.2.2, spirantization is blocked in contexts following [l], suggesting a more than coincidental relationship between place assimilation and the blocking of spirantization. Discussion on this last point will be withheld until after we address voiced stop spirantization in § 1.4.2.

1.3 EXPRESSING PHONOLOGICAL GENERALIZATIONS

In the preceding section we have introduced four common processes in Spanish phonology. We have seen that vowels in Spanish are all oral. When following nasal consonants [m, n, ɲ], oral vowels become nasalized as a result of a slight aperture in the velum which allows a narrow air stream to escape through the nasal cavity. The context in which nasalized vowels may emerge is restricted such that only vowels directly preceding nasals may take on the nasal condition of the following consonant. As a consequence, the oral and nasal vowel opposition constitutes an example of complementary distribution, since oral vowels never appear before nasal consonants, and nasalized vowels never emerge under other conditions aside from the pre-nasal position.

Next we have shown the systematic spirantization of voiced stops [b,d,g] in determined contexts. Basically, spirantization implies a feature value shift from [-continuous] to [+continuous] when the voiced stop follows a contiguous vowel. We have seen that this process is blocked by nasal consonants [m, n, ɲ], as well as by [l] in cases involving the voiced dental stop [d] and in word-initial position following a pause.

Later, we have seen that sonorization motivates a value shift involving the feature [voice]. The effects of sonorization emerge when certain voiceless consonants precede voiced consonants. Sometimes this feature transformation involves no neutralization of underlying contrasts, as with /s/, since both allophones, the voiced [s̬] and voiceless [s], are exclusive to an underlying segment /s/. In other cases such as the transformation of /θ/→[ð], underlying contrasts are lost, or neutralized, in the phonetic representation since the surface forms that sonorization produces are allophones of distinct underlying segments. In these neutralized forms, the underlying segments from which the sonorized surface representations radiate are not altogether transparent. A similar situation is repeated in the devoicing of word-final voiced stops.

To conclude our introduction to phonological generalizations we have taken a brief look at the place assimilation of nasal and lateral consonants. Our data shows a systematic process by which nasal consonants, and laterals to a certain extent, assimilate the place of articulation of the following contiguous consonant.

Interestingly, we see a patent relationship between place assimilation and spirantization. We have seen that spirantization is blocked by all nasal consonants. Additionally, spirantization of [d] is blocked by the lateral [l][17]. We have also seen that nasal consonants assimilate the place of articulation of the following contiguous consonant. Therefore [n] becomes labial [m] before [b], and [n] becomes velarized before velar [g]. The lateral [l] becomes dental before [d]. We can conclude that the blocking of spirantization seems to be motivated not by any individual quality of the nasal or lateral consonants, but rather by the process of place assimilation, which

[17] The blocking of spirantization of [d] before [l] can effectively be dealt with in two ways. The first entails the idea that /l/ is underlyingly underspecified for [continuous]. Therefore, at the surface level, [l] can be [+cont.] and [-cont.]. If [-cont.] [l] precedes [+cont.] [d], spirantization is effectively obstructed. The second justification which has appeared in the literature is that there exists a ban on sequences of [coronal] + [coronal]. Here we accept this first argument.

necessarily produces a derived consonantal sequence consisting of C_1[-continuous]C_2[-continuous]. In this case, [+continuous] cannot spread rightwards from C_1 to C_2 since C_1, which is phonologically unmarked for [continuous], becomes marked for [-continuous] upon appearing to the left of a consonant which is underlyingly marked for [-continuous].

For the remainder of this chapter we will see different ways in which we may model the phonological generalizations that we have presented in this section. First, we present the generalizations in the form of **rules**. Rule-based paradigms were one of the defining characteristics of **Generative Phonology**. Essentially, every generalization between the phonological or underlying level and the phonetic or surface level is governed by the application of some rule which emerges to motivate a structural change.

Later, we offer an account of these generalizations based on conflict resolution of competing **constraints**. This constraint-based paradigm is the result of contemporary research in Optimality Theory (Prince and Smolensky, 1993). Basically, OT envisions all surface forms as the correct, or **optimal**, representation for a given phonological, or underlying form. All structural changes stem from the resolution of hierarchically ranked competing constraints.

1.4 OPTIMALITY THEORY

Optimality Theory is not a phonological theory, per se, in the sense that it does not explain language-specific phonological functions as in Generative Phonology (Chomsky and Halle, 1968), but rather offers a formal mapping of underlying features to their surface forms by way of constraint satisfaction. In this way, OT is really a theory of formal **grammar**, which is capable of expressing the systematic patterns which surface in phonological systems. Basically, OT takes into account that for every phonological, or underlying representation, known in OT jargon as an **input**, various surface forms, or **outputs**, are possible. These possible outputs are called **candidates**. In theory, all candidates of a given input are viable outputs as long as they satisfy the higher ranked constraints of a **constraint hierarchy**, while minimally violating the lower constraints. In this section we will offer a brief introduction to the basic theoretic architecture outlined in Prince and Smolensky (1993).

Rule-based paradigms in classical Generative Phonology manifested a phonological generalization by stating that an underlying or phonological representation φ is realized as φ +1 in a context π by way of some phonological rule that applied at a nondescript point between φ and φ +1. These rules were formalized in the following manner:

(25) Rule based formalism of phonological generalization

$$\varphi \rightarrow \varphi+1 \ / \_\_\pi$$

This formalism may be expressed in a less abstract way by stating that φ is realized (indicated by "→") as φ+1 in a context (shown by "/") π. Examples of common contexts might be "at word boundaries" (/ #___, or ___#), "between vowels" (/ V__V), after a consonant marked for [+continuous] (/ C[+continuos] __) and so forth. So for example, we could express our generalization of spirantization of the voiced stop /d/ following a vowel using the following rule-based formalism:

(26)

d→ð/V___

This may be read as a phoneme /d/ converts to an allophone [ð] in a phonological context in which /d/ directly follows a vowel.

Optimality Theory eliminates the notion of rules. In Optimality Theory, a phonological input φ and its corresponding phonetic output φ+1 are formally separated. The way in which φ becomes φ+1 is expressed by φ+1's satisfaction of highly ranked constraints which are organized in a constraint hierarchy. Therefore in Optimality-Theoretic terms, with regards to our rule in (26), we can state that a candidate V[d] is **suboptimal** while V[ð] is the **optimal candidate**. We already knew that V[ð] was optimal since this is the form that actually surfaces. OT simply provides a formal manner to express this fact. In this way, OT envisions the surface, or phonetic level as an important stage of phonological analysis since this is the only level to which analysts are privy.

We can formulate two generalizations based on the possible candidates presented in our rule which appears in (27):

(27)

i. V[d] is not preferable. (*V[d])
ii. V[ð] is preferable. (V[ð])

Although basic, these generalizations offer some very important assumptions. First, these generalizations take into account that, a priori, both allophones of /d/ are plausible output candidates. Secondly, no candidate is banned or prohibited and none is an undeniable or absolute winner. Independently, the existence of these generalizations means nothing in OT. First they must be ranked hierarchically.

Before ranking these generalizations, we must formalize a set of constraints which expresses their essential assumptions. To do this, we must consider two distinct constraint types. **Markedness constraints** apply to the output level only. These constraints represent universal preferences and tendencies. By their nature, markedness constraints are grounded in phonetic principles. Effectively, these constraints are responsible for motivating a structural change to the input in accordance with the norms of **well-formedness** in a given language. In the event that an input, or phonological representation provides a marked structure such that its full realization in an output form would violate some norm of well-formedness in a given language, markedness constraints will seek to motivate a structural change so that the output which is derived from the marked input will coincide with the norms of well-formedness. Therefore, in OT we can say that any change that occurs between an input and an output is provoked by markedness.

On the other hand, **Faithfulness constraints**, seek to prevent any changes to the input form. Faithfulness constraints are the only restrictions which have access to the underlying level, although only passively. The objective function of faithfulness is to establish and maintain a strict correspondence between the input, or phonological representation, and the output, or phonetic representation. This assumption is simple yet logical. Afterall, there must be some function of the grammar which seeks to restrict structural changes to the phonetic component. If we return to our example of the young language learner that we presented earlier, she has learned that acoustic sounds can be mapped to meaning through phonological intermediation. Upon producing an output, she has learned that meaning can be mapped to sound in a similar way. If there were no force which restricts the amount of structural changes that a speaker may make when producing a given output, any association between meaning and sound would be arbitrary. Since phonological components connect with meaning, major structural changes induced by markedness, logically, threaten the transmission of meaning. Given that the goal of all language is communication, it would seem unwise to hypothesize a computational model which does not take into account the fact that, although structural changes are unquestionably possible in a language when necessary, they must be highly restricted. Faithfulness provides this vital restrictiveness.

The active constraints for any given process are listed in the **constraint set.** Subsequently, these constraints are ranked hierarchically in a **constraint hierarchy.** These ranked constraints are arranged in a **tableau**. The highest ranked constraints are situated to the left of the first row of the tableau, while the lowest ranked constraints are situated to the far right side of this same row. The constraints to the left, the highest ranked, are violated less frequently, especially by the optimal output, while the lowest ranked ones may be violated more frequently:

(28)

Highest ranked constraints Lowest ranked constraints

Input: abc	Constraint I	Constraint II	Constraint III	Constraint IV

Both types of constraints are **universal**. In principle, constraints do not directly induce structural changes. In fact, in OT, no structural changes are ever **ordered**, but result from constraint interaction. Logically, if faithfulness seeks to maintain a strict correspondence between the input and output, and markedness constraints express the idea that certain representations are disfavored in the surface form, we can assume that any structural or feature deviation between the phonological, or underlying level and the phonetic, or surface level will involve some violation of faithfulness. Consequently, we can assume that if the optimal form involves a structural change of some sort which deviates from the representation provided by the input, then the hierarchy which produced the optimal form is dominated by markedness, since optimal outputs always satisfy the highly ranked constraints. In OT terms, this dominance is denoted with "»".

Therefore, we should read the following hypothetical constraint hierarchy: *markedness*

» *faithfulness*, as *markedness dominates faithfulness*. All structural changes are motivated by this basic schema. Referring to the tableau we presented in (28), *markedness* would assume the leftmost position in the first row of the constraint hierarchy and faithfulness would be situated to the far right.

Output candidates are generated by a function **GEN**(erator). In theory, all outputs are possible. That is to say that GEN is not restricted in the amount of outputs it may generate for any given input. Perceptibly, some outputs will never be selected as optimal candidates and, in the interest of time and space, will not be considered. The list of possible output candidates appears in the far left column of the tableau:

(29) Highest ranked constraints Lowest ranked constraints

Input: abc

Candidate Set

	Constraint I	Constraint II	Constraint III	Constraint IV
abc				
ebc				
ibc				
obc				
ubc				

Once the constraint hierarchy is arranged and the candidates are in place, **EVAL**(uation) acts to determine which output candidate will emerge optimal based on the satisfaction of the superior constraints. To see how this works, let us consider the following hypothetical case. All languages have constraints that restrict which consonants, and sequences of consonants, may appear in specific syllabic positions. Most European languages prohibit the sequence [ŋg] from appearing word-initially, although it may appear word-finally. Now, let us suppose that the input provides a hypothetical underlying sequence structure /ŋgat/. If [ŋg] violates some surface level norm of well formedness, markedness will try to prohibit this structure from emerging in the phonetic level. This type of prohibition is expressed as the following:

(30)

*[ŋg
[ŋg] may not appear in word-initial position

However, as we have seen, any structural change involves some violation of faithfulness. The notion that all features of a given structure must be retained in the output structure is expressed as the following:

(31)

IDENT(ity) I/O
All features of the input must appear identically in the output.

The ranking of markedness, *[ŋg, over faithfulness, IDENT(ity) I/O, would permit some change to occur. On the other hand, the ranking of faithfulness over markedness would motivate EVAL to choose the candidate in which no structural change has been produced. Let us observe this process in the following tableau:

(32)
*[ŋg» IDENT(ity) I/O

Input: /ŋgat/

	*[ŋg	IDENT-I/O
☞a. ŋegat		*
☞b. gat		*
c. ŋgat	*!	
☞d. eŋgat		*

This hierarchy eliminates candidate (c) because it fatally violates the superior constraint of the hierarchy, illustrated by the “*”. The “!” indicates that this violation is **fatal,** in that it constitutes a violation of a highly ranked constraint and is therefore eliminated from the evaluation process.

As we can see, the optimal candidate in this tableau is not obvious given the constraint hierarchy. Candidates (a), (b) and (d) all satisfy the highly ranked *[ŋg. In OT, optimal outputs are denoted with the pointed finger “☞“. To arrive at the optimal output, refinements to this basic hierarchy are evidently necessary. Recall that *[ŋg only stipulates that this structure may not surface in the output, but makes no provisions for the necessary repair strategy.

However, this preliminary tableau illustrates a very important concept in OT; **all constraints may be violated**. The gravity of the violation is determined by the ranking of the constraints. The violation of a constraint should always be motivated by the desire to satisfy another, higher ranked constraint. In this tableau, all the candidates violate some constraint. However, candidates (a) ,(b) and (d) violate the inferior constraint in order to satisfy*[ŋg. Candidate (c) infringes the superior constraint, and is therefore eliminated as a possible optimal output.

Let us suppose that candidate (b) is the optimal candidate. This candidate eliminates the initial consonant of the illicit cluster [ŋg] in order to satisfy *[ŋg. Therefore we must assume that a constraint that prohibits segment deletion is ranked lowly, since it is violated by the optimal output. In OT, the constraint that prohibits the elimination of a segment appears in the following:

(33)

MAX(IMALITY)
Every segment in the input has a correspondent in output (no segment deletion).

Both candidates (a) and (d) insert a vowel [e] into the output to resyllabify the illicit structure provided by the input. This process is called epenthesis and is a common repair strategy in an array of different, unrelated languages. The constraint that prohibits epenthesis in OT is **DEP**(ENDENCY) and is formalized in the following example:

(34)

DEP(ENDENCY)
Every segment in the output has a correspondent in input (no segment insertion)

In our revised hierarchy, DEP must dominate MAX since its violation will eliminate the possibility that candidates (a) and (d) emerge optimal. Since all three of the possible optimal candidates present some structural change, we must assume that DEP and MAX will both dominate IDENT-I/O, since faithfulness correspondence is obviously less important in the optimal output than repairing an ill-formed structure before it has the opportunity to surface. Our revised hierarchy will appear as the following:

(35)
*[ŋg » DEP » MAX » IDENT(ity) I/O

The interaction of these constraints is illustrated in the following example (31):

(36)
Input: /ŋgat/

	*[ŋg	DEP	MAX	IDENT-I/O
a. ŋegat		*!		*
☞b. gat			*	*
c. ŋgat	*!			
d. eŋgat		*!		*

In our hypothetical case, candidate (b) is the optimal candidate. By eliminating the initial consonant, the illicit structure prohibited by the highest ranking constraint is circumvented. Although this candidate violates MAX, it does so in order to satisfy a higher ranked constraint, an important concession of conflict resolution. Candidates (a) and (d) also satisfy *[ŋg. However, in doing so they violate another relatively highly ranked constraint, DEP, which prohibits the insertion of segments which do not appear in the input.

This hypothetical case offers some noteworthy details into how OT operates. First, unlike rule-based paradigms, no change has been ordered. OT recognizes that there are a number of ways to arrive at the optimal output. In this case, deletion of the word-initial segment was desirable. In other languages, however, epenthesis may be the answer. This is no problem for OT, since the difference between an optimal output which deletes a segment and one that inserts a segment can easily be expressed by a simple restructuration of this basic hierarchy. In this way, OT analyses are decidedly grounded in universal tendencies and not in language-specific phenomena.

As we have seen, optimal outputs, and the phonological generalizations which motivate them, result from several intervening factors. On one hand, markedness wants all output candidates to adhere to the norms of well-formedness in a specific language. However, to a certain extent all languages tolerate some level of markedness (Kager, 1999). Faithfulness restricts markedness by requiring a strict input/output correspondence. OT considers these two concepts to be in a continuous state of conflict. Referring back to tableau (36) we see that the resolution of this conflict is attained by constraint satisfaction.

No changes are ordered in OT. This leads to a much greater amount of transparency with regards to the individual processes which intervene to affect an optimal output. If we consider for a moment how we might express the generalization presented in (36) from a rule-based paradigm, we might hypothesize a language-specific rule something to the effect of:

(37)

[ŋ]→Ø/ [___g

Indeed, this rule does accomplish the desired result, which is to express the structural transformation which occurs between the phonological and phonetic representations. However, there is no perceptible explanation as to what motivates this process to occur, nor why. In effect, rule-based paradigms are opaque in the sense that all the intervening factors which may influence the optimal output are obscured by rule ordering. OT's transparency is a major advantage in this regard.

1.4.1 Nasalization of Spanish vowels

Our task in this section is to express the generalization that oral vowels in Spanish become nasalized when preceding a nasal consonant from a constraint-based approach. Classical generative frameworks would propose the following rule to explain this process:

(38)

V [+sonant,-consonant]→ V [+sonant,-consonant, +nasal]/__C [+nasal]

This example orders a feature transformation from [-nasal] to [+nasal] in contexts preceding consonants marked for [+nasal]. This is a fairly straight-forward approach, if not overly simplistic.

As we have shown in the last section, OT does not order any change. Structural or feature transformations are the result of constraint satisfaction. To start off our analysis, we can already notice some immediate generalizations with regard to how our hierarchy will look. First, we can assume that our hierarchy will be dominated by some markedness constraint, since nasalized vowels involve a feature transformation which deviates from the underlying representation. Likewise, we may assume that faithfulness will assume an inferior role in this hierarchy since the optimal nasalized output indicates that the phonotactic tendency which leads to nasalization is a stronger force than the desire to maintain an exact replication of the input at the phonetic level.

With regards to markedness, our hierarchy will employ a dominant *contextual* constraint $*V_{ORAL}N$ (Kager, 1999). This constraint expresses the impossibility that an oral vowel followed by a nasal consonant can result optimal. This constraint will naturally dominate a ban on nasal vowels, *V_{nasal}, since this constraint is systematically violated by the optimal nasalized output. As well, this constraint expresses the fact that vowels in Spanish are oral, or rather, not nasal. In normal contexts in which vowels are not followed by a nasal consonant, the dominant ranking of this constraint will prohibit the emergence of an illicit nasal vowel. Consequently, both *V_{ORAL}N and *V_{nasal} must dominate a faithfulness constraint which seeks to maintain identical feature values for [nasal] in the output. This proclivity toward the maintenance of underlying feature values of the input in the surface representation will be expressed with IDENT-(nasal). Our constraint set is formalized in the following example:

(39)

*V_{ORAL}N
Oral vowels may not precede nasal consonants.

*V_{nasal}
Nasal vowels are prohibited.

IDENT-(nasal)
No feature deviation of [nasal] between input and output.

The hierarchy of these constraints appears in the following example (40):

(40)
V_{ORAL}N»[18]V_{NASAL}» IDENT-(nasal)

The interaction of these constraints can be observed in the following tableau:

(41)
Input: /flan/ (-*flan, -custard*)

	*V_{ORAL}N	*V_{NASAL}	IDENT-(nasal)
a. flan	*!		
☞ b. flãn		*	*

In this tableau, candidate (b) is the optimal output. Although this candidate violates *V_{NASAL} and IDENT-(nasal), it does so in order to satisfy *V_{ORAL}N, the dominant constraint of the hierarchy. This detail illustrates an interesting point of OT analyses. An optimal output only needs to satisfy more of the dominant constraints than the other competitors. Ultimately, it is not the **quantity** of violation marks which renders an output optimal, but rather the hierarchical position of the constraint being violated. An optimal output may accrue an infinite amount of violations of inferior constraints, as long as it does so in order to satisfy the dominant constraints, and it satisfies more of the dominant constraints than the other candidates. As we can observe, candidate (a) would win if the appraisal of optimality were left to the quantity of violation marks. Candidate (a), however, violates the dominant constraint of the hierarchy, and therefore cannot result optimal.

Another noteworthy point of this tableau, and of OT in general, is that this tableau delivers the same results regardless of the nasal condition of the input. Let us suppose for a moment that vowels in Spanish were nasal. The underlying nasal condition of an input /flãn/ would not change the results of this tableau in any way:

(42)

Input: /flãn /

	$*V_{ORAL}N$	$*V_{NASAL}$	IDENT-(nasal)
a. flan	*!		
☞ b. flãn		*	*

As we can see, candidate (b) is optimal regardless of the underlying representation from which it is derived. Candidate (a) still violates the dominant constraint of this hierarchy even though the input is modified. This point illustrates the surface-level orientation inherent to OT analyses, which is regarded as a major paradigmatic benefit in justifying phonological generalizations.

Although not initially obvious, this tableau is also capable of delivering the desired results in cases in which nasalized vowels do not emerge in the optimal output. Let us consider an input /sal/ (*salt*). Since the vowel in this phoneme string is not followed by a nasal consonant, the optimal output of /sal/ should be [sal], [a] being oral in this case. The following tableau is capable of justifying the maintenance of the underlying oral condition of the vowel in the surface representation:

(43)

Input: /sal/

	$*V_{ORAL}N$	$*V_{NASAL}$	IDENT-(nasal)
☞ a. sal			
b. sãl		*!	*

In this tableau, the output candidate which retains the oral feature of the input vowel is that which emerges optimal, candidate (a). In this case, the dominant constraint is inactive since it only exercises domain over contexts in which the input vowel is followed by a nasal consonant. Therefore, the decisive constraint in this case is the second highest constraint, $*V_{NASAL,}$ which bans nasal vowels.

Our analysis demonstrates a major advantage of constraint-based paradigms; many different processes can be explained by a single hierarchy. The previous hierarchy is capable of justifying both the transformation of oral vowels to nasal vowels in the appropriate context *and* the maintenance of oral vowels when the need arises. This represents a rupture from analyses of a generative ilk, since rules only explain transformation. If we consider again the rule we presented in (38), this advantage becomes more obvious:

(44)

V [+son,-cons]→ V [+son,-cons, +nasal]/__C [+nasal]

This rule simply explains that oral vowels become nasal when followed by a consonant marked for [+nasal]. In cases to the contrary, it is incapable of expressing the proclivity, expressed by faithfulness, toward maintaining a strict correlation between the phonological and phonetic levels. Even though no feature transformation occurs in the previous tableau (43), the inclination toward feature correlation is explicit and, a priori, hardwired into the analysis.

1.4.2 Spirantization of stop consonants

The voiced stops /b,d,g/ are realized as [β,ð,γ] in all contexts except when following nasals and word-initially after a pause. Additionally, the conversion of /d/ to [ð] is blocked following lateral [l]. In these exceptional cases, /b,d,g/ are realized as [b,d,g]. It should be clear that the voiced stops and their fricative counterparts interact in a state of complementary distribution. That is to say that [b,d,g] and [β,ð,γ] never appear in the same phonological context. This fact confirms the assertion that both the voiced stops along with their fricative correlates stem from one underlying, phonological unit, or phoneme. Essentially, each voiced stop produces two distinct allophones which emerge in different contexts.

We have mentioned that the allophones [β,ð,γ] are lenited, or more specifically, spirantized forms of [b,d,g]. Spirantization is defined from an articulatory point of view as "the reduction of the magnitude of stop gesture… to the point where closure is lost" (Kirchner, 1998). In OT, this reduction is understood as the result of a constraint hierarchy dominated by a universal phonotactic propensity which prefers consonants to be produced with minimal articulatory exertion. In descriptive terms, spirantization involves a feature transformation of [-continuous] to [+continuous] between the input and output.

Although our analysis is restricted here to Spanish, it should be noted that spirantization is a common synchronic process in several non-related languages. Rule-based paradigms are incapable of conveying this idea. Let us consider once more the rule we presented earlier:

(45)

d→ð/V___

Again, there is nothing incorrect about the rule itself. In fact, it does seem to illustrate the essence of the procedure. Nevertheless, we could modify this rule so that spirantization of the other voiced stops is also expressed:

(46)

[+C,-S, +voice]→[+C,-S, +voice, **+continuous**] / V___

This rule orders the inclusion of the feature [+continuous] in contexts following vowels. The problem is that the phonological stimulus that produces the optimal output is hidden, or simply is not expressed, in the rule itself. Basically, rules of this type describe the procedure while discarding the motivation for the process.

If we recall, OT does not impose structural changes. Any transformation between input and output is the result of a dominant markedness constraint in a constraint hierarchy. In our case of voiced stop spirantization in Spanish, we can assume that markedness dominates faithfulness since a structural change occurs between the phonological and phonetic levels.

Kirchner's (1998) functional model of articulatory effort demonstrates that the fricatives [β,ð,γ] require an inferior amount of articulatory exertion to produce than their [-continuous] stop counterparts. Cross-linguistically, we see a patent tendency toward the production of less effortful consonants in certain phonological positions. In OT terms, this tendency is expressed by way of a markedness constraint LAZY. This constraint is formalized in the following example (Kirchner, 1998):

(47)

LAZY
Reduce articulatory effort.

Notwithstanding, faithfulness always prefers that outputs be identical to their input correspondent. In order for an output to satisfy LAZY, it must incur some violation to faithfulness since full correspondence is ruptured. We pointed out earlier that spirantization involves the alteration of the feature value [continuous] from negative to positive between the phonological and surface levels. Consequently, our constraint hierarchy must include a correspondence constraint which seeks to ban the modification of feature values for [continuous] between the input and output. We can achieve this by programming IDENT I/O to specifically treat the value for [continuous]. Our constraint set appears in the following example:

(48)

IDENT-I/O$_{(cont)}$

No feature deviation of [continuous] between input and output.

Our constraint hierarchy is illustrated in the following example:

(49)

LAZY»IDENT-I/O$_{(cont)}$

Their interaction can be observed in tableaux (50), (51) and (52)

(50)

/d/	LAZY	IDENT-I/O$_{(cont)}$
a.[d]	*!	
☞ b.[ð]		*

(51)

/g/	LAZY	IDENT-I/O$_{(cont)}$
a.[g]	*!	
☞ b.[ɣ]		*

(52)

/b/	LAZY	IDENT-I/O$_{(cont)}$
a. [b]	*!	
☞ b.[β]		*

These tableaux, 50-52, express the fact that consonants which require a less amount of articulatory effort are desirable, while at the same time, a strict correspondence with respect to [continuous] is also favorable. Since LAZY dominates IDENT-I/O$_{(cont)}$ change will occur, but not without remonstration. However, LAZY is context-free in the sense that its effects may emerge in any consonant. To restrict LAZY such that its effects may only surface in voiced stops, we must supply further provisions to our basic hierarchy. Moreover, we must program a constraint which preserves the place of articulation of the debilitated consonant since phonetic zero, [Ø], or total segment deletion, satisfies LAZY as well.

To restrict spirantization to voiced stops, we can specify LAZY to only take effect in consonants marked [+Con, -Son,+ voice]. We will formalize this constraint as the following:

(53)

LAZY$_{[\text{voiced stops}]}$
Reduce articulatory effort in voiced stops

In order to avoid total segment deletion, or debilitation to a divergent segment, we must order a faithfulness restriction, IDENT$_{(place)}$, which maintains underlying place features in the optimal output. Since this constraint is never violated in the optimal output, we can assume it occupies a dominant position in our hierarchy. A revised version of our original schema appears in the following:

(54)

IDENT$_{(place)}$»LAZY$_{[voiced\ stops]}$» IDENT-I/O$_{(cont)}$

Their interaction is illustrated in the following tableaux:

(55)
Input: /kada/ (*each*)

/kada/	IDENT$_{(place)}$	LAZY$_{[voiced\ stops]}$	IDENT-I/O$_{(cont)}$
a.[kada]		*!	
☞b.[kaða]			*
c.[kaØa]	*!		

(56)
Input: /lago/ (*lake*)

/lago/	IDENT$_{(place)}$	LAZY$_{[voiced\ stops]}$	IDENT-I/O$_{(cont)}$
a.[lago]		*!	
☞b.[laγo]			*
c.[laØo]	*!		

(57)
Input: /kaba/ (*sparkling wine*)

/kaba/	IDENT$_{(place)}$	LAZY$_{[voiced\ stops]}$	IDENT-I/O$_{(cont)}$
a. [kaba]		*!	
☞b.[kaβa]			*
c.[kaØa]	*!		

These tableaux, 55-57, restrict LAZY such that its effects are limited to a specific context. In so doing, we can properly explain how spirantization of the Spanish voiced stops occurs without having to impose the change itself. The previous hierarchy expresses the generalization that debilitation of voiced stops is desirable in certain contexts. However, debilitation may only occur as long as place features of the input are retained in the optimal output. The inferior faithfulness constraint makes clear that spirantization is not favorable, yet due to its low ranking in the hierarchy, this constraint does not have an active role in determining the optimal output.

Now, we have provided a sound justification based on conflict resolution for voiced stop spirantization in Spanish. However, we must now focus our attention on explaining why in certain instances, this process is prohibited. We have seen that nasal consonants, pauses and [l] may prevent stop spirantization. Previous studies have programmed this generalization into their justifications by simply specifying the individual components which ban spirantization. For example, it is not uncommon to see generalizations such as "after [l]", or "after nasal consonants", etc. This rationalization, however, avoids a very important generalization of spirantization, which is that place assimilation of the preceding nasal, or [l], is responsible for blocking debilitation of the voiced stops in Spanish by way of a dominant constraint which requires nasals and [l] to share one place of articulation with the consonant that follows. The fact that both [l] and nasals become marked for [-continuous] as a result of this place assimilation, blocks any feature value transformation for [continuous] in /d/.

Phrase initially is another case altogether. In word-initial position after a pause, consonants do not debilitate since spirantization is the result of the rightward spreading of the positive feature value for [continuous] from the contiguous preceding vowel. Since there is no vowel, debilitation will not occur.

We can easily formalize these last two generalizations into an OT framework. Basically, our conflict resolution involves a constraint, $\text{AGREE}_{\text{(continuous)}}$ (based on Baković, 2000), which requires that consonant sequences agree on one feature value for [continuous]. Secondly, we must restrict this constraint with a faithfulness constraint, ONSET-IDENT(cont), such that only the first consonant, <u>C</u>C, may alter its feature value for [continuous].

(58)

AGREE-CONT(inuous)
Contiguous nasal+consonant and lateral+consonant clusters must have one feature value for [continuous].

(59)

ONSET-IDENT(continuous)
Onset consonants must retain input specifications for [continuous] in the output.

These constraints express the notion that only one feature specification for [continuous] is permitted, and this value is determined by the input condition of the second consonant of the sequence. In this way, we circumvent having to postulate two separate conditions, one for nasals and another for [l], in order to forbid debilitation. Moreover, these constraints express a universal correlation between assimilation and the ban on stop spirantization. In some Proto-Bantu languages from the Niger-Congo African language family, for example, spirantization of /b/ is systematically blocked before [m] (Kirchner, 1998). Since [m] and [b] must agree on one value for [continuous], and this value is determined by the input specification [-continuous] of /b/, spirantization of the labial stop is effectively prohibited. In Tümpisa Shoshone (Dayley, 1989), [β] is banned from appearing after [m], for the same reason. In Catalán, we see an identical process in which [ð] cannot appear after [l] or [n], both of which assimilate [-continuous] from [-continuous] /d/ (Hualde, 1992). Many more examples can be given.

To justify the ban on spirantization in word-initial position following a pause, we can hypothesize the following context sensitive, or local, markedness constraint:

(60)

[ONS-COND $_{\text{(for voiced stops)}}$
Spirantization is banned following a pause.

Again, a brief survey of the literature on spirantization suggests that this constraint represents a universal disinclination toward word-initial spirantization following a pause. Ladakhi, a Sino-Tibetan language (Koshal, 1976), Catalán (Hualde, 1992), and Taiwanese (Hsu, 1995) all have similar bans prohibiting spirantization of voiced stops in identical phonological contexts.

In the following tableau (62), [ONS-COND will occupy the superior hierarchical position since spirantization never surfaces following a pause. We can assume that both AGREE-CONT and ONS-IDENT(cont.) will occupy superior positions as well in tableaux (63) and (64), as they are never violated by the optimal output. An amended version of our original hierarchy will appear as the following:

(61)
(AGREE-CONT » ONS-IDENT(cont.)) » [ONS-COND » $\text{IDENT}_{(\text{place})}$ » LAZY[voiced stops] » $\text{IDENT-I/O}_{(\text{cont})}$

The interaction of these constraints appears in the following tableaux:

(62)
Input: /beso/ (*kiss*)

/beso/	[ONS-COND	$\text{IDENT}_{(\text{place})}$	LAZY[voiced stops]	$\text{IDENT-I/O}_{(\text{cont})}$
☞ a.[beso]			*	
b.[βeso]	*!			*
c.[peso]			*!	

(63)
Input: /alkalde/ (*mayor*)

/alkalde/	AGREE-CONT	ONS-IDENT(cont.)	$\text{IDENT}_{(\text{place})}$	LAZY[voiced stops]	$\text{IDENT-I/O}_{(\text{cont})}$
☞ a.[alkal̪de]				*	
b.[alkal̪ðe]	*!	*			*
c.[alkalØe]			*!		

(64)
Input: /angula/ (*eel*)

/angula/	AGREE-CONT	ONS-IDENT(cont.)	$IDENT_{(place)}$	LAZY[voiced stops]	$IDENT\text{-}I/O_{(cont)}$
☞ a.[aŋgula]				*	
b.[aŋɣula]	*!	*			*
c.[aŋkula]				*!	

In tableaux (62-64), the candidates with voiced stops which maintain a negative feature value for [continuous] are those which result optimal, candidates (a). In all the tableaux, the retention of the negative feature value for [continuous] satisfies the superior restrictions of the hierarchy, which either ban spirantization altogether, as in tableau (62), or require double consonant sequences to agree upon one feature value for [continuous]. In tableau (62), the sub-optimal output (b) violates the ban on spirantization after a pause by presenting an output which begins with the spirantized [β]. In tableaux (63) and (64), the candidates (b) are eliminated for proposing an output in which the double consonant sequences manifest two different feature values for [continuous], a sub-optimal strategy.

1.4.2.1 Sprirantization of voiceless stops

The non-standard[19] spirantization of voiceless stops can also be justified using a similar hierarchy. In these cases, there is no surface level distinction between the voiceless stop segments, /p,t,k/, and their voiced counterparts /b,d,g/ To refresh our

[19] We use *non-standard* to mean that this form deviates from the accepted form of most educated speakers of a middle socio-economic status. This term should not be considered synonymous with the term *incorrect*.

memories, let us contemplate the data presented in (19):

(65)
Sonorization of voiceless stops[20]

cápsula	[káβsula] *(capsule)*	atlas	[aðlas]	*(atlas)*
atleta	[aθleta] *(athlete)*	ritmo	[riðmo]	*(rhythm)*
eclipse	[ekliβse] *(eclipse)*	étnico	[éðniko]	*(ethnic)*
inepcia	[ineβθja] *(ineptness)*	atmósfera	[aðmósfeɾa]	*(atmosphere)*
apto	[aβto] *(apt)*	actor	[aɣtóɾ]	*(actor)*
		acción	[aɣθjón]	*(action)*
		examen	[eɣsámen]	*(exam)*

(Alarcos Llorach, 1964)

This data indicates a ban on voiceless codas marked for [-continuous]. In certain dialects of Andalusian Spanish, a related ban is extended to affect all oral codas, causing near neutralized forms of syllable-final aspirated forms: *resto*→*re*[h]*to*, *re*[k]*to*→*re*[h]*to* (Morris, 2000; Gerfen and Hall, 2001). By specifying a condition which restricts codas to only consonants marked for [+continuous], we can easily justify this form of lenition:

(66)

$*\text{CODA}_{[\text{-continuous}]}$[21]
Codas must be [+continuous]

Next we must program two constraints to restrict the illicit conversion of voiceless stops to other undesirable continuous consonants. We can do this by specifying conditions for place of articulation and feature values for [continuous] into our faithfulness constraint IDENT:

(67)

$\text{IDENT-I/O}_{(\text{cont})}$
No feature deviation of [continuous] between input and output.

---

[20] We must make note of the fact again that this style of speech is not standard in Madrid. Often it occurs in fast, informal speech.

[21] We could have programmed a constraint, LAZY, to motivate the same results.

(68)

IDENT-I/O$_{(place)}$
No feature deviation of [place] between input and output.

We can assume that any hierarchy which produces these non-standard forms will be dominated by *CODA$_{[-continuous]}$. This is expressed in the following hierarchy:

(69)

*CODA$_{[-continuous]}$» IDENT-I/O$_{(cont)}$» IDENT-I/O$_{(place)}$

Their interaction can be observed in the following tableau:

(70)
Input: /actor/

/aktor/	*CODA$_{[-continuous]}$	IDENT-I/O$_{(cont)}$	IDENT-I/O$_{(place)}$
a. a[k]tor	*!		
☞ b.a[γ]tor		*	

In this tableau, conflict is resolved by leniting the voiceless stop /k/ to a consonant marked for [+continuous], [γ]. To satisfy faithfulness, candidate (a) is forced to violate the ban on consonants marked for [-continuous] in the output. Candidate (b) is the optimal candidate since it presents a voiced consonant, although at the cost of violating faithfulness.

As we have seen in all of our cases, the superior ranking of markedness always produces some sort of structural or featural transformation. We have shown that by restricting the effects induced by LAZY, we can offer a satisfactory account of voiced stop spirantization in Spanish.

One of the major benefits of OT analyses is that hierarchies explain, and not merely demonstrate, a given process. Moreover, the explanation provided is universal. Let us consider again the hierarchy which we presented in (54):

(71)

IDENT$_{(place)}$» LAZY[voiced stops]»IDENT-I/O$_{(cont)}$

We demonstrated that this hierarchy expresses the notion that, although spirantization is desirable, so too, is maintaining certain underlying features of the input. We have shown that these tendencies ranked appropriately can explain the process of spirantization in Spanish. However, there is a more profound benefit to this analysis which we have not yet mentioned. As we can observe in the following tableau (72), the hierarchy we have proposed is not only capable of justifying the process of spirantization in Spanish, but rather serves as a functional explanation of spirantization in a number of different languages. Let us observe what happens if we insert an example from Sardinian, an Italic-Romance language spoken in Sardinia, into our hierarchy. In this language, spirantization occurs in a similar phonological context:

(72)

Input: /logu/ (*later*)

/logu/	$IDENT_{(place)}$	LAZY[voiced stops]	$IDENT\text{-}I/O_{(cont)}$
a.[logu]		*!	
☞b.[loγu]			*
c.[loØu]	*!		

As we can notice, this hierarchy is blind to individual languages. Essentially, the hierarchy explains the process of spirantization independently of which languages it might effect. In light of this fact, we can claim that OT analyses express a much greater amount of universality than rule-based models. This universality leads us to make more profound generalizations with regards to the independent development of the Romance phonologies and the processes which have shaped them.

If we consider an example from French, in which spirantization of voiced stops does not occur, we can see a very interesting divergence within the Romance languages on this point of stop spirantization. First we must make a minor alteration to our hierarchy to express the fact that spirantization does not occur in the optimal ouput. We can do this by restructuring our hierarchy such that $IDENT\text{-}I/O_{(cont)}$ dominates LAZY, as in the following example:

(73)

$IDENT_{(place)}$» IDENT-$I/O_{(cont)}$ »LAZY[voiced stops]

The interaction of the constraints in this hierarchy will produce the following optimal output:

(74)
Input: /abit/ (*habite*, 1st and 3rd p. sing. *habiter*) (*live*)

/abit/	$IDENT_{(place)}$	IDENT-$I/O_{(cont)}$	LAZY[voiced stops]
☞ a.[abit]			*!
b.[aβit]		*!	
c.[aØit]	*!	*	

In this tableau, the output with the spirantized segment, candidate (b), results sub-optimal. Candidate (a) violates LAZY, but due to LAZY's demotion in the new hierarchy, this does not constitute a fatal violation. Taking this information into account, we can begin to formalize an interesting generalization with respect to the independent evolution of the Romance phonologies. We can claim that the differing grade of LAZY's dominance within the phonological systems of the Romance languages is one of the defining features which led to the autonomous development of the individual languages. Spanish, Portuguese, Catalán, Sardinian, and others prefer to spirantize the voiced stops in certain phonological contexts, while French does not. And although this generalization may in itself seem insignificant, it forms part of a bigger picture with regards to the diachronic processes which have had influence on the phonological development of the Romance languages. The universal character of OT renders this strikingly clear.

1.4.3 Sonorization and devoicing

Sonorization, or voicing, implies simultaneous, passive vocal chord vibration caused by vocal tract expansion from the maintenance of trans-glottal pressure (Alonso-Cortés, 2002). Some voiced forms of Spanish consonants constitute individual phonemes, as in the /p/-/b/ opposition. We know these are separate phonemes because they form minimal pairs: *pino*/*vino*. Synchronic voicing, on the other hand, is responsible for the /s/ →[s̬] and /θ/ → [ð] oppositions preceding voiced consonants. In these cases, we can be sure that [s̬] and [ð] are allophonic dependents of underlying /s/ and /θ/ since there is no lexical distinction made by substituting [s̬] and [ð] for [s] and [θ]: mi[s]mo/mi[s̬]mo, pa[θ]guato/pa[ð]guato.

In contexts preceding voiced consonants, /s/ is realized as [s̬] in syllable-final, or coda position, both word-internally and across prosodic boundaries. Let us reconsider the data we presented in (20):

(75)

Sonorization of /s/ before voiced consonants

/s/ before voiceless consonants		/s/ before voiced consonants		
susto	[sústo] *(scare)*	desde	[des̬ðe]	*(since)*
atmósfera	[atmósfera] *(atmosphere)*	mismo	[mís̬mo]	*(same)*
espejo	[espéxo] *(mirror)*	cisne	[θís̬ne]	*(swan)*
escena	[esθéna] *(scene)*	resbalar	[res̬βalár]	*(to slip)*
mosca	[móska] *(fly)*	resguardar	[res̬ɣwárðaɾ]	*(to preserve)*
		más leve	[mas̬leβe]	*(more trivial)*
		Israel	[is̬rael]	*(Israel)*

We have seen that voicing of /θ/ occurs in the same phonological context:

(76)

Sonorization of /θ/ before voiced consonants

/θ/ before voiceless consonants			/θ/ before voiced consonants		
mízcalo	[míθkalo]	*(milk mushroom)*	gaznápiro	[gaðnápiɾo]	*(bumpkin)*
mezquita	[meθkita]	*(mosque)*	pazguato	[paðgwato]	*(dolt)*
izquierda	[iθkjerda]	*(left)*	jazmín	[xaðmín]	*(jazmine)*
mozcorra	[moθkorra]	*(harlot)*	juzgar	[juðɣaɾ]	*(to judge)*
pizpireta	[piθpireta]	(*brisk*)	lezda	[maðnaɾ]	*(to knead)*
			lezna	[leðna]	*(awl)*

We proposed that this process results from a paradigm of conflict resolution in which a phonotactic tendency causes voiceless /s/ and /θ/ to be realized as [s̬] and [ð] respectively due to the passive vibration of the vocal chords in anticipation of the following voiced consonant. At the same time, correspondence principles seek to maintain full underlying feature specification for any given element of the input.

We can treat this process easily from an OT perspective by stipulating a dominant markedness constraint, AGREE(voice), which forces two contiguous consonants to agree on one value for [voice] in the optimal output. This constraint is formalized in the following manner:

(77)

AGREE(voice)
Contiguous consonants must share the same value for voice.

Again, by stipulating a proviso which prohibits feature transformations in the second consonant of a double consonant cluster, ONS-IDENT$_{\text{(voice)}}$, we can construct a preliminary hierarchy which treats voicing of syllable-final /s/:

(78)

ONSET-IDENT(voice)
Onset consonants must retain input specifications for [voice] in the output.

Since faithfulness is violated by the optimal output, we should consider IDENT$_{\text{[voice]}}$ to be dominated by AGREE(voice):

(79)

AGREE(voice) » ONS-IDENT$_{(voice)}$, IDENT$_{(voice)}$

We can observe the interaction of these two constraints in the following tableau:

(80)

Input: /desde/

/desde/	AGREE(voice)	ONS-IDENT$_{(voice)}$	IDENT$_{(voice)}$
a. de[s]de	*!		
☞ b.de[s̬]de			*

Candidate (a) commits a fatal violation of the dominant constraint since voiceless [s] emerges before a voiced consonant. Candidate (b) avoids this violation by converting voiceless /s/ to a voiced sibilant [s̬], an optimal strategy.

The following tableau offers an example of /θ/ voicing using an identical constraint hierarchy:

(81)

Input: /xaθmin/

/xaθmin/	AGREE(voice)	ONS-IDENT$_{(voice)}$	IDENT$_{(voice)}$
a. xa[θ]min	*!		
☞ b. xa[ð]min			*

Again, candidate (a) commits a fatal violation of AGREE upon maintaining the input value for [-voice] in the output preceding the voiced nasal. The optimal candidate (b) presents voiced [ð], satisfying the dominant constraint at the cost of violating faithfulness.

It is clear that conflict resolution has no trouble expressing that the optimal voiced outputs emerge as a result of two opposing forces; a phonotactic tendency causing spontaneous voicing and a specific desire to maintain all features of the underlying structure. Now, we must turn our attention to the devoicing of voiced stops in word-final position. It should be mentioned that although we will only treat the devoicing of voiced stop [d], the hierarchy we present is effective for all voiced stops. However, as patrimonial Spanish words do not end with [g] or [b], it would prove to be a fruitless venture to expand on the devoicing of illicit word-final segments.

We have mentioned that this type of neutralization is a common phenomenon in many languages and is probably the result of a slight vocal fold contraction which consequently causes a drastic reduction in sub-glottal pressure in expectation of word-final breathing (Kirchner, 1998). In Guayabero, a Guahiban language spoken in Colombia, /d/ lenites to [θ] in the same phonological context as in Spanish (Keels, 1985). In Dutch, all voiced obstruents are banned in word-final position. Hence, underlying /d/ surfaces as [t]. Certain voiced consonants of RP English are also known to experience this process in word-final position (Hughes and Trudgill, 1996). In the Spanish of Madrid, Spain, devoicing occurs in the following phonological context:

(82)

Devoicing of word-final consonants in Spanish[22]

Madrid	[madriθ]	(*Madrid*)
libertad	[liβeɾtáθ]	(*liberty, freedom*)
virtud	[biɾtúθ]	(*virtue*)
usted	[ustéθ]	(*you, 3rd person singular formal*)

We can justify this process by programming a constraint which bans all voiced stops and approximates in word-final position,*VOICE-CODA(stops/approximates)]. A close examination of the allophonic inventory of Spanish, however, will show that devoicing is only plausible in voiced stops, since the other permissible voiced word-final segments, [n,r,l], have no voiceless counterpart in Spanish, and logically cannot be affected by such a ban unless left unpronounced:

[22] Devoicing is in fact a type of lenition by which consonants marked for [+voice] become [-voice]. We offer a generative style rule like the following to describe this process: /d/ [-cont., +voice]→[θ] [+cont., -voice] /___#.

(83)

*VOICE-CODA$_{(stops)}$][23]
*Word-final stops [+voice].

This constraint, ranked above IDENT$_{(voice)}$ and IDENT$_{(place)}$, expresses the notion that voiced coda segments are permissible, but not at word boundaries. By specifying that this constraint may only affect voiced stops and approximates, it will not be able to influence acceptable word-final consonants such as /s, r, n, θ, l/. Additionally, we will have to express the fact that spirantization of the final voiced stop is tolerable even though [+voice] is banned. We can accomplish this by including a markedness constraint ordering spirantization, LAZY-CODA. This proposition is justified since [θ] requires less articulatory effort to produce than [d] (Kirchner, 1998). Since no optimal output maintains negative feature values for [continuous] in this case, we should assume LAZY to occupy a relatively superior position in our hierarchy.

Our constraint set is offered in the following example:

(84)

*VOICE-CODA$_{(stops)}$][24]
Word-final voiced stops and/or approximants are prohibited.

LAZY-CODA
Reduce articulatory effort of syllable-final segments.

IDENT$_{(voice)}$
No feature deviation of [voice] between input and output.

IDENT$_{(place)}$[25]
No feature deviation of [place] between input and output.

These constraints will assume the following positions in our hierarchy:

---

[23] We could just as well have specified that voicing may only take place word-internally, instead of introducing a ban on word-final voicing. Had we done so, we would still have had to specify a constraint then that devoicing may only effect word-final codas. Both models would function and ultimately the difference between the two paradigms is trivial in the final result.

[25] This constraint, although present, does not appear in all tableaux since place identity is respected in most of the cases. However, in cases in which the optimal output is affected by this constraint, we do include it in the constraint hierarchy.

(85)
*VOICE-CODA$_{(stops)}$]» LAZY-CODA» IDENT$_{(voice)}$» IDENT$_{(place)}$

Observe their interaction below:

(86)
Input: /birtud/

/biɾtud/	*VOICE -CODA$_{(stops)}$]	LAZY-CODA	IDENT$_{(voice)}$	IDENT$_{(place)}$
☞ a.[biɾtuθ]			*	*
b.[biɾtud]		*!	*	
c.[biɾtuð]	*!			*

In this hierarchy, candidate (a) is optimal since it satisfies both of the superior constraints while committing only negligible violations of IDENT, the inferior constraints. LAZY-CODA is satisfied by [θ] since this consonant requires less articulatory effort to produce than [d]. Candidate (b) maintains full faithfulness to the input representation, but does so at the cost of incurring a fatal violation of LAZY-CODA, which requires that codas be realized with minimal articulatory exertion. Similarly, candidate (c) allows spirantization but at the same time retains voice, thus causing a fatal infraction of *VOICE -CODA$_{(stops)}$].

The hierarchies we have presented in this section demonstrate an interesting and recurring trend in Spanish Phonology; syllable-final consonants, or codas, are acutely constrained. By composing a hierarchy of minimal constraints, we are able to express the phonological generalizations of both sibilant and /θ/ sonorization before a voiced consonant. We have shown that upon programming a markedness constraint, AGREE, which requires that medial consonant clusters agree on one feature value for [voice], leftward-spreading feature assimilation of [+voice] can be motivated. Of course, this transformation, as well as all feature deviations, was met with conflict. In response, we programmed two inferior faithfulness constraints which objected to any feature divergence between the input and output representations. As we observed, the superior ranking of markedness over faithfulness proved to be a decisive strategy in resolving this conflict, in favor of internal structural transformation of the phonological unit.

Subsequently, we offered a brief explanation of the process of word-final devoicing in Spanish, which we based on the concept that position-specific constraints can shape phonological patterns at syllable margins. We conclude that the flexible nature of OT's hierarchies, along with the universal character of the individual constraints, offers a satisfactory justification for coda devoicing which obliges the cooperation of an abundant quantity of phonological generalizations not readily perceivable in rule-based models.

In chapters 3 and 4 we delve deeper into the phonological patterns which occur at syllable boundaries. We will illustrate how phonological constraints influence syllabification in Spanish and, conversely, how syllable structure can mold the phonological constituents which appear at syllable margins.

1.4.4 Place Assimilation

In Spanish, nasal consonants, and laterals to a more restricted degree, integrate the place of articulation of the consonant they precede:

(87)

Place assimilation of Spanish nasals

UR		SR	Generalization
u/n/ beso	(*kiss*)	u[m] b̲eso	[n] becomes [m] preceding bilabial [b].
u/n/ peso	(*scale*)	u[m] p̲eso	[n] becomes [m] preceding bilabial [p].
u/n/ faro	(*lamp*)	u[ɱ] f̲aro	[n] becomes [m] preceding labial-dental [f].
u/n/ tiro	(*shot*)	u[n̪] tiro	[n] becomes dental before [t].
u/n/ yate	(*yacht*)	u[ɲ] yate	[n] becomes [ɲ] before palatal [ʝ̞/ d͡ʝ̞].
u/n/ gato	(*cat*)	u[ŋ] gato	[n] becomes [ŋ] before velar [g].

(88)

Place assimilation of [l]

UR		SR	Generalization
e/l/ tío	(*the uncle*)	e[l̪] [t̪]ío	[l] becomes dental before [t̪].
e/l/ día	(*the day*)	e[l̪] [d̪]ía	[l] becomes dental before [d].
e/l/ niño	(*the boy*)	e[l] niño	[l] becomes alveolar before [n].
e/l/ llavero	(*the keychain*)	e[ʎ] llavero	[l] becomes palatal before [ʝ̞ / d͡ʝ̞].

Rule-based paradigms understand this process, like all the processes we have seen up to this point, as a procedure by which some feature from the phonological environment **spreads** to another segment in the triggers' environment. With regard to nasal assimilation, this process is expressed by the following rule (Harris, 1984a):

(89)

$$[+\text{nasal}] \rightarrow \begin{bmatrix} \alpha\ \text{coronal} \\ \beta\ \text{anterior} \\ \mu\ \text{distributed} \\ \delta\ \text{back} \end{bmatrix} \ / \ \_\_ \begin{bmatrix} +\text{consonant} \\ \alpha\ \text{coronal} \\ \beta\ \text{anterior} \\ \mu\ \text{distributed} \\ \delta\ \text{back} \end{bmatrix}$$

This type of ordered rule flouts Okham's general assumption that, given the choice between two equally effective models, the desirable theoretical prototype is that which proves simplest. As one can perceive, this rule expresses little more than what we have provided up to this point in our analysis concerning place assimilation; nasals take on the place of articulation of the following consonant. Ostensibly, why and how this process occurs seems unimportant in rule-based models.

Cressey (1978) offers an almost identical explanation with the exception of excluding individual aspects of [place] and grouping them all under the guise of PA, point of articulation (Cressey, 1978):

(90)

$$[+\text{nasal}] \rightarrow [\alpha\ \text{PA}]\ /\ \_\_\_\ \begin{bmatrix} +\text{cons} \\ \alpha\ \text{PA} \end{bmatrix}$$

These rules consider that nasals appearing in the rhyme are not specified for place of articulation. This empty feature is thus filled in by feature spreading from the following contiguous consonant. Regardless, the revisions made in this modified version seem to be a matter of implementation, which still avoid any sound explanation as to the process of assimilation itself. However, the advantageous part of this rule is that it is expressed in terms of universal principles and is equally applicable in a large range of languages.

In OT, assimilation is seen as the result of two conflicting types of constraints. On one hand, markedness constraints seek to restructure the internal configuration of place features of nasal consonants so that their point of articulation matches that of the following contiguous consonant. From an articulatory perspective, place assimilation can be seen as an effort to reduce the articulatory exertion involved in producing a sequence of segments. The conversion /n/ to [m] before labials saves an additional movement of the tongue blade. Thus, full place specification for [n] is lost in anticipation of the following bilabial, the whole while reducing articulatory effort. We can express this notion by programming a highly ranked markedness constraint, AGREE-PA (Baković, 2000), which forces the consonantal cluster which appears in the optimal output to agree on one feature for [place]. This is notably an economical option.

On the other hand, faithfulness constraints seek to preserve all underlying components of the input, or underlying representation, in the output. As we have seen before, IDENT constraints are responsible for maintaining underlying feature values in the output. By specifying that we want to retain place of articulation, IDENT(place) will penalize any output candidate which proposes a deviant place feature aside from the one introduced by the input.

Our analysis contends that assimilation results from a highly ranked markedness constraint, AGREE-PA, which requires nasal+consonant and lateral+consonant clusters to converge on one mutual place of articulation. Next, a context specific faithfulness constraint ONSET-IDENT(pa) which specifically targets syllable initial, or onset, consonants prohibits place feature transformations in pre-nuclear segments. In other words, in sequences of [np], [p] cannot change to accommodate AGREE-PA; it must be the nasal. Naturally, satisfaction of AGREE-PA violates an identity constraint, IDENT-PA, which seeks to maintain the place features of the input at the phonetic level. Obviously, since place assimilation occurs, we can assume that this constraint occupies the inferior position of our hierarchy. The complete constraint set we will employ in our justification of nasal place assimilation is offered in the following:

(91)
Constraint set for nasal assimilation

AGREE-PA
Contiguous nasal+consonant clusters must have one place of articulation.

ONSET-IDENT(pa)
Onset consonants must retain input specifications for place in the output.

IDENT-PA
Input specifications for place of articulation must be retained in the output.

Our hierarchy will appear as the following:

(92)

AGREE-PA » ONSET-IDENT(pa) » IDENT-PA

The interaction of these constraints can be observed in the following tableau:

(93)
Input: /un+policia/

	AGREE-PA	ONSET-IDENT(pa)	IDENT-PA
☞ a. u[m+p]olicía			*
b. u[n+p]olicia	*!		
c. u[ŋ+p]olicia	*!		*
d. u[n+t]olicia		*!	*

In this tableau, candidate (a) is the optimal output since the nasal and following bilabial stop share one point of articulation. Critically, it is the nasal, and not the bilabial, which undergoes featural transformation, satisfying ONSET-IDENT(pa). Of course, this transformation violates IDENT-PA, but this does not count as a fatal violation due to the inferior ranking of this last constraint.

In contrast, candidates (b) and (c) both fatally violate AGREE-PA since the nasal and following bilabial have two points of articulation. Candidate (c) also violates IDENT-PA since underlying alveolar /n/ has converted to velar [ŋ] in the output. Candidate (d) presents an interesting point, which is that AGREE-PA is also satisfied by feature coalescence of the bilabial to the place of articulation of the underlying nasal. Notwithstanding, ONSET-IDENT(pa) penalizes this conversion and suitably eliminates this candidate from the evaluation process.

Earlier we indicated that laterals as well undergo a similar, yet more restricted, process of place assimilation in Spanish. If we inserted the cluster [l+p], (for example, *el policia*, Eng. *the police officer*), into the previous example using this same basic hierarchy, all candidates would come out sub-optimal since bilabial laterals simply do not exist. We would see a similar predicament when /l/ precedes velar consonants, although rare languages in Papua New Guinea do have velar laterals (Ladefoged, 1982; 156). Hualde (1991) formalizes the following generalizations to deal with these difficulties:

(94)

i. A segment X cannot bear both [labial] and [lateral]. (Universal)
ii. A segment X cannot bear both [dorsal] and [lateral]. (Near universal)

We can easily adjust these observations to form markedness constraints for our analysis. With regard to (94i), we propose a constraint, *LAB(ial)-LAT(erals), which, ranked dominantly, will block place assimilation before labial consonants due to the phonetic impossibility of having to produce such a segment. The second constraint we must program is *DOR(sal)-LAT(eral). This restriction may be more complicated to justify since dorsal laterals do indeed exist. However, we could consider this constraint to be a language-specific ban on dorsal-lateral consonants; an obvious possibility in a majority of the world's languages. We can achieve this language-specific ban by ordering *DOR(sal)-LAT(eral) to a dominant hierarchical position so that its violation will eliminate the structure as sub-optimal. Accordingly, this explanation substantiates the scarcity of dorsal laterals in phonological systems in a vast majority of the world's languages:

(95)

*DOR-LAT
No dorsal laterals

Additionally, we must make a provision for lateral assimilation in our constraint, AGREE-PA, which obliges two contiguous consonants to have one place of articulation:

(96)

AGREE-PA
Contiguous nasal+consonant and lateral+consonant clusters must have one place of articulation.

Our revised constraint set will appear as the following:

(97)

*LAB-LAT
No labial laterals

*DOR-LAT
No dorsal laterals

AGREE-PA
Contiguous nasal+consonant and lateral+consonant clusters must have one place of articulation.

ONSET-IDENT(pa)
Onset consonants must retain input specifications for place in the output.

IDENT-PA
Input specifications for place of articulation must be retained in the output.

These constraints will interact in the following hierarchy:

(98)

*LAB-LAT»*DOR-LAT»AGREE-PA»ONSET-IDENT(pa)»IDENT-PA

Observe their interaction in the following tableau:

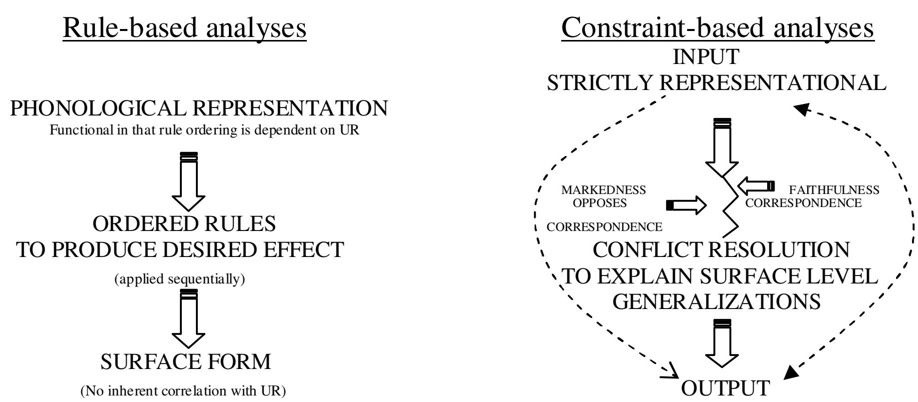
(99)
Input: /alkalde/

	*LAB-LAT	*DOR-LAT	AGREE-PA	ONSET-IDENT(pa)	IDENT-PA
☞ a.[alkal̪d̪e]					*
b.[aɫkal̪d̪e]		*!	*		
c.[alkald̪e]			*!		

Since /d/ in Spanish is [+ant], hence dental, no major identity constraints are violated by place spreading in candidate (a). The first [l] in *al̲calde* does not assimilate place from /k/ as this would violate *DOR-LAT. However, the second lateral does indeed assimilate place from /d/, satisfying all of the superior constraints in the hierarchy. Candidate (b) assimilates place from both /k/ and /d/ and therefore violates *DOR-LAT, consequently being eliminated from the evaluation process. Candidate (c) does not assimilate any place, incurring a fatal violation of AGREE-PA. Inputs which propose lateral+bilabial sequences would show similar results.

The analysis based on constraint interaction we have just offered illustrates a central principle of OT, which is the output-oriented approach to explaining phonological generalizations. Aside from the obvious implementation disparities between rule-based models and OT's constraint-based paradigm, one can also observe that the concept of conflict resolution is decisively couched in phonetic observation and surface level data. Rule-based paradigms, in contrast, part from the fundamental notion of underlying supremacy:

(100)



To clarify these diagrams, let us contemplate once again the assimilation rule we introduced at the beginning of this section:

(101)

$$[+\text{nasal}] \rightarrow \begin{bmatrix} \alpha \text{ coronal} \\ \beta \text{ anterior} \\ \mu \text{ distributed} \\ \delta \text{ back} \end{bmatrix} \;/\; \_\_\_ \begin{bmatrix} +\text{consonant} \\ \alpha \text{ coronal} \\ \beta \text{ anterior} \\ \mu \text{ distributed} \\ \delta \text{ back} \end{bmatrix}$$

This rule parts from the critical implication that an underlying segment [+nasal] undergoes some process by which the phonological place of articulation of the nasal is lost, and later somehow replaced in certain contexts. Here, the phonological representation provides part of the explanation for the phonetic level transformation.

OT on the other hand envisages phonetic level observations as the parting point of analysis. If we consider the constraint-based paradigm we introduced previously, we can notice a very interesting aspect of conflict resolution:

(102)

Input: /alkalde/

	*LAB-LAT	*DOR-LAT	AGREE-PA	ONSET-IDENT(pa)	IDENT-PA
☞ a.[alkal̪d̪e]					
b.[aɫʲkal̪d̪e]		*!	*		
c.[alkald̪e]			*!		

In this analysis we started from the phonetic perspective and worked backwards. We identified the observation that nasals and laterals assimilate place of articulation of the following consonant. Knowing this, we theorized a set of constraints, and their corresponding hierarchical positions, which could produce this output. Since phonetic data is concrete, and quantifiable to a large degree, surface forms are considered a more reliable source on which to ground the motivations for phonological generalizations.

The phonological representation is taken for granted. Since there are no constraints in OT which deal exclusively with the input representation, phonological representations have no real functional value. This is a benefit since total abstraction is maintained. Let us suppose for a moment that the underlying representation of /un beso/ (*a kiss*) were /um beso/. This still does not change the results of the previous tableau:

(103)

Input: /um beso/

	*LAB-LAT	*DOR-LAT	AGREE-PA	ONSET-IDENT(pa)	IDENT-PA
☞ a.[um beso]					*
b.[un beso]			*!		
c.[uŋ keso]			*!	*	

The result of this output-oriented hierarchy remains the same. As we can see, constraints do not impose a specific process. This hierarchy, keeping surface level generalizations in mind, simply expresses that (1) both labial-laterals and dorsal-laterals are impossible segments in Spanish, (2) nasal and lateral consonants must share *one* place feature with the following consonant, (3) onset consonants may not alter their place of articulation, and (4) all things being equal, it is preferable to maintain input feature values in the output. Since no structural change is imposed, as in rule-based paradigms, outputs are free to satisfy these constraints in various ways. If the input is changed, the result of the hierarchy is not altered since no process based on input specification alone has ever been proposed.

Rule-based paradigms, however, depend a great deal on underlying representation. As it represents a functional input to some procedure, the process in question, and the result therein, could depend a great deal on accurate, or at least consistent, underlying detail. The problem with this, which we will not take up here, is that phonological representations are less tangible, often times speculative and depend more on the deductive interpretation of the author and less on irrefutable data.

1.5 CONCLUSIONS

In this chapter we have offered a brief review of the sounds of Spanish and their phonological classification, paying special attention to the features which compose sounds and their abstract mental representations. We have illustrated that sound inventories engage two levels in the meaning-to-sound mapping. Phonological level classification involves the distribution of abstract phonemes, while acoustic sequences pertain to the surface level, or phonetic domain. We have shown that often times phonetic level representations differ from their underlying equivalent due to some intermediary process, or generalization, which emerges to change some feature of the phonological input.

We have offered examples from Spanish of this phonological/phonetic divergence mentioned above. First, we looked at the process of nasalization of Spanish vowels. We offered an Optimality-Theoretic analysis which is based on the conflicting interaction of two types of constraints. Markedness constraints require pre-nasal vowels to be marked for [+nasal] at the surface level in response to a physical restriction on the speech apparatus which expels air from the nasal cavity due to velum lowering. An inferiorly ranked faithfulness constraint, seeking to maintain full input identity of oral features, opposed this markedness constraint in a conflict resolution which eventually produced a nasalized vowel in the optimal output.

Next, we examined the case of voiced stop spirantization in Spanish. We proposed an analysis that was derived from the global notion that certain consonants in determined phonological positions become debilitated due to a highly ranked markedness constraint, LAZY, which requires minimal articulatory exertion. In this case, minimal articulatory effort implied a feature transformation such that underlying consonants marked for [-continuous] became [+continuous] at the phonetic level. Again, the low ranking of faithfulness constraints produced a hierarchy which was easily capable of capturing the essence of this process.

In this same section, we showed that by programming a set of local, or contextual markedness constraints, we could offer a concise analysis based on the same basic hierarchy to explain why spirantization is blocked in certain phonological contexts. This involved the specification that voiced stops may not debilitate in the context following consonants marked for [+nasal] or [+laterals], both of which assimilate [place] features. This is an important correlation from a theoretic perspective since rule-based paradigms envisage these two processes as effectively unrelated phenomena. In so doing, we have offered an analysis which establishes a more universal application than classical generative analyses have proposed, while simultaneously illustrating the functional consequences on the independent evolution of other Romance phonologies.

Subsequently, we offered an analysis of coda sonorization in word-internal contexts. We offered a unified account of standard sibilant voicing as well as the devoicing of voiced stops in the same phonological context. We presented a hierarchy based on universal tendencies which was capable of justifying both types of coda transformation. Again, by hardwiring a local markedness constraint which prohibited consonants marked for [+voice] in word-final codas, we were able to offer an integral analysis of coda voicing and devoicing without hypothesizing language specific rules, indicative of generative frameworks.

Finally, we examined the case of place assimilation of nasal and lateral consonants in Spanish. We proposed a hierarchy based on Baković (2000) which imposed acute restrictions on place features of contiguous [nasal]+consonant and [lateral]+consonant sequences. By requiring these sequences to distribute the same feature for [place], we arrived at a model of place assimilation in Spanish which envisions both nasal and lateral assimilation in a broader phonological scope. Additionally, the generalizations we were able to express with this hierarchy espouse the justification we presented for spirantization blocking in §1.4.2.

Throughout the course of this chapter we have made special note of the inherent advantages of the Optimality-Theoretic framework in Spanish phonology. We have illustrated that, in OT, all structural or featural transformations between the phonological and phonetic levels can be abridged in one central assertion; markedness dominance produces change. One can observe that in every case we examined, markedness constraints occupied the superior hierarchical position. This is no coincidence, but rather a central and programmed tenet of OT.

We maintain that one of the preeminent advantages to constraint-based analysis is the explicative character, versus rule-based description, yielded by the inherent transparency of conflict resolution. All phonological generalizations are a compromise between two competing forces. Dominant processes occupy dominant hierarchical positions. However, in OT, no phonological generalization is the domain of one motivating factor, but rather the conciliation of various constraints. This means that even constraints which occupy inferior positions play some role in the production of the optimal output.

To emphasize this point, let us consider our analysis of place assimilation from

§1.4.4. One of the inferior constraints we programmed into our hierarchy was IDENT-ONSET (pa), which prohibited the alteration of feature values in the onset. In the context of place assimilation, this was not a terribly important constraint since onsets in Spanish do not typically undergo regressive assimilation. However, the transparency of this analysis is important to our hierarchical model of voiced stop spirantization, since it illustrates with maximum clarity the intersection of two coinciding processes. The rule of place assimilation we illustrated in example (90) merely describes the process in a specific context, leaving to the side any mention of what phonetic constraints might motivate the procedure. Just as importantly, this rule omits any recognition of which constraints seek to prohibit the process. Parenthetically, generative analyses have continually been plagued by deficits of transparency, since imposition intrinsically obscures stimuli.

Throughout the next two chapters, we continue with our examination of the phonology of Spanish. We look at the internal structure of Spanish syllables and the constraints which shape Spanish prosody. We will pay special attention to the constraints which influence the phonemic distribution at syllable margins and nuclei.

Where appropriate, we will ground our explanations in topics of acquisition. We do this for a very special purpose, which is to provide a clear, while at the same time practical justification for the utility of our study. In examining past research we have found that meta-linguistic abstraction is often times confused with intangible elucidation. We hope to remedy this shortcoming by couching our theoretical justifications in concrete examples from an acquisition perspective.

2

SYLLABLES

2.0 AN INTRODUCTION TO SYLLALBLES

The previous chapter dealt with the phonemic and allophonic representations of Spanish. We alluded to the fact that the position in which a phoneme appears may be subjected to very specific constraints that govern phonological well-formedness. In this chapter, we will address how phonological units can be grouped and organized to form **syllables**. Loosely defined, a syllable is the organization of sounds into groups, in accordance with a set of language-specific well-formedness guidelines. In this chapter we consider a structure well-formed if its phonetic realization is not modified by any phonotactic restriction in the course of normal discourse.

Like phonemes, syllables have no inherent link to semantic meaning. However, we consider the study of syllables to occupy an important place in theoretical phonology since syllabic margins represent a position at which many phonological generalizations are expressed. Throughout the course of this chapter and the next, we will characterize the syllable and discuss the implications of syllabic theory in Spanish. We will show how the phonological distribution which shapes Spanish syllables can be satisfactorily explained by conflict resolution from an Optimality-Theoretical approach.

We take for granted two main syllable types. Phonetic syllables, as envisaged by Saussure (1916) and later in Jesperson's (1926) *Lehrbuch der Fonetik*, "are usually described as consisting of a centre which has little or no obstruction to airflow and which sounds comparatively loud; before and after that centre (…) there will be greater obstruction to airflow and/or less loud sound" (Roach, 2000: 70). Due to the acoustic nature of phonetic syllables, they are more easily defined and can be measured to a certain extent using sophisticated machinery. It is generally accepted that unpredictable suprasegmental information such as prosodic stress is imposed over the syllable at the phonetic juncture.

Phonological syllables, in contrast, entail a more abstract description which is based on the distribution of the phonological constituents which comprise the syllable. We can generally define a phonological syllable as a complex grouping of phonemes, comprised of an obligatory nuclear constituent, in addition to facultative marginal components. The marginal elements in Spanish are consonants while the nuclear constituent(s) is necessarily a vowel. To cite a concrete example, let us consider the monosyllabic word *–pan* (*bread*), which consists of a nucleus, or **peak** /a/, a pre-nuclear, or **onset** consonant /p/ and a post-nuclear, or **coda** constituent /n/. The nucleus and coda form the **rhyme**.

There has been some doubt expressed in the literature regarding the veracity of the phonological syllable. The process of haplology, or the elimination of a word - internal syllable in which two identical syllables appear contiguously, however, in many languages provides convincing proof in favor of this phonological unit. Spanish is no exception: *-bon-dad→-bon-dad-oso* (*-goodness, –kind natured*), *-mal-dad→-mal-dad-oso* (*-wickedness, -evil-mindedness*), *-piedad→-pia-d-oso* / **-pie-dad-oso* (*-piety, -pious*). Noticeably, in the last form *–piadoso*, part of the second syllable which appears in the root –pie<u>da</u>d, has been precluded, suggesting the existence a process that targets underlying syllables.

In the following sections, §2.1 and §2.2 (pages 83-109), we review evidence supporting the claim that native speakers of languages are intuitively aware that the sounds which compose a word can be parsed into distinct clusters, syllables. It would not be exceptional for a native Spanish speaker to be able to express that the word –

otorrinolaringólogo (*ear, nose and throat specialist*) has nine distinct groupings of sounds, syllables; o$_{(1)}$-to$_{(2)}$-rri$_{(3)}$-no$_{(4)}$-la$_{(5)}$-rin$_{(6)}$-go$_{(7)}$-lo$_{(8)}$-go$_{(9)}$. However, it would probably tax the speaker to convey the quantity of individual sounds the word is composed of. This notion espouses the fundamental argument that the grouping of sounds into syllables, or **syllabification**, is an inherent operation of the phonological grammar. Seen as such, the study of syllables can tell us a great deal about the internal structure and distribution of a language's phonological system and the phonotactic constraints which emerge when the phonological components which comprise the syllable come into contact with one another.

As in the preceding chapter, our study of Spanish syllables involves two levels of representation. The underlying organization of sounds and their corresponding surface level ordering. Again we will show that deviation between the two levels will result from a paradigm in which markedness constraints dominate faithfulness correspondences.

2.1 INTUITIVE ARGUMENT FOR THE SYLLABLE

In the previous section, we defined the basic components of the syllable. It should be mentioned that the inclusion of syllabic structure in theoretical linguistics has been rigorously debated in the phonological literature. Our global objective in this unit is to propose and espouse an intuitive argument for the inclusion of syllabic organization in phonological theory. We base our contention on the fact that (1) native speakers of a language are intuitively aware of the sound groupings of their native language, (2) the parsing of prosodic components into distinct syllables is a consistent, systematic and observable process governed by the phonological grammar of a given language, and (3) speakers produce and *utilize* the systematic patterns which emerge in syllabic structure for various communicative purposes.

We start by taking a brief excursus outside of language to propose the argument that the capacity to group phonemes into larger categories, syllables, is a natural upshot of the taxonomic and computational functions of natural language. As such, we will argue that the grouping of phonemes into higher categories is fundamentally related to other innately human abilities such as visual recognition, the capacity to organize musical elements into larger arrangements, and human's ability to order numerical values into sophisticated mathematical operations.

Later we will discuss the instinctive linguistic evidence which substantiates our argument with regard to point (1) above concerning the idea that speakers of a language are intuitively aware of the skeletal prosodic structure of their native language. The manipulation of this structure in poetry, language games and truncated forms of Spanish names offers convincing evidence to support our claim.

We will assume that the human mind is both taxonomical and computational. Needless to say, taxonomy, or the classificatory function which is responsible for categorizing data along a defined set of criteria, is not terribly useful unless there exists a global objective established for such a system. Computation, on the other hand, allows what has been categorized in memory to be grouped such that smaller components can be combined in order to create a more sophisticated *system*. The patterns which emerge as a result of these operations in natural language provide profound insight into the nature of language production and grammar.

In the previous chapter, we saw that phonemes are categorized using a specific criteria composed of binary features. We illustrated that this feature taxonomy provides a useful and economic way to define acoustic elements based on the abstract binary conditions of material sounds. Later, we showed that a computational function permits determined permutations in the event that the input provides a disfavored structure in a given language. In this chapter we will maintain the phonemic taxonomy we introduced in Chapter 1, but will change our computational focus to examine the distribution of phonological segments into larger units.

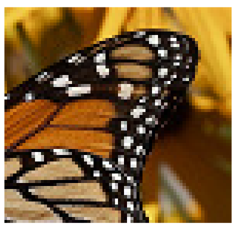
Taxonomic and computational functions are not restricted to language, *per se*. The processes which occur in language simply provide a strong argument in favor of these operations. At the same time, the patterns which surface as a result of these operations provide strong evidence in favor of the inclusion of syllabic structure as a fundamental component of natural language. In the following paragraphs, we will address three analogous procedures outside of language in order to shed light on our claim that syllable structure forms an underlying cornerstone of human linguistic communication.

Let us briefly contemplate visual recognition. The psychological literature provides evidence that humans store components such as lines, shapes, colors and textures extracted from more complicated images to memory. The phonological literature makes similar assertions related to sound inventories. These features give a basic structure to the image, or prosodic unit in the case of phonology, but do not provide discrete information regarding the specific details. The features simply establish a global skeletal template which must be *filled in* with more refined, local information.

Upon viewing an image, most do not focus on the discreet, or local, components of the representation, but rather on the global appearance, just as listeners of a conversation normally do not contemplate every phoneme the speaker utters. Consider a computer keyboard, for example. Most will have some idea as to what their personal keypad looks like with respect to general shape and size, but would be perplexed to have to give a detailed description of the color, dimensions and position of the keys. In a similar way, most interlocutors would be just as perplexed to repeat the strings of the phonological segments they perceive in any given linguistic exchange.

To offer a concrete example of how humans utilize the grouping of visual stimuli to identify images, let us focus on the following example, which is a partial picture of a butterfly:

(1) Top right portion of a monarch butterfly wing



In spite of the fact that only twenty percent of the picture is being shown, it would not be unreasonably difficult based on the visual stimuli available, for an average adult to express that this is a picture of a butterfly. Most could probably even refine their answer to include that this is a monarch butterfly. This is perceptible because the brain classifies, and consequently perceives colors, lines, spatial and textural information as smaller units which can combine to form *systematic* patterns in a more sophisticated representation[1]. Therefore upon observing the image in (1), one should be reasonably capable of relaying what appears in the picture even though the entire object is not revealed. Although the individual components of the entire image are not available, the systematic patterns created by the lines, colors, shape and texture of the partial picture are sufficient to trigger recognition.

[1] For a detailed account of visual recognition see (*Information Visualization: Perception for Design*, Second Edition, Colin Ware, Morgan Kaufmann Publishers, San Francisco, 2004, pages 20-22).

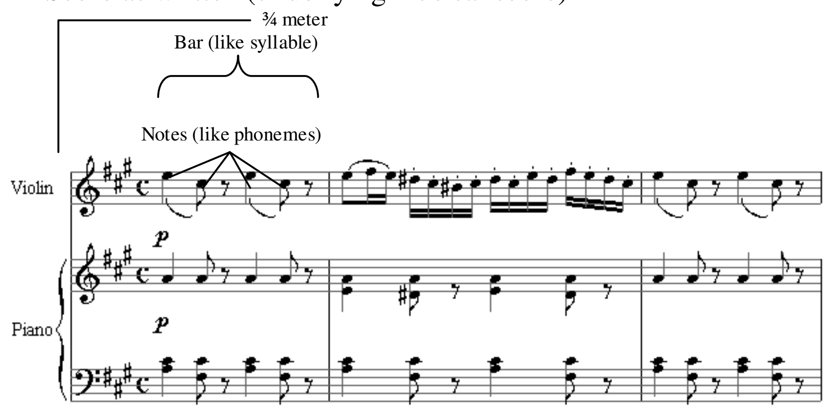
The linguistic literature presents similar conclusions with regard to how interlocutors use prosodic templates as audio stimuli for word recognition. Vieru-Dimulescu and Boula de Mareüil (2005) show that native speakers of French are capable of discerning in a high percentage of the cases certain nationalities of foreign speakers based on prosodic cues. Basically, the crux of this research provides important evidence to suggest that **listeners exploit the systematic detail of language specific syllabic structure as a communicative tool**. Gow, Melvold and Manuel (1996) demonstrate that word-initial onsets alone are acutely capable of activating lexical representations and lexical segmentation, corroborating our last claim.

Although the data extracted from speech perception studies are excluded from phonological modeling, the results of these studies suggest that (1) speakers are innately aware of the sound groups which emerge in their language and, (2) subsequently utilize the systematic patterns which emerge in prosodic structure for lexical access. The symbiotic nature of speech perception and production forces us to consider this data as either the result of the methodical and systematic grouping of phonemes at the level of production or as mere coincidence. Here, we will favor the former.

If we examine the *productive* functions of taxonomy and computation, we observe undeniable similarities between syllabic grouping and other exclusively human capabilities. For example, consider the capacity to group musical elements, notes, into larger units. The manipulation of musical notes into higher categories superimposed with metric structure is an underpinning of musical composition, just as the manipulation of phonological segments into syllabic templates is a primordial foundation of linguistic communication. Musical scores are written using a restricted set of material (sounds) and temporal (time, beats) information. The individual notes are similar to phonemes. The organization of the notes into larger units, bars, is analogous to syllabic grouping of sounds. At a later stage, meter and rhythm are imposed over this organization before being interpreted by the musician:

(2)

Score as written (underlying musical score)



As we can see in example (2), the distribution of notes into more sophisticated units, bars, is strikingly similar to the distribution of phonemes in syllables, both of which would be impossible without a taxonomical function which defines and classifies the essential qualities of each, and the computational operations which link these units together.

The score represents a musical template of sorts. The notes which appear are abstract, probably definable to some extent by way of distinctive feature values. Upon being interpreted by the musician, the score becomes material, an acoustic version composed of measurable units calculated in vibrations per millisecond, merged with a metric system of temporal aspects, beats. What we can observe, however, is the composer's ability to group individual notes, or musical sounds, into consistent higher units, in effect forming systematic patterns which later become superimposed with suprasegmental information.

Mathematical ordering, as well, entails a similar organizational capacity. The categorization of smaller units into larger algorithms permits the representation of more sophisticated operations:

(3) Functional grouping of integers for mathematical computation

$$\overbrace{P(H|D)}= \frac{\overbrace{P(D|H)}\ \overbrace{P(H)}}{P(D)}$$

This model, which is a Bayesian probability calculus, expresses that the probability of a hypothesis, taking into account the data, is in direct proportion to the product of the likelihood multiplied by the previous, or prior probability. The grouping P(D|H) represents the conditional probability which must be calculated before being multiplied by P(H), the prior probability. Once this procedure is carried out, the result of P(D|H) P(H) must be divided by the marginal probability of D. In this case, a divergent grouping of the numerical values assigned P,D, and H will yield incorrect probabilities, in much the same way as the variable parsing of phonemic units into syllables could impair the transmission and perception of the lexical signal.

To offer a specific example of this last assertion, consider the variable parsing of /s/ in the following examples from English: [mɪs.teik]-[mɪ.steik] both -*mistake*. In the first example, the parsing of /s/ as a syllable coda implies that the prefix [mɪs] is a productive morpheme adjoined to a root –take [teik][2]. Thus, [mɪs.teik] in this context would apply to a –*mis*take on a film set, where filming sessions are called –*takes*. The divergent syllabification of /s/ as part of a complex onset in –*mistake*, [mɪ.stéik], implies that the morpheme is not productive and therefore transmits the meaning –*error*.

[2] See Hawkins (2001)

Crucially, this example shows that the production grammar which organizes the phonological constituents to their proper syllabic position is systematic and influenced by higher linguistic operations.

The previous cases offer evidence to suggest that syllabification is the result of both taxonomic and computational functions in the language faculty. We have shown some patent similarities between the linguistic materialization of these operations and their inherent relationship to similar manifestations in other arenas outside of language. However, for the remainder of this section, we will return to language specific phenomenon which support the inclusion of prosodic structure in theoretical phonology. We couch our argument in the notion that speakers are intuitively aware of the prosodic structure of their native language. In the following examples, we will examine the evidence which comes from inside language to support this assertion.

The fact that all languages permit the grouping of sounds into syllables (Kager, 1999) offers convincing evidence to support our argument for prosodic structure as a fundamental cornerstone of natural language. As such, we would expect speakers to possess a certain amount of intuitive knowledge concerning the categorization of sound groups.

One of the basic arguments to support the claim that speakers are inherently aware of sound groupings within prosodic boundaries is their capacity to identify the quantity of groups appearing within the confines of word margins. This is true regardless of the speaker's education, socio-economic status and level of formal linguistic study. The following list of words from Spanish provides examples of words in which defining the quantity of segments may be troublesome for speakers but in which identifying the quantity of syllables would not be:

(4)

Quantity of segments versus quantity of syllables

Word	Syllable	Segment	Phonetic transcription	
construcción	3	12	[kõnstɾuɣθjõn]	(*construction*)
actualización	5	13	[aɣtwaliθaθjõn]	(*update*)
fanfarronear	5	12	[fàɱfaròneár]	(*to complain*)
tienda	2	6	[tjẽnda]	(*shop*)

It is readily observable in these examples that the quantity of segments which compose the words far exceeds the quantity of sound groups. For this reason, a child or illiterate adult is usually able to count the quantity of syllables a word contains yet be perfectly unable to determine the quantity of segments contained therein.

A speaker's capacity to manipulate at will the syllables of her native language suggests an intuitive awareness of syllabic categorization. Poets and musicians have known this to be the case throughout history. In fact, their livelihoods have depended to a large extent on understanding how to manipulate this organization in order to create an esthetically pleasing use of language not necessarily intended for communication. The artistic understanding of language-specific syllable organization supports the claim that the grouping of linguistic sounds into higher categories is a universal condition of natural language.

Additional evidence supporting the veracity of the syllable in phonological systems can be seen in ancient writing systems. Ancient Syrian, Cherokee and Mycenaean Greek all represented clusters of sounds in a syllabary writing system, in lieu of phonemic-based depiction (Alonso-Cortés, 2003). Thus, in ancient Mycenaean Greek, the word –*horse* would have been transcribed , *hikkwoi. Each of the two characters represents a separate syllable.

Spanish children's riddles, along with other language games, offer convincing evidence to support the inclusion of syllabic constituency in prosodic structure. Let us contemplate the following children's riddle in Spanish:

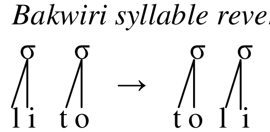
(5)

> ***Este bán****co está ocupado por un padre y un hijo.*
> *El padre se llama Juan y el hijo ya te lo he dicho.*
> *¿Cómo se llama el hijo? Esteban*
>
> (This bench is occupied by a father and son. The father's name is Juan and the son's name I've already told you. What is the son's name?)

In this riddle, the first two syllables of the son's name are the two syllables of the first word –*este* (-*this*). The last syllable of the son's name is the first syllable of the word –***ban****co*. In order for the listener to deduce the correct answer, she must have some intuitive understanding of the syllabic arrangement of her native language, since the correct solution to the riddle does not appear as an independent prosodic element.

The common children's game, Bakwiri, provides further intuitive evidence supporting syllabic constituency in word structure (Katada, 1990). In this game, the interlocutors must speak *backwards*. However, what is understood by backwards means that syllables of words are reversed, while the phonological components which comprise them remain in tact. So, a player might produce a game form [toli] from a stimulus [lito] instead of [otil], which would represent a true backwards form in the conventional sense of the word. In the following diagrams, syllables are represented using the Greek letter sigma, σ:

(6) *Bakwiri syllable reversal*



As we can see, the syllable is treated as an **autonomous unit**. This data is significant because we see that the phonological constituents function in unison, as part of a syllable, and not independently as we would expect. These forms support the premise that the **syllable represents a fundamental constituent of phonological theory** (Katada, 1990).

On a final note, truncated forms of Spanish names provide additional verification to support the claim that syllables form an integral part of the internal and systematic structure of words. In the following example, we provide a short list of some truncated forms:

(7)

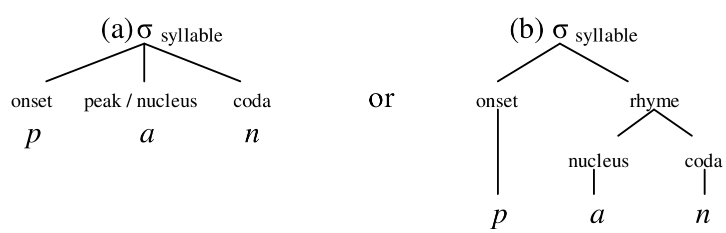
Truncated forms of Spanish names	
Maite	*María Teresa*
Semi	*José Miguel*
Juanma	*Juan Manuel*
Juanra	*Juan Ramón*
Jime	*Jimena*
Alfon	*Alfonso*
Fer	*Fernando*
Josema	*Jose Manuel*
Manu	*Manuel*

Although these forms have little in common, one aspect should be especially clear. All truncated forms comply with the norms of syllabic structure in Spanish. Note that no form presents a deviant syllabic structure in the truncated form which is not present in the actual name. In other words, illicit forms like **Alfons*, **Fern,* or **Jimen* never emerge. The [s] at the end of **Alfons* is the onset of the last syllable [so] in the name *Alfonso* and, therefore, may not syllabify as the coda of the truncated form. We see an identical situation with the other unpermissible forms. Even when the final segment is a totally acceptable word-final coda, as in **Jimen*, this form will never appear, since regrouping the onset [n] of the name form as the final segment of the truncated form is stringently forbidden.

2.2 DISTRIBUTIONAL ARGUMENT FOR THE SYLLABLE

In §2.1 we offered a brief synopsis of the argument supporting the claim that speaker's of a language have an intuitive understanding of the norms which govern the sound groupings of their native language. As one will surely appreciate, we did not offer any genuine phonological explanation for syllabic classification or composition. In this section, we will focus on the distribution of the segments, consonants and vowels, which appear in the syllable nucleus and its extremities. We mentioned in the introduction to this chapter that syllables are obligated to contain a nuclear element, while both onsets and codas are optional. Often times, phonological analyses depict this model using a branching tree figure, similar to those used in syntactic analyses:

(8)



In example (8a), the phoneme /p/ forms the onset. The nucleus is occupied by /a/ and the coda is /n/. Example (8b) groups the nucleus and coda into a rhyme. The difference between the two models in this chapter is inconsequential.

Onsets in Spanish can be occupied by most allophones. The following is a list of possible singleton onsets in word-initial position in Spanish:

(9)

Singleton word-initial onsets in Spanish

[m]	[máno]	[n]	[no]	[ɲ]	[ñóño]	[k]	[káma]
[p]	[pan]	[t]	[tú]	[t͡ʃ]	[t͡ʃiβáto]	[g]	[gáma]
[b]	[béso]	[d]	[diciémbre]				
				[d͡ʝ/ʝ]	[ʝáno]	[x]	[xiména]
[f]	[fonoloxía]	[θ]	[θapáto]			[w]	[wé.βo]
		[s]	[sjémpre]				
		[r]	[rey]				
		[l]	[láta]				

As can be seen in the chart, the allophones [ŋ], [s̬], and [ɾ] may not appear in word initial position in Spanish. The consonant [ɾ] may appear as a singleton onset in word-internal position: [peɾo] (*but*).

Now, let us observe the singleton consonants which may appear in word-final coda position in Spanish:

(10)

Singleton word-final codas in Spanish

[ð]	[θju.ðáð]	(*-city*)
[s]	[mes]	(*-month*)
[n]	[xó.βen]	(*-young*)
[l]	[mal]	(*-badly*)
[ɾ]	[maɾ]	(*-sea*)
[θ]	[peθ]	(*-fish*)

It should be fairly conspicuous that consonants in word-final position are considerably more restricted than in word-initial position. We can observe from example (10) that the only possible word-final consonants in patrimonial words in Spanish are [ð,s,n,l,ɾ,θ], or [+coronal, +anterior].[3]

Word-internal double consonant clusters provide an interesting insight into how sounds are grouped in Spanish. As we will notice, the first consonant of the double

[3] Some unnaturalized foreign loan words appear with segments not permitted in Spanish words.

grouping is far more limited than the second. Let us concentrate for a moment on the first consonant in the following word-internal double-consonant clusters:

(11)
Word-internal double consonant clusters in Spanish ([…]C)

[b]	*			[d]	*			[g]	*		
[p]	apto			[t]	atmosfera			[k]	aktor		
[β]	oβteneɾ	[ð]	aðβeɾtiɾ	[s̬]	mis̬mo	[ʝ]	*	[ɣ]	doɣma	[w]	*
[f]	afɣano	[θ]	biθkotʃo	[s]	resto					[x]	*
						[t͡ʃ]	*				
						[d͡ʝ]	*				
[m]	ambos			[n]	djente	[ɲ]	iɲd͡ʝektar	[ŋ]	aŋxel		
				[l]	aldea						
		[ɾ]	paɾto	[r]	perla						

Now, let us consider the final consonant in the double consonant clusters:

(12)

Word-internal double consonant clusters in Spanish (C[…])

[b]	ambos			[d]	bondað			[g]	aŋgustja		
[p]	caspa			[t]	antena			[k]	arko		
[β]	baɾβa	[ð]	beɾðað	[s̬]	*	[d͡ʝ/ʝ]	iɲd͡ʝektar	[ɣ]	aɾɣuiɾ	[w]	dezwesaɾ
[f]	eɱfɾiaɾ	[θ]	akθjon	[s]	aβsoluto					[x]	aŋxel
						[tʃ]	intʃaɾ				
[m]	esmeralda			[n]	etniko	[ɲ]	*	[ŋ]	*		
				[l]	atleta						
		[ɾ]	paðɾe	[r]	enrollar						

If we observe closely, we can see some outstanding similarities between the permissible second segments of the double-consonant clusters presented in (12) and the singleton word-initial onsets presented in (9). In both cases, [ŋ] and [s̬] are illicit segments. The initial segments of the consonant clusters presented in (11) are noticeably more restricted than the first segment, yet not quite as restricted as the word-final singleton segments in (10).

This data leads to two generalizations. First, we can assert that if a segment can not appear syllable-finally, it may not appear word-finally either. This is an adaptation of Itô's (1989) argument asserting that if a segment cannot appear word-finally, then it may not appear word-internally at the post-nuclear margin. At this point in our study, however, it is unclear if this last claim can hold true against the Spanish data.

Secondly and more importantly, if a segment can appear word-initially, it may also appear in onset position word-internally. In a similar vein, an illicit word-initial onset consonant may not appear in onset position word-internally. Itô (1989) accounts for this regularity by proposing an intimate correlation between segments at prosodic margins and syllable margins. Basically, word-initial segments are also syllable-initial and word-final segments are also syllable-final. On the surface, it seems that our data from Spanish supports the underlying principle proposed by Itô related to segment distribution at syllabic and prosodic extremities.

To illustrate this concept, let us consider the consonant cluster which appears in the word, *-esmerar* [es̬meɾaɾ] (*-to polish/brighten*). From the outset, we can notice that this gloss contains three nuclei: /e/,/a/, **e**<u>CC</u>**e**C**a**C. We must contemplate with which nuclei the marginal consonants of the first two nuclei pertain. Table (9) shows that [s̬] represents an illicit onset word-initially. Taking into consideration the generalizations we mentioned above, then, we must also conclude that [s̬] represents an illicit word-internal onset. At the same time, we observe in table (11) that [m] is an illicit word-final coda in Spanish[4]. The fact that no word in Spanish begins with the sequence [s̬m] suggests that the conjunction of these consonants forms an impermissible complex onset. Moreover, this last argument can be extended to apply to word-final complex codas as well, since this sequence never surfaces word-finally. We ought to postulate, therefore, a syllabic separation between [s̬] and [m] such that [s̬] must represent the coda of the syllable containing the first nucleus [e], and [m] must constitute the onset of the following nucleus [e]. Itô (1989) programs this scheme into his syllabic licensing hypothesis, which proposes that words are systematically **parsed** into syllables (Itô, 1989):

(13)

Syllabic Licensing
Words are exhaustively parsed into syllables.

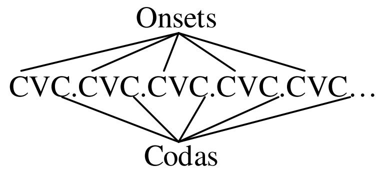
Let us suppose that syllables in Spanish were restricted to a nucleus, one onset and one coda: CVC. If we accept the general assumption that word-initial consonants are also syllable-initial, and that word-final syllables are also syllable-final, then it would follow that the first consonant of a medial cluster, CV**C**CVC, must be a syllable final segment, a coda, while the second consonant, CVC**C**VC, must necessarily

[4] Later in this chapter, we will see that word-internal syllables do in fact end in /m/. Word-finally, some words do exhibit /m/ in the input, although subsequent phonotactic constraints convert /m/ to [n], corroborating our claim that [m] is an illicit word-final coda.

represent the first segment of the following syllable, an onset. Hammond (1999) offers the following schematic illustration of this process[5]:

(14)

Schematic syllable parsing



Hammond points out two interesting details pertaining to syllabic licensing. Foremost, the structure of words in a language is not *coincidental*, but rather follows a rigid regiment with respect to phoneme allocation and organization. All words are composed of well-formed syllables. Furthermore, we can assume that constraints governing syllable margins at prosodic boundaries also dominate syllable edges word-internally. Consequently, this hypothesis assumes that illicit word-final consonants are also prohibited as word-internal codas if the ban which governs word-final coda emergence is a function of syllable structure. Conversely, if word-initial onsets are excluded due to some ban imposed on the syllable structure itself, it should stand to reason then that the same segment forms an ill-formed onset in all syllable-initial positions, word-initially or medially. We redact the predictions proposed by Itô (1989) as well as Hammond's (1999) additions in the following:

[5] Here and throughout the remainder of this thesis, breaks in syllables will be represented with a period: "."

(15)

Predictions regarding syllable distribution

i. **Word-initial onsets are also syllable-initial.** Therefore, we should see some correlation between permissible word-initial segments and word-internal syllable-initial segments.

ii. **Word-final segments are also syllable-final**. Therefore, we should see some correlation between permissible word-final segments and word-internal codas.

Returning to our example of [ş] in syllable-initial position, we can assert that the ban which excludes [ş] from syllable-initial position is indeed a direct injunction on syllable structure in Spanish. Since [ş] is an allophonic dependent of /s/, which may appear exclusively preceding a consonant marked for [voice], and since no word in Spanish may begin /s/C (except for semi-consonant glides), even if [C] is marked for [+voice], we must assume that the only context in which [ş] may appear is syllable-final. That no word in Spanish begins with [ş], yet word-finally this consonant is quite common, supports the basic premise made by Itô's parsing schema. Effectively, Itô's syllabic licensing principle allows us to show, *a priori*, that word-margin constraints are intrinsically linked to restrictions governing syllable margins. As we will see, the data from Spanish syllables substantiates this claim.

Although basic, the argument we introduced previously for the syllabic division of *-esmerar* inadvertently reveals a very important aspect of Spanish syllable typology: **whenever phonologically feasible, nuclei in Spanish always prefer to have onsets**. The data indicates that Spanish will tolerate codas in the event that medial clusters cannot be syllabified as a complex onset. In the case we presented there was no discrepancy as to the syllabification of the constituents. Since the emergence of [ş] is impossible syllable-initially, and [m] is impossible, or at very least highly undesirable, syllable-finally, and the combination [s̬m] is an illicit complex onset and coda, we were left with only one option; to divide the syllable between [s̬] and [m].

But of course, Spanish is not limited to the CVC pattern of singleton onsets and codas which Itô's schematic parsing model considers. In fact, Spanish permits up to eleven different syllable types:

(16)

Syllable patterns and examples in Spanish

a)	V	a.mo	(-*I love*)
b)	VV	au.tor	(-*author*)
c)	CV	na.ta	(-*heavy cream*)
d)	CVV	bau.tis.mo	(-*baptism*)
e)	CCV	pla.za	(-*square*)
f)	CCVV	frau.de	(-*fraud*)
g)	CVC	tan.to	(-*so much*)
h)	CVVC	faus.to	(-*fortunate*)
i)	CCVC	tran.ví.a	(-*tramway*)
j)	CCVVC	claus.tro	(-*cloister*)
k)	CCVCC	trans.por.tar	(-*to transport*) (morphologically complex word)[6]
	-CVCC	Herranz	(-*proper surname*) (morphologically simple word)

As these examples illustrate, complex onsets and codas are restricted to two segments. Therefore if a two segment coda cluster precedes a two consonant onset cluster, the maximum number of contiguous word-internal consonants permitted in Spanish is four.

Let us consider a different case, -*doble* (-*double*), in which the medial cluster –*bl* can, at least in theory, be syllabified in a number of ways:

(17) *Hypothetical syllabification of* [doble]

i. [do.ble]
ii. [dob.le]
iii. [dobl.e]

[6] In casual speech, syllable-final clusters are habitually reduced such that /n/ does not surface -*transportar*→*tra*[Ø]*sportar*

Example (17ii) is similar to the syllabification we offered for *–esmerar*. Nevertheless, the difference between the two structures is that, in *–doble*, the consonant [b] is a permissible word-internal onset consonant and [l] is a permissible coda. To recall, the syllabification we offered for *–esmerar* was governed by the fact that [s̬] can not appear syllable-initially. The only option available was to divide the word according to the most appropriate distribution of the phonological segments on hand. In [doble], however, this is not the case.

Example (17i), which is the true syllabification, provides an alternative syllabification. This structure proves viable since we know that the medial cluster *-bl* is also a feasible syllable-initial cluster. In point of fact, we can observe this word-initial structure in a large range of examples; *blusa* (*blouse*), *blanco* (*white*), *blando* (*soft*), *blasonería* (*boasting*) etc. Permitting the syllable-initial cluster to represent the onset of the second syllable allows the coda, [b], to be precluded in the first syllable, substantiating our earlier claim that, when possible, Spanish prefers to cluster consonants as onsets. If we extend the generalization we made earlier, which stated that word-initial onsets were also syllable-initial, even word-internally, to include word-initial complex onsets, we can justify the syllabification offered in (17ii) as a strategy to syllabify peaks with onsets even if this means circumventing the coda. Since this last postulation holds cross-linguistically, we will suppose this to be a universal implication on syllable structure in Spanish.

Kager (1999) formalizes similar cross-linguistic data in the following universal for syllable onsets:

(18)

Implicational universal for syllable onsets
If a language has syllables that lack an onset, then it also has syllables that have onsets.
(No language bans onsets)

As previous research has shown, languages which permit onsets may fall in one of two sub-categories; those which require a pre-nuclear consonant, and those in which the pre-nuclear segment is facultative. Japanese, Diola Fogny, English, Ponapean and Spanish fall into this latter category while Tamiar, Arabic and Axininca Campa completely prohibit syllables with no onset (Itô, 1989; Kager, 1999). It is not uncommon for languages such as the latter to provide an onset in cases in which no underlying segment satisfies this syllabic requirement. Fundamentally, there is no empirical data to indicate that **any language prohibits onsets**, suggesting a cross-linguistically substantiated predilection for pre-nuclear segments.

Our empirical data extracted from a syllable count of 1,000 random syllables demonstrates a patent tendency toward onset supremacy in Spanish, corroborating the underlying essence on which Kager's implicational universal is based. The following figures illustrate that Spanish always prefers to syllabify phonological segments as onsets whenever phonologically feasible. The statistics related to Spanish onsets appear in the following table:

(19) *Empirical evidence for onsets in Spanish*[7]

	Onsets	word-internal singleton	word-initial singleton	word-internal complex	word-initial complex
% of total syllables	97.6%	55.2%	35.3%	7.1%	0%
% of total onsets	100%	56.5%	36%	7.27%	0%
% of word-internal onsets	-	77%	-	12.8%	
% of word-initial onsets	-	-	100%	-	0%
Raw numbers	976	552	353	71	0

[7] From the Tuesday, January 20 edition of *20 Minutos*, a free morning periodical.

Observing this data, it should be obvious that Spanish prefers all peaks to have onsets. If we look closely, we can see that only 2.4% of the syllables in our study do not have an onset, confirming Kager's claim regarding the proclivity toward onsets. Importantly, we can add that all segments appearing in word-initial syllables also appeared in word-internal syllable onsets, substantiating Itô's predictions concerning the distributional symmetry of phonological segments at syllable margins. Later, we will address the empirical evidence for codas in Spanish.

Of course, favoring onsets necessarily implies rejecting codas to some extent. Cross-linguistically, this does seem to be an accurate generalization. We know this to be the case since not all languages allow a syllable nucleus to be grouped with a following consonant (Kager, 1999). Mazateco, an autochthonous Mesoamerican language spoken in Oaxaca, Mexico, for example, bans all post-nuclear consonants (Blevins, 1995). The syllabification offered in example (17iii) prefers to group both segments of the medial cluster as the coda of the first nucleus. As we can observe in table (16), word-internal complex codas are not forbidden, a priori, in Spanish. Even though the second nucleus, [e], is permissible as it appears in (17iii), the consonant cluster attached to the coda of the first syllable, [bl], is not permitted as a complex coda in Spanish. If it were, we should expect to see cases in which [bl] appear word-finally, according to the predictions made by Itô's syllabic licensing principle. The data, however, indicate no such possibility. And since peaks never actively reject onsets when one is provided, it would be theoretically implausible to accept the syllabification proposed in (17iii).

Aside from the distributional evidence, the previous claim that [bl] is not a permissible coda in Spanish is corroborated by independent evidence concerning the sonority grade of the consonant constituents which appear at the syllable margins.

Basically, consonant groupings at syllable margins are governed in accordance to abstract sonority values (from 1-5) assigned to each manner feature. Syllable structure in Spanish requires that sonority values at the leftmost onset margin start low and become increasingly higher until the nucleus, which, being a vowel, necessarily represents the highest sonority value of the syllable. After the nucleus, the grade of sonority falls progressively until reaching the rightmost margin of the coda:

$\overparen{t_{(1)}r_{(3)}a\ n_{(2)}s_{(1)}}$ *porte*.

The maximum difference between two consonantal segments in any syllabic position in Spanish is two. Plosive obstruents and fricatives represent the lowest grade of sonority followed by nasals. Liquids have the highest sonority of all consonants. High vowels are less sonorous than non-high vowels. Seen in this light, the structure [dobl], is not only distributionally unsubstantiated, but is also rejected by restrictions governing sonority values, since [l] is more sonorous than [b].

The rejected forms (17i) and (17iii) illustrate that Spanish always prefers to parse segments as onsets instead of codas. Form (17ii) demonstrates that even complex onsets are favored over singleton codas. While Spanish does permit codas, the distributional evidence which we have seen so far indicates that they will never be favored over onsets. Kager (1999) abridges these assumptions under the guise of a universal implication for codas:

(20)

Implicational universal for syllable-final segments
If a language has closed syllables, then it must have open syllables. (No language requires codas)

Again, we can further sub-divide languages into two categories along this condition. Some languages, like Spanish, do allow consonants in syllable-final position, but place severe restrictions on the segment itself, and the quantity of segments which may appear. We illustrated an example of this in the previous chapter in our analysis of voicing and devoicing of Spanish codas in §1.4.3. Other languages such as Fijian ban codas altogether (Blevins, 1995). The critical point here is that **no language requires codas**, suggesting a diminutive status for coda in prosodic structure relative to onset. This last point will be reflected in our constraint-based analysis of Spanish syllables in chapter 3.

Again, our data extracted from the syllable survey of 1,000 Spanish syllables supports the notion that coda is generally a disfavored position relative to onset in Spanish[8]. Let us observe the following chart which illustrates empirical evidence regarding coda distribution in Spanish:

(21)

Empirical evidence for codas in Spanish

	Codas	word-internal singleton	word-final singleton {s}	word-internal complex	word-final complex	word-internal singleton /rsdnlθ/	word-internal singleton not /rsdnlθ/
% of total syllables	33%	18%	13%	1%	0%	17%	1%
% of total codas	100%	56.25%	41%	6.25%	0%	54.8%	3.2%
% of word-internal codas	-	90%	-	11%		94.4%	7.6%
% of word-final codas	-	-	100%	-	0%	-	-
Raw numbers	330	180	130	20	0	170	10

Some interesting generalizations can be obtained from a close examination of this data. Foremost, we see that only 33% of all syllables contain a coda. Compare this with the 97.6% of Spanish syllables which contain onsets. Additionally, we can see an obvious proclivity toward word-internal singleton codas. Of the 330 codas, only twenty presented a complex coda. Of these twenty, a majority were morphologically modified items. This data, compared to the facts presented concerning Spanish onsets, provides sound proof for our claim regarding onset supremacy in Spanish syllables.

[8] Tuesday, January 20 edition of *20 Minutos*, a free morning periodical.

Let us turn now to another example. As we have seen above in example (16), the maximum number of consonants permitted in a medial cluster in Spanish is four. The word –*co<u>nstr</u>ucción* (*construction*) provides an example[9]. Mainly, the predicament we face lies in the syllabic position of [s]. On one hand, [s] can be syllabified with [n] as a complex coda: -$c_{(1)}$ $o_{(5)}$ $n_{(3)}$ $s_{(1)}$. Naturally, this would challenge the predictions regarding the syllable and word-final symmetry of phonological constituents made by Itô (1989), since word-final complex codas, even those in accordance with sonority scale values, are not permitted in Spanish. Hypothetically, we could propose that [s] formed part of the onset of the following syllable –[struk], as in Italian or English: -*istruzione* [i.**stru**.d͡zió.ne] -*instruction* [ɪn.**strʌk**.šə̃n]. However, distributional evidence indicates that the structure [sC] is unambiguously prohibited in Spanish onsets, both word-initially and medially. The systematic appearance of word-initial [e] before [sC] structures in naturalized foreign loan words suggests that this cluster is highly ill-formed in Spanish: (English) *stop*→*<u>est</u>op* (Spanish). In fact, no patrimonial word in Spanish begins with this sequence. In this case, the distributional evidence supporting a positional ban against the sequence [sC] provides a strong argument to include [s] as part of the coda of the first syllable. The fact that complex codas do not productively emerge word-finally will be dealt with by way of constraint interaction in the following chapter.

The generalizations we have proposed so far can be easily expressed by constraint interaction in an Optimality-Theoretic framework. The facts from Spanish syllable structure coincide with the basic universal tendencies presented by Kager (1999), Itô (1989) and Hammond (1999). To express the generalizations we have

[9] In formal speech [kõ<u>nstr</u>ukθjõn]. In informal, casual speech however, [kõ<u>str</u>ukθjõn]

outlined up to this point concerning the parsing of words into syllables, we will have to program a constraint which conveys the notion that words must be exhaustively parsed into syllables:

(22)

PARSE
Words must be exhaustively parsed into syllables.

We have claimed that, whenever phonologically feasible, Spanish prefers to syllabify medial clusters as the onset of a nucleus instead of as the coda. We have shown that Spanish does indeed allow codas although the distribution of permissible segments which may appear in this position is significantly more restricted than onsets.

The cross-linguistic proclivity to syllabify consonant segments as onsets is formalized in the following constraint (Kager, 1999):

(23)
ONSET
$*[_\sigma$ V (‘Syllables must have onsets’)

In contrast, the cross-linguistic proclivity toward open, or coda-*less*, syllables is programmed into the following constraint (Kager, 1999):

(24)
NoCODA
$*C]_\sigma$ (‘Syllables must be open’)

Without further refinement, and regardless of hierarchical position, these constraints are capable of capturing the generalization that intervocalic singleton consonants always become syllabified as the onset of the second syllable. Essentially, hierarchical ranking is unnecessary since both constraints prefer to group the intervocalic consonant as an onset. Kager (1999) abbreviates this generalization with the following model of universal syllabification for intervocalic consonants:

(25)
Universal syllabification of single intervocalic consonants
CV.CV>CVC.V

We can observe this constraint interaction in the following tableau:

(26)
Input: /nata/ (-*heavy cream*)

	PARSE	ONSET	NoCODA
☞ a. na.ta			
b. nat.a		*	*
c. nata	*!		

As we can see in the following tableau, ranking is completely inconsequential:

(27)
Input: /nata/ (-*heavy cream*)

	PARSE	NoCODA	ONSET
☞ a. na.ta			
b. nat.a		*	*
c. nata	*!		

These tableaux express that all words must be parsed into syllables and nuclei prefer to syllabify consonants as onsets. A resulting coda is tolerated but only in the event that it cannot appear in the onset. In the following chapter we will take a more discerning look at the specific syllabic structure of Spanish words and show that constraint-based conflict resolution provides a model which is capable of justifying phonological distribution at syllable margins.

2.3 A FEW NOTES ON MORAIC THEORY

In this section we will briefly introduce the mora and discuss some of its implications in Spanish Phonology. However, due to time and space, we do not intend to offer an exhaustive analysis of all aspects of moraic theory[10]. Essentially, a mora is unit of syllabic weight which is equal to the duration of a short vowel. Although Spanish is an isosyllabic language[11], meaning that all peaks are afforded approximately the same temporal duration, we will see that moras can play an important role in the developments which shape Modern Spanish phonology.

There is some intuitive evidence to substantiate the formal study of the mora as a syllabic constituent. The classic case cited in the phonological literature is the Japanese poetry form known as *haiku*. As opposed to Spanish poetry, which is measured in peaks or nuclei, haikus are measured by the quantity of moras:

(28) Haiku[12]

Furu ike ya	(*old pond*
kawazu tobikomu	*a frog jumps*
mizu no oto	*the sound of water*)

Although not readily perceivable in the translated version, haikus consist of three lines which contain five moras in the first line, seven in the second and five in the third.

Syllables may be treated as either **heavy** or **light** depending on the number of moras they contain. Heavy syllables have two moras while light syllables have a single mora. Depending on the language, heavy syllables may be of two types, either CVC, or CV(V). In moraic-theoretical terms, heavy syllables are said to be **bimoraic**, meaning they contain two moras. Light syllables consist of a structure type CV in which the nucleus is a single tense vowel, and are referred to as **monomoraic**.

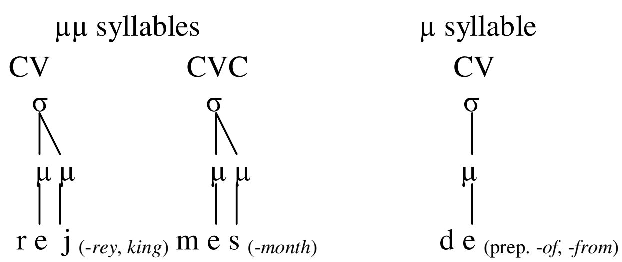
[10] The aspects we discuss here related to mora theory are based on the work of Hyman (1985) and Hayes (1989). When making reference to mora theory, we are indicating specifically the work elaborated by these authors.
[11] A. Bello made this observation in his *Principios de ortografía y métrica*, in 1832.

[12] see: Matsuo Bashō: Frog Haiku (Thirty Translations and One Commentary), including commentary from Robert Aitken's *A Zen Wave: Bashô's Haiku and Zen* (revised ed., Shoemaker & Hoard, 2003).

One of the cornerstones of the formal moraic theory proposed by Hyman (1985) is that moraic structure is exclusive to individual languages and that moras constitute independent structural units separate from the syllable. In Latin, CVV and CVC syllables are heavy and CV syllables are light. However, In Lardil (a Tangkic language spoken on Mornington Island, Queensland) CVC syllables are light and only CVV syllables are heavy.

In the transition from Latin to Spanish, the distinction between heavy and light syllables was lost, due to the eradication, or in certain cases lexicalization, of Latin stress. Even though no length contrast exists in Spanish vowels, diphthongs are bimoraic even if no consonant follows. Closed syllables may be bimoraic, but this is not necessarily so[13]. In contrast, onsets, regardless of the number of components, are never moraic[14]. In the following example, moras are expressed using the Greek letter μ. Association lines are drawn between the syllable to which each mora pertains and the phonological representation:

(29)



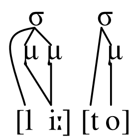
Returning briefly to the example of the children's game Bakwiri cited above, an interesting phenomenon related to moraic structure occurs when one of the syllables of

[13] In chapter 5 we offer an examination of stress and foot patterns in Spanish, in which we return to the subject of heavy in light syllables. Contrary to Harris (1983), we will argue that heavy/light oppositions are inactive in the process of stress application in Modern Spanish.

[14] Onsets in most languages, however, do not regularly intervene in phonological generalizations.

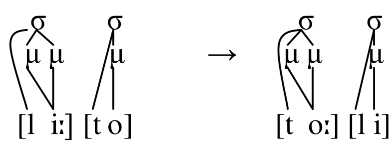
the game word contains a long vowel and the other syllable contains a short vowel: [li:.to]. In this case, the first syllable is bimoraic while the second is monomoraic:

(30)



Upon being reversed, the short vowel from the second syllable becomes a long vowel, hence making it bimoraic, while the long vowel converts to a short vowel, becoming monomoraic (Katada, 1990):

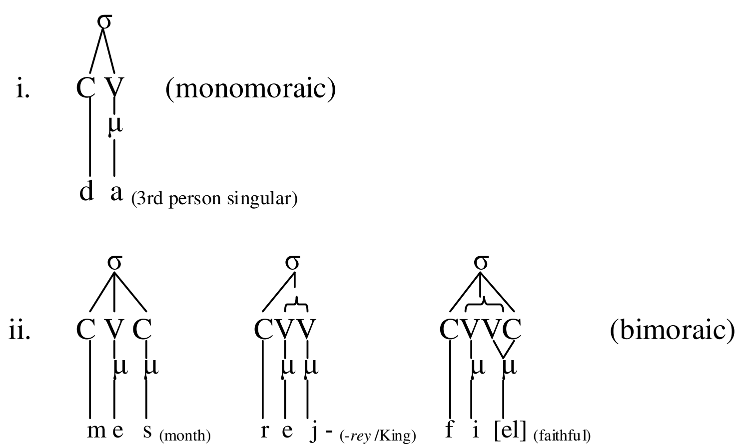
(31)



In this example, even though the syllables are reversed, the moraic structure of the syllables is maintained, suggesting an independent status of the mora which is disassociated from the syllable, yet at the same time, closely related. Consequently, and perhaps more importantly, this example also illustrates that moraic structure has a direct impact on the phonological components, which is what concerns us here. The evolution of the alternating diphthongs in Spanish, [we] and [je], along with processes of compensatory lengthening, can all be explained using a similar scheme based on moraic structure.

Unlike English, Spanish does not impose any minimal limit as to how many moras a word must contain. Monomoraic words consist of one peak with no coda: *de,* *da, lo*, etc. Both types of bimoraic syllables also appear: *mes, buey, rey, sol*, etc[15]. We can generalize that Spanish prefers not to end prosodic words with heavy, or bimoraic syllables, although there is no general ban militating against them. In the following example, we provide a list of possible syllables with their corresponding moraic structures in Spanish:

(32)



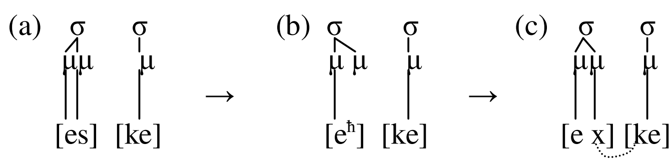
The astute reader will notice that no association lines are drawn between onsets and moras. As we have mentioned, onsets are never moraic, regardless of the number of segments they may contain. For ease and economy, all onsets in the examples are singleton consonants, although we could have just as easily shown our examples with complex onsets. The difference in moraic theory is arbitrary.

Variant forms found in the south of Madrid, namely in the neighborhoods of Vallecas and parts of Moratalaz, provide good evidence to exclude onsets from bearing any sort of moraic weight. In these neighborhoods, and in certain zones of Andalusia, there exists a phenomenon by which coda /s/ is reduced to pharyngeal [ħ] or phonetic

[15] We will limit our discussion to two moras. In the event that a bimoraic diphthong nucleus appears before a moraic coda, *-buen* for example, we will include the coda as part of the rightmost mora of the nucleus.

zero [Ø], especially before voiceless stops. This process is called debuccalization[16] and entails the suppression of all oral features. When preceding [k], it is not exceptional that the misplaced coda /s/ be produced as a velar consonant [x]: *e*[x] *que…* instead of *es que…* (*it is that…*) by way of feature spreading of [place] from the contiguous onset /k/. This process is called compensatory lengthening and is easily explained by moraic theory. Let us observe the following example:

(33)



In this example, form (a) represents the standard representation with its corresponding mora. Form (b) illustrates the process by which coda /s/ is reduced to [h], shown in superscript to emphasize its low salience. As coda /s/ was associated with a mora, place of articulation of the following consonant extends leftward to fill in the empty mora left by debuccalization, or the suppression of the oral features associated with /s/. In fact, this process is cross-linguistically quite widespread. And while interesting in itself, there is a more profound generalization to be made, and that is **onset deletion *never* produces compensatory lengthening** (Hyman, 1985).

Vowel lengthening as well is capable of satisfying the moraic void produced by coda erosion. Diachronic diphthongization in Spanish demonstrates that nucleus fracturing is an effective way to provide the lacking mora in post-nuclear position (see Holt, 2001). In the diachronic development of glosses such as Spanish -*s<u>ie</u>te* (Eng. *seven*), we can observe some manifest similarities between compensatory lengthening

[16] Debuccalization entails the transformation of [+coronal] to [+dorsal].

and loss of mora-bearing codas. The following example offers a linear account of the processes which led to the alternating diphthongs in Modern Spanish:

(34)

1. Latin: sĕptem: elimination of coda /p/ due to bans on coda
2. Hispano Romance: sɛ′te→sɛɛte: nucleus splits to fill displaced mora upon deletion of coda /p/. Bans against long lax vowels lead to vowel raising in Old Spanish.
3. Old Spanish: seɛte: Constraints mitigating syllable peaks motivate complete diphthongization.
4. Modern Spanish: *siete*

Meanwhile, modern Italian *sette* (Eng. *seven*) obviously prefers compensatory lengthening to fulfill the mora condition produced from coda erosion.

2.4 CONCLUSIONS

In this chapter we have introduced the intuitive and distributional evidence that provide the theoretical framework for the analyses associated with syllabic structure in Spanish which we will address in the following chapters. We have illustrated that the mapping of Spanish sounds onto syllabic patterns is a relatively predictable process that can be explained by universal tendencies. We have shown that onsets in Spanish are far less restricted than codas with regard to the distribution of the phonological components which may occupy each position. Accordingly, we demonstrated an intimate relationship between constraints on word-boundary and syllable-boundary constituents in Spanish. We saw that word-initial consonants are also syllable-initial and that word-final consonants are also syllable-final. Afterward, we provided cross-linguistic evidence which corroborates the tendencies found in Spanish syllable structure. Importantly, we have seen that these tendencies are easily accounted for by a set of OT constraints which govern syllabic structure. In the following chapter, we will show that by refining these constraints to include specific bans on position and sequence, and by ranking these constraints accordingly, we can provide transparent explanations for many of the phonological processes which occur at syllable margins.

We have also pondered the idea that syllables in Spanish can be moraic, and that the autonomous moraic structure in Spanish words can prompt a series of phonological processes. The processes we have outlined above can be straightforwardly explained by translating the propensity to maintain the moraic structure provided by the input into constraint conflict. In subsequent chapters, we will formalize these tendencies as universal constraints in a constraint-based framework.

3

SYLLABLES IN SPANISH

3.0 INTRODUCTION

In this chapter we take a more acute look at the internal structure of Spanish words and the constraints that shape phonological patterns at syllable margins. We elaborate on the data presented in chapter 2 concerning the phonemic distribution of Spanish syllables. Primarily, we will pay special attention to both position and sequence of the phonological constituents involved in syllable formation. Additionally, we address several points of Itô's predictions relevant to syllabic parsing, taking into account the data we present from Spanish phonology.

We begin our study in §3.1 (page 118) with an exhaustive examination of onsets in Spanish. We introduce a set of OT constraints which is capable of expressing the restrictions we presented in chapter 2 with regard to the specific phonological segments in onset position. Subsequently in §3.1.2 (page 123), we consider complex onsets in Spanish and formalize a set of sequence and positional constraints which govern onset well-formedness.

Afterward, §3.2 (page 137) we treat codas in Spanish. As we have shown in the previous two chapters, codas are significantly more restricted in Spanish vis-à-vis the phonological segments which may occupy this position and the sequence of the units themselves.

Later in §3.3 (page 155), we examine word-internal consonant clusters. We will illustrate how the constraints we propose in the first two sections can be hierarchically ordered in order to justify the process of syllabification in Spanish.

Finally, in §3.4 (page 180) we make some assumptions regarding syllable peaks. We will examine the data from Spanish words a propos of the composition of syllable nuclei and subsequently program a set of OT constraints which justify the generalizations we present concerning the permissible vocalic segments which may occupy this position.

3.1 WORD ONSETS

In the last chapter we introduced the notion that all words must be exhaustively parsed into syllables. The logical extension of this hypothesis is that word-initial onsets are also syllable-initial, and, thus, subject to constraints governing the phonological distribution at the pre-nuclear margin. The data we provided concerning the distribution of Spanish phonemes across syllables seems to corroborate this claim, in as far as no illicit word-initial segment forms a licit word-internal onset. If we recall, [s̬] never appears syllable-initially in Spanish, neither word-initially nor word-internally. We can surmise then that this is a ban on syllable position, and not against [s̬] itself, since [s̬] appears rather profusely in syllable coda position in Spanish.

Also in the previous chapter, we proposed the idea that, whenever phonologically feasible, Spanish tends to syllabify consonants as onsets and not codas. We were able to formalize this generalization by ranking a set of syllable-governing constraints, proposed by Hammond (1999) and Kager (1999), which expressed that (1) words must be parsed into syllables and that (2) parsing will always prefer onsets.

3.1.1 Singleton onsets

In this first section dealing with Spanish onsets, we will explore the internal structure of Spanish syllables a bit further in order to treat the specific bans on certain segments in onset position. As in all sections of this chapter, our analysis of onsets begins with the smallest onset segments, singletons, and progresses to larger, complex, sequences.

Table (9) of the previous chapter illustrated the permissible word-initial onsets in Spanish. This distribution revealed some interesting generalizations about what segments may appear in well-formed syllable onsets in Spanish. The following table is offered again to refresh our memories:

(1)

Singleton word-initial onsets in Spanish: #.......#

[m]	[máno]	[n]	[no]	[ɲ]	[ñóño]	[k]	[káma]
[p]	[pan]	[t]	[tú]	[tʃ]	[tʃiβáto]	[g]	[gáma]
[b]	[béso]	[d]	[diciémbre]				
				[ʝ/d͡ʝ]	[ʝ/d͡ʝáno]	[x]	[xiména]
[f]	[fonoloxía]	[θ]	[θapáto]			[w]	[wé.βo]
		[s]	[sjémpre]				
		[r]	[reʝ]				
		[l]	[láta]				

No words in Spanish begin with the segments [ŋ], [ɾ] or [s̬]. We have already mentioned that this ban is a consequence of positional well-formedness and not due to any inherent quality of the segment. In other words, these segments are acceptable in

Spanish, just not word-, and therefore syllable-, initially[1]. Table (12) revealed that these segments also never appear as the second member of a two-consonant medial cluster, corroborating the segment ban on onset position. We can formalize this ban in an OT framework by hypothesizing a constraint, *ONSET/[s̬,ŋ,ɾ] (Hammond, 1999), which expresses the generalization that these segments are prohibited in onset position:

(2)

*ONSET/[s̬,ŋ,ɾ]

Onsets may not contain [s̬,ŋ,ɾ].

Let us suppose for a moment that a hypothetical polysyllabic input, /des̬wesaɾ/ were proposed in which /s̬/ could not be syllabified as a syllable-initial segment. A ranking schemata of PARSE and *ONSET/[s̬,ŋ,ɾ] would render an optimal output in which [s̬] is necessarily syllabified as a coda. This scheme is formalized in the following constraint ranking:

(3)

*ONSET/[s̬,ŋ,ɾ] » PARSE[2]

We can see their interaction in the following tableau:

(4)

/des̬wesaɾ/	*ONSET/[s̬,ŋ,ɾ]	PARSE
a. [de.s̬we.saɾ]	*!	
☞b. [des̬.we.saɾ]		
c. [de.s̬.we.saɾ]		*

[1] Except for [ɾ], which can appear syllable-initially, but not word-initially.

[2] In this hierarchy, we rank PARSE below *ONSET/[z,ŋ,ɾ] due to the specific theme which we are treating; no [s̬] onsets. However, these constraints are virtually interchangeable since neither is ever violated in Spanish outputs.

In this tableau, candidate (b) is the optimal candidate since syllabifying [s̬] as the coda of the first syllable avoids a violation of the dominant constraint. Candidate (a) clearly violates *ONSET/[s̬,ŋ,ɾ] by allowing [s̬] to syllabify as a constituent of a complex onset [s̬w], resulting sub-optimal. Candidate (c) avoids a fatal violation of the dominant constraint by not parsing [s̬] to any syllabic position. This strategy is obviously not optimal since it obliges a violation of PARSE.

We know that the input we presented in (4) is not the true input for [des̬wesar][3], from –*deshuesar* (-*to debone*), but now we must formalize a strategy which explains how the grammar justifies the fact that the consonants [s̬,ŋ,ɾ], never emerge in optimal outputs. Let us contemplate how the grammar would process an underlying sequence [s̬a]. Although this may seem insignificant, considering the impossibility of surface forms with onsets [s̬,ŋ,ɾ], we must find an acceptable strategy to justify this process, since the lack of these consonants in onset position is governed by the Spanish grammar. We will consider a few options now to explain this fact.

First, if we look at the adaptation of loan words into Spanish, we could hypothesize some sort of phonological generalization which maps an underlying /s̬/, or in this example /z/, to a divergent surface form, thus circumventing the emergence of the illicit onset. Let us consider the English loan word –*zapping* (colloquial, -*channel*

[3] We base the justification of this input on two principle points. First, Alonso-Cortés (1997) presents solid proof that the alternating diphthongs /je/ and /we/ are underlying in certain examples. As well, this justification is espoused by predictions made by the concept of Lexicon Optimization made by Prince and Smolensky (1993), which proposes that unless there is convincing proof to believe otherwise, underlying forms will always coincide with their corresponding surface forms.

surfing), in Spanish, [θá.pin].[4] We could contemplate that since Spanish bans the onset surface form [s̬][5], an underlying segment /z/ maps to [θ] as a means to avoid positional ill-formedness. The problem with this strategy, and consequently the reason we reject it, is that there is no evidence to suggest that the underlying segments of this word is anything but /θ/, which is probably based more on orthographical conventions than on any solid phonological process.

The second possibility is to assume that the ONSET constraint which we introduced previously eliminates these segments just as in our previous example (4). The obvious problem with this approach is that it makes no predictions with regards to how the underlying forms /s̬,ŋ/ in onset position would be treated.

The concluding argument would be to consider that GEN renders whole sequences, or even words, unpronounceable (Hammond, 1999). This can be achieved by ordering a constraint M-PARSE which requires all words to be pronounced (Hammond, 1999):

(5)

M-PARSE
Words are pronounced.

So a hypothetical input /s̬a/ would result as the following. The use of curly brackets indicates that the word is left unpronounced:

[4] –*zapping* refers to the act of changing the television channel looking for a program to watch, an act native English speakers might call *browsing.*

[5] [s̬] is also impossible in syllable initial position.

(6)

Input: /s̺a/

/s̺a/	*ONSET/[s̺,ŋ,ɾ]	M-PARSE
a. [s̺a]	*!	
☞b. {s̺a}		*

This tactic assumes the grammar has no way to process the input segments /s̺,ŋ,ɾ/ in onset position, while at the same time explains the absence of such surface forms. Additionally, this approach makes some interesting assumptions regarding certain principles of language acquisition, but it is beyond our scope to consider those here. We will set aside further commentary until after we address word-internal consonant clusters.

3.1.2 Complex onsets

The following examples of word-initial consonant clusters provide an intriguing preliminary insight concerning the distribution of consonants in Spanish onsets. Notice that of the 361 possibilities, calculated by multiplying all possible combinations of the nineteen possible singleton onsets, only a relative few can combine to produce well-formed complex onsets.

(7)

/pl/	playa	[plá.ʝa]	(*beach*)
/pr/	primo	[prí.mo]	(*cousin*)
/bl/	blusa	[blú.sa]	(*blouse*)
/br/	brazo	[bɾá.θo]	(*arm*)
/tr/	trapo	[tɾá.po]	(*rag*)
*/tl/[6]			

[6] The Real Academia Española (1992) recognizes a few indigenous American loan words in which the sequence /tl/ emerges: -*tlaco* (-*a type of coin used in America*),- *tlacote* (-*small inflammatory tumor*), -*náhuatl* (-*indigenous language of Mexico and Central America sometimes improperly referred to as Aztec*). Nevertheless, all of our native speaking informants from Madrid find this construction strange and question its articulation.

/dr/	droga	[dró.ɣa]	(*drug*)
*/dl/			
/kl/	clavo	[klá.βo]	(*nail*)
/kr/	credo	[kɾe.ðo]	(*credo*)
/gl/	globo	[gló.βo]	(*balloon*)
/gr/	grúa	[gɾú.a]	(*crane*, as in the heavy equipment used for construction)
/fl/	flojo	[fló.xo]	(*lazy*)
/fr/	fruta	[fɾu.ta]	(*fruit*)

First, the mere fact that complex onsets are permitted at all in Spanish, implies a violation to any language-specific ban on complex onsets. Particularly, this prohibition is expressed by *COMPLEX$^{\text{ONSETS}}$ (Prince and Smolensky, 1993):

(8)

*COMPLEX$^{\text{ONSETS}}$
No complex onsets

Next, these data show that the combination of consonants is severely restricted relative to the number of possible singleton onsets in Spanish; only obstruent/liquid combinations are possible. Additionally, we see that no illicit singleton onset may form part of a complex onset. Hence [ʂ̬,ŋ] cannot cluster with other consonants in complex onsets because they are not well-formed singleton onsets themselves. We will discuss these observations below.

We must refine our observation concerning the organization of obstruents and liquids in order to provide the necessary generalizations associated with Spanish syllable typology. To begin, we can observe that although only obstruent/liquid combinations are possible complex word-onsets, not *all* combinations of obstruents and liquids are possible. Coronal stops may not cluster with liquid [l], for example. This point is expressed in the following generalization (Hammond, 1999):

(9)

Coronal dissimilation
Coronal stops do not cluster with lateral [l] in onsets[7].

In a similar way, /xl/ and /xr/ never appear in complex onsets in Spanish. Harris (1983) proposes that /xl/ and /xr/ represent well-formed onsets in Spanish since their articulation is not altered in normal discourse. Even so, this cluster in onset position is so rare in Spanish that only one example can be found: *Jruschef.* Pensado (1985) agrees with the essence of Harris' claim regarding the well-formedness of /xl/ and /xr/ onsets, but discards the example on the grounds that this name is usually pronounced [krústʧef]. Morales-Front and Holt (1997) reject Harris' claim on the basis that there is not enough data available in Spanish in order to properly corroborate the claim and that the example represents a foreign name.

Here we will consider these clusters ill-formed based on the distributional evidence available. Since these clusters do not exist in patrimonial words in Spanish, we will consider these to represent illicit onsets. We express this notion in the following dorsal-fricative (+liquid) proscription for Spanish onsets:

(10)

Dorsal-fricative proscription for Spanish onsets
Dorsal fricatives do not appear in complex onsets

Additionally, we must make note of the fact that /s/ never appears in complex onsets. Unlike English and Italian, Spanish strictly forbids clusters of /s/ + consonant

[7] Núñez-Cedeño and Morales Front (1999) provide evidence which suggests that these clusters often form well-formed onsets in many American dialects of Spanish. In Madrid, however, medial clusters containing [tl] and [dl] are divided, the stop representing the coda of the preceding syllable and the liquid forming the onset of the following syllable.

(other than semi-consonants /w/ and /j/; *siete* [sjéte] (*seven*), *sueco* [swéko] (*Swedish*)[8]). This generalization is important to make explicit since foreign loan words in Spanish do provide this input structure, and accordingly, must be dealt with by way of some grammatical operation. Here we will refer to this restriction as a *sibilant-headed cluster generalization for Spanish onsets*:

(11)

Sibilant-headed cluster generalization for Spanish onsets
/s/ + Consonant is strictly forbidden in syllable onsets.

Furthermore, we must contemplate a similar ban against the clustering of interdental fricative, /θ/, in complex onsets. This generalization is fairly straight-forward since /θ/ never groups with any consonant, even liquids, in syllable-initial position, due to historic reasons related to the distribution of the phonological predecessors of /θ/. We can express this detail with the following ban:

(12)

Interdental fricative ban in Spanish complex onsets
/θ/ is prohibited in complex onsets

We can abridge the bans expressed in examples (11) and (12) by proposing the following stipulation:

(13)

$$*\sigma \left\{ \begin{array}{l} +\text{cons} \\ +\text{cont} \\ +\text{coronal} \\ +\text{anterior} \end{array} \right\} + \text{Consonant}$$

No complex onsets with [+cons., +cont., + cor.,+anterior][9]: */s/ or /θ/.

[8] We will not give this matter any attention here. There is a wealth of research, both distributional as well as empirical, which situates these semi-consonants as a constituent of the nucleus. For further reading on the topic, see Van der Veer (2007).

[9] For the time being, we will keep these constraints separated, as we will specifically treat one, and not the other in the subsequent chapter.

Finally, like English, Spanish does not allow affricate/consonant clusters in word-initial position. That is to say that no Spanish word begins, [ʧ]C. Hammond (1999) formalizes the following proscription for affricate clusters:

(14)
Affricate proscription
Affricates do not appear in complex onsets.

The sequence of the segments which emerge in Spanish complex onsets appears to be restricted as well. Interestingly, we observe that the arrangement of onset phonemes seems to be just as important as the individual segment in determining onset well-formedness. For example, [tr] is a well-formed word-onset, yet [rt] is not. This seems to represent a typological universal; if a double consonant cluster can appear in one order, it cannot appear in reverse order. This is an important detail which Hammond (1999) describes in the following generalization:

(15)

Position Generalization
If two segments, α and β, can occur as an onset in the order αβ, then they cannot occur as an onset in the order βα.

The data from example (7) substantiates this claim in Spanish.

Finally, we must take into consideration the fact that the segments [ŋ, s̹] may not occur in complex onsets[10]. Hammond (1999), quoting Greenberg (uncited in the bibliography), notes that, in fact, each segment which appears in a complex onset must also represent a well-formed onset. This generalization is redacted in the following example:

[10] [ɾ] may cluster as the second consonant of a complex onset. However the complementary distribution of [ɾ] and [r] only permits [r] to appear in singleton onsets.

(16)

Substring Generalization
All substrings of a well-formed onset of coda should themselves be well-formed.

Now, we are ready to introduce the following generalizations regarding complex onset typology in Spanish:

(17)

Generalizations for double-consonant word-initial onsets in Spanish

i. Only obstruents may occupy the first position of a complex onset[11].
ii. Only liquids may occupy the second position of a complex onset.
iii. Each component of a well-formed complex onset is a well-formed singleton onset.
iv. Coronal stops followed by lateral [l] are prohibited.
v. /s/C clusters are strictly prohibited in Spanish onsets.
vi. /θ/ is banned in complex onsets.
vii. Dorsal fricatives cannot appear in complex onsets.

We can easily convert these generalizations into OT constraints. We will delay certain formalizations until after we present coda and medial clusters, as both provide interesting nuances to our present analysis. Nevertheless, taking into account the generalizations offered (17), we can formulate the following constraints:

(18)

OT constraints governing onset well-formedness is Spanish

i. OL (obstruent +liquid)[12] (Hammond, 1999)
ii. *ONSET/[s̬,ɾ,ŋ]
iii. *ONSET/[sC]
iv. *ONSET/[θC]
v. *ONSET/[d,t+l] (Hammond, 1999)
vi. *ONSET/[affricate]α (Hammond, 1999)
vii. *ONSET/[x+l/ɾ]

Before illustrating the constraint interaction which justifies complex onset formation in Spanish, we must return briefly to the notion that the margin positions of syllables follow a rigid adherence to abstract sonority values of the individual phonological constituents. We presented the basis for this concept in the previous

---

[12] A constraint *CCC appears sporadically in the literature. Our shape constraint which defines the permissible segments is less ambiguous, and to our mind more representative of the Spanish data.

chapter. Basically, contiguous consonants in onset position increase in value from less sonorous to more sonorous, parting from the leftmost segment of the syllable onset and culminating at the nucleus. The difference in sonority values of the segments which comprise well-formed onsets in Spanish is two. Obstruents are considered to have the lowest sonority. This category can be further divided into stops and fricatives, the former being less sonorous than the latter (Martínez-Gil, 1996, 1997)[13]. Nasals are more sonorous than obstuents yet less so than liquids. Glides, or semi-consonants, are only slightly less sonorous than vowels, but we will consider these as part of the nucleus. The abstract values we assign to each appear in the following:

(19)

Sonority contour values

obstruents	stops / fricatives	1
nasals		2
liquids		3
glides		4
vowels		5

(Harris, 1989b)

A quick perusal of the possible onsets in example (7) reveals that all well-formed complex onsets in Spanish follow this basic configuration:

(20)

Sonority values of Spanish onsets

/pl/	$p_{(1)}l_{(3)}$aya	[plá.ja]	(*beach*)
/pr/	$p_{(1)}r_{(3)}$imo	[pɾí.mo]	(*cousin*)
/bl/	$b_{(1)}l_{(3)}$usa	[blú.sa]	(*blouse*)
/br/	$b_{(1)}r_{(3)}$azo	[bɾá.θo]	(*arm*)
/tr/	$t_{(1)}r_{(3)}$apo	[tɾá.po]	(*rag*)
*/tl/			
/dr/	$d_{(1)}r_{(3)}$oga	[dɾó.ɣa]	(*drug*)
*/dl/			

[13] For ease, we will give stops and fricatives the same abstract value, 1. The distinction in our analysis is not crucial to the results.

/kl/	$k_{(1)}l_{(3)}$avo (*clavo*)	[klá.βo]	(*nail*)
/kr/	$k_{(1)}r_{(3)}$edo (*credo*)	[kɾe.ðo]	(*creed*)
/gl/	$g_{(1)}l_{(3)}$obo	[gló.βo]	(*balloon*)
/gr/	$g_{(1)}r_{(3)}$úa	[gɾú.a]	(*crane*, as in the heavy equipment used for construction)
/fl/	$f_{(1)}l_{(3)}$ojo	[fló.xo]	(*lazy*)
/fr/	$f_{(1)}r_{(3)}$uta	[fɾu.ta]	(*fruit*)

Based on the data presented in (20), we can formulate the following constraints to treat the relationship between the segments in complex onsets and their abstract sonority values:

(21)[14]

MSD-2^{ONS}
The minimal sonority distance between the two elements of a complex onset is 2.

(22)

SONSEQ
Onsets rise in sonority towards the nucleus and codas fall in sonority from the nucleus.

(Kenstowicz 1994)

Already, we can account for some important generalizations regarding the sequence of complex onsets in Spanish. Without being ranked, MSD-2^{ONS} eliminates all obstuent/nasal and obstruent/glide onsets:

(23)

[CCV	MSD-2^{ONS}
a. bmV	*!
b. pyV	*!
c. tnV	*!
d. kwV	*!

[14] Hammond (1999) presents a sonority scale for complex onsets in English based on the *ONSET constraint. Although this algorithm functions for English complex onsets, it is actually quite cumbersome for Spanish onsets due to the incongruent nature of obstruent/liquid groupings in Spanish complex onsets. We will not consider this hierarchy here but recognize that, with refinement, this concept could be plausible for Spanish onsets.

In a similar way, SONSEQ precludes any sequence whose components do not rise in sonority toward the syllable nucleus:

(24)

[CCV	SONSEQ
a. mbV	*!
b. ypV	*!
c. ntV	*!
d. wkV	*!

As we can see, undominated MSD-2^{ONS} and SONSEQ can account for many of the typological factors which dominate onset well-formedness in Spanish.

To conclude our analysis of complex onsets in Spanish, we must change our focus to ponder the difficult questions as to what tangible purpose there is in addressing the aspects we have just introduced, and why are these points an important part of theoretical phonology. The answers to these questions can best be understood by considering the aforementioned constraints in context from an acquisition perspective. Afterall, OT is fundamentally a theory of **grammar**, and not isolated proscriptions. As such, we must contemplate the constraints we have just introduced as integral particles of a **system**, and not independent particles on their own. In essence, acquisition provides the system in which to frame our constraints.

Returning to the example we presented in the introduction of the first chapter, a child in her preliminary stages of phonological acquisition will surely intuit many of the same restrictions governing the structure of onsets that we presented above. In an OT framework, as our language learner perceives new structures from her environment, she discovers that a given structure X is a permissible configuration in her native language. Consequently, she programs a constraint *X to the far right of the constraint hierarchy, since she has solid proof that *X can indeed be violated (remember that righthand constraints are inferior and hence more often violated).

With regard to syllable onset structures, our language learner will process the constraints we presented above in a similar scheme as the one just discussed. To illustrate this model, let us begin by considering all 361 possible onsets which could occur if segments were to cluster freely. The column to the far left represents the initial consonant of a complex onset. The top row represents the second consonant. Areas shaded in grey denote that the combination of the two consonants is illicit in Spanish onsets:

(25)[15]

	m	p	b	f	n	t	d	θ	s	ş	r	ɾ	l	ɲ	ʧ	ʝ	ŋ	k	g	x	w
m																					
p												pɾ	pl								
b												bɾ	bl								
f												fɾ	fl								
n																					
t												tɾ									
d												dɾ									
θ																					
s																					
ş																					
r																					
ɾ																					
l																					
ɲ																					
ʧ																					
ʝ																					
ŋ																					
k												kɾ	kl								
g												gɾ	gl								
x																					
w																					

This table presents two types of input data the language learner must process in order to produce well-formed onsets in Spanish. First, she must be able to compile the constraints in order to account for the positive data. In other words, she must learn the correct hierarchical order that justifies the optimal forms. Simultaneously, this ranking must also be able to eliminate ill-formed Spanish onsets. Assuming the language learner

[15] The astute reader will recognize that there are more than 361 possible combinations in this table since we have included the allophones [ɾ] and [ş]

begins from zero, all constraints she deduces from the input data will enter unranked. The preliminary constraint set which justifies the emergence of optimal complex onsets while rejecting the sub-optimal forms appears in the following:

(26)

M-PARSE
Words are pronounced.

PARSE
Segments must be syllabified.

ONSET
All vowels have onsets.

*ONSET-V
Onsets may not be vowels.

SONSEQ
Onsets rise in sonority towards the nucleus and codas fall in sonority from the nucleus.

MSD-2^{ONS}
The minimal sonority distance between the two elements of a complex onset is 2.

*ONSET/[s̬,ɾ,ŋ]
Complex onsets must be composed of well-formed onset segments.

*ONSET/[sC]
/s/C clusters are strictly prohibited in Spanish onsets.

*ONSET/[θC]

*ONSET/[d,t+l][16] (Hammond, 1999)
Coronal stops do not cluster with lateral [l] in onsets.

*ONSET/[affricate]α (Hammond, 1999)
Affricates do not appear in complex onsets.

*ONSET/[x+l/ɾ]
Dorsal fricatives cannot appear in complex onsets.

*ONSET/[NC]
Onset clusters with nasal+consonant may not appear in complex onsets.

---

[16] This constraint can also be expressed as OCP Coronal (-*Obligatory Contour Principle for Coronal*). For full explicity, we have simply included the segment sequences assumed in this constraint.

*OL (obstruent +liquid)
Obstruent+lateral onsets are banned.

*COMPLEX^{ONSET}
Complex onsets are banned.

This constraint set is capable of expressing the positive generalizations extracted from the input data presented in (25), while, at the same time, eliminating sub-optimal complex onsets. Still, we have not programmed any constraints which can compete in any conflict paradigm.

In this preliminary analysis, we can represent hypothetically any conflicting faithfulness constraint under the general heading FAITHFUL:

(27)

FAITHFUL
All input/output correlations are preferred.

This constraint contends that any hypothetical input/output correspondence which is maintained in Spanish onsets, no matter how ill-formed, will always be favored over the well-formed outputs produced by the previous markedness constraints. In the following hierarchy, we have modified our constraint, OL, to represent its negative value *OL. From a learnability point of view, this allows us to rank the constraint to an inferior position of the hierarchy since it is habitually violated by the output forms. As we will see, this is strictly a matter of implementation, but instead of ordering all onsets to be composed of obstruent/liquid clusters as it would if we ranked OL to a dominant position in the hierarchy, the inferior ranking expresses the fact that a ban against these clusters can be deduced from the data and consequently demoted to an inactive position. Having learned that obstruent/liquid clusters are permissible complex onsets in Spanish, we should assume that our language learner has learned that *OL is not a highly valued constraint mitigating complex onset well-formedness.

Our complete hierarchy governing complex onset formation in Spanish appears in the following:

(28)

M-PARSE » PARSE » ONSET » *ONSET-V » SONSEQ»MSD2^{ONS} »*ONSET/[z,ɾ,ŋ],*ONSET/[sC],*ONSET/[d,t+l],*ONSET/[θC],*ONSET/[x+l/ɾ],*ONSET/[affricate]α» *OL » *COMPLEX^{ONSET}» FAITHFUL

We should mention that the *ONSET/[segment] constraints listed above are not ranked in relation to one another. This fact is denoted by the dotted line separating each constraint in the tableau (29) below. A violation of any, except *OL, renders a form sub-optimal. The contrary would imply a gradient notion of ill-formedness, which does not exist in OT.

Let us observe how the constraints we proposed in the past sections are able to preclude all sub-optimal forms, while rendering correct predictions regarding onset well-formedness in Spanish:

(29)[17]

	M-PARSE	PARSE	ONSET	*ONSET-V	SONSEQ	MSD-2^{ONS}	*ONSET/[ʂ,ɾ,ŋ]	*ONSET/[NC]	*ONSET/[sC]	*ONSET/[d,t+l]	*ONSET/[θC]	*ONSET/[x+l/ɾ]	*ONSET/[affricate]α	*OL	*COMPLEX^{ONSET}	FAITHFUL
{Nasal+consonant}	*!							*!							*	
☞ Obstruent+liquid														*	*	
☞ [pl]														*	*	
☞ [pr]														*	*	
☞ [bl]														*	*	
☞ [br]														*	*	
☞ [fl]														*	*	
☞ [fr]														*	*	
[tl]	*!						*			*				*	*	*
☞ [tr]														*	*	
[dl]	*!						*			*				*	*	*
☞ [dr]														*	*	
☞ [kl]														*	*	
☞ [kr]														*	*	
☞ [gl]														*	*	
☞ [gr]														*	*	
{xl}	*!											*		*	*	*
{xr}	*!											*		*	*	*
{θ+consonant}	*!										*			*	*	*
{/s/+consonant $_{[-liquid]}$}	*!								*					*	*	*
{sl}	*!								*					*	*	*
{sr}	*!								*					*	*	*
{[ʂ,ɾ,ŋ]+consonant}	*!						*								*	*
{Liquid+consonant}	*!				*	*									*	*
{Affricate+ consonant}	*!												*		*	*
{Glide+consonant}	*!				*	*									*	*
{Onset-V}	*!			*											*	*

This tableau simulating the paradigm of constraints necessary for our language learner to program her productive grammar, based on the data input extracted from table (25), provides an exhaustive justification grounded in conflict resolution of the organization of phonological constituents in Spanish complex onsets. As can be observed, the highly ranked constraints are capable of producing optimal complex onsets while concurrently eliminating ill-formed clusters.

[17] It is clear that several of our constraints overlap in application. This is of no real concern in our analysis since this detail does not impact the optimal results.

One can observe that the ordering of the alignment constraints SONSEQ and MSD serve a dual purpose. First, they oblige all optimal outputs to conform to the sonority scale at syllable margins we mentioned earlier. Secondly, MSD-2^{ONS} eliminates clusters such as liquid/consonant and glide/consonant, since there is no possibility that the second consonant can satisfy the abstract difference of two between the sonority values of the two constituents. This ranking, therefore, is economic in the sense that programming special positional constraints which ban liquid and glide headed complex onsets is rendered superfluous and redundant.

Additionally, we must mention here a few of the inherent benefits of this paradigm in relation to previous generative models. There is no fundamental difference in the fact that both generative and constraint based models are capable of predicting the correct outputs for complex onsets in Spanish. However, our model based on conflict resolution extends these predictions and offers justifications for why sub-optimal outputs are discarded. In this way, conflict resolution by way of constraint satisfaction is not only productive, but also systematically *discriminating*. This is an important aspect of OT since a more profound understanding of complex onset formation in Spanish is attained. If we consider that the distribution of the phonological constituents in syllable structure is an operation of the grammar, one must concede that this nuance that OT provides supposes an enormous theoretical advantage with regard to understanding how the grammar chooses correct outputs. Seen in this way, the study of sub-optimal forms in OT represents an equally important aspect of constraint based analyses, since knowing why a form is discarded in a given language renders a more refutable theory and facilitates the appraisal of efficacy of the theory itself. It has never been worked out in the literature how to accomplish this in rule-based paradigms.

3.2 WORD-FINAL CODAS

In §2.2 we introduced the possible singleton word-final codas permitted in Spanish. In this section we will formalize the constraints which our language learner must program in order to justify the distribution of the phonological components in word-final codas.

To review, the following example provides a complete list of word-final codas in patrimonial Spanish words:

(30)

Singleton word-final codas in Spanish

[d]	[θju.ðáð̲]	(-*city*)
[s]	[mes̲]	(-*month*)
[n]	[xó.βen̲]	(-*young*)
[l]	[mal̲]	(-*badly*)
[ɾ]	[maɾ]	(-*sea*)
[θ]	[peθ]	(-*fish*)
[x][18]	[re.lóx]	(-*watch, -clock*)

As we can observe, Spanish excludes more consonants in word-final codas than it permits. We can justify these outputs with a similar paradigm based on positional constraints as we proposed above with onsets. We will program these constraints as simple positional bans expressed by *CODA/[segment] (Hammond, 1999):

(31)
*CODA/[segment]
[segment] may not appear as a coda.

The following is a complete constraint set for word-final coda well-formedness in Spanish:

[18] In a scarce few items and in formal register, [x] may surface word-finally: -*reloj*. Nevertheless, the normal pronunciation of this item is [re.ló], but in plural forms [re.ló.xes]. After resyllabification, this consonant becomes an onset of the following syllable.

(32) Constraints governing the distribution of consonants in word-final codas

*CODA/m]
*CODA/p]
*CODA/b]
*CODA/f]
*CODA/t]
*CODA/λ]
*CODA/ɲ]
*CODA/ʧ]
*CODA/j]
*CODA/d͡ʝ]
*CODA/ŋ]
*CODA/k]
*CODA/g]
*CODA/x]
*CODA/d]
*CODA/r]
*CODA/l]
*CODA/s]
*CODA/θ]
*CODA/n]

Again, our language learner's grammar remains unprogrammed until solid proof justifying the optimal output is extracted from the input data she receives from the linguistic environment. Upon detection of permissible elements, the constraint which is violated by said form is categorized to the far right side of the constraint hierarchy. Therefore, given the data concerning permissible word-final codas in Spanish, the hierarchical model governing word-final codas will appear as the following:

(33)
*CODA/m], *CODA/p], *CODA/b], *CODA/f], *CODA/t], *CODA/λ], *CODA/ɲ],
*CODA/ʧ], *CODA/j], *CODA/d͡ʝ *CODA/ŋ], *CODA/k], *CODA/g], »
*CODA/x], *CODA/d], *CODA/r], *CODA/l], *CODA/s], *CODA/θ], *CODA/n]

Observably, there are only two real rankings of constraints in this hierarchy. Since [m, p, b, f, t, λ, ɲ, ʧ, j, d͡ʝ, ŋ, k, g] are all illicit word-final codas, there is no reason, nor way, to rank them in relation to one another. This same system is repeated with the permissible segments which appear to the far right side of the tableau below.

The two groups are ranked hierarchically in a scheme in which the impermissible segments' corresponding constraints appear to the left side of the tableau below, while the permissible segments' constraints appear to the right. A darkened black line separates the two categories for ease. Let us observe how this hierarchy is capable of justifying the correct output while simultaneously rejecting the sub-optimal forms:

(34)

	*CODA/[m]	*CODA/[p]	*CODA/[b]	*CODA/[t]	*CODA/[λ]	*CODA/[f]	*CODA/[ɲ]	*CODA/[ʧ]	*CODA/[j]	*CODA/[d͡j]	*CODA/[ŋ]	*CODA/[k]	*CODA/[g]	*CODA/[x]	*CODA/[d]	*CODA/[r]	*CODA/[l]	*CODA/[s]	*CODA/[θ]	*CODA/[n]
a. [m]	*!																			
b. [p]		*!																		
c. [b]			*!																	
d. [t]				*!																
e. [λ]					*!															
f. [f]						*!														
g. [ɲ]							*!													
h. [ʧ]								*!												
i. [j]									*!											
j [d͡j]										*!										
k. [ŋ]											*!									
l. [k]												*!								
m. [g]													*!							
☞o. [x][19]														*						
☞p. [d]															*					
☞q. [r]																*				
☞r. [l]																	*			
☞s. [s]																		*		
☞t. [θ]																			*	
☞u. [n]																				*

As we can see, this hierarchy based on positional restrictions is capable of determining the distribution of consonants in singleton word-final codas in Spanish.

Now, there exist a relative few examples of divergent singleton codas of foreign origin in Spanish which we must address at this point. A partial list is offered in the following:

[19] Only permissible in very formal, affected speech. A case could be made to classify this consonant with the illicit segments which appear above.

(35) Foreign loan words with divergent word-final coda segments in Spanish[20]

club	[klub] ~ [klú]	-*club*
chalet	[chalet] ~ [chalé]	-*house*
argot	[aɾ.ɣót] ~ [aɾ.ɣó]	-*slang*
vermut	[beɾ.mút] ~ [beɾ.mú]	-*vermouth*
carnet	[kaɾ.nét] ~ [kaɾ.né]	-*card*
complot	[kom.plót]	-*plot, intrigue*
bistec	[bis.ték]	-*steak*
coñac	[ko.ɲák]	-*cognac*
robot	[ro.βót]	-*robot*
boicot	[boi.kót]	-*boycott*
donut	[dó.nut]	-*doughnut*
		(Shepherd, 2003)

We ought to refine our description of these examples to include that, aside from being loan words, the majority are **unnaturalized**, or unassimilated, loan words, meaning that their form does not proceed from the production grammar of Spanish, but rather enjoys a certain leeway to deviate from the norms of well-formedness established by the language. Consequently, most Spanish speakers are aware of their foreign origin. The astute reader will notice that in some of the cases, certain examples are in an intermediate phase between unnaturalized and naturalized forms, meaning that some speakers apply the norms of coda well-formedness established by the productive Spanish grammar, and others prefer to articulate the word according to its foreign structure. Where applicable, we have given both representations.

There are a number of ways to justify the emergence of such forms from an OT perspective. First, we could reprogram the former hierarchy of permissible coda segments such that the exceptional segments can emerge optimal. Theoretically, this option is viable, since the grammar can be reprogrammed to account for a certain

[20] The final consonant in all of these words is only pronounced in formal, sometimes erudite, speech.

amount of variable input data[21]. However, this reprogramming usually takes place when the language learner is exposed to a wide variety of different token types (Hamman, Apoussidou and Boersma, 2008). Given that the examples of these forms in Spanish are relatively scarce, and the examples which do exist are not at all frequent, we would have to conclude that any reprogramming which could be construed from the exceptional input data presented in the previous table is not theoretically justified. Additionally, there is no plausible way to restrict the emergence of certain segments in distinct lexical items in OT. In other words, if we create a hierarchy allowing [k] to appear in some words, in theory, it must be able to emerge in any word.

Another way to deal with these exceptional forms is to hypothesize an accompanying lexical marker, [+foreign], which expresses the fact that these forms are of foreign origin and do not adhere to the norms of coda well-formedness proposed by Spanish (Wunderlich, 1999; Schulte, 2003). Basically, the problem with this rationalization is that there is no solid justification on which to substantiate such a marker.

Finally, we could propose that the hierarchy which produces these exceptional segments does not actually produce them at all, but rather simply allows them to occur. This is easily expressed in OT by allowing faithfulness to dominate any markedness constraint which may seek to modify their form. Essentially, this justification takes into account the notion that all native speakers of Spanish would intuit that the words are of foreign origin, but recognizes that the phonological constituents and the lexical representation are too inherently associated as to let markedness alter its surface articulation.

[21] See Boersma (1997) for a complete explanation of variation and learnability.

Let us consider the justification for the lexical item *coñac* [ko.ɲak]. On one hand, we have shown that *CODA/k] is capable of rendering [k] a sub-optimal coda in word-final position in Spanish. If ranked dominantly, this constraint would force some modification to the output, perhaps by eliminating the segment or by adding an epenthetic vowel in order to resyllabify the segment as an onset. Nonetheless, if this segment were to be dominated by a faithfulness constraint, IDENT, which demanded full replication of the underlying representation in the output, we could devise a scheme which allows [k] to emerge in certain forms, without requiring the grammar to actively produce such an output. This constraint set is formalized in the following example:

(36)

IDENT
All input features must be present in the output.

*CODA/k]
Words may not end in [k].

Our hierarchy will appear as the following:

IDENT»*CODA/k]

Let us observe this interaction in the following tablea:

(37)

/koɲak/	IDENT	*CODA/k]
a. koɲa[Ø]	*!	
☞ b. koɲak		*

In this tableau, candidate (b) emerges optimal as it is the only form which maintains all aspects of the input identity in the output. Upon eliminating the illicit word-final segment [k], candidate (a) would be rendered optimal by the productive Spanish grammar. But in so doing, this candidate incurs a fatal violation of IDENT, the dominant constraint in this hierarchy.

We can justify the naturalized, or near naturalized, examples offered in (35), by restructuring this same hierarchy so that the *CODA constraint may affect the optimal output. Let us consider the example -*chalet*, [ʧalet] ~ [ʧalé]. The elimination of [t] in this case can be easily explained by ordering a markedness constraint, *CODA/t], to a dominant position relative to IDENT:

(38)[22]

*CODA/t]» IDENT

(39)

Input: /ʧalet/

/ʧalet/	*CODA/t]	IDENT
☞ a. ʧalé[Ø]		*
b. ʧalet	*!	

In this tableau, candidate (a) surfaces as the optimal output due to its satisfaction of the highly ranked *CODA/t]. Candidate (b) is sub-optimal since illicit input features are maintained in the output, satisfying IDENT in exchange for a fatal violation of *CODA/t].

3.2.1 Word-final complex codas

Word-final complex codas are strictly forbidden in Spanish. Hammond states,

> "*A hypothetical lexeme such as 'placers' not only does not occur in Spanish, it is impossible because Spanish disallows word-final codas consisting of more than one consonant*" (Hammond, 2001: 130).

[22] This paradigm supposes a number of complications related to the concept of strict domination. Of course, the scheme we propose would imply that constraints have a certain freedom to shift within the hierarchy, challenging a key tenet of strict domination in OT. For a more thorough theoretical clarification on this question, see Hayes' (2000) research on gradient well-formedness.

Empirical evidence from Spanish plural formation seems to corroborate Hammond's argument. In normal cases, the plural morpheme {s} is adjoined to the final vowel of nouns, adjectives and adverbs. In the case that the lexical item ends in a consonant, epenthetic [e] is affixed between the final consonant and {s} to prohibit the ill-formed complex coda. Importantly, plural formation *never* produces a complex coda in patrimonial Spanish lexical items. More on Spanish plural formation will be addressed in chapter 4.

Yet, from an OT perspective, no pattern emerges by coincidence. All phonological configurations result from a paradigm of conflict resolution between markedness and faithfulness. We can express the ban on word-final consonant sequences in Spanish as the result of a dominant markedness constraint *COMPLEX$^{\text{CODA]}}$ which severely penalizes consonant clusters word-finally:

(40)

*COMPLEX$^{\text{CODA]}}$
Word-final consonant clusters are banned.

In the event that the input structure presents a complex coda word-finally, *COMPLEX$^{\text{CODA]}}$ will compel some repair strategy to occur before the illicit structure may surface. Examples of some common cross-linguistic repair strategies include epenthesis, deletion of one of the segments and feature coalescence. We will deal with these in chapter four.

Nonetheless, there exist a comparative few examples of word-final complex codas of foreign and Latin origin which we must address here. The following example (41) offers a partial list of these exceptional codas:

(41) Word-final complex codas with Latin or foreign origin[23]

Gloss	UR	SR (a) Formal or Hypercorrect form	(b) Casual form
-torax *(thorax)*	/toraks/	[tó.ɾaks]	[tó.ɾas]
-Felix[24] *(proper name)*	/felix/-/felis/	[fé.liks]	[fé.liɣs] /[fé.lis]
-biceps *(biceps)*	/biceps/	[bi.θeps]	[bi.θes]
-vals *(waltz)*	/bals/	[bals]	[bals]
-fórceps *(forceps)*	/forθeps/	[fóɾ.θeps]	[fóɾ.θeps]

In addition, certain **unnaturalized** loan words may appear with a word-final complex coda when modified by the plural marker {s}. These words appear in the following example:

(42)[25] Complex codas in **unnaturalized** foreign loan words[26]

póster	[pós.ter]	[pósters]	*pósteres	(*poster*(s))
club	[klub]	[klubs] ~ [klú.βes]		(*club*(s))
coñac	[koɲak]	[koɲaks]	*coñaques	(*cognac*(s))
máster	[másteɾ]	[másteɾs]	*másteres	(*Master*(s))
boicot	[boicot]	[boicots]	*boicotes	(*boycott*(s))
complot	[komplot]	[komplots]	*komplotes	(*plot*(s))

Compare these last forms with the plural forms of **naturalized** loan words which appear in the following example:

[23] Long before the conception of constraints such as NOCODA and *COMPLEX, Menéndez-Pidal's *Manual de la pronunciación española* (1940) illustrated that word-final consonantal sequences were illicit in Spanish.

[24] *-Félix* was a Gothic Cartusian from Sardinia (967 B.C.E). In Menédndez-Pidal's interpretation of *Cantar de Mio Cid* (page 234), this name was represented orthographically as both -Féles, and –Félis suggesting the word-final complex coda is an orthographic remnant, exclusively, and that the proper UR for this name is /felis/.

[25] Again, as naturalization of load words is often a lengthy, seemingly sporadic process, overlapping forms may coexist. In these cases, we offer both forms.

[26] The full phonetic realization of both components of the complex coda would only occur in highly effected formal speech.

(43) Plural forms of **naturalized** loan words in Spanish

carnet	[kaɾné]	[kaɾnés]	*carnets	(driver licence(s))
mítin	[mítin]	[mitínes]	*mítins	(meeting(s))
bar	[baɾ]	[bá.ɾes]	*bars	(bar(s))
hotel	[otél]	[otéles]	*hotels	(hotel(s))
cruasán	[kruasán]	[kruasénes]	*cruasanes	(croissant(s))
líder	[líder]	[líderes]	*líders	(leader(s))

Being morphologically unmodified, the forms presented in (41a) are relatively simple to justify using the same faithfulness headed hierarchy we introduced previously to justify the emergence of illicit word-final segments. To recall, we proposed that these words are not so much *produced* by the grammar as they are simply *allowed* to surface, under duress. We illustrated that a hierarchy dominated by faithfulness overrules any desire made by markedness to alter the surface forms of these lexical items. With a few minor adjustments, this hierarchy can be recycled in order to justify the exceptional complex codas which emerge in foreign loan words and certain Latinates. Our constraint set will consist of the following:

(44)

IDENT
All input features must be present in the output.

*COMPLEX^{CODA}]
No word-final complex codas.

These will be ranked in the following manner:

(45)
IDENT»*COMPLEX^{CODA}]

Observe how this hierarchy can allow the emergence of otherwise illicit complex codas in word-final position:

(46)
Input: /bals/[27]

/bals/	IDENT	*COMPLEX^{CODA}]
a. bal[Ø]	*!	
b. bas	*!	
☞ c. bals		*
d. bales	*!	

This tableau shows that any attempt to modify the illicit word-final complex coda will not be tolerated. Candidates (a), (b) and (d) all make some minor alteration to the word-final sequence, fulfilling requirements made by *COMPLEX^{CODA}] at the expense of fatally violating IDENT, the dominant constraint in the hierarchy. Candidate (c) violates *COMPLEX^{CODA}] in order to satisfy IDENT. Consequently, this strategy produces the optimal result.

Likewise, the forms presented in (41b), those which represent a casual style pronunciation, can also be explained by the same constraint set, albeit with minor modifications. To justify the deletion of one of the segments which compose the word-final sequence, *COMPLEX^{CODA}] must dominate IDENT. However, we must program some constraint which stipulates that the segment which is omitted is that which is marked for [-cont], since all word-final codas in Spanish are marked for [+cont.], CODA$_{[+cont]}$].

(47)

CODA$_{[+cont]}$]
Word-final codas must be marked for [+continuous]

This constraint, ordered subordinately to *COMPLEX^{CODA}] yet superiorly in relation to IDENT, will produce an optimal output which (1) does not allow a word-final complex coda to surface and (2) eliminates the segment of the word-final

[27] Notice that the phonological representation of this item is identical to an allomorph.

consonant sequence which is not marked for [+continuous]. Let us observe this interaction in the following tableau:

(48)

*COMPLEX^{CODA}] » CODA$_{[+cont]}$] » IDENT

(49)

Input: /toraks/

/toraks/	*COMPLEX^{CODA}]	CODA$_{[+cont]}$]	IDENT
a. tórak		*!	*
b. tóraks	*!	*	
☞ c. tóras			*

As we can observe, the demotion of IDENT in this revised hierarchy justifying the casual, informal articulation of the data in (41b) proves fruitful due to the fact that the deletion of one of the final segments is no longer considered a fatal violation, as it was in tableau (46). In this new tableau (49), candidate (a) narrowly avoids a violation of the dominant constraint, but at the peril of violating the condition stipulating that word-final consonants must be marked for [+cont.], a sub-optimal strategy. Candidate (b) prefers maximum faithfulness to the underlying representation, which would have yielded an optimal output in tableau (46), but here is not warranted given the revised ranking of the constraint set. Candidate (c) turns out to be the optimal candidate since no complex coda is permitted to surface and the correct underlying segment is deleted in order to avoid this sequence.

The forms presented in (42), however, are somewhat trickier to justify since these are generated by the production grammar. As we can see, their form deviates from the plural forms of naturalized loan words in that the complex coda induced by plural modification is not interrupted with an epenthetic [e]. We must address our options concerning how to deal with their justification before introducing our constraint set.

Initially, it might seem tempting to follow Shepherd (2003), Wunderlich (1999) and Schulte (2003) in proposing a [+foreign] marker which justifies the surfacing of deviant forms. Shepherd proposes a productive hierarchy dominated by the coda correlates of the linear constraints SONSEQ and DSM we used to justify complex onsets. Later, a constraint requiring that contiguous input segments be left contiguous in the output militates against any interruption of the input sequence in the output. Two correspondence constraints, MAX-IO and MAX-BA[28], manifest that epenthesis between the plural marker {s} and the morphological root is not permitted. Later, a faithfulness constraint, DEP, rules out the possibility of segment insertion. All of these dominate *COMPLEX^{CODA}]:

(50)

Hierarchy justifying complex codas in a derived context in Spanish[29]

DSM_2, SONSEQ, CONTIG-I/O, MAX-BA, MAX-MI, MAX-/s/-I/O>>
DEP-I/O ⟷ *COMPLEX^{CODA}] >>NO-CODA(Obs)>>DEP-$C_{(onsonants)}$-I/O

The bidirectional arrow, "⟷", indicates that DEP, the constraint banning segment insertion, and *COMPLEX^{CODA}] are interchangeable in the hierarchy[30]. Upon including a marker [+foreign], DEP, which in most cases is subordinate to *COMPLEX^{CODA}], can change position and become dominant, thus penalizing the insertion of [e]. Let us contemplate Shepherd's constraint-based justification of word-

[28] As to not over complicate our analysis, we will not formally introduce these constraints here. We will present these restrictions in chapter 4 when we take a more discriminating look at Spanish plural formation .

[29] This hierarchy is offered to illustrate the unnecessary complexity of the argument proposed by Shepherd (2003). We will return to these constraints in the following chapter.

[30] For a theoretical explanation see Hayes, 2000.

final complex codas in morphologically modified unnaturalized foreign loan words in Spanish which appear in the tableau below:

(51)
Input: /poster/

/poster/ [+foreign]	DSM$_2$	SEC-SON	CONTIG-I/O	MAX-BA	MAX-MI	MAX-/s/-I/O	DEP-I/O	*COMPLEX^{CODA}]	NO-CODA(Obs)	DEP-C-I/O
☞ a. pos.ters								*		
b. pos.ter						*!				*
c. pos.tes			*!							*
d. pos.te.res			*!				*			
e. pos.ter.se							*!			

Although thorough, this justification is theoretically misconstrued. First, there is no empirical data in which to couch the justification for a marker [+foreign]. Secondly, this rationalization tries to justify the production of *unnaturalized* foreign loan words, which by definition do not adhere to the norms of the new phonological system in which they appear. Moreover, this same hierarchy is incapable of justifying the fact that in *naturalized* loan words such as *–bar,* complex codas are avoided by epenthesis, implying that unnaturalized loan words have a special compartment in the production grammar. To conclude, in maintaining a certain symmetry, if we accept the hypothesis that the marker [+foreign] is an accessible lexical concept, then we must also have to postulate that all patrimonial words in Spanish would necessarily be marked for [-foreign]. This is obviously not economical.

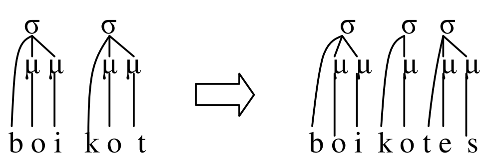
Another possible option is to claim that the emergence of the complex coda in morphologically altered unnaturalized foreign loan words is not governed by the phonology at all, but rather is determined by sociolinguistic and pragmatic factors. Although we recognize that this assumption can indeed provide promising nuances to our present study, we will discard this justification for now.

We propose an analysis for the aforementioned exceptional forms based on input identity, which we will define here as a strong inclination toward maintaining a maximum amount of defining input features in the output. Basically, our justification claims that, being foreign and relatively infrequent tokens, all aspects of input identity are essential to the transmission and lexical access of the divergent structures. We claim that even a mild deviation from syllable structure, and consequently the moraic structure, proposed by the input is sufficient to signal a rupture in communication of the lexical signal associated with these forms.

As we can notice, the insertion of [e] which normally occurs in the plural forms of naturalized loan words[31] implies a restructuring of the phonological components. If we consider the English loan word *–boicot* (*-boycott*), we can notice that the insertion of [e] in the sub-optimal form **boicotes* motivates a process by which [t] becomes the onset of the newly formed final syllable [tes], due to constraints governing syllabification[32]. Accordingly, what previously constituted a heavy syllable in the input, [boi.**kot**], now becomes a light, monomoraic syllable in the output [boi.**ko**.tes].

(52)

<u>Syllable and mora restructuration caused by epenthesis</u>



In naturalized loan words this is not a problem because lexical transmission and access is not challenged by this trivial change. However, we propose that in unnaturalized loan words, this transformation supposes a deviation which threatens communication of the lexical signal.

[31] [e] appears in the plural forms both patrimonial and naturalized loan words ending in a consonant.

[32] ONSET.

OT provides the necessary components with which to frame this justification. By ordering a constraint DEP, which prevents epenthesis, superior to *COMPLEX^{CODA}], we can generate a preliminary scheme which justifies the production of the exceptional structures without hypothesizing empirically empty markers such as [+foreign]. As the only way the word-final input segment can become an onset in the output is by way of vocalic insertion between [t] and the plural morpheme {s}, by blocking segment insertion, we circuitously maintain [t] as a coda in the output, albeit as part of a complex-coda. Our constraint set appears in the following:

(53)

DEP-I/O
Output segments must have input correspondents. (No insertion)

*COMPLEX^{CODA}]
Word-final consonant clusters are banned.

The constraint hierarchy will appear as the following:

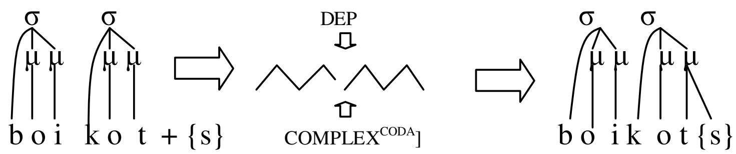
(54)

DEP-I/O » *COMPLEX^{CODA}]

The dominant ranking of the DEP constraints relative to *COMPLEX^{CODA}] make the following predictions concerning word-final complex codas and {s} affixation:

(55)

Blocking of syllabic and moraic restructuration by DEP[33]



Let us observe the interaction of these constraints in the following tableau:

(56)

Input: /poster/

/poster/+ {s}	DEP	*COMPLEX^{CODA}]
☞ b. posters		*
c. posteres	*	

This hierarchy justifies the fact that [e] does not insert between the plural morpheme {s} and the unnaturalized morphological root. However, this hierarchy is inherently flawed pending necessary revisions. As is obvious, there are no provisions made for the fact that segment deletion as well can satisfy the dominant identity constraints: *postes, poster[Ø]. To arrive at a functional hierarchy, we must program a faithfulness constraint which penalizes segment deletion in the output. As we mentioned above, in OT, this constraint is called MAX-I/O and it stipulates that all input segments must appear in the output:

(57)

MAX-I/O

Every element of the input has a corresponding element in the output.

The ranking of MAX-I/O between DEP-I/O and *COMPLEX^{CODA}] will express the idea that (1) segment insertion is strictly forbidden, (2) all input segments must

[33] Effectively, we are proposing a ban on resyllabification. Here, we have chosen to justify this process by banning the insertion of an epenthetic vowel, which does in fact block resyllabification. In chapter 6, we address the issue of resyllabification, and its prohibition, in a more sophisticated way by introducing a set of alignment constraints which require that the boundaries of phonological domains coincide with syllable boundaries.

appear in the optimal outputs and (3) word-final complex codas are stringently banned. We can observe this interaction in the next tableau:

(58)
Input: /poster/

/poster/+ {s}	DEP	MAX-I/O	*COMPLEX^{CODA}]
a. poster[Ø]		*!	
☞ b. posters			*
c. posteres	*		
d. postes		*!	

This tableau demonstrates that the maintenance of input identity exercises supremacy over all aspects of syllable well-formedness. Candidates (a) and (d) eliminate segments from the output in order to satisfy *COMPLEX^{CODA}], but do so at the detriment of fatally violating MAX-I/O. Candidate (c) proposes an output which, in normal circumstances, would prove optimal, but is discarded as it fatally violates the structural requirements established by DEP, the superior constraints in the hierarchy. Candidate (b) is the winning candidate since it satisfies all the higher ranked constraints while minimally violating *COMPLEX^{CODA}], the most inferior constraint of the hierarchy.

In this section we have offered a rigorous analysis of word-final codas in Spanish from an Optimality-Theoretical framework. Our discussion has brought to the forefront some important issues concerning coda well-formedness in Spanish. First, we have shown that by ranking a relative few positional constraints which govern permissible segments in word-final codas, we can justify the distribution of the phonological constituents at the final prosodic boundary.

Subsequently, we dealt with complex codas. We illustrated that an adherence to a markedness ban against complex codas is responsible for the fact that consonants may not cluster at the word-final margin. Later, we addressed the exceptional emergence of word-final complex codas in morphologically altered unnaturalized foreign loan words and their theoretical justification from a constraint-based framework. We proposed an explanation for said forms on the notion of input identity and that any rearrangement of the input organization of phonological constituents would impair lexical transmission and access. We showed that a constraint hierarchy headed by faithfulness is capable of offering a justification for the appearance of these otherwise illicit forms without directly implicating an active procedure in the production grammar.

In the next section we will address word-internal consonant clusters. We will explore the idea proposed by Itô (1989) that segment distribution at word boundaries is a functional dependent of syllabic organization as a whole. According to Itô's predictions, we should expect to see a certain distributional congruence between permissible prosodic margin segments and those appearing at syllable edges word-internally. We will discuss the data from Spanish concerning word-internal consonant clusters and the implications these data have on Itô's (1989) predictions regarding the intimate relationship between prosodic and syllable edges.

At first glance, Itô's hypothesis seems accurate with regard to the segment distribution at syllable and word onsets. However, as the astute reader is already well aware, the task ahead in the next section is a daunting one with regard to syllable codas. We must address the empirical irregularity posed by the data from Spanish codas and attempt to offer a theoretical justification for this discrepancy in distribution. It should be clear from our discussion in this section that complex codas in word-final position are strictly forbidden except in highly extraordinary cases. OT affords us the proper theoretic architecture to program this generalization into our constraint hierarchy while supplying the flexibility and leeway, by way of constraint restructuration, to provide a proper justification of divergent outputs, an advantage that rule satisfaction cannot offer.

3.3 INTERNAL CLUSTERS

3.3.1 Two-consonant internal clusters

Before commencing our analysis, we must clarify the data set for study. Here we will consider all word-internal two-consonant clusters in monomorphemic Spanish words. We specify monomorphemic for a special purpose, and that is to restrict our study to morphologically simple lexical items. This is important because morphologically altered words present special clusters which otherwise would not appear in Spanish. Let us consider the word *innovación* (Eng. -*innovation*). As we can see, this word can be broken into three morphological constituents; a prefix –*in*, a verbal root, *nova*(r), and a nominal suffix –*ión*. We observe a peculiar process in which the combination of the final consonant of the prefix with the first consonant of the verbal root creates a **geminated** coda, [nn] which, as we will see, are prohibited sequences in Spanish[34]. In fact, no monomorphemic word has a geminated coda. The fact that this structure emerges implies that more restrictions than simple positional and sequence constraints play a role in the optimal output.

However, we must clarify this proviso by defining what we will consider here to be monomorphemic words, since this concept is somewhat ambiguous. In the following section we will consider all words with no productive affix to be monomorphemic. We

[34] The fact that –*innovar* is a phonologized lexical item does not affect our argument since it is not the productive process of affixation itself which makes these forms exceptional but rather the fact that no phonotactic constraints alters their form in the optimal output.

specify the condition *productive* so that we may include Latinate items in our analysis, although we will separate these items from the other words. To understand this point better, consider the lexical item –*obtener*. This is a Latinate form composed originally of two morphemes; a prefix –*ob* and a verbal root –*tener* (*to have*). We will consider this form monomorphemic because the prefix –*ob* has no productive lexical meaning in Spanish, nor does it productively affix to any new glosses in Spanish. Simply, it is a phonologized prefix leftover from Latin which, together with the root –*tener*, represent one lexical signal. If we compare this prefix with –*im,* in -*imposible* (impossible), we see a different case altogether. Here, the prefix is productive, as any native Spanish speaker can intuit, since –*im* has a lexical meaning which indicates the opposite of what the adjective root proposes. In all cases where there may some discrepancy as to whether a word is monomorphemic or polymorphemic, we rely on a native speakers intuition as the definitive criteria.

A full list of all two-consonant clusters appears in the following[35]. Again, the phonemes appearing on the left column of the table represent the first consonant of the sequence while those appearing in the top row represent the second element[36]:

[35] We consider a word Spanish, regardless of its etymological root, if its phonological form adheres to the norms of phonological well-formedness in Spanish. Therefore, naturalized loan words are considered since the grammar must be able to treat these items.

[36] We consider the diphthongs [we] and [je] to form part of the nucleus. Therefore we have not included [w] and [j] in the following list of two-consonant clusters unless separated from the diphthong.

(59)[37]

Double consonant medial clusters in Spanish

	m	p	b	f	n	t	d	θ	s	r	l	ɲ	ʧ	ʝ	k	g	x
m	*			*		*	*	*	*	*	*	*	*	*	*	*	*
p	*	*	*	*			*					*	*	*	*	*	*
b	*	*	*	*								*	*		*	*	
f	*	*	*	*	*		*	*	*			*	*	*	*		*
n		*	*	*	*							*					
t		*	*	*		*	*	*	*			*	*	*	*	*	*
d		*		*		*	*	*	*			*	*	*		*	
θ			*	*				*	*	*	*	*	*	*			*
s									*			*	*	*			*
r												*		*			
l											*	*		*			*
ɲ	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
ʧ	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
ʝ	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
k		*	*	*	*		*					*	*	*	*	*	*
g		*	*			*		*	*			*	*	*	*	*	*
x	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

geminate codas *unattested clusters* *attested clusters* *acceptable complex onsets* *Latinate*

A complete list of examples is offered in the following:

[37] We have simplified the table by replacing the approximates [β,ð,γ] as well as [w], [s̬], [ŋ] and [ɾ] with their underlying correlate.

(60)[38] Two consonant clusters in Spanish

Coronal-headed two consonant clusters

-n	[nt]	die[nt]e	-diente	(*tooth*)
	[nd]	due[nd]e	-duende	(*spirit*)
	[nθ]	ra[nθ]io	-rancio	(*rancid*)
	[ns]	de[ns]o	-denso	(*dense*)
	[nr]	ho[nr]ar	-honrar	(*to honor*)
	[nl]*	ma[nl]evar	-manlevar	(*to go into debt past one's financial capacity*)
	[nʧ]	ma[nʧ]a	-mancha	(*stain*)
	[ng]	ra[ng]o	-rango	(*range*)
	[nk]	arra[nk]ar	-arrancar	(*to start, rip out/off*)
-t	[tm]*	a[tm]ósefera	-atmósfera	(*atmosphere*)
	[tn]*	e[tn]ia	-etnia	(*ethnicity*)
	[tr]	ma[tr]iz	-matriz	(*matrix*)
	[tl]	a[tl]ántico	-atlántico	(*Atlantic*)
-d	[dr]	e[dr]edón	-edredón	(*bed cover*)
	[dl]			
-θ	[θm]*	gu[θm]án	-gúzman	(referring to *Alonso Pérez de Guzmán*, proper name)
	[θt]*	Ga[θt]ambide	-Gaztambide	(*proper street name in Madrid of Basque origin*)
	[θp]*	Lega[θp]i	-Legazpi	(*proper name incorporated into Spanish from Basque*)
	[θn]*	le[θn]a	-lezna	(*shoemakers tool*)
	[θk]	bi[θk]ocho	-bizcocho	(*cake*)
	[θg]	pa[θg]uato	-pazguato	(*describes a simple person, as in one that is easily manipulated*)
-s	[sm]	mi[sm]o	-mismo	(*same*)
	[sp]	ra[sp]ar	-raspar	(*to rub gently*)
	[sb]	re[sb]alar	-resbalar	(*to slip*, from *–re* and *-esbarar*)
	[sf]*	fó[sf]oro	-fósforo	(*phosphorous*)
	[sn]	a[sn]o	-asno	(*ass, donkey*)
	[st]	ga[st]ar	-gastar	(*to spend, waste*)
	[sd]	de[sd]e	-desde	(*since, from*)
	[sθ]	pi[sθ]ina	-piscina	(*swimming pool*)
	[sr]	I[sr]ael	-Israel	(*proper name*)
	[sl]	i[sl]a	-isla	(*island*)
	[sk]	ra[sk]ar	-rascar	(*to scratch*)
	[sg]	ra[sg]o	-rasgo	(*trait, feature*)
-r	[rm]	a[rm]a	-arma	(*firearm*)
	[rp]	a[rp]a	-arpa	(*arpa*)
	[rb]	ba[rb]a	-barba	(*beard*)
	[rf]*	hué[rf]ano	-huérfano	(*orphan*)
	[rn]	u[rn]a	-urna	(*urna*)

[38] We use '*' to denote clusters for which a relative few examples can be found.

	[rt]	ha[rt]o	-harto	(*irritated*)
	[rd]	ca[rd]o	-cardo	(*cardoon*)
	[rθ]	a[rθ]e	-arce	(*maple*)
	[rs]	cu[rs]i	-cursi	(*describes a person who presumes a refinement which does not correspond to him*)
	[rr]	ca[rr]o	-carro	(*charriot*)
	[rl]	pe[rl]a	-perla	(*perla*)
	[rʧ]	co[rʧ]o	-corcho	(*cork*)
	[rk]	ba[rk]o	-barco	(*boat*)
	[rg]	ama[rg]o	-amargo	(*bitter*)
	[rx]	u[rx]ente	-urgente	(*urgent*)
-l	[lm]	a[lm]a	-alma	(*soul*)
	[lp]*	A[lp]es	-alpes	(*Alps*)
	[lb]	a[lb]a	-alba	(*sunrise*)
	[lf]*	de[lf]in	-delfín	(*dolphin*)
	[ln]*	a[ln]a	-alna	(*ell*)
	[lt]	a[lt]o	-alto	(*tall*)
	[ld]	ca[ld]o	-caldo	(*broth*)
	[lθ]	ca[lθ]ar	-calzar	(*to cover one's feet*)
	[ls]	sa[ls]a	-salsa	(*sauce*)
	[lr]	a[lr]ededor	-alrededor	(*around*)
	[lʧ]	co[lʧ]ón	-colchón	(*mattress*)
	[lk]	ca[lk]ular	-calcular	(*to calculate*)
	[lg]	a[lg]o	-algo	(*something*)

Labial-headed two-consonant clusters

-m	[mp]	lá[mp]ara	-lámpara	(*lamp*)
	[mb]	tu[mb]ar	-tumbar	(*to lie, lay*)
	[mn]	alu[mn]o	-alumno	(*student*)
-p	[pn]	a[pn]ea	-ápnea	(*apnea*)
	[pt]	ca[pt]ar	-captar	(*to capture*)
	[pθ]	ine[pθ]ia	-inepcia	(*silliness, ineptitude*)
	[ps]	la[ps]o	-lapso	(*lapse*)
-b	[br]	que[br]ar	-quebrar	(*to bend*)
	[bl]	ro[bl]e	-roble	(*oak*)
-f	[ft]*	ca[ft]án	-caftán	(*caftan*, from arabic qafṭān)
	[fr]	ci[fr]a	-cifra	(*statistic, numerical fact*)
	[fl]*	ri[fl]e	-rifle	(from English, *rifle*)
	[fg]*	a[fg]ano	-afgano	(*Afghan, from Afghanistan. Only examples of foreign origin*)

Dorsal-headed two-consonant clusters

-k	[ks]	ta[ks]i	-taxi	(*taxi*)
	[kr]	mi[kr]ófono	-micrófono	(*microphone*)
	[kl]	re[kl]uso	-recluso	(*recluso/a*)
-g	[gm]	do[gm]a	-dogma	(*dogma*)
	[gn]	inkó[gn]ito	-incógnito	(*unknown, undercover*)
	[gd]*	ma[gd]alena	-magdalena	(*from María Magdalena,* proper name)
	[gr]	sue[gr]a	-suegra	(*mother-in-law*)
	[gl]	re[gl]a	-regla	(*regla*)

Morphologically altered / Latinate items

Coronal-headed Latinate clusters

-n	[nm]	co[nm]emorar	-conmemorar	(*commemorate*)
	[nʝ]	i[nʝ]ectar	-inyectar	(*injection*)
-d	[dm]	a[dm]itir	-admitir	(*to accept, admit*)
	[db]	a[db]ertir	-advertir	(*to warn*)
	[dn]	a[dn]ato	-adnato	(*adnate*)
	[dk]	a[dk]irir	-adquirir	(*to acquire*)
	[dx]	a[dx]unto	-adjunto	(*attached*)

Labial-headed Latinate clusters

-b	[bn]	su[bn]ormal	-subnormal	(*mentally challenged*)
	[bt]	o[bt]ener	-obtener	(*obtain*)
	[bθ]	o[bθ]ecación	-obcecación	(*obfuscation*)
	[bd]	a[bd]ómen	-abdómen	(*abdomen*)
	[bs]	o[bs]ervar	-observar	(*observe*)
	[bʝ]	o[bʝ]ecto	-obyecto	(*objection*)
	[bx]	o[bx]eto	-objeto	(*object*)

Dorsal-headed Latinate clusters

-k	[kt][39]	a[kt]uación	-actuación	(*show*)
	[kθ]	a[kθ]ión	-acción	(*action*)
	[km]*	a[km]é	-acmé	(*acme*)
	[kn]*	a[kn]é	-acné	(*acne*)

[39] As we have mentioned, the habitual pronunciation of underlying /kt/ is in fact [ɣt], leaving [kt] to formal, sometimes erudite speech styles.

The data in this chart bring to light some intriguing inclinations related to the distribution of phonological segments at syllable margins. Initially, we can notice that geminate codas are strictly banned in monomorphemic patrimonial words in Spanish. Next, if we consider the segments which appear in the far left column, we can see that the permissible word-final codas (/r, s, d, l, n, θ/) enjoy a much more ample distribution in word-internal codas than most other consonants from this column. This observation is confirmed by the distributional statistics of 1,000 random Spanish syllables we introduced in the previous chapter. To recall, our count revealed that 94.4% of all word-internal codas are /r, s, d, l, n, θ/. Finally, we see that some of the double consonant clusters may form complex onsets while others must be separated. Notice that no two-consonant cluster forms a complex coda leaving the following nucleus with no onset.

Even though this table presents a fairly straight forward input data set, we are still left with the question as to the most economical way to formalize the information presented. Theoretically, we could propose separate hierarchies to treat onset and coda well-formedness. Another option is to hypothesize a revised hierarchy based on coda well-formedness which is responsible for selecting optimal outputs based on the satisfaction of the coda-governing constraints we presented in the last section. This is a viable option given that codas are significantly more restricted than onsets in Spanish. However, given the asymmetry between word-internal codas and word-final codas, we would be forced to hypothesize separate constraints for each position. This is obviously not the most economical solution.

We propose a third option to justify the distribution of phonological segments to their appropriate syllabic position. In fact, we have already done so conspicuously in §3.1.2 (example 29). A close reading of the hierarchy presented in example (29) shows that this model is not only capable of rejecting illicit onsets, but also accounts for the phonological distribution of word-internal codas as well. Let us consider again the table presented (29). We will randomly present an input structure from the last table of word-internal clusters along with a full candidate set. As we will see, onset well-formedness in Spanish is capable of governing coda distribution in word-internal clusters[40]:

(61)[41]
Input: [sl]

	M-PARSE	PARSE	ONSET	SONSEQ	MSD-2^{ONS}	*ONSET/[s̬,ɾ,ŋ]	*ONSET/[NC]	*ONSET/[sC]	*ONSET/[d,t+l]	*ONSET/[θC]	*ONSET/[affricate]α	*OL	*COMPLEX^{ONSET}	FAITHFUL
a. [.sl]								*!				*	*	
☞ b. [s.l]														
c. [sl.]			*!											

Although the majority of the constraints in this hierarchy remain inactive, there is a very important hypothesis to be made here regarding syllable parsing in Spanish; **word-internal coda distribution is a side effect of onset well-formedness**. This hypothesis is formalized in the following example:

(62)
Distribution hypothesis for word-internal codas in Spanish
Word-internal coda distribution is the result of onset well-formedness

As we can see in this last tableau, [s] is parsed as an onset in the optimal output because markedness laws governing syllable onsets strictly forbid Spanish syllables

[40] In our tableaux, we consider codas to be all segments which do not syllabify as part of the onset.

[41] This hierarchy is admittedly superfluous for the given candidate set. However, we presented this hierarchy as a way to organize the data input exclusive to Spanish in such a way that all optimal onsets will be selected while all sub-optimal outputs will be simultaneously rejected. In so doing, the hierarchy is capable of demonstrating that any two consonant cluster will have no choice but to be parsed into separate syllables.

from beginning with /sC/. Seen from this perspective then, word-internal codas are residual segments excluded from the following onset. Syllabification as a coda is a last resort. The only other viable option would be to render the first segment of a medial cluster unpronounceable, which we will not consider here. Naturally, since word-final codas are the last segment in the prosodic unit, we can assume that word-final coda formation is influenced by other forces.

Perceivably, this model predicts the correct optimal candidate as long as the input provides segments which can be syllabified to their respective syllabic position. However, for efficacy sake, now we must consider how this paradigm would process illicit segments which may be presented by GEN. To recall, there is a limited inventory of segments which are illicit codas regardless of whether they emerge in word-final or syllable final position. These segments are [ɲ, d͡ʝ, r̄, t͡ʃ, ʝ̥, λ][42]. In theory, these segments would only be presented by way of loan word incorporation in Spanish. Let us suppose that the grammar is forced to process the illicit sequence V[ɲs̬]V, in which the first segment cannot be a coda, and the second segment may not be an onset. The fact that [ɲ] cannot be syllabified as a singleton coda rules out the possibility of its being parsed as a complex coda. This last option, on top of violating linear constraints for complex codas, would never emerge optional due to the fact that it violates universal principles for onset. Nevertheless, let us observe how our model based on onset well-formedness would process such a peculiar input. For ease of interpretation, we have precluded inactive constraints:

[42] [x] can also be included in this category, although here we will consider this consonant marginally acceptable as a word-final coda based on the fact that it may be pronounced in formal, exceptionally careful speech in glosses such as *–reloj*.

(63) Input: V [ɲs̬]V

	M-PARSE	PARSE	ONSET	SONSEQ	MSD-2^{ONS}	*ONSET/[s̬, ɾ, ɲ]	*OL	FAITHFUL
a. {ɲ s̬}	*!							
b. [.ɲ s̬]				*!	*	*		
c. [ɲ s̬.]			*!		*			
d. [. s̬]{ɲ}	*!	*				*		
☞ e. [.ɲ Vowel s̬]								
☞ f. [n. s̬]								

This tableau expresses some important generalizations regarding how Spanish might repair a less-than-ideal input structure before it has a chance to surface. Candidate (a) is left unpronounced, violating the dominant constraint in the hierarchy. Candidate (b) syllabifies both segments as a complex onset violating linear constraints governing sonority values, as well as the positional ban against [s̬] in onsets. Candidate (c) prefers to syllabify both segments as a complex coda, but in so doing, violates the constraint requiring at least one of the components to serve as the onset of the following syllable. Candidate (d) eliminates the second segment, leaving [s̬] to occupy the onset of the second syllable, violating the superior constraints of the hierarchy. Candidates (e) and (f) both satisfy this hierarchy. Candidate (e) inserts an epenthetic vowel, causing [ɲ] to be syllabified as the onset of a syllable of which [s̬] is the coda; an optimal choice. Candidate (f) motivates a phonological generalization such that the internal structure of the phonological components is transformed so that they may surface as permissible segments for their respective syllabic positions.

Although this tableau is incapable of predicting which strategy will finally yield the appropriate way to deal with the provided input, one point should be conspicuously clear; **ill-formed inputs are forced to comply with syllabic well-formedness principles**. More will be discussed on the topic of repair strategies in chapter 4.

Now, we must formalize our explanation concerning the root of the distributional asymmetry that emerges between word-final and word-internal codas, which consequently challenges Itô's predictions regarding the distribution of phonological segments at syllable margins. The validity of the hierarchy we presented in §3.2 to justify the distribution of singleton word-final codas is seemingly put in doubt by the data we presented in (60) with respect to the permissible word-internal coda segments. However, the distributional statistics we have offered in the previous chapter suggest that the only preferable codas in Spanish are indeed /r,s,d[43],θ,l,n/. All other word-internal codas emerge as a result of a strict adherence to onset well-formedness, as our hypothesis in (62) proposes. A close reading of the word-final singleton coda hierarchy we presented in §3.2, along with the statistical evidence we presented from our syllable survey leads to the following generalization:

(64)
Coda preference in Spanish
The only preferable codas, both word-final and word-internal, in Spanish are coronals marked for [+continuous][44].

Nevertheless, this generalization seems to contradict the assertion we have made earlier regarding the notion that codas are only tolerated in Spanish, and never preferred. Here, we use the term *preferred* in a relative sense. We consider word-final coda distribution as a consequence of faithfulness correspondence, and thus driven by

[43] This can only be considered a preferable coda when marked for [+cont], [ð]. Even still, the phonotactic tendencies we illustrated in chapter 1 which transform /d/ to [θ], challenges this assertion. A solid case could be made against the inclusion of /d/ in our categorization of preferred coda consonants but we will not do so here.
[44] It is true that /d/ is not phonologically marked for [+cont]. However, given the nature of word-final position, it is impossible for [d] to emerge in this case. Only [ð], a continuous consonant, may appear.

forces of input identity. Our syllable survey, as well as universal syllable typology indicates that no coda is really preferred, but emerges as a result of different, language dependent conditions. We consider that the [+continuous] nature of these segments in Spanish influences their high distribution in Spanish codas.

The important point to be extracted from these generalizations is that word-final coda well-formedness is not governed by onset well-formedness. This point explains why in word-internal codas we see a larger number of permissible codas than in word-final position.

A careful examination of the word-final segment model we presented in the last section reveals that our claim regarding the preferred status of continuous coronals is already programmed into the production hierarchy, since inferior ranking is intrinsically linked to frequent violations by optimal candidates. There are, however, some theoretical problems which prohibit us from programming this preference by way of constraint ranking into our syllabification model of word-internal segments. Based on the distributional evidence we have offered up to this point concerning the profuseness of continuous coronals in syllable-final position, we would be justified in introducing a series of no-coda constraints for word-internal position,*CODA/segment]σ, into our onset based model. However, since there is no way to rank permissible codas relative to one another, this proposition would imply a major burden for the language learner with no apparent benefits, since the well-formedness of the coda never affects syllabification. Our model based on onset well-formedness avoids this extra burden on the grammar.

We can, though, introduce the notion that a limited number of segments are completely banned in syllable-final position, [ɲ, d͡ʝ, r̄, t͡ʃ, ʝ, λ]. Hypothetically, we could program these as *CODA constraints, which in light of the previous data, would have to be ranked inferiorly in relation to the set of constraints governing onset well-formedness. Let us see this hypothetical hierarchy and the interaction of the constraints when we introduce an illicit combination *V[ɲt]V. Again, for ease we will exclude inactive constraints. Our constraint hierarchy appears in the following:

(65)
M-PARSE» PARSE» ONSET» SONSEQ» MSD-2^{ONS} »*ONSET/[NC]» *OL»*CODA[ɲ, d͡ʝ, r̄, t͡ʃ, j, λ] » *COMPLEX^{ONSET}» FAITHFUL

Let us observe how the grammar we have programmed will treat this sequence in the following tableau:

(66)

Input: *V[ɲt]V

	M-PARSE	PARSE	ONSET	SONSEQ	MSD-2^{ONS}	*ONSET/[NC]	*OL	*CODA[ɲ, d͡ʝ, r̄, t͡ʃ, j, λ]	*COMPLEXONSET
☞ a. V[ɲ.t]V								*	
b. V[.ɲt]V				*!	*	*			*
c. V[ɲt.]V			*!		*	*		*	

In this tableau, candidate (b) syllabifies both consonants as an illicit complex onset. Its violation to SONSEQ upon proposing a complex onset that does not adhere to sonority stipulations of onset segments proves fatal. Candidate (c) fatally violates ONSET by clustering both consonants as a complex coda, infringing on universal principles of syllable typology. Candidate (a) is the only possible optimal outcome since the segments are parsed into different syllables.

The important aspect that this tableau illustrates is not its capacity to parse segments into their respective syllabic positions, but rather the fact that segment distribution is already accounted for by the time the *CODA stipulations have a chance to take effect. As we can see, their role in this hierarchy is strictly totemic. Essentially, there is no paradigmatic advantage to include them in our model. At a later stage, some phonological generalization will need to occur to deal with the ill-formedness of the coda provided by the input, [ɲ], but this is beyond the realm of distribution and will not be considered here.

A natural offshoot of our distributional hypothesis based on onset well-formedness in Spanish is that the desire to reduce markedness in onsets by severely restricting the distribution of complex syllable-initial clusters creates a more marked structure for the preceding syllable. We can generalize therefore that the desire to reduce phonological markedness in onsets actually serves to increase phonological markedness in codas. Seen in this way, it should not be surprising that a great deal of the phonotactic constraints which motivate phonological generalizations in Spanish seek to modify codas (recall our analyses from chapter 1 dealing with voicing, place assimilation and neutralization). As we have seen in this last tableau (66), repair strategies are a necessary component of constraint interaction.

The hypotheses we have introduced, if correct, will provide an attractive justification for why the data from Spanish syllabification do not seem to harmonize with the predictions made by Itô's (1989) parsing hypothesis. To summarize, in the past sections we have shown that word-final coda well-formedness is a result of conflict resolution involving constraints governing input identity and positional constraints which strictly define the permissible segments. The result is a rather uncompromising inventory of acceptable word-final codas. We have shown in this section that word-internal coda distribution seems to have less to do with any productive hierarchy governing the well-formedness of coda, but rather is the secondary effect of onset well-formedness. A convenient side effect of this hypothesis is that we do not need to conceive of a separate constraint set to justify word-internal coda distribution, but can rely on the hierarchy we proposed for complex coda formation.

An added benefit of this proposition is that it provides an efficient justification for word-internal coda formation from the point of view of acquisition. Essentially, the language learner is not overly burdened by having to posit separate hierarchies for word-internal onset and coda formation, which, in turn, creates a cumbersome tax for the grammar, and yet, yields no productive benefit. In the following sections, we will test the effectiveness our hypothesis concerning coda distribution in larger medial clusters.

3.3.2 Three-consonant internal clusters

As we have seen, two consonant medial clusters in Spanish are rather profuse. In a perceivable way, consonants seem to be rather uninhibited with respect to their assembly. Since obstruent/liquid combinations can form complex onsets, and most other two consonant clusters can be parsed in different syllables as both codas and onsets, the quantity of possible combinations is abundant. However, in this section we will take a detained look at three consonant medial clusters in Spanish. We will see a dramatic reduction in the segments which can occupy the different positions of a three-segment cluster. Additionally, we will notice a more systematic nature of the segments' organization.

We mentioned in §3.3.1 that one of our foremost objectives in this section is to account for the distributional asymmetry between permissible word-final and syllable-final segments. In the previous section, we proposed a hypothesis which claimed that the profuseness of segments which may serve as word-internal codas is a consequence of the adherence to onset well-formedness. Basically, if there are no constraints which limit, a priori, the clusters that the input may propose, the natural side effect on syllable formation would logically imply the proliferation of rogue segments in coda position which would ordinarily not emerge. In this section, we will test this hypothesis and model the results accordingly in a constraint-based framework.

The following table provides a list of permissible medial three-consonant clusters in Spanish. Notice that for ease we have intentionally eliminated the tables. Additionally, we will not make any special separation for Latinate words. The reason should be obvious upon observing the list[45]. We should also note that we have relaxed our criteria with regard to what we consider monomorphemic items, due to the fact that a great majority of the clusters in our list would be off-limits for analysis:

(67)

Coronal-headed three consonant clusters

-n	[nkl]	a[nkl]a	-ankla	(*-anchor*)
	[nkr]	co[nkr]eto	-concreto	(*-concrete*)
	[ngl]	i[ngl]és	-inglés	(*-English*)
	[ngr]	co[ngr]eso	-congreso	(*-congress*)
	[nfl]**	i[nfl]ar	-inflar	(*-to inflate*)
	[nfr]**	i[nfr]ingir	-infringer	(*-to violate/ infringe upon*)
	[nsf]**	tra[nsf]erir	-transferir	(*-to transfer*)
	[ntr]	de[ntr]o	-dentro	(*-inside*)
	[ndr]	a[ndr]oide	-androide	(*-android*)
	[nst]	co[nst]ar	-constar	(*-to make known*)
-l	[lkl]	fo[lkl]ore	-folclore	(*from English –folklore*)
-r	[rsp]	pe[rsp]icaz	-perspicaz	(*-perspicacious*)
-s	[str]	clau[str]o	-claustro	(*-cloister*)
	[sdr]**	e[sdr]újula[46]	-esdrújula	(*-proparaxytone*)
	[sgr]**	e[sgr]imir[47]	-esgrimir	(*-to wield*)

[45] Again, one asterisk '*' denotes clusters for which a very few examples can be found. Two asterisks '**' denotes morphologically altered Latinate words.

[46] From Italian -*sdrucciolo*

[47] From Provençal -*escremir*

Labial-headed three consonant clusters

-*m*	[mbr]	ha[mbr]e	-hambre	(-*hunger*)
	[mbl]	e[mbl]ema	-emblema	(-*emblem*)
	[mpl]	a[mpl]io	-amplio	(-*ample*)
	[mpr]	sie[mpr]e	-siempre	(-*always*)
-*b*	[bst]	o[bst]etricía	-obstetricía	(-*obstetrics*)
	[bsθ]	o[bsθ]eno	-obsceno	(-*obscene*)

Dorsal-headed three consonant clusters

-*k*	[kst]**	te[kst]o	-texto	(-*text*)
	[ksk]**	e[ksk]usa	-excusa	(-*excuse*)
	[ksp]**	e[ksp]osición	-exposición	(-*exposition*)
	[ksθ]**	e[ksθ]epción	-excepción	(-*exception*)
	[ksb]**	e[ksb]oto	-exvoto	(-*votive offering*)

Three-consonant medial clusters are obviously more restricted than two-consonant clusters. Basically, even though the individual constituents of the clusters may vary, there are only two ways in which to parse the segments: C.CC, or CC.C. To recall, the hypothesis we made in the last section predicts that syllabification is dominated by onset well-formedness. As a result, the basic hierarchy we presented in (28) which was capable of justifying all optimal onsets while simultaneously rejecting sub-optimal sequences should be able to justify the parsing of the phonological components which comprise three-consonant clusters. We will test this hypothesis below.

First, in order for our hierarchy to be able to predict a parsing scheme C.CC, we must program a constraint which requires the grouping of clusters as complex onsets as opposed to complex codas. Observe that the low ranking of *COMPLEX$^{\text{ONSET}}$ is not sufficient to express this aspect of Spanish syllable typology. Essentially, our new constraint must oblige, whenever phonologically possible to do so, all well-formed complex onsets to cluster:

(68)

ONSET CLUSTER IMPERATIVE (ONS-IMP)[48]
All permissible complex onsets must be syllabified as two-consonant complex onsets.

In other words, complex-onsets will always be preferred to complex codas. Since this constraint is never violated by optimal outputs, we can assume it enjoys a dominant position in our constraint hierarchy.

Again, we have eliminated all inactive constraints from our main hierarchy presented in (29). Observe the syllabification of the following three-consonant clusters predicted by onset well-formedness:

(69)
Input: [nkl]

	M-PARSE	PARSE	ONSET	ONS-IMP	SONSEQ	MSD-2^{ONS}	*ONSET/[NC]	*OL	*COMPLEXONSET
a. [nk].[l]				*!					
☞ b. [n].[kl]								*	*
c. [.nkl]				*!	*	*	*		*
d. [nkl.]			*!	*	*				

Although this tableau makes no concessions for coda well-formedness, it is quite apt to justify the optimal syllabification of the three-consonant cluster provided by the input. Candidate (a) prefers to parse the first component of an otherwise well-formed onset as the final component of a complex coda. This strategy incurs a fatal violation of ONS-IMP, and ultimately leads to this candidate's elimination as an optimal output. Candidate (c) is eliminated by the same constraint. Candidate (d) is of particular

[48] Commonly, this process is acheived by the combination of two constraints, ONSET and NoCODA. Onset obliges an onset while no coda expresses that no coda may emerge in the optimal output. Aside from theoretical difficulties, this constraint paradigm is not economical.

interest. Even though this candidate does not parse any segment as an onset, it can still be eliminated in a number of ways. First, it does not parse the segments into separate syllables, which coincidentally counts as a violation of ONSET. Naturally, this candidate receives another violation mark for ignoring our requirement that all well-formed complex-onsets be syllabified as complex onsets. Interestingly, this candidate receives a violation mark for its violation of SONSEQ since the sonority values of [nkl.] do not fall rightward from the presumed nucleus that would preceed [n]. Recall, that SONSEQ addresses both extremities of the syllable margin, not simply onsets.

Before treating the alternative syllabification of three-consonant clusters, CC.C, it would be beneficial to review a couple obvious generalizations related to the complex codas which result from said syllabic division. Primarily we should make note of the fact that in all cases, the second consonant of the three-consonant cluster is always /s/. An analysis based on onset well-formedness expresses this fact by way of a constraint which bans complex onsets of the type s/C/. Basically, the fact that the second consonant which emerges is consistently /s/, producing a certain regularity in word-internal complex codas, and in effect tempting us to program a series of complex coda well-formedness constraints into our hierarchy, the result of this programming would be highly redundant since onset constraints leave no alternative parsing of the input segments. Recall that constraints governing sonority values in complex codas are already programmed into SONSEQ.

Let us observe the predictions made by our hierarchy dominated by onset well-formedness principles:

(70)

Input: [nst]

	M-PARSE	PARSE	ONSET	ONS-IMP	SONSEQ	MSD-2^{ONS}	*ONSET/[sC]	*OL	*COMPLEXONSET
☞ a. [ns].[t]									
b. [n].[st]				*!	*	*	*		*
c. [.nst]				*!	*	*	*		*
d. [nst.]			*!	*					

In this tableau, candidate (a) emerges as the optimal output due to its satisfaction of all constraints. Notice that there is no violation of ONS-IMP since [st] is not a permissible complex onset. Candidates (b) and (c) are eliminated by ONS-IMP due to this constraint's well-formedness provision for complex onsets. Both candidates incur identical violations of SONSEQ since requisites concerning sonority principles are not respected in the outputs. Since both candidates present an onset [st], wholly or partially, the constraint which stipulates a maximum sonority distance between phonological segments, MSD-2^{ONS}, is also gravely violated. Candidate (d) groups all consonants as a super complex coda, violating ONSET, which always prefers that peaks be syllabified with onsets.

As we can see, our hierarchical model dominated by onset well-formedness is capable of justifying the proper syllabification of three-consonant medial clusters in Spanish without having to redundantly program special constraints for complex coda well-formedness. However, we must consider now how the grammar would deal with a three-consonant cluster in the case that neither syllabification results optimal. Let us consider the input cluster /ftf/, in which the parsing [ft.f] provides an ill-formed complex coda, while the syllabification [f.tf] provokes grave violations to principles of onset well-formedness. Consider the following tableau:

(71)
Input: /ftf/

	M-PARSE	PARSE	ONSET	ONS-IMP	SONSEQ	MSD-2^{ONS}	*OL	*COMPLEXONSET
☞ a. [ft].[f]					*			
b. [f].[tf]				*!	*	*		*
c. [.ftf]				*!	*	*		*
d. [ftf.]			*!	*				

The syllabification, [ft].[f], proposed by candidate (a) turns out optimal. However, we must make some justification as to how our grammar is capable of producing an illicit coda [ft]. The answer lies in the theoretical equivalent of a lesser-of-two-evils argument. In this case, the only viable option our grammar has is to adhere to the universal principle of syllable onsets provided by Kager (1999), which states that peaks always prefer to have onsets. This accomplished, there is not much that the grammar at this juncture can do to repair the faulty structure provided by the input.

We propose that the resolution to this problem lies in the emergence of subsequent phonotactic constraints which will rearrange or repair the illicit structure by way of epenthesis or segment deletion. As we are dealing with a structure that is always phonetically neutralized in Spanish, there is no theoretical ground on which to argue for the inclusion of special constraints which militate against these types of structures in our basic hierarchy. The logical extension to the argument supporting the inclusion of specific constraints to govern strings of segments which never emerge would be to abandon language specific grammars altogether in exchange for hierarchies which consider *all* the possible combinations of *all* three-consonant clusters of *all* segments from *all* languages. Naturally, this would result not only redundant, but also superfluous from the acquisition perspective.

Alternatively, we could follow Hammond's (1999) lead and propose that the unsyllabified segments were left unpronounced. This argument presents somewhat of a moot point, however, since there is not much empirical data to support the existence of structures which *never* get pronounced. Effectively, Hammond's argument in favor of unpronounced segments, although functional, is inherently circular and theoretically unsubstantiated since there is no way to empirically corroborate such a claim.

3.3.3 Four-consonant internal clusters

In this section we will address four-consonant medial clusters. Unlike three-consonant clusters, there is only one acceptable way to parse four-consonant clusters in Spanish; onsets and codas must be complex. In the table that follows, we have nearly abandoned altogether our monomorphemic criteria established for two- and three-consonant clusters. As the reader will surely perceive, with the exception of an extraordinary few, all four-consonant clusters in Spanish represent morphologically complex words. For ease and the scarcity of data, we do not divide the clusters into distinct categories according to the initial phoneme:

(72)
Four-consonant clusters in Spanish

-b	[bstr]	a[bstr]acto	-abstracto	(*-abstract*)
	[bskr]	su[bskr]ibir	-subscribir[49]	(*-to subscribe*)
-d	[dskr]	a[dskr]ito	-adscrito	(*-attached, assigned*)
	[dstr]	a[dstr]ato	-adstrato	(*-Linguistic term that describes a language that has dominance over another in the same geographic region*)
-n	[nskr]	i[nskr]ibir	-inscribir	(*-to inscribe*)
	[nstr]	co[nstr]eñir	-constreñir	(*-to obligate or force someone to do something*)
	[nsfl]	tra[nsfl]orear	-transflorear	(*-to adorn with painting*)
	[nsfr]	tra[nsfr]etano	-transfretano	(*-situated on the other side of a lake*)
	[nsgr]	tra[nsgr]edir	-transgredir	(*-to transgress, break, violate*)
-k[50]	[kskl]	e[kscl]uir	-excluir	(*-excluir*)
	[kskr]	e[kskr]eción	-excreción	(*-excretion*)
	[kspl]	e[kspl]orar	-explorar	(*-explorar*)
	[kspr]	e[kspr]esar	-expresar	(*-to express*)
	[kstr]	e[kstr]aer	-extraer	(*-to extract, take out*)

Before formalizing any generalizations concerning the forms above, we must first make a theoretical distinction between the coincidental and the productive nature of optimal outputs. If we look closely, the second segment of all four-consonant clusters in Spanish is [s]. We have two options with regard to how we can express this generalization in the grammar. Our first option would be to program a series of coda well-formedness constraints which eliminates the emergence of all other segments in this position. The problem with this is that there are thirteen other permissible segments which may occupy this position if we exclude [ʝ, ʧ, d͡ʝ, ɲ, λ, r̄], which never appear in codas. This means that thirteen segment bans are needed to justify one optimal output by the grammar. This is obviously not an economic solution.

The second option is to propose that [s] emerges by circumstance. Since all the forms represent morphologically altered Latinate items, [s] emerges consistently in this position, not by any inherent quality of the segment itself, but rather due to the fact that

[49] The accepted form in Modern Spanish is *–suscribir*. In writing, the first consonant of the complex coda [bs] is sometimes retained.

[50] Most often realized as [γ].

Latin prefixes presented such a structure. The fact that Spanish will tolerate this sequence to a certain point does not need special justification in the grammar since onset well-formedness already predicts the correct distribution. However, the emergence of these sequences does indicate that, at a later stage, adherence to faithfulness outranks any phonotactic constraint which may want to repair the disfavored output. The diachronic loss of [b] in –*su*[b]*scribir* (-*to subscribe*), as well as the loss of [n] in –*tra*[n]*sfregar* (-*to rub, rumple*), corroborates our claim of subsequent interaction between faithfulness and phontactics as well as our proposal that complex codas do not result from a productive paradigm, but rather from circumstantial coda distribution in Latin prefixes which is preserved in Spanish by way of faithfulness.

If we wanted to observe how the *productive* Spanish grammar would deal with these forms, we would have to consider the adaptation of the English loan –*backstage*, [bæksteiǰ], as in *backstage pass*. In fact, what we observe in cases like these, where the Spanish grammar is forced to actively compute such an input, is the emergence of an epenthetic vowel between the segments [ks]: [ba.kes.téiǰ]. If we compare this productive form, [ba.kes.téiǰ], to one of the Latinate forms, [eks.ter.no] (-*externo*, Eng. -*external*), we see a marked difference with regard to how the productive Spanish grammar prefers to deal with complex codas. Since all the forms presented in the last table (72) are phonologized forms, the productive grammar is dominated by faithfulness principles which require all input segments to be represented in the optimal output. The fact that these forms have emerged in Spanish demonstrates that the ban on complex codas is a relatively new restriction in the Spanish grammar.

We formalize these assertions in the following generalizations:

(73)

Generalizations for complex coda formation in Spanish

i. **Complex codas are universally banned in Spanish**. They are tolerated word-internally in phonologized Latinate forms due to the fact that faithfulness outranks any phontactic constraints which would repair the structure.

ii. **Complex coda formation is a passive upshot of onset well-formedness** and, therefore, does not require representation in the production grammar with regard to segment distribution at syllable margins.

iii. The ban on complex codas emerged after the incorporation and phonologization of the morphologically altered Latinate forms listed in table (72).

To test the hypothesis that onset well-formedness dominates syllabic parsing in Spanish, consider the following tableau. Again, we have eliminated inactive constraints for ease and space:

(74)

Input: /bstr/

	M-PARSE	PARSE	ONSET	ONS-IMP	*ONSET/[sC]	SONSEQ	MSD-2^{ONS}	*OL	*COMPLEXONSET
☞ a. [bs].[tr]								*	
b. [b].[str]				*!	*	*	*	*	*
c. [.bstr]				*!	*	*	*	*	*
d. [bstr.]			*!	*		*			
e. [bst.r]				*!					

In this tableau, the candidate which parses the correct complex onset consequently produces the optimal syllabification for the complex coda. In this case, candidate (a). Candidates (b) and (c) incur fatal violations to ONS-IMP which requires that all possible complex onsets be parsed as such. Candidate (d) rejects the onset altogether in favor of parsing all four segments as a complex coda. Again, candidate (d) only parses half of the complex onset as the onset of the second syllable, gravely violating ONS-IMP.

As we predicted, this basic hierarchy founded on onset well-formedness is capable of justifying the parsing of all syllabic constituents to their appropriate positions. We have proposed and demonstrated that the concept of coda well-formedness is a programmed dependent of the input structure. In other words, all consistency and well-formedness with regard to coda radiates from the nature of the input and the morphological procedures which shape it. Additionally, we have shown that if the input provides a defective coda structure, there is never any impact on onset well-formedness. In other words, the repair of illicit coda structures is internally and locally restricted to the coda position.

3.4 SYLLABLE PEAKS

The Spanish vowel system consists of five vowels, of which two are front vowels, [i] and [e], two are back vowels [o] and [u] and one which is neither back nor front, [a]. The front vowels consist of one high vowel, [i], and another mid-vowel, [e]. Symmetrically, the two back vowels as well consist of one high vowel, [u], and one mid-vowel, [o].

All Spanish vowels emerge as syllable peaks in all positions, word-internally and at prosodic boundaries, regardless of the consonant which precedes them. Certain vowels, like [i], only appear stressed at word-final position save in a scarce few exceptions. Consider the distribution of singleton vowels in the following table:

(75)

Singleton peak distribution in Spanish

	Word-initial		Word-final		Word-internal	
-a	[a]*stuto*/[á]*gua*	(*astute/water*)	*min*[a]/*baj*[á]	(*mine/Pasha*)	*g*[a]*nar*/*g*[á]*fas*	(*earn/glasses*)
-e	[e]*nemigo*/[é]*sto*	(*enemy/this*)	*padr*[e]/*llegu*[é]	(*father/ I arrived*)	*n*[e]*gar*/*p*[é]*na*	(*deny/pity*)
-i	[i]*mán*/[í]*sla*	(*magnet/island*)	*tax*[i]/*Israel*[í]	(*taxiIsraeli*)	*m*[i]*gar*/*l*[í]*sto*	(*crumble/clever*)
-o	[o]*brero*/[o]*so*	(*worker/bear*)	*man*[o]/*lleg*[ó]	(*hand/arrived*)	ll[o]ver/*l*[ó]*co*	(*rain/mad*)
-u	[u]*ntar*/[ú]*no*	(*to spread/one*)	*trib*[u]/*men*[ú]	(*tribe/menu*)	*m*[u]*ltar*/*m*[u]*lto*	(*to fine/ fine*)

Although unstressed [i] does not appear often in word-final position, truncated forms of Spanish diminutives in colloquial speech, *-gordi* (from *–gordito/a*, Eng. *-fatty*) and *–guapi* (from *–guapito/a*, Eng. *-pretty*), indicate that there is no ban, *a priori*, which prohibits its emergence.

The fact that all vowels may appear at prosodic boundaries and word-internally does not imply that all vowels enjoy the same frequency of occurrence. In point of fact, we see that that the emergence of high vowels in general is much lower than the appearance of mid- and low vowels, [o,e] and [a], respectively. We observe that [a] enjoys the most ample distribution, occupying 13.70% of the total phoneme distribution, followed by mid-vowels [e] and [o] which represent 12.60% and 10.30% respectively. Finally, [i] and [u] have the lowest frequency of occurrence, occupying only 8.60% of the total distribution of phonemes in the case of [i], and 2.10% of total phonemes in the case of [u] (Alarcos Llorach, 1964). In our independent recount of 1,000 phonemes in a typical Spanish text[51], we found nearly identical statistics.

Diphthongs are more restricted than singleton vowels. As we mentioned in the first chapter, there are six falling diphthongs in Spanish and eight rising dipthongs. The following chart is offered to refresh our memories:

(76) Spanish diphthongs

Falling diphthong	Rising dipthongs
[ej]	[je]
[aj]	[ja]
[oj]	[jo]
[ew]	[ju]
[aw]	[wi]
[ow]	[we]
	[wa]
	[wo]

[51] From the Tuesday, January 20 edition of *20 Minutos*, a free morning periodical.

A close reading of the table will reveal that both [ji] and [wu][52] never appear in Spanish. Additionally, the data indicates that Spanish does not permit double peaks of the sort [aa] or [oo]. Examples of both rising and falling diphthongs are offered in the following chart:

(77)
Distribution of Spanish diphthongs

		Word initial	Word-internal	Word-final
Falling Diphthongs				
	-ej	-	p[ej]ne- *peine* (*comb*)	r[ej]- rey (*king*)
	-aj	[aj]re- *aire* (*air*)	fr[aj]le- *fraile* (*friar*)	h[aj]- hay (*there is*)
	-oj	[oj]dor- *oidor* (*hearer*)	b[oj]na- *boina* (*beret*)	h[oj]- hoy (*today*)
	-ew	[ew]ropeo- *europeo* (*European*)	n[ew]tro- *neutro* (*neutral*)	-
	-aw	[aw]sente- *ausente* (*absent*)	p[aw]ta- *pauta* (guideline)	-
	-ow	-	-	b[ow] (fish boat casting)
Rising Diphthongs				
	-je	[je]lo- *hielo* (*ice*)	d[je]nte- *diente* (*tooth*)	-
	-ja	[ja]to- *hiato* (*hiatus*)	mar[ja]no- *mariano*(*mariano*)	demenc[ja]-*demencia*(*insanity*)
	-jo	-	od[jo]so- *odioso* (*hateful*)	od[jo]- *oido* (*hate*)
	-ju	-	d[ju]turno- *diuturno* (*diuturnal*)	-
	-wi	[wi]da- *huida* (*escape*)	b[wi]tre- *buitre* (*vulture*)	f[wi]- *fui* (*I went*)
	-we	[wé]rfano- *huérfano* (*orphan*)	ab[we]lo- *abuelo* (*grandfather*)	desag[we]-*desagüe*(*drain*)
	-wa	-	ag[wa]ntar- *aguantar* (*to bear*)	ag[wa]- *agua* (*water*)
	-wo	-	c[wo]ta- *cuota* (*quota*)	contig[wo]-*contiguo*(*contiguous*)

We have seen that both singleton peaks and diphthongs have a significant amount of liberty with regards to prosodic distribution in Spanish. However, this claim does not imply that all enjoy equal rates of occurrence. Our count of 1,000 peaks of patrimonial words in Spanish reveals a striking preference for singleton peaks. Of the total peaks, 921 were singleton peaks, thirty nine were word-internal rising diphthongs, ten were word-final rising diphthongs, twenty one were word-initial falling diphthongs and nine were word-final falling diphthongs[53]. These data are organized in the following table:

[52] See *Obligatory Contour Principle* (Leben,1973) and subsequent work in McCarthy 1979, McCarthy 1981, Steriade 1982, Clements & Keyser 1983, Hyman 1985, Hayes 1989. Among other issues, this principle expresses the cross-linguistically substantiated notion that no single morpheme may contain two contiguous underlying high vowels.

[53] Although we do not address such topics here, these data are also significant for learnability and acquisition models.

(78)

Total peaks/% of total	Word-initial	Word-internal	Word-final
Singleton	921/92.10%		
Rising diphthongs	0/0	39/3.90%	10/1.00%
Falling diphthongs	21/2.10%		9/0.900%

Triphthongs are the least common vowel cluster in Spanish. In our survey of 1,000 Spanish peaks, none emerged. These clusters are composed of an initial high vowel, [i] or [u], followed by the falling diphthongs [ej] or [aj]. Although triphthongs appear in a limited number of Spanish substantives, they enjoy the highest frequency in the second person informal plural (-*vosotros*, Eng. -*you*) verb conjugation. Let us observe the following data:

(79)

Triphthongs in the 2nd person informal plural verb conjugations

[jej]	var[iei]s	variéis	subjunctive form of infinitive –*variar* (*to vary*)
[jaj]	var[iai]s	variáis	indicative form of infinitive -*variar*
[wej]	perpet[wei]s	perpetuéis	subjunctive form of infinitive –*perpetuar* (*to perpetuate*)
[waj]	perpet[wai]s	perpetuáis	indicative form of infinitive -*perpetuar*

Now, after considering the previous data we are ready to formalize some preliminary generalizations regarding syllable peaks in Spanish. Most obviously, all peaks in Spanish are either vowels or semi-consonants[54]. Secondly, no vocalic cluster may contain more than three vowels. All syllables contain at least one segment. Additionally, we have already mentioned that [wu] and [ji] are illicit clusters in Spanish. Finally, we can generalize that two identical vowels may not appear contiguously in the same nucleus, *[aa] for example. These generalizations are formalized in the following example:

[54] The syllabic position of the semi-consonants [w] and [j] in diphthongs has been rigorously debated in the literature. Van der Veer's (2007) spectrographic data on Italian diphthongs suggest that the semi-consonants indeed form part of the syllable nucleus.

(80)
Generalizations for syllable peaks in Spanish

i. All peaks are vowels or a vowel/semi-consonant cluster.
ii. The maximum number of segments in Spanish peaks is three.
iii. The minimum number of segments in Spanish peaks is one.
iv. *[wu] peaks.
v. *[ji] peaks.
vi. No double vowel peaks.

These generalizations can be easily translated into constraints in an OT framework. We will express most of these generalizations as variants of the constraint *PEAK/[…]. The remainder (v and vi), we will specify separately. These constraints appear in the following example:

(81)
Constraints governing syllable peaks in Spanish

i. *PEAK/[C]
ii. *PEAK/[wu]
iii. *PEAK/[ji]
iv. *PEAK/[$V_{(1)}V_{(1)}$]
v. MIN-SEG-(1)
vi. MAX-SEG-(3)

These constraints are capable of selecting all possible Spanish peaks while rejecting suboptimal nuclei. Consider the following constraint set:

(82)

MAX-SEG-(3)
The maximum number of segments in a Spanish peak is three.

MIN-SEG-(1)
The minimum number of segments in a Spanish peak is one.

*PEAK/[$V_{(1)}V_{(1)}$]
No double peaks ([aa,ee,ii,uu,oo])

*PEAK/[ji]
No diphthongs [ji]

*PEAK/[wu]
No diphthongs [wu]

*PEAK/[C]
Peaks must consist of vowels, or semi-consonants and vowels in the case of diphthongs.

Consider the following tableau which selects optimal peaks using the previous constraints:

(83)

	MAX-SEG-(3)	MIN-SEG-(1)	*PEAK/[$V_{(1)}V_{(1)}$]	*PEAK/[ji]	*PEAK/[wu]	*PEAK/[C]
☞a. [a]						
☞b. [e]						
☞c. [i]						
☞d. [o]						
☞e. [u]						
☞f. [ej]						
☞g. [aj]						
☞h. [oj]						
☞i. [ew]						
☞j. [aw]						
☞k. [ow]						
☞l. [je]						
☞m. [ja]						
☞n. [jo]						
☞o. [ju]						
☞p. [we]						
☞q. [wi]						
☞r. [wa]						
☞s. [wo]						
t. [wu]					*!	
u. [ji]				*!		
v. [C]						*!
w. [aeio….]	*!					
x. [V_1V_1]			*!			
y. C[Ø]C		*!				

In this tableau, all outputs in violation of any one constraint are considered sub-optimal, candidates (t-y), while those which do not incur any constraint infractions, candidates (a-s), are well-formed peaks in Spanish.

Now let us consider how the basic rankings we have introduced in this chapter can select the correct syllabification in a concrete example. We have programmed the constraint PARSE to a dominant position in order to insure that no segment is left unsyllabified. To recall, PARSE requires that all words be thoroughly parsed into syllables. ONSET requires that peaks be syllabified with a pre-nuclear consonant. Additionally, since we are dealing with strings of segments, we will program a dominant constraint $\text{IDENT}_{(\text{segment})}$ which will militate against any feature deviation between input and output with regard to segments. This constraint, working in conjunction with PARSE will force any coda to syllabify as the post-nuclear segment. Our constraint hierarchy will appear as the following:

(84)
IDENT » PARSE » ONSET » MIN-SEG-(1) » *PEAK/[c]

Let us observe their interaction in the next tableau:

(85) Input: /pan/ (*bread*)

	IDENT	PARSE	ONSET	MIN-SEG-(1)	*PEAK/[C]
a. p[an]		*!	*		*
☞b. [pan]					
c. [pa]n		*!			*
d. [pØn]	*!			*	*
e. [pa]	*!				*

In this tableau, there is only one possible optimal output, candidate (b). Since there is only one nucleus, the only possible syllabification is to parse all the constituents into one syllable. Candidate (a) parses the entire rime as the syllable peak, violating both PARSE and the constraint requiring that peaks be vowels, *PEAK/[C]. Candidate (c) proposes a similar syllabification and is eliminated by the same constraints. Candidates (d) and (e) eliminate segments and include consonants as part of the nucleus, fatally violating FAITH as well as *PEAK/[C].

3.5 CONCLUSIONS

In this chapter we have provided an exhaustive analysis of the constraints responsible for shaping Spanish syllables. We argued that a major part of the structure of Spanish syllables, especially word-internally, is determined by onset well-formedness. We demonstrated that whenever phonologically feasible, Spanish prefers to parse consonants as onsets. Subsequently, we illustrated that a hierarchy dominated by universal constraints favoring onset well-formedness is easily capable of justifying these prosodic generalizations in Spanish.

The natural upshot of this hypothesis is the notion that word-internal codas emerge as a result of circumstance and input structure, as opposed to any adherence to coda well-formedness. We have shown that for this very reason, there is an observable discrepancy between segments which may appear in coda position word-internally and those which appear word-finally. On the surface, it appeared as if this incongruity challenged the predictions made by Itô (1989) regarding the correlation between codas which surface at prosodic boundaries and those which appear word-internally.

Our analysis illustrated, however, that the leeway granted to coda segments word-internally is the consequence of a strict set of constraints which govern onset well-formedness and not a programmed proclivity for any coda segment specifically. Basically, this analysis allowed us to show that the distribution of phonological constituents is determined by (1) the distribution of phonological segments in the input, and (2) the stringent bans imposed on onset. Given the fact that divergent segments in word-internal coda position only constitute 5.6% of the total word-internal coda segments in our random syllable count, we conclude that Itô's predictions are effectively corroborated by the Spanish data we presented here, even though a relative few examples challenge the veracity of these predictions. Additionally, the data we provided indicated that a disproportionate amount of the cases in which divergent codas surface, can be linked to (1) morphological modification in Latin, and (2) their subsequent phonologization in Spanish. Seen in this way then, our analysis not only offered a coherent justification for the synchronic processes which shape Spanish syllables, but also recognizes that diachronic issues also play a major role in as far as they have an important effect on the structure of Spanish inputs.

We made the claim that the only well-formed codas in Spanish are coronals marked for [+continuous]. We drew this conclusion from the fact that these are the only coda segments permitted at word boundaries in Spanish. Additionally, this assertion is crucially supported by the unusually high frequency of [+continuous] coda coronals word-internally.

Finally, we demonstrated that a constraint-based model grounded in universal principles of onset well-formedness is deftly capable of expressing the generalizations we provided for Spanish. One of the major benefits of this model is that word-internal coda well-formedness need not be represented hierarchically. In fact, we demonstrated that such a strategy would be gratuitous and constitute an excessive burden for the grammar, and essentially the language learner, since syllable formation in Spanish can be deduced from principles of onset well-formedness to a major extent. As a result, we were not forced to postulate two separate hierarchies for word-internal syllable margins and word-final margins. Thus, the model we provided is not only effective, but also economic in the sense that the language learner does not have to learn two separate hierarchies to justify the distribution of phonological segments at what is ultimately one syllabic position.

4

SYLLABIC LICENSING AND STRUCTURAL WELL-FORMEDNESS IN SPANISH

4.0 INTRODUCTION

This chapter examines the conciliation of conflict between two principal factors; syllabic licensing and structural well-formedness. In chapter 3, we demonstrated that PARSE requires all phonological constituents to be parsed into syllables. Importantly, we have seen that in Spanish, this constraint is *never* violated. Crucial to the viability of PARSE, however, is the notion that all inputs are, or may be with modification, well formed with regard to the distribution of the phonological segments which comprise the word. Explicitly, the constituents that compose the word must be *parseable*. In this chapter, we will consider the different repair strategies that Spanish has at its disposal to reconfigure ill-formed, or marked, input structures, and defective structures that emerge as a result of morphological modification, which would otherwise be impossible to parse without external provisions.

In the cases we examined in the last chapter, the impact of PARSE was only seen internally, in the way the segments were syllabified. That is, segments, and clusters of segments, not permitted in one position were simply parsed to a contiguous position. The illicitness of /s/C onsets word-internally, for example, prompts a syllabic division between /s/ and the following consonant whereby /s/ becomes syllabified as the coda of the preceding syllable and the following consonant is necessarily parsed as an onset.

However, in this chapter we examine cases in which parsing alone is incapable of producing the optimal output. We will see that in certain cases, the solution to syllabic well-formedness must come from outside prosodic conventions in order for the optimal output to avoid fatal violations of the dominant phonotactic constraints we introduced in the last chapter.

The organization of this chapter progresses as follows. First we deal with vowel prosthesis in Spanish, (§4.1, page 193). Loosely defined, prosthesis entails the insertion of a phonological segment in word-initial position so as to avoid the emergence of a highly marked structure in the output. Often, this process is motivated by the input structure itself. Consider the English loan word, -*stop*. Here the input structure of the monomorphemic word is sufficiently ill-formed to prevent it from surfacing in the optimal output due to bans prevailing over complex /s/C onsets. A prothetic [e], -*estop*, therefore inserts in order to syllabify the /s/ as the coda of the newly formed syllable [es], and the [t] is parsed as the onset of the remaining syllable [top].

Consonants, as well, may insert to fulfill stipulations made by principles of syllabic and phonological well-formedness. Essentially, consonants insert to provide onsets for nuclei in the event that the input, for diverse reasons, does not provide one. This is often the case when vowel-initial suffixes must align to a vowel-final base. Our preliminary analysis of consonant epenthesis in Spanish begins with a brief survey of epenthetic consonants followed by a justification based on conflict resolution. We demonstrate that consonant insertion results from a constraint schema dominated by ONSET, which requires peaks to be parsed with a pre-nuclear consonant. In both sections addressing segment insertion, we will pay particular attention to both the segment itself and the alignment of the prosodic constituents.

In §4.2 (page 219), we analyze Spanish plural formation. We will offer an extensive analysis of Spanish plurals based on the interaction of bans on complex codas and faithfulness notions of input/output correspondence. We demonstrate that the uniform processes involved in Spanish plural formation can easily be captured in a constraint-based model by a ranking schema in which the markedness constraint, *COMPLEX^{CODA}, dominates any desire proposed by faithfulness to maintain full input/output correspondence.

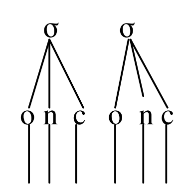
4.1 REPAIR STRATEGIES

4.1.1 Vowel insertion

In this section we analyze data pertaining to vowel prosthesis in /s/C word-initial onsets in Spanish. Specifically, we will consider the alignment of prosthetic, [e] in unassimilated foreign loan words which begin with illicit /s/C clusters. As we saw in the last chapter, this sequence in onset position is positively banned in Spanish. However, given the high frequency of /s/C onsets in English and Latin, the appearance of this marked input structure in Spanish is quite common due to the etymological origin of Spanish and by loan word incorporation.

In the previous chapter, we demonstrated that word-internally, the constraint *σ[/s/C is satisfied by regularly parsing /s/ as a coda, while the second consonant is always syllabified as the onset of the syllable that follows:

(1)



/de<u>sd</u>en/ → [d e s] [d e n]

Nevertheless, this is not a viable option in word-initial position since there is no preceding nucleus to which /s/ can be aligned as a coda:

(2)

```
              σ
           o  n  c
/stop/ →[Ø][st] o  p]
```

Let us observe the following data of unassimilated English loan words in Spanish:

(3)

Illicit word-initial /s/C clusters in foreign loan words[1]

English word	Spanish adaptation	
[st]op	[e]stop	/s/ + coronal obstruent
[str]ess	[es]trés	/s/ + coronal obstruent/liquid cluster
[spr]ay	[es]pray	/s/ + labial obstruent/liquid cluster
[spr]int	[es]prin(t)[2]	/s/+ labial obstruent/liquid cluster
[sm]art[3] (car)	[e]smart	/s/ + labial obstruent
[sk]anner	[e]scáner	/s/ + dorsal obstruent
[sp]eech	[e]spich	/s/ + labial obstruent
[sl]ogan	[e]slogan	/s/ + lateral sonorant
[sm]oking	[e]smoquin	/s/ + nasal sonorant

In these cases, [e] is supplied post-lexically by a synchronic process governed by principles of prosodic well-formedness. Additionally, we can observe cases of organic prosthetic /e/ in the following phonologized Latinate items. In fact these are rather common in Modern Spanish:

(4)

Prothetic /e/ in phonologized Latinate forms

Spanish adaptation	Latin root
-esperado	*sperāre*
-espejo	*specŭlum*
-estado	*status*
-esfera	*sphaera*

[1] Most of the words in this data set are not recognized by the Real Academia Española (RAE). This is not surprising given the fact that the RAE does not normally recognize loan words until after they have been in active use for more than one generation.
[2] Final /t/ is precluded in casual speech.
[3] Proper brand name.

Although the vowels that surface in these last examples are organic, meaning they are phonologized segments and, therefore, form part of the underlying representation, the process which motivated their original insertion would be theoretically identical to that which we will offer for the synchronic cases in (3).

Already, we can formalize a series of generalizations based on the previous data which we will later translate into constraints. First, with regard to segment, the initial segment in all cases is [e]. Secondly, in both data sets, the inserted segments never disrupt the contiguity of the root segments. That is *–estop* is a suitable output yet *-*setop* is not. Next, it is clear that the stimulus behind the vocalic insertion is unquestionably linked to the illicitness of /s/C onsets in Spanish. To recall, PARSE requires all segments to be parsed to their appropriate syllabic position. The problem is that the /s/C structure provided by the input cannot be parsed as a well-formed onset in Spanish. Finally, the mere insertion of [e] implies that epenthesis, as a strategy, is preferred to segment deletion in order to resolve the conflict between PARSE and *σ[sC. Notice that segment deletion would also avoid a fatal violation of *σ[/s/C. Before formalizing our constraints, we will review each generalization more in depth below.

First we must address the nature of the ill-formed sibilant/consonant structure. Observing the data we presented in (3) and (4), we notice that the illicitness of many of the /s/C sequences is attributable to their failure to align to the abstract sonority distance expressed by SONSEQ and MSD-2^{ONSET} that we introduced in the last chapter. This explanation justifies the ill-formedness of [sp], [sm], [sf], [st], [sp], [sk] and others, but does not offer any sort of sound reason as to the ban on [sl] and [sr] sequences. Notice that both structures are formed by an obstruent and liquid, entirely tolerable permutations from the point of view of sonority distance.

We could postulate that their prohibition is governed by the fact that double coronal clusters are disfavored in Spanish, but this claim would force us to justify the appearance of [dr] and [tr] clusters. Additionally, we could attribute the ill-formedness of these forms to the fact that contiguous segments marked for [+continuous] are forbidden in Spanish, but this justification as well would oblige us to consider forms such as [fl] and [fr] as somewhat exceptional, in effect requiring an equally awkward explanation. Given the contentious nature of the phonological justification concerning the [sr] and [sl] clusters, we will not formulate any hypothesis here to treat this matter. Simply, we recognize that the sequence is an ill-formed Spanish onset even though the specific reason is not known.

Next, with regard to the segment which inserts, Alonso-Cortés (1997) and later Lombardi (2002), specifically citing Spanish, note that the insertion of [e] is somewhat exceptional as an epenthetic segment, proposing that [a] is the more cross-linguistically corroborated segment in cases of vowel epenthesis. Of course, this assertion contradicts the predictions made by Archangelli (1984) and Harris (1985) who consider [e] to be the unmarked vowel in Spanish. A large part of Archangelli's and Harris' argument is based on similar cases of epenthesis to the ones we offer here.

The arguments proposed by Harris and Archangelli cited above are primarily centered round the global hypothesis elaborated in Underspecification and markedness Theory (see Steriade, 1995 for a complete review) which supposes that the epenthetic segment is determined by its quantity of negative or positive feature specifications, known as **marks**, in relation to other segments in a specific language's phonological system. Accordingly, /t/ is appreciably less marked than /θ/ because this latter consonant receives a mark for [+continuous], whereas /t/ is unmarked for this feature. The two consonants are identical for all other feature values.

The critical problem with the predictions based on markedness is that, cross-linguistically, there is an expansive variety of segments which insert in contexts of epenthesis, not all of which are the least marked segments of the particular language's phonological inventory (see Hume, 2002).

Certain data from Spanish, in point of fact, challenge key predictions related to segment insertion based solely on principles of markedness. Consider the epenthetic vowel in the following data set:

(5)

Additional epenthetic segments in Spanish (vowels)

Spanish	gloss
a.	
-[a]rrepentirse	(*to feel guilty, repent*)
-[a]rrascarse	(*to scratch*)
-[a]rremangar	(*to pull up one's sleeves*)
	(Cornu, 1882 in Alonso-Cortés, 1997)
b.[4]	
-culpab[i]lidad[5]	(*culpability, guilt*)
-inteligib[i]lidad	(*intelligibility*)
-visib[i]lidad	(*visibility*)
-comprensib[i]lidad	(*understanding*)
	(Alonso Cortés, 1997)

The data from (5) present clear proof that any predictions as to the epenthetic segment made exclusively on markedness are misconstrued. Lombardi (2002), to the contrary, presents an alternative universal schema grounded in the relative markedness of major [place] classes. Essentially, Lombardi proposes a ranking hierarchy based on empirical evidence which reflects the fact that /a/ is the universally preferred epenthetic

[4] We consider the /i/ which inserts to the right of the affix /dad/ to be part of the suffix. The motivation of the epenthetic vowel in these cases is unclear since /bl/, the final consonants of all the stems in this category, is a well formed onset, and should not need to insert an extra vowel for reasons of syllabification. Our hunch is that insertion in these cases can be justified as an historical case of leftward vowel spreading from the initial vowel of the suffix.

[5] Our justification is in line with the generalizations regarding the suffix *–dad* outlined by the Royal Spanish Academy: (1) *–dad* itself does not productively affix to modern Spanish adjectives, (2) bisyllabic adjectives ending in a consonant take the affix *–idad*, and (3) the affix *-bilidad* attaches to all adjectives that contain the ending *–ble*. The third generalization indicates that the /i/ which appears between /b/ and /l/ forms part of the underlying representation of the morpheme and does not count as a case of productive epenthesis.

vowel. The facts from Spanish which we have presented up to this point do not coincide with Lombardi's empirical evidence, but due to the flexible nature of OT, the data from Spanish can still be modeled by restructuring the proposed hierarchy.

For Spanish, we could conceive of a preliminary hierarchy in which *[o] and *[u][6] would occupy the dominant position of the hierarchy, and *[e], *[a] and *[i] would occupy the inferior positions. Given that both [a] and [i] as epenthetic segments are restricted to very specific phonological contexts, the optional insertion of [a] before /r/ in non-standard speech and [i] before the morpheme {dad}, the inferior ranking of *[e] relative to these last two segments is theoretically viable. Thus, we propose the following constraint hierarchy to specifically justify the insertion of [e] in unassimilated English loan words in Spanish:

(6)
*[i], *[u] » *[a],*[i] » *[e]

Let us observe the predictions this hierarchy makes regarding the insertion of [e] in the examples we introduced in (3):

(7) Input: /stop/

	*[o], *[u]	*[a],*[i]	*[e]
☞ a. [e]stop			*
b. [o]stop	*!		
c. [u]stop	*!		
d. [a]stop		*!	
e. [i]stop		*!	

As we can observe, the insertion of [e] violates the lowest ranked constraint and consequently results as the optimal candidate.

Hitherto, we have offered a theoretical justification for the epenthetic segment itself, but we must now turn our attention to the influences which govern the alignment

[6] Alonso-Cortés (1997) presents cases of [u] epenthesis but claims that there is no systematic evidence supporting [u] as a productive epenthetic segment.

of the segment to the input base. Harris (1969) offered the following rule to justify the process of vowel epenthesis in Spanish:

(8)
$\emptyset \rightarrow [e] / \# \_\_\_ s[+cons]$

Like all of the rules that we have seen in this thesis, this rule negates the fundamental assumption that output forms represent the appeasement of competing phonological forces. Although this rule is functional in the sense that it offers an accurate *description* of the process at hand, it does so at the cost of neglecting any sort of phonological explanation of the procedure itself.

Returning to the generalizations we expressed at the outset of this section, we notice a clear preference for segment insertion, and not segment deletion, to repair the illicit input structure, σ[/s/C, before it has an opportunity to surface. In OT, this can be expressed by the dominance of a constraint MAX-I/O, which bans segment deletion, relative to DEP-I/O, which bans segment insertion. In the following example, we formalize these constraints:

(9)
MAX-I/O
Input segments must have output correspondents. (No deletion)

DEP-I/O
Output segments must have input correspondents. (No epenthesis)

Observe their hierarchical ordering:

(10)
PARSE » MAX » DEP

Let us examine their interaction in the following tableau:

(11)
Input: /stop/

	PARSE	MAX-I/O	DEP-I/O
☞ a. σ[es.top]			*
b. σ[top]		*!	
c. σ-s[top]	*!		

This tableau effectively expresses the notion that segment deletion is a disfavored strategy to repair the banned onset provided by the input. Candidate (a) is the optimal candidate because all input features are maintained in the output. Additional segments also appear, but due to the inferior hierarchical position of DEP-I/O, this strategy is still capable of producing the desired output. Candidate (b) results sub-optimal by deleting the first segment of the prohibited /s/C onset. Candidate (c) prefers maximal faithfulness to input structure at the expense of incurring a fatal violation to the dominant constraint PARSE.

The former expressed, thus, we now must program provisions for the fact that epenthesis, although permissible, may never interrupt the contiguity of the segments of the base to which it attaches. In OT this can be achieved in a number of ways. We propose a straightforward explanation based on the contiguity of the stem segments. This preference can be formalized in the following way:

(12)
CONTIGUOUS
Contiguous input segments must have contiguous output correspondence.
(Adapted from Gouskova, 2001)

This constraint prohibits the vocalic segment from appearing inside the lexical stem. The only viable option that remains, therefore, is to align the prosthetic vowel to the left margin of the stem, in effect syllabifying /s/ as the coda of the first syllable while concurrently preventing the impermissible sequence /s/C from surfacing.

Now, we are ready to configure our hierarchy to justify [e] insertion in unassimilated English loan words in Spanish. The fact that all phonological segments in Spanish are parsed into syllables obliges us to rank PARSE to the dominant position in the hierarchy. Given the stimulus for the prosthetic segment is the banned /s/C structure in syllable-initial position, we can assume that *σ[sC enjoys the next dominant status in the hierarchy. Likewise, we can assume that DEP will occupy an inferior position since optimal outputs always violate this constraint with the post-lexical vowel. CONTIGUOUS will be ranked inferiorly to *σ[sC but will still represent an important position in determining the correct output. Finally, MAX will be ranked between CONTIG and DEP. This hierarchy is formalized in the following example:

(13)
PARSE » *[sC» CONTIG» MAX» DEP

Let us observe the interaction of these constraints in the following tableau. The use of curly brackets once more implies the segment is left unparsed:

(14)
Input: /stop/

	PARSE	*[sC	CONTIG	MAX	DEP
☞ a. estop					*
b. top				*!	
c. sop				*!	
d. setop			*!		
e. stop		*!			
f. s{t}op	*!		*		
g.{s}top	*!		*		

This tableau illustrates that outputs are free to propose virtually any resolution conceivable in order to satisfy specific bans on syllable structure. However, given the relative ranking of the constraints in the hierarchy, only one will result optimal in a given language. First, we see that candidates (b) and (c) present output candidates which prefer segment deletion over insertion, a viable option, but sub-optimal according to the ranking of the present constraints. Next, candidate (d) prefers epenthesis, but the location of the segment fatally violates stipulations regarding the contiguity of adjacent segments in the prosodic base. Candidate (e) prefers total faithfulness to input structure, but in so doing incurs a fatal violation of the dominant constraint in the hierarchy. Finally, candidates (f) and (g) leave one of the initial two segments unparsed, incurring a fatal violation of the dominant constraint PARSE.

4.1.2 Consonant epenthesis

Consonant epenthesis in Spanish presents a special set of theoretical quagmires which we will address in this section. Mainly the difficulty lies in isolating and justifying the consonantal segments which productively insert in contexts in which epenthesis is required. This task is complicated by the fact that consonant epenthesis, relative to vocalic insertion, has received little attention in previous studies in Spanish phonology. In this section, we remedy this lack of research and offer an exhaustive analysis of consonant epenthesis from a constraint-based architecture.

To commence our study, let us observe the preliminary data provided in (15):

(15)
Consonant insertion in Spanish (preliminary data set)

Spanish root	derived form with epenthesis	epenthetic consonant
-hombre (man)	-hombre[t]**ón**[7] (*great/big man*)	[t]
-reggae (reggae music)	-raggae[t]**ón**(*style of rap from the Carribean*)	[t]
-puño (fist)	-puñe[t]**azo** (*punch*)	[t]
-pistola (pistola)	-pistole[t]**azo** (*bludgeoning by a pistol*)	[t]
-pico (beak)	-pico[t]**azo** (*peck*)	[t]
-pico (beak)	-pico[t]**ada** (*peck*)	[t]
-café (coffee)	-café[t]**ería** (*coffee shop*)	[t]
-café (coffee)	-café[t]**ín** (*diminutive form of coffee*)	[t]
-té (tea)	-te[t]**era** (*teapot*)	[t]
-tu (2nd pers. inform. sing)	-tu[t]**ear** (*to use the 2nd pers.inform.sing.*)	[t]
-golpe (a punch or hit)	-golpe[t]**ear** (*to punch or hit*)	[t]
-pico (beak)	-pico[t]**ear** (*to nibble, have a bite to eat*)	[t]
-chispa (spark)	-chisporro[t]**ear** (*colloq: to flicker*)	[t]
-tiro (gunshot)	-tiro[t]**ear** (*to fire a gun repeatedly*)	[t]
-pata (leg, foot, hoof)	-pata[t]**ús** (*fainting fit*)	[t]

First with regard to alignment, we see that, in contrast to the vocalic insertion we illustrated in the previous section, consonant insertion always involves morphological modification. That is, all the words in which a consonantal segment inserts consist of two or more morphemes which combine to form one lexical item. Secondly, we see that in all the previous examples, the segment which inserts is necessarily parsed as a syllable onset. This constitutes an interesting distinction from the cases of vowel insertion we saw in the previous section. Recall, in vowel insertion, the addition of the post-lexical segment created a syllable coda in order to circuitously avoid a fatal violation of the dominant constraint *σ[/s/C. Similar to the cases of vowel prosthesis, however, the forms in (15) prefer segment insertion, as opposed to deletion, as a means to repair the marked input structure before it has an opportunity to surface in the output. Finally, we see that any desire there may be on behalf of the suffix to align directly to the substantive base is dominated by the proclivity for nuclei to have onsets.

[7] The form –*hombrón*, without the epenthetic segment, also exists. For the sake of time and space, we will not treat this form specifically. However, once we present our hierarchy justifying the alignment of the epenthetic segment, it should be clear that the form without the epenthetic consonant is easily explainable by a minor restructuration of the hiearchy.

The theoretical explanation concerning the inserted segment is a somewhat more problematic matter to justify. As we can observe in (15), all the epenthetic segments are [t]. This is a rather unsurprising fact given that [t] is the least marked segment of the major place class [coronal], which in lack of glottal stop, would represent the least marked [place] category in Modern Spanish (see Lombardi, 2001). Cross-linguistically, [t] insertion is quite common, as we see in the cases from Axininca Campa, a Maipurean language from Peru (Payne, 1981) and others. Broselow (1984), Paradis and Prunet (1991), McCarthy and Prince (1993), and Anttila (1997) all make the claim that, cross-linguistically, [t] is the preferable epenthetic segment by default.

Apart from the examples we see in (15), we also find cases of [t] insertion in morphologically altered forms in predecessors to Modern Spanish. For example, [t] inserted in future forms following the voiceless palatal: *–is$\underline{t}$ra*, from *–exir* (-*to leave*), and in cases following [n], -*fintra*. Ancient forms in Aragonés, the autochthonous language of Aragón, also exhibited [t] insertion: *pertaynneç$\underline{t}$ra, parez$\underline{t}$rá, naz$\underline{t}$rién* (Moreno Bernal, 2004).

Even so, there is a significant amount of data in Spanish supporting /θ/ as an epenthetic consonant, the manifestation of which obfuscates any phonological predictions we can make regarding the epenthetic segment. Let us observe the following cases:

(16)

Insertion of /θ/ in morphologically modified words in Spanish

	Spanish root	morphologically altered word	epenthetic segment
a.	-rey (*king*)	-reye[θ]ito	[θ]
	-joven (*young*)	-joven[θ]ito	[θ]
	-café (*coffee*)	-café[θ]ito	[θ]
b.	-informar (*to inform*)	-informa[θ]ión	[θ]
	-dominar (*to dominate*)	-domina[θ]ión	[θ]
	-diluir (*to dilute*)	-dilu[θ]ión	[θ]
	-contribuir (*to contribute*)	-contribu[θ]ión	[θ]

The perplexity presented by the forms in (16a) is surmounted by the fact that divergent cases also exist in which [l] and [t] can occasionally substitute [θ] in optimal diminutive outputs: exceptionally *cafe*[l]*ito*, café[t]*ito*. Add this to the complication we find when we consider the epenthetic segments which emerged in Old Spanish forms, most of which still appear, although phonologically, in Modern Spanish:

(17) Consonant epenthesis in Old Spanish forms

	Latin root	Old Spanish word with epenthesis	epenthetic segment
a.	-homine	-om[b]re *(man)*	[b]
	-femina	-fem[b]ra *(female)*	[b]
	-columinare	-colum[b]rar *(to see in the distance)*	[b]
	-adluminare	-alum[b]rar *(to illuminate)*	[b]
	-homeru	-hom[b]ro *(shoulder)*	[b]
b.	-ingenerare	-engen[d]rar *(to engender)*	[d]
	-pignora	-pein[d]ra *(pledge)*	[d]
	-sicera>sizra	-siz[d]ra *(pledge)*	[d]
			(Martínez-Gil, 2001)

As is obvious from the previous data, regularities with respect to the epenthetic segment are difficult to observe. Basically, there seem to be few systematic data on which to base any sound hypothesis concerning the consonant which inserts in cases of consonant epenthesis in Spanish.

Before we formalize any assumptions related to the epenthetic segment, we must consider our options. First, we could claim that consonant insertion is dependent on the suffix which attaches to the morpheme root. Therefore we could hypothesize separate hierarchies which predict different segments for different morphological contexts. This is a viable option, but would not provide much insight into the nature of productive consonant epenthesis in Spanish, and would entail a questionable burden for the grammar. Next, we could propose that the choice of epenthetic segments were dominated by the phonological context in which the segment appears. However, due to the high irregularity of the different contexts in which the segments surface, this is not a plausible option. Finally, we could justify the insertion of [θ] in the examples in (16) as exceptional cases which result from diachronic processes of insertion and later spirantization which, over time, have become phonologized segments in Modern Spanish. Consequently, this argument would allow us claim that [t] is the only truly productive epenthetic consonant in Modern Spanish, effectively corroborating predictions for epenthetic segments based on the relative unmarked status of the major place class [coronal]. We will develop this argument below and subsequently formulate these generalizations into an OT framework.

First we must contend with the theoretical account of the insertion of /θ/ in the forms offered in (16b). As we can see from the data, /θ/ inserts between the morphological root and the suffix *–ion* in cases in which the last segment of the morphological stem is vocalic:

(18)

[θ] insertion after vocalic segment in morphological stems

[**Morphological stem**] θ] ión]

[[**informa**] θ] ión]]

[[**domina**] θ] ión]]

[[**dilu**] θ] ión]

[[**contribu**] θ]ión]

In these cases, we can be certain that [θ] does not form part of the nominal suffix since *–ión* can, in fact, operate as an autonomous unit, as we can observe in examples such as *–unión*, from [[un[ión]] (*-union*). Moreover, there are no phonological grounds on which to propose that the epenthetic segment forms part of the morphological base since all the stems in (16) end in their respective thematic vowels, and /θ/ does not appear in any corresponding infinitive form.

A passing inspection of Latin affixation correlating to [θ] insertion in Modern Spanish will shed light on our analysis. We can observe that the [θ] which emerges in the examples in (18) initially surfaced as the voiceless coronal stop [t] in its original Latin form:

(19)

Spanish word	Latin Root	Latin infinitive
[[informa] θ] ión]]	[[[informa] **t**] ĭo] ōnis]]]	informāre
[[domina] θ] ión]]	[[[domina] **t**] ĭo] ōnis]]]	domināre
[[dilu] θ] ión]	[[[dilu] **t**] ĭo] ōnis]]]	diluĕre
[[contribu] θ]ión]	[[[contribu] **t**] ĭo] ōnis]]]	contribuĕre

Based on the examples in (19), we can postulate that the [θ] which appears in the substantive forms in Modern Spanish is the product of a diachronic process of spirantization motivated by the leftward spreading of the positive feature value for [continuous] to the preceding coronal [t][8]. This conversion is a well documented process cross-linguistically, as we can observe in the data from Ancient Greek (Bubeník, 1983), Florentive Italian (Gianelli and Savoia, 1979), Liverpool English (Wells, 1982) among many others. And although the data in (19) certainly seem to provide evidence of productive epenthetic insertion in Latin, the appearance of /θ/ in Modern Spanish forms is best considered to be a phonologized relic which surfaces, under restriction, in very specific and limited contexts.

In contrast, we know surprisingly little concerning the etymological origins of the supplementary segment presented in (16a). Martin Camacho (2002) proposes the

[8] The /d/ to /s/ alternation is the result of a diachronic process of asibilation which converts /d/ to /s/. See Kirchner (1998) for an exhaustive explanation.

argument that the [θ] which surfaces in the diminutive forms in Spanish stems from the allomorph *–culus,* used in three distinct declinations in Latin diminutive formation. In these forms, the segment [k] would have affixed to the normal diminutive Latin suffix –*ulus*, eventually neutralizing to the allomorph *–culus* by way of morphological reanalysis:

(20)
Latin roots with suffix *-ulus*

Latin diminutive	Latin infinitive	Spanish form
[ridi]-k-ŭlus	*ridere* (to laugh)	*ridículo*
[meti]-k-ul-ōsus	*metus* (fear)	*meticuloso*
[maius]-k-ŭlus	*maior* (major, old)	*mayúsculo*

As we can observe, the segment [k] which inserted does appear to be epenthetic[9].

Martin Camacho goes on to predict that over time, -*culus* would have converted into *–cellus*, and later *–cillo*, producing the alternation *–cillo*/*-illo* we observe today in certain Modern Spanish diminutive forms. Again, the position of the dorsal stop next to the adjacent high vowel [i] would have motivated the conversion /k/ →/θ/ that we observe in Modern Spanish diminutives (see Kirchner, 1998 and Clements and Hume, 1985, 1993). According to Martin Camacho, the two forms would have existed in a state of complementary distribution until the Latin flexions were eventually lost and the contrast became strictly phonological.

However convincing, there are a number of irregularities with this argument which we must address before proposing our hypothesis regarding the insertion of /θ/. First, Martin Camacho's proposal makes no concession for the proclivity of [θ] to appear in cadence with [e] in certain diminutive forms. Secondly, there is no explicit

[9] Insertion of /k/ as an epenthetic consonant would be quite tricky to prove, since [dorsal] is usually not considered an *unmarked* [place] class. This case is especially complicated considering that the phonological inventory of Latin contained other less marked consonants. However, there are many cases of dorsal insertion in cases of epenthesis. (See Hume, 2002)

reason as to why the epenthetic segments [eθ] systematically affix to monosyllabic roots and those which contain penultimate diphthongs in Modern Spanish: *sol*→*sol*[ec]*ito* (-*sun*); -*huevo*→*huev*[ec]*ito* (-*egg*). For all intents and purposes, to this author's explanation, there is no meaningful morphological connection whatsoever between the infix and the morphological base. Finally, Martin Camacho's argument is appreciably grounded in the notion that the segment /θ/ groups with the diminutive morpheme {it} to form a separate allomorph. Although convenient, this proposal does not explain why the diminutive morpheme, {it}, acts as an autonomous suffix in a majority of the diminutive forms: *lobo*→*lob-ito*. Basically, for this author's proposal to be valid, either a morpho-phonological explanation is needed addressing the proclivity of /eθ/ to affix to monosyllabic bases and those containing diphthongs, or a justification as to why these segments are precluded in other diminutive forms.

We offer an alternative justification for the epenthetic segment. Adams (1913) offers evidence that the suffix [ek], orthographic –*ec*, was a productive affix signaling diminutive status is Old Provençal:

(21)

Diminutive forms with [ek], -*ec*, in Old Provençal

Provençal	English
bav[ek]	-*talkative*
can[ek]	-*grey*
man[ek]	-*fixed, immobile*

A careful reading of the data in this table reveals that all known examples of [ek] suffixation in Provençal adjoined to **monosyllabic** bases. This interestingly coincides with the contextual behavior of the infix /eθ/ in Spanish. The diffusion of this suffix into Old Spanish would not have been difficult due to the prolific nature of poetry forms performed by migrant performers, known as the troubadours, throughout Europe and, especially, the Iberian Peninsula. As these forms took hold in Medieval Spanish, it would be plausible that the Latin suffix would have also aligned to the left margin of the Provençal diminutive, effectively creating a double diminutive, as in the following hypothetical examples:

(22)

Double diminutive forms (hypothetical) with [ek], *-ec*, and Latin *-ulus*

Provençal	English
bav[ek] ulus]	*-talkative*
can[ek] ulus]	*-grey*
man[ek] ulus]	*-fixed, immobile*

If we explore a bit beyond the surface, we discover that Spanish has many phonologized forms of historical double diminutives modifying a single stem. In fact, this was a fairly common practice in hispanized Arabic place names in the era pre-dating the reconquest of Spain: *-Alborágicos*, diminutive of *-Alborache* from – *al-burajya*, *torrecilla* (1944:49) and *-Albufareta* (Alicante), a Spanish diminutive form of *-Albufera*, from *al-buḥayra* (Abu-Haidar, 2001).

If our hypothesis is correct, it should stand to reason then that at least some trace of phonologized forms containing [ek] should be retained in contemporary Spanish. We do, indeed, find just this: *-ceneque* [θe.n(é.k)e], (Span. *–panecillo*, Eng. *-small piece of bread*). The [e] would have affixed word-finally when the constraint banning the word-final dorsal stop, /k/, became a dominant hierarchical priority.

In many American forms, an overwhelming number of words ending in [eke] in contemporary forms are associated with an inherent notion of diminutive status, hinting at a possible morphological correlation to the ancient Provençal ending [ek]: *-muleque* (Cuba, *-small slave between seven and ten years old*), *-neneque* (Honduras, *very weak person*), *-manseque* (Chile, *children's dance*), *-zarambeque* (from *–zambra*, *-typical* *dance of African origin*). And although the Real Academia Española classifies these words as Americanisms, we think that a reasonable case could be made relating these words to much earlier morphological and etymological forms which crossed the Atlantic but were later lost on the Peninsula.

Let us now consider another piece of interesting data. In normal cases, the diminutive form of Spanish *–mano* (hand) is *–manita*. Nonetheless, we also find a phonologized form *–manecilla* (*-handle of an instrument or a clock*) in which the adjunct segments [eθ] emerge for no apparent phonological reason. However, we find a remarkable lexical association between the Spanish diminutive *–man<u>ec</u>illa* and the Catalán *–man<u>ec</u>* (*-handle*), revealing two important facets concerning the adjunct segments [eθ] which appear in modern Spanish diminutive forms.

First, in the Catalán *–manec*, we see proof of the autonomous behavior of [ek], which we should expect to observe if our hypothesis regarding the double diminutives were correct. Secondly, we detect an historical, morphological and lexical connection between the words *–manec* and *–manecilla*.

In addition, we also find a phonologized form *–canecillo* (*-bracket, corbel*) which the Real Academia Española connects to a Latin form *–can*, from *–canis* (*-dog*). We argue, however, that the phonological association between the Spanish *–canecillo* and the old Provençal *–canec* (*-grey*, from Latin *-canus*) suggests that *–canecillo* is lexically, morphologically and phonologically more akin to Latin *–canus* (*-white, or grey*) than to Latin *–canis* (*-dog*). And seeing as the material used to make a *–canecillo* has typically been lead, a grey substance, it would seem logical to propose a lexical connection between *–canecillo* and *–canus*, by way of *–canec*.

The fact that the affixation of [ek] would have conveniently coincided with the development of the alternating diphthongs [we] and [je] (see Holt, 1997) in Old Spanish would explain the historical link between the affix [ek] and roots containing diphthongs. Once the subsequent shift from [u] → [i] took place in the first vowel of the suffix -*ulus*, the second segment of the affix, [k], would have proper motivation to convert to [θ] by way of spirantization. Like the /t/→/θ/ conversion we mentioned above, this process as well is quite common cross-linguistically.

Although far from substantiated, if correct, our hypothesis could explain a great deal about the diachronic processes which shape Spanish diminutives. Nevertheless, all the data related to the segment [θ] in Modern Spanish diminutives converge on one clear point; **[θ] emerges as the result of a sound shift:** /k/→/θ/.

As noteworthy as these diachronic data may be, nonetheless, our discussion here is centered round productive consonant epenthesis in *Modern Spanish*. Based on the previous data, we can extract the following generalizations: First, the /θ/ which appears in (16a) and that which appears in (16b) are **fundamentally different segments**, which (1) have neutralized underlying contrasts of their original segments, effectively rendering all identifying features opaque in the convergent forms, and (2) result from independent sound shifts provoked in both cases by the proximity of a following high vowel. Moreover, it is rather obvious that both of these segments are extremely restricted with regard to their productive distribution: certain diminutive forms and substantives ending in –*ión*.

We propose that the insertion of [θ] in Spanish diminutives and substantives which take the noun suffix –*ión,* is governed by forces outside of simple onset and alignment principles. And although our research indicates that the distribution and frequency of [θ] in the forms presented in (16) are superior to the frequency of epenthetic [t], this can be explained by the prolific nature of diminutive formation in Spanish and not any inherent preference for [θ] specifically as an epenthetic segment. Critically, our research indicates that [θ] appears in more prosodic *tokens* in Spanish, but [t] has a greater distribution with regard to morphological *types*.

Finally, the data we have seen regarding [θ] insertion suggests that these segments are historically and unquestionably linked to the morphological base to which they affix, as well as to their respective suffixes. Notice in Spanish diminutive forms such as *–hueve*[θ]*ito* (*-little egg*), the emergence of [(e)θ] is *systematic* in monosyllabic roots and those containing diphthongs[10]. Likewise, this sequence appears *exclusively* with the diminutive suffix *–it*V, suggesting a more than casual relationship between the emergence of [(e)θ] and the morphological constituents involved in Spanish diminutive formation.

We can model these details into a paradigm grounded in conflict resolution by ranking the elements of the major place class [coronal] in a hierarchy in which a constraint *[t] assumes the inferior position. We propose the following coronal internal ranking scheme for productive epenthetic segments in Modern Spanish[11]:

(23)
Coronal internal ranking scheme for epenthesis in Spanish
*[r], *[s], *[n], *[l], *[d], *[θ] » *[t]

This schema, which contains only one principal ranking, expresses that [t] is the preferred epenthetic segment in Spanish. For our purposes, this hierarchy is sufficient

[10] As well as in other forms: -*joven→joven*[θ]*ísimo* (-*young/very young*), -mayor→mayor[θ]ísimo (-*old/very old*). It is not clear however, if the [θ] which appears in this context is the same which appears in diminutive forms.
[11] This is an extension of Lombardi's (2002) universal hierarchy for epenthetic segments: *Lab, *Dor>> *Cor>> *Far. Lacking pharyngeal consonants, Spanish must choose its epenthetic segment from among the coronals. The hierarchy we offer here divides [coronal] even further in order to predict the proper coronal segment for insertion in Spanish.

to predict [t] in cases of epenthesis. However, the superior constraints which appear to the left of the *dominate* signal, », could be ranked further upon compiling and calculating empirical data for frequency of occurrence in epenthetic contexts, taking into account the tokens and types in which the segments may surface. Yet, it would be beyond our scope to do so here.

Now, let us demonstrate how this hierarchy is capable of predicting the correct epenthetic segment in a context of vowel hiatus caused by morphological modification:

(24)
Input: V]__[V

	*[r]	*[s]	*[n]	*[l]	*[d]	*[θ]	*[t]
a. V]_[r]_[V	*!						
b. V]_[s]_[V		*!					
c. V]_[n]_[V			*!				
d. V]_[l]_[V				*!			
e. V]_[d]_[V					*!		
f. V]_[θ]_[V						*!	
☞ g. V]_[t]_[V							*

This tableau demonstrates that an internal ranking of coronal segments is able to justify the preference for [t] in cases in which an epenthetic segment is required. The optimal output (g) violates the lowest constraint, *[t], and is therefore rendered optimal. The rest all incur fatal violations of the highly ranked constraints and are accordingly eliminated from the evaluation process[12].

We have seen that OT is capable of offering a coherent account of the segment which inserts in cases of consonant epenthesis in Spanish, but now we must frame our constraint set to treat the alignment and subsequent parsing of the constituents which compose the morphologically complex words. We have already cited these

[12] In the worst case scenario that our interpretation of the diachronic data regarding the epenthetic insertion of [θ] in Modern Spanish were off mark, a simple demotion of the constraint *[θ] would effectively remedy this discrepancy.

observations regarding the insertion of [t] in the examples from (14) at the beginning of this section.

As we mentioned, the epenthetic segment always acts as an onset for the initial vowel of the suffix. We can encode this regularity into our ranking schema by ordering the constraint ONSET to a dominant position of the hierarchy. To recall, ONSET expresses the stipulation that peaks must align to a pre-nuclear consonant. A convenient fallout of ONSET satisfaction by way of epenthesis, is that we do not need to program any specific constraint to militate against hiatus since this condition is circuitously avoided upon providing a pre-nuclear consonant.

Still, thus far we have not addressed any principle which governs the alignment of the three components of the morphologically modified word; [[[**base**] **epenthetic segment**] **suffix**]]]. In all the cases, we observe a rigid system in which the epenthetic segment is aligned to the right margin of the morphological base and just to the left of the suffix. These observations can be easily expressed by a set of **generalized alignment** constraints (Prince and Smolensky, 1993), which align different prosodic components to their appropriate positions. For our analysis we will utilize a constraint ALIGN-[suffix]-R, which obliges the left edge of the suffix align to the right edge of the morphological base[13]:

(25)
ALIGN-[suffix]-R
Align the left edge of [suffix] with the right margin of the prosodic word.

Perceptibly, this constraint must occupy an inferior position in our hierarchy since epenthesis prevents direct alignment to the prosodic base in the optimal output. The natural upshot, however, of any schema which allows unrestricted epenthesis is that

[13] We use the vague term –*base* here for a very specific reason. Generalized Alignment constraints can affix suffixes to stems, prosodic words, syllables and other prosodic categories. Therefore we use the ambiguous term to avoid any mention of technical prosodic and morphological terminology.

there is no theoretical mechanism with which to prevent an infinite number of epenthetic segments from surfacing. This can be avoided by counting each incursion to ALIGN-[suffix]-R as a separate violation mark. As long as ONSET dominates ALIGN-[suffix]-R, minimal epenthesis will never rule out any candidate due to violations of this latter constraint, since violating this constraint implies the satisfaction of ONSET , the dominant constraint of the hierarchy.

Focus on the following hierarchy:

(26)
ONSET » ALIGN-[ón]-R

Let us observe the resolution of conflict in this hierarchy:

(27)
Input: hombre, {ón}

	ONSET	ALIGN-[ón]-R
a. hombreón	*!	
☞b. hombre[t]ón		*
c. hombre[tt]ón		*!*

In this tableau, candidate (b) turns out optimal since the violation it incurs by inserting the epenthetic segment [t] satisfies ONSET, the dominant constraint of the hierarchy. In satisfying ALIGN-[suffix]-R, however, candidate (a) results sub-optimal since the initial vowel of the suffix is left without an onset, violating ONSET. Candidate (c) incurs a double and capricious infraction to the inferior constraint governing alignment, yielding a sub-optimal output.

Now, we must consider that, according to this hierarchy, the deletion of segments as well would produce an optimal output: *–hombrón*. Indeed, this form does surface in Modern Spanish. We stated in our analysis of vowel epenthesis at the beginning of this chapter that the constraint which bans segment deletion is MAX-I/O. We will present this constraint again:

(28)
MAX-I/O
Input segments must have output correspondents. (No deletion)

We should assume that since epenthesis surfaces in the optimal output that this constraint will rank highly in our hierarchy. By ranking it superiorly to our alignment constraint but subordinately to ONSET, we arrive at a ranking schema which expresses that (1) all nuclei must have onsets, (2) segment deletion will be penalized, and (3) the left edge of the suffix should align to the right edge of the prosodic word, if feasible given the satisfaction of the previous two constraints:

(29)
Basic ranking schema for consonant epenthesis
ONSET»MAX-I/O» ALIGN-[suffix]-R

Let us observe the resolution of this conflict in the following tableau:

(30)
Input: hombre, {ón}

	ONSET	MAX-I/O	ALIGN-[suffix]-R
☞a. hombre[t]ón			*
b. hombreón	*!		
c. hombrón		*!	

In this tableau (30), candidate (a) is the optimal output since inserting [t] between the augmentative suffix and stem supplies an onset for the initial vowel of the suffix without deleting any input segments. It falls short of aligning the suffix to the right margin of the prosodic word, but due to the low ranking of ALIGN-[suffix]-R, this is not a significant infraction. Candidate (c) also satisfies ONSET but does so at the relatively high cost of violating MAX. Although this is a plausible strategy, the present ranking of the constraints eliminates this form from the evaluation process[14]. Candidate

[14] The form –*hombrón* can be satisfied by restructuring the hiearchy such that MAX dominates ONSET.

(b) prefers full faithfulness to the input structure. Unfortunately, this strategy is the least desirable since it implies a grave violation of ONSET.

One aspect of the past two units dealing with segment insertion should be strikingly clear: morphological modification impacts prosodic structure and is subject to universal forces governing syllabic well-formedness in Spanish. In both cases, a desire to adhere to universal principles for onset has had a major impact on the shape of Spanish words.

In our analysis of vowel prosthesis, the desire to modify the input structure so that the output does not violate a ban on σ[/s/C clusters resulted in a systematic process of word-initial vowel insertion. Consequently, the initial components of the input were reconfigured whereby the original initial segment /s/ became the coda of the first, newly formed, syllable. In this case, onset well-formedness was the impetus for the external alteration.

Our analysis of consonant epenthesis illustrated that in certain instances an onset can actually be added to the output structure even though none is presented by the input. This is a remarkable detail supporting our claim for onset supremacy in Spanish. Notice that, in Spanish, coda insertion is not an attested repair strategy for defective inputs.

As we have seen in both cases, segment insertion is preferred to segment deletion to rectify a marked structure before it has a chance to emerge in the surface form. This is an interesting aspect in itself. Nonetheless, even more interesting is the symmetry we can begin to detect between onset and coda repair strategies. Recall from our discussion in chapter 3, §3.2, that when codas are faced with a similar phonological predicament such as illicit word-final segments, as in [t͡ʃa.let] (-*chalet*, Eng. -*house*), the desired repair strategy is deletion, and not insertion. This further corroborates our claim of onset supremacy in Spanish since, obviously in some instances, codas do not merit repairing. Simply, they may be precluded all together in the event that their structure might threaten principles of syllabic and phonological well-formedness.

In the following section, we will see that this last generalization is not a universal dismissal of coda's importance in Spanish phonology. We will examine the various strategies Spanish has at its disposal to thwart the formation of complex codas when a word is modified by the plural morpheme {s}.

4.2 PLURAL FORMATION IN SPANISH

In this unit we look at the special challenges plural formation presents for syllabic licensing and phonological well-formedness in Spanish. Until now, we have given onset well-formedness more attention than the phonological restrictions which govern codas. But here, we will examine the resolution of conflict between two competing forces relevant to coda well-formedness in Spanish.

To briefly contemplate our present analysis in a different light, let us return to our example of the language learner in her primary stages of phonological acquisition. By this point, she will certainly have deduced two major factors from the input data related to prosodic structure in Spanish. Primarily she will have perceived that all sounds which compose a word must be parsed into syllables. At the same time, it seems reasonable to suggest that she will have deduced that word-final complex codas are banned in Spanish. We will assume that she has learned that this latter ban is not absolute, but the former undoubtedly is.

Upon deciding to communicate linguistically the notion of plurality, she has to sort out a couple of difficult details. First, she must know that plurality in Spanish is expressed by adding a morpheme {s} to the substantive or adjective root which is to be modified. For most cases, those in which the root ends in a vowel, this process poses no difficulty. All she needs to do is affix the morpheme to the prosodic base. Upon doing so, {s} is conveniently parsed as a word-final coda.

But in other cases, the language learner will have to make some difficult concessions. Let us suppose that she wants to communicate the plural form of a substantive *–biberón* (*baby bottle*). On one hand she knows that if she does not affix the plural morpheme to the base, the notion of plurality is effectively lost. If she adds it, but leaves the segment unparsed, a possible rupture in communication is probable. On the other hand, if she affixes the segment directly to the final segment [n], she violates principles of well-formedness in her native language. We will discuss the effects and conciliation of these competing forces below to find the optimal solution. Subsequently, we will address the best way to arrive at this solution by means of constraint ranking in an OT framework.

Let us commence our study with the pertinent data. For ease, we will divide the data into smaller sets based on the specification which appears above each category. We will hold off making any assumptions until after all the data are presented, whereupon, each category will receive individual consideration:

(31)

(a)

Addition of {s} to roots ending in vowels (predominantly [a], [o] and [e][15]):

Singlular	Plural	English
-libro	-libro[s]	-*book*(s)
-casa	-casa[s]	-*house*(s)
-enchufe	-enchufe[s]	-*electrical outlet*(s)
-llave	-llave[s]	-*key*(s)
-lobo	-lobo[s]	-*wolf*(ves)
-anillo	-anillo[s]	-*ring*(s)

[15] These represent the most common word-final vowels although any vowel may appear in said position. Sometimes, forms ending in accented [i] and [u] take an epenthetic segment [e] between the vowel and the morpheme {s}, although this appears to be a matter of personal preference and both forms are accepted by the RAE.

-pulsera	-pulsera[s]	-*bracelet*(s)
-disco	-disco[s]	-*disk*(s)
-clase	-clase[s]	-*class*(es)
-tribu	-tribu[s]	-*tribe*(s)
-boli* (from bolígrafo)[16]	-boli[s]	-*pen*(s)
-espíritu	-espíritu[s]	-*spirit*(s)
-peli* (from película)	-peli[s]	-*film*(s)
-taxi	-taxi[s]	-*taxi*(s)

(b) Addition of [e]{s} to forms whose final consonant is a consonant apart from /s/, monosyllabic words with final consonant /s/, or words ending with /s/ in which the final syllable is stressed:

-ciudad	-ciudad[es]	-*city*(ies)
-avión	-avion[es]	-*plane*(s)
-ángel	-ángel[es]	-*angel*(s)
-actor	-actor[es]	-*actor*(s)
-as	-as[es]	-*ass*(es)
-mes	-mes[es]	-*month*(s)
-japonés	-japones[es]	-*Japanese*
-país	-país[es]	-*country*(ies)

(c) Addition of [Ø] to non-monosyllabic words ending in /s/ in which the final syllable is unstressed and /s/ does not form part of the morphological root:

-lunes	-lunes[Ø]	-*Monday*(s)
-virus	-virus[Ø]	-*virus*(es)
-dosis	-dosis[Ø]	-*dose*(s)
-análisis	-análisis[Ø]	-*analysis*(es)
-tesis	-tesis[Ø]	-*thesis*(es)

(d) Addition of [e]{s} to forms that end in a tonic vowel[17]:

-rondó	-rondó[es]/[s]	-*rondo*(s)
-tabú	-tabú[es]/[s]	-*taboo*(s)
-menú	-menú[es]/[s]	-*menu*(s)
-jabalí	-jabalí[es]/[s]	-*boar*(s)
-sofá	-sofá[es]/[s]	-*sofa*(s)
-colibrí	-colibrí[es]/[s]	-*humming bird*(s)
-sí	-sí[es]/[s]	-*yes*(es)

[16] Forms marked with "*" are common truncated forms which can be, and often are, made plural.
[17] This is not an absolute category. Often, these same words can simply add the plural morpheme {s} directly to the tonic vowel. Although we have not done empirical research to reveal which form enjoys the more ample diffusion in Madrid, our intuition tells us that the simpler forms which only add {s} are more common in spoken language.

(e) Addition of [Ø] after complex-codas provided by input structure[18]:

-biceps[19]	-biceps	-*biceps*
-tórax	-tórax	-*thorax*
-fórceps	-fórceps	-*forceps*
-Félix	-Félix	-*Felix* (proper name)

(f) Addition of {s}, instead of [e]{s}, following unnaturalized loan words ending in a consonant[20]:

póster	pósters	*pósteres	-*poster*(s)
club	clubs ~ clubes		-*club*(s)
coñac	coñacs	*coñaques	-*cognac*(s)
máster	master	*másteres	-*Master*(s)
boicot	boicots	*boicotes	-*boycott*(s)
complot	complots	*komplotes	-*plot*(s)

Before dealing with the individual formation of each category, we must formalize a constraint to define the segment. Again, this is a fairly uncomplicated matter, but we must detain ourselves for a moment in order to clarify some possible difficulties. Observably, all plural forms in Spanish end in /s/. Morales-Front and Holt (1997) formulate a constraint MORPH, for Portuguese plurals, which asserts that the plural morpheme in Portuguese is {s}. Shepherd rightfully appoints that this constraint can be easily incorporated into Spanish:

(32)
MORPH
The plural morpheme in Spanish is {s} and it aligns to word-final position.

However, the forms (c) and (e) we presented in (31), as well as the tendency in certain dialectal zones to reduce /s/ to [h] and/or [Ø] in coda position, complicate this seemingly straightforward proposal. If we will notice, the forms in (c) and (e) circumvent this constraint by input identity alone. Notice that these forms already

[18] We have included these forms here in order to offer a complete list of plural forms in Spanish. However, we already dealt with their justification in the previous chapter and, therefore, will not address this theme again.
[19] We remind the reader that the realization of both final elements in these examples is quite uncommon. In normal speech, only the final [s] is realized due to a ban on complex codas. A copious amount of morphophonological alternations such as *Felix̲* / *Felis̲a* support this claim.
[20] See §3.2.1 (page 137) for our analysis of these forms.

provide a word-final /s/ in the input. Theoretically, we could propose an amendment to Morales-Front and Holt's constraint MORPH to include that the plural morpheme in Spanish *can only* be {s}, leaving implicit that not all word-final sibilants are *obligated* to represent plurality. The evident problem with this proposition, though, is that in certain zones of the Iberian Peninsula and Hispano-America, the notion of plurality is also expressed by [h][21], due to a process of debuccalization by which all oral features of /s/ are eliminated[22].

This point compels Shepherd to propose a complementary constraint which states that plurality can be expressed by /s/, or any allophonic dependent of /s/:

(33)
PLURAL
A noun or adjective marked for the feature [+plural] must end with an element which corresponds to the phoneme /s/.

Although an interesting justification, we find this constraint superfluous for one critical reason. We base our opinion on the notion that alignment and distribution form a separate morphological cycle from the phonotactic constraints which motivate debuccalization. Fundamentally, Shepherd's analysis confuses the levels at which morpho-phonological processes occur and those at which phonotactic procedures are provoked. Basically, if our task is to explain the functional procedure by which the morpheme aligns to the prosodic base and its subsequent parsing, naturally we do not need to take into account predictions of potential phonotactic processes which may or may not occur in a subsequent stratum. And besides, this subsequent interaction which

[21] [h], however, is still an allophonic dependent of the underlying /s/ which aligns to the prosodic base. Subsequent phonotactic processes reduce /s/ to [h], but these processes take place at the phonetic level, and thus do not affect the underlying qualities of /s/. Perception studies show that listeners are capable of extracting the morphological information associated with {s} from a phonetic cue [h].

[22] This is not the case in the Spanish of Madrid. Although aspiration is a common feature in certain neighborhoods and in determined socio-economic strata, this phenomenon is not commonly associated with the Spanish spoken in Madrid.

would produce a debuccalized form of the plural morpheme would not have any effect on the affixation and parsing of the segment.

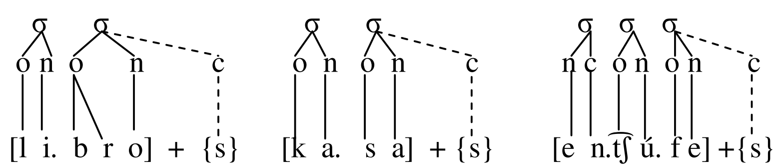
Here, and in the rest of the analyses on plural formation, we follow Morales-Front and Holt's characterization of the plural morpheme {s} we illustrated above. However, we modify this constraint slightly in order to not make predictions on the alignment of the morpheme to the prosodic base. For the remainder of this chapter, MORPH will simply express the following:

(34)
PLUR-MORPH
The plural morpheme in Spanish is {s} and must appear in words marked for [+plural][23]. No derivational suffix may appear to the right edge of the suffix.

4.2.1 Regular plural formation

As we can see from the data, the forms in (31a) pose no particular challenge for syllabic parsing. Essentially, {s} adjoins to the prosodic base and is easily parsed as a post-nuclear consonant for the word-final vowel. This process has a minimal impact on the individual phonological elements which compose the word and the syllable structure provided by the input:

(35)



[23] Notice that our constraint merely states that /s/ must affix to the base. Subsequent processes may reduce /s/ to [h], but this would be after /s/ aligns to the base.

The only change to the input structure is the addition of a singleton [s] as a word-final coda. Since this addition satisfies the segment requirement for permissible word-final consonants, there is no conflict to resolve.

Correspondingly, the only task we are faced with is to provide an explanation of the alignment of the segment to the prosodic base and its subsequent parsing. This latter is easily captured by programming PARSE to a superior position of the hierarchy justifying plural formation:

(36)
PARSE
Words must be exhaustively parsed into syllables.
(Hammond, 1999)

In §4.1 we presented a constraint, ALIGN[suffix]-R, which made detailed stipulations regarding the alignment of affixes to their corresponding prosodic bases. Upon specifying this constraint with the necessary information regarding {s} affixation, we can justify the alignment of the plural suffix without hypothesizing a separate constraint to specifically treat this process. In this way, the analyses we offer in this chapter are fundamentally unified by the universal constraints which compose the hierarchies, the only differences being the superficial details of the individual analyses. Contrary to the cases we presented in §4.1, here we are forced to assume that ALIGN will occupy a fairly dominant position of the hierarchy since it is never violated by the forms provided in (31a):

(37)
ALIGN{s}-R
Align the left edge of {s} with the right margin of the morphological base.

Next we must consider the idea that any form which allows codas, implicitly violates a universal ban on codas. In OT, this ban is expressed as NOCODA. The fact that plural formation necessarily involves the creation of a coda indicates that NOCODA must be ordered to a relatively inferior position in our hierarchy:

(38)
NOCODA
Codas are banned.

Finally, we must program constraints which ban segment insertion and deletion in the optimal output. Again, in OT these two constraints are known as MAX and DEP:

(39)
MAX-I/O
Input segments must have output correspondents. (No deletion)

DEP
Output segments must have input correspondents. (No insertion)

Our hierarchy will appear as the following:

(40)
PARSE » PLUR-MORPH, ALIGN{s}-R » MAX » DEP » NOCODA

Let us observe their interaction in the following tableau:

(41)
Input: /kasa/ + {s}

	PARSE	PLUR-MORPH	ALIGN{s}-R	MAX	DEP	NOCODA
☞ a. [ka][sas]						*
b. [ka.s]				*!*		
c. [ka][sa]		*!	*	*		
d. [ka][sa][se]		*!	*		*	
e. [ka][sa] [s]	*!					

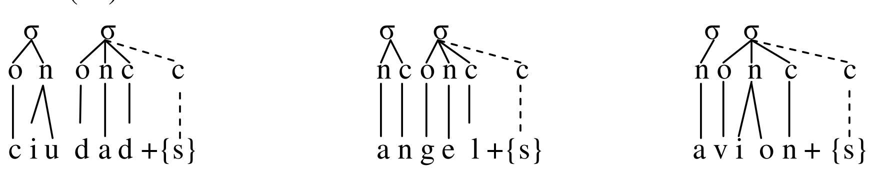
In this tableau, candidate (a) presents the desired output. The appearance of the coda provoked by the affixation of {s} incurs a mild violation of NOCODA, the lowest constraint in our hierarchy. Candidate (b) satisfies the top three constraints by eliminating the last two segments from the input structure. However, this implies a double and fatal violation of MAX, which forbids the deletion of input segments.

Candidates (c) and (d) both provoke grave violations to PLUR-MORPH. Candidate (c) does not present the morpheme at all, while candidate (d) does not allow this affix to occupy word-final position as ALIGN{s}-R implies. Candidate (e) is eliminated immediately from the evaluation process by not parsing the segment to its appropriate syllabic position, the like of which *never* occurs.

4.2.2 Consonant-final nouns and adjectives

The affixation of the plural morpheme to nouns and adjectives ending in a consonant poses a particular challenge to the concept of syllabic parsing. On one hand, the verbal morpheme must align to the prosodic base in order for plural modification to occur. On the other hand, in doing so, a complex coda is formed with the final segment of the prosodic word and the morpheme {s}. On its own, this does not present a major difficulty. However, we have seen that complex codas are banned in Spanish, meaning that, without help, the two segments which compose the newly formed complex coda cannot simultaneously satisfy PARSE and the provisos made by phonological well-formedness. Theoretically, a grave violation to PARSE is not viable in Spanish since we have seen that *all* segments must be exhaustively parsed into syllables:

(42)



The data we saw in (31) illustrate that the solution to the conflict sparked by the creation of a complex coda is to insert an epenthetic [e] between the prosodic base and the plural morpheme, in effect reorganizing the syllabic constituents such that the former word-final consonant is reparsed as the onset of the syllable created by the insertion of a new nucleus. Below we will discuss the procedures and their paradigmatic representations by which this is accomplished.

The insertion of the epenthetic segment is motivated by several factors. We can assume that PARSE plays an active role since, if there were no constraint requiring that the segments be parsed into syllables, in theory, the verbal morpheme {s} could be left unparsed, thus satisfying any ban against complex codas:

(43)
PARSE
Words must be exhaustively parsed into syllables.

However, we know that all segments in optimal outputs must be parsed in Spanish. Consequently, PARSE must dominate a superior position of the hierarchy.

By forcing all segments to be parsed into syllables, affixation of {s} necessarily violates a ban on complex codas, *COMPLEX^{CODA}:

(44)
*COMPLEX^{CODA}
Complex codas are banned.

Again, we see that the answer to avoiding the emergence of the ill-formed structure in the output is by inserting an epenthetic vowel [e] between the prosodic word and the plural morpheme. This counts as a grave infraction of DEP, which requires that all output segments have an input counterpart:

(45)
DEP-I/O
Output segments must have input correspondents. (No insertion)

We can assume this constraint is ranked to a low position since it is consistently violated by the optimal output.

Conversely, we see that deletion of one of the segments is *never* a viable strategy to repair illicit structures in Spanish plural formation, suggesting that MAX must be ordered to a relatively dominant position in the hierarchy:

(46)
MAX-I/O
Input segments must have output correspondents. (No deletion)

Next, as with the case of consonant epenthesis which we presented in §4.1.2, any desire on behalf of the morpheme to align to the left edge of the prosodic word is dominated by principles of structural well-formedness, namely conditions on codas. Therefore, ALIGN-{s}-R must be ranked to an inferior position in relation to *COMPLEX^{CODA} in order for the optimal output to surface:

(47)
ALIGN{s}-R
Align the left edge of {s} with the right margin of the morphological base.

Our hierarchy will appear as the following:

(48)
PARSE » PLUR-MORPH » MAX-I/O » *COMPLEX^{CODA} » DEP-I/O» ALIGN{s}-R

Consider their interaction in the following tableau:

(49)
Input: /anxel/ + {s}

	PARSE	PLUR-MORPH	MAX	*COMPLEX^{CODA}	DEP	ALIGN{s}-R
☞ a. [an].[xe].[les]					*	*
b. [an].[xel]		*!				*
c. [an].[xels]				*!		
d. [an].[xes]			*!			*
e. [an].[xe].[le]		*!			*	
f. [an].[xel][s]	*!					

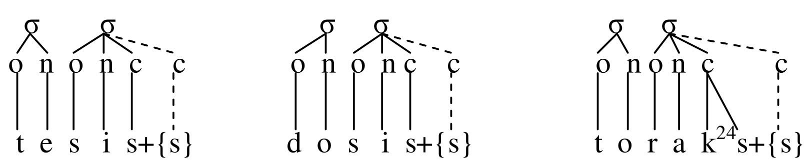
As we can observe, the optimal output is that which inserts an epenthetic [e] between the final segment of the prosodic base and the plural morpheme {s}, candidate (a). This candidate fails to align the morpheme directly to the prosodic base but does so to satisfy *COMPLEX^{CODA}, an optimal strategy. Candidate (b) does not affix any plural indicator and is therefore eliminated by PLUR-MORPH, a highly ranked constraint. Candidate (c) permits a complex coda to form between the final segment of the base and morpheme {s}, gravely violating *COMPLEX^{CODA}. Candidate (d) eliminates the final [l] in order to avoid the formation of a word-final complex coda, a sub-optimal strategy since it incurs a fatal violation to MAX. Candidate (e) is eliminated by failing to align the morpheme {s} to the epenthetic [e] while candidate (f) leaves the plural morpheme unparsed. These candidates violate the highest ranked constraints of the hierarchy and are quickly eliminated from the evaluation process.

4.2.3 Exceptional plural forms with [Ø]

As is usually the case, the simplest forms require a more complex theoretical explication. The forms found in (c) and (e) present a myriad of complicated questions which we will address throughout the course of this section. Unlike some previous studies, we center our analysis round the *observable* data.

The problem we must address is the following: The input provides a singular form which ends in /s/. The plural form which emerges is the same form as in the singular:

(50)

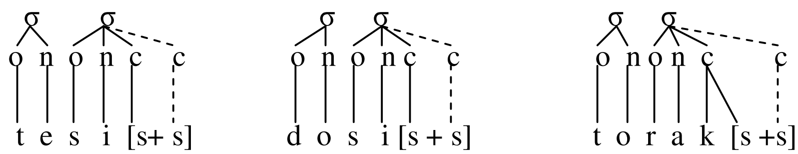


Foley (1967), responding to Saporta's (1965) attempt to provide a general rule of plural formation in Spanish, formulates an account of these plural forms, among

[24] Again, in normal discourse /k/ is either left unarticulated or greatly debilitated.

others, by postulating a rule by which {s} is actually affixed to the prosodic base, only to be later condensed to a single [s] by an assimilatory rule:

(51)
Diagram of Foley's account



Assimilation Rule

-tesi[s] -dosi[s] -torak[s]

Harris (1980) provides a nonconcatenative explanation based on the satisfaction of syllabic templates, claiming that forms like *–tesis*, *dosis*, (*-thesis*, *-dose*) etc. are morphologically complex words containing two underlying morphemes: /tes|**is**/, /dos|**is**/. Thus the /s/ which appears in the singular form satisfies the template as would plural modification.

Shepherd (2003) posits an analysis based on conflict resolution in which moraic structure plays a crucial role in the determination of optimality. Shepherd claims that if the final /s/ of the singular form is non-moraic, then an invariable plural such as the ones found in (31) (c) and (e) are optimal. In the event that the final /s/ is moraic, then the affixation of [es] is optimal: *-mes*→*mes*[es] (*-months*).

The first two analyses provoke a series of theoretical complications, among the most important is the fact that there is no empirical evidence to support such claims. Effectively, neither argument is *provable*.

With respect to Foley's proposal, let us ponder an underlying representation ψ. The singular form of said form would also be ψ. If the plural form is also ψ, it would tax all sense of reason to comprehend how and why the grammar would prompt a circular procedure which ultimately ends, where the underlying form began, ψ. Theoretically, this is not very economical.

Harris bases his argument around an underlying explanation. Basically, the strictly phonological segment /s/ which appears in word-final position of the exceptional forms can, in certain instances, fill in for the plural marker {s}. This argument is reminiscent of proposals made in the contemporary debate around the concept of phonological analogy. And although interesting and to a certain extent viable, it would be very difficult to prove if the prediction is correct or not, since we have no direct access to the underlying form.

The difficulties we expose above are only the superficial complications. Essentially, the lack of empirical evidence to prove or disprove each claim poses a major problem from an acquisition perspective. In Foley's claim, it is doubtful that a language learner could actually deduce this process from her input environment. Harris' claim is somewhat more tangible, but models based on syllabic templates have been proven to be unreliable in Spanish (see Alonso-Cortés, 1997). In both cases, it is doubtful that either process is **learnable,** based on the input the language learner receives.

We propose an explanation based solely on observable fact. The only observable evidence we see in the forms presented in (31c) and (31e) is that the plural forms are morphologically unmarked for plurality. Therefore it would be difficult to postulate any sort of interceding process by which a plural indicator becomes associated with the prosodic base if said indicator is systematically and consistently neutralized in the optimal form.

We propose that these forms are lexically and syntactically underspecified for singular or plural. We use as evidence the idea that, in isolation, no native speaker can know if the form is one or the other. In English, we see an identical situation with the plurals of *–fish* and *–sheep*. However, in our cases, upon being syntactically modified by a definite determiner, or other indicator which expresses the notion of plurality, any native Spanish speaker can deduce the status of the forms found in (31) (c) and (e) even though there is no morphological indicator affixed to the word itself.

Essentially then, in order to model this hypothesis into a paradigm of conflict resolution, all we need to do is justify the fact that there is no modification of the input in the output. If we remember from preceding chapters, in OT, this is achieved by ordering faithfulness constraints to dominant positions in the production hierarchy.

Particularly, we must order DEP, which bans segment insertion, to a dominant position in order to prohibit any restructuration of the syllabic structure. This would inhibit any chance of vowel epenthesis in the event that a plural morpheme were affixed. Incidentally, this constraint would prevent any modification to the metric structure of the words due to resyllabification, which probably plays some role in the fact that these forms remain exceptional. Of course, this constraint must dominate any penchant to affix a morphological indicator of plurality, which as we have seen is represented by ALIGN{s}-R. Finally, we must make some concession for the fact that the deletion of segments is disfavored in the optimal output. By ordering MAX to a medial position, we can represent this notion.

This hierarchy is offered in the following constraint hierarchy:

(52)
PARSE » DEP » CONTIGUOUS » MAX-I/O» ALIGN{s}-R

We can observe their interaction in the following tableaux:

(53)

Input: /tesis/ [±plural]

/tesis/ [+plural]	PARSE	DEP	MAX	ALIGN{s}-R
a. [te.sis][s]	*!			
☞ b. [te.sis]				*
c. [te.si]			*!	*
d. [te.si.se]		*!		*
e. [te.si.ses]		*!		

(54)[25]

Input: /toraks[26]/ [±plural]

/toraks/ [+plural]	PARSE	DEP	MAX	ALIGN{s}-R
a. [tó.raks][s]	*!			
☞ b. [tó.raks]				*
c. [tó.rak]			*!	*
d. [to.rák.se]		*!		*
e. [to.rák.ses]		*!		

In both tableaux (53) and (54), we see that the candidate which maintains maximum faithfulness to input structure is the candidate which turns out optimal, candidates (b). In tableau (53), candidate (a) aligns the morphological plural indicator {s} to the prosodic word, but violates PARSE by being unable to syllabify the segment without the aid of vowel epenthesis. Candidate (c) arbitrarily eliminates the word-final /s/, incurring a grave violation to MAX. Candidates (d) and (e) affix epenthetic segments, [e] and [es] respectively, but in so doing violate the ban on segment insertion expressed by DEP.

Thus given this hierarchy of constraints, we see that the best strategy is to violate the inferior constraint by not affixing a plural morpheme to the prosodic base. Naturally, this means that the notion of plurality is phonologically and morphologically opaque in the optimal surface form. Nevertheless, since plurality in Spanish is a syntactically redundant concept, it will always be expressed by way of the modifying

[25] In casual speech, [k] is always omitted or debilitated in the surface form. We include it here as to not disorganize our analysis with processes which occur in subsequent phonological domains.

[26] As we pointed out in chapter 3, the pronunciation -[tóra<u>ks</u>] is formal, or even hypercorrect. We use this representation here however in order to not detain our study unnecessarily. As far as the plural forms of these words are concerned, it makes no difference whether the [k] is present or not.

determiners, adjectives or verb accompanying the substantive. When the morphologically opaque form is introduced into its proper syntactic environment, the underspecified mark [$\pm$plural] converts to [+plural] in the output, in effect, indicating plurality even though there is no phonological or morphological cue.

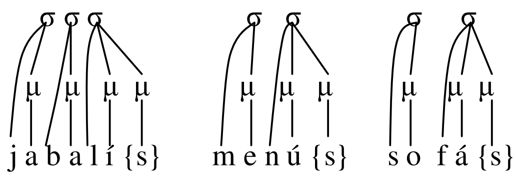
4.2.4 Words ending in a tonic vowel

In §4.2.2 we saw that [es] affixes to roots ending in consonants apart from /s/, monosyllabic words with final consonant /s/, or words ending with /s/ in which the final syllable is stressed. In these cases, the motivation was phonological in the sense that {s} could not affix directly to the base as a result of the well-formedness ban against complex codas. In this section, however, we will argue that the epenthetic segment which emerges between the prosodic base and plural suffix is not motivated by well-formedness at all, but rather is triggered by a ban on word-final heavy syllables produced by plural modification.

This contention differs drastically with past analysis such as Foley (1967), in which this author hypothesized an underlying word-final /e/ in the phonological representations of words like -*tabú*, /tabu<u>e</u>/ (-*taboo*), which only surfaced in Spanish plurals. In the singular form, /e/ would be deleted by an apocope rule, an idea that Harris (1969, 1970) was quick to espouse but later exchanged for an explanation based on epenthesis. Contreras (1977), following Saltarelli (1970), based her analysis on epenthesis as well, the most important contribution being a revised rule of epenthesis for word-final /s/ sequences. None of these aforementioned justifications advances our discussion on Spanish plural formation.

Let us consider the following diagrams in which the plural morpheme aligns directly to the tonic vowel. Specifically, pay close attention to the number of moras which appear in the final syllable:

(55)



In Spanish, the combination of tonic vowels and some coda consonants, in this case /s/, produces a bimoraic syllable. In chapter 2, we mentioned that, by and large, Spanish prefers not to end words in heavy syllables, although we did not elaborate further on this topic. We assume that the tendency to insert an epenthetic [e] between the tonic vowel and plural indicator in the cases under study is associated to the disinclination toward heavy word-final syllables. Crucially, the insertion of [e] prevents the creation of an additional mora in the final syllable motivated by plural affixation.

This generalization can be formally captured by stipulating a constraint, DEP-I/Oμ, which prohibits the emergence of non-underlying moras:

(56)[27]
DEP-I/Oμ
All surface level moras must have an underlying counterpart.
(No insertion of moras)

Naturally, when ranked to a dominant position relative to DEP, this constraint can easily trigger vocalic epenthesis. Both constraints must dominate ALIGN{s}-R, since the optimal output falls short of aligning the morpheme to the right edge of the prosodic base. In these cases, we must express the fact that plurality must be reflected

[27] We maintain that this is an historic restriction which, over the years, has fallen out of favor in Modern Spanish. Plural forms of modern words, like –*gays* [geis] (-*gays*) and –*guays* [gwais] (colloq. adj. -*cool*) indicate no such ban against the creation of heavy syllables upon being morphologically modified.

morphologically. Recall from previous sections that this concept is expressed by PLUR-MORPH:

(57)
PLUR-MORPH
The plural morpheme in Spanish is {s} and must appear in words marked for [+plural][28]. No derivational suffix may appear to the right edge of the suffix.

We suppose that this constraint ranks dominantly in our hierarchy since optimal outputs from this data set always express plurality with a morpho-phonological cue.

Finally, we must program MAX to a relatively dominant position since segment deletion as well is a viable strategy by which prevent the emergence of surface level moras prohibited by DEP-I/Oμ. Consider the following hierarchy:

(58)
PARSE » PLUR-MORPH » MAX »DEP-I/Oμ » DEP » ALIGN{s}-R

Observe their interaction in the following tableau:

(59)
Input: menú {s}

	PARSE	PLUR-MORPH	MAX	DEP-I/Oμ	DEP	ALIGN{s}-R
a. menús				*!		
☞b. menúes					*	*
c. mes			**!			*
d. menutes					**!	*
e. menú		*!				*

This tableau expresses that (1) all phonological segments must be parsed into syllables, (2) plural affixation may not produce a bimoraic final syllable, and (3) plurality must be morphologically specified. Given these stipulations, each candidate is unbounded with respect to the individual form which it may propose for evaluation.

Candidate (a) aligns the plural morpheme directly to the prosodic base but violates DEP-I/Oμ in order to do so. Recall that the direct alignment of {s} creates an

[28] Notice that our constraint merely states that /s/ must affix to the base. Subsequent processes may reduce /s/ to [h], but this would be after /s/ aligns to the base.

additional surface level mora which is banned by DEP-I/Oμ. Given the relative ranking of DEP-I/Oμ, this strategy proves sub-optimal. Candidate (c) eliminates segments from the input in order to prevent the emergence of an additional mora, satisfying DEP-I/Oμ at the cost of fatally violating MAX. Candidate (e) fails to align the plural morpheme to the prosodic base and is accordingly eliminated by MOPRH.

As we can observe, candidates (b) and (d) only differ on one point, an additional epenthetic segment [t] in candidate (d). This is a creative solution, and almost optimal, were it not for DEP, which penalizes each post-lexical segment as a separate violation.

Now, we must turn our attention to the fact that the forms found in (31d) alternate with variant forms in which the plural morpheme affixes directly to the prosodic base. Thus, the variant forms appear as the regular plural forms we found in (31a): menú→menú{s} etc.

Although this matter has historically occupied a good part of the debate in theoretical phonology and morphology in Spanish, its explanation from an Optimality-Theoretic approach is quite simple. Basically, form variation is justified by constraint restructuration. We specify the word *restructuration* to avoid making any presumptuous conclusions, as this matter has been rigorously discussed in recent literature.

The original learnability model exposed in an important paper by Tesar and Smolensky (1993) explains variation by constraint demotion, as Prince and Smolensky (1993) had envisaged it. Work in Functional Phonology, predominantly headed by Boersma (see Boersma, 1997), challenges this claim, offering an abundance of empirical as well as algorithmic substantiation to justify the claim that constraints can actually shift bi-directionally.

In this thesis, we will justify the emergence of the variant forms by constraint demotion alone. We must make explicit however, that this should be understood more as a matter of requirement and not interpreted as any preference for one specific model.

The minimal demotion of DEP-I/Oμ below DEP will produce forms in which the plural morpheme {s} affixes directly to the prosodic word. Notice this interaction in the following tableau:

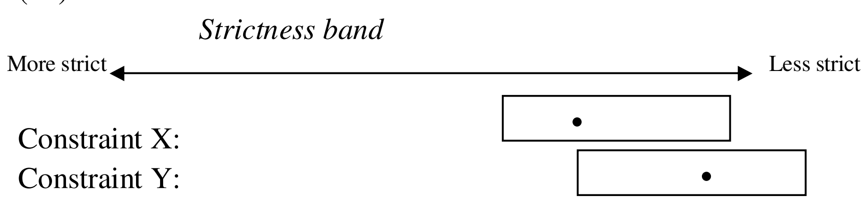
(60)
Input: /menu/

	PARSE	PLUR-MORPH	MAX	DEP	DEP-I/Oμ	ALIGN{s}-R
☞a. menus					*	
b. menus				*!		*
c. mes			**!			**
d. menutes				**!		**
e. menu		*!				*

But the problem is not that we did not know how to produce such an output using constraint interaction. This, to a certain extent, is the easy part of OT. The problem is how to represent such a paradigm in a way that the two hierarchies are intuitively linked. Proposing two separate hierarchies in the production grammar to produce an inconsequential variation is neither economic nor efficient[29].

Hayes (1998) and Boersma (1997, 1998) propose a notion of gradient well-formedness to clarify precisely these types of paradigmatic discrepancies. As Hayes (quoting Boersma) explains, constraints express a wide assortment of values on an abstract continuum, or *strictness band*:

(61)



[29] This, however, is a frequent strategy employed in many analyses.

Basically, this hypothesis is derived from the notion that speakers of a language do not always judge well-formedness in binary terms, in a deterministic fashion, but rather assess a specific form on a continuum ranging from absolute ungrammaticality to absolute well-formedness. This idea is formalized by assigning a selection point to each constraint illustrated by the black dot on the strictness band, as seen in (61). When the strictness bands of two competing constraints overlap, logically the selection points for the competing constraints may interact in such a way that in one circumstance constraint X may dominate Y, and in the next, Y may dominate X. Of course this contradicts the paradigm of strict domination proposed by Prince and Smolensky (1993), but, we will leave aside any commentary on this matter for now.

Let us consider our constraints DEP-I/Oμ and DEP in a similar example. The fact that the forms which take [es] interchange freely with those which only take [s] indicates an overlapping of DEP-I/Oμ and DEP. In certain cases, DEP can effectively *switch* places with DEP-I/Oμ, producing an optimal candidate in which a bimoraic final syllable produced by plural affixation does not produce any violation which would eliminate it from the evaluation process.

We can represent this dynamic interplay between constraints in the production hierarchy by separating the two constraints with a bidirectional arrow, ◀▶ , between DEP-I/Oμ and DEP. This expresses the fact that neither constraint *absolutely* dominates the other. In certain cases, DEP can overtake DEP-I/Oμ and vice versa.

Our revised hierarchy to justify both forms presented in (31d) appears as the following:

(62)
PARSE » PLUR-MORPH » MAX »DEP-I/Oμ ◀▶DEP » ALIGN{s}-R

In the case that DEP-I/Oμ dominates DEP, epenthesis will occur between the final tonic vowel and the plural morpheme. To the contrary, when DEP is ranked superiorly to DEP-I/Oμ, the morpheme is free to align directly to the right edge of the prosodic base, as it would do in normal cases of Spanish plural formation.

4.3 CONCLUSIONS

In this chapter we have examined one principle repair strategy, segment insertion, which is intimately associated to syllable structure and syllabic well-formedness in Spanish. First, we saw that onset well-formedness does not only effect the parsing of phonological constituents to their proper syllabic position, but rather can trigger a determined repair process in the event that the input provides a structure that cannot emerge as a well-formed output. In our case of vowel prosthesis, we illustrated that PARSE could be satisfied in a number of ways. In Spanish, the preferred manner to deal with this dilemma was by inserting a word-initial vowel, thus forcing the first consonant of the illicit sequence, /s/, to syllabify as the coda of the first syllable.

In our second case of consonant epenthesis, the repair strategy we examined was prompted by ONSET itself. We saw that by ranking a limited set of constraints which govern syllabic well-formedness, we can satisfactorily justify consonant epenthesis as a means to provide an essential onset for the following nucleus, while circuitously preventing vocalic hiatus.

The constraints we presented in the first sections served as the functional base for our analyses of Spanish plural formation. We showed that normal cases of plural formation can be expressed using a simple hierarchy based on syllabic well-formedness and generalized alignment constraints. In our second analysis we saw that PARSE was challenged by the complex coda which was to form without some operational interference by the grammar. We saw that the Spanish grammar inserts an epenthetic [e] in order to syllabify the final consonant of the prosodic base as the onset of the new syllable formed by the addition of the epenthetic nucleus.

Later, we examined plural cases in which no phonological or morphological modification occurs. We claimed that these items are lexically underspecified for [plural] in Spanish. We suppose this to be the result of a diachronic process which, for one reason or another, impeded the addition of a morphological plural marker, or rendered the segment altogether redundant. Implicitly linked with this assertion, is the idea that a learner would have very little information with which to classify the seemingly anomalous stem type. We proposed a hierarchy headed by correspondence principles, represented by faithfulness, which prevented any sort of phonological or morphological modification between the input and output.

Finally, we offered an account of two plural forms which coexist in a state of relative free variation. We provided a theoretical model which proposed that constraints interact in certain instances such that either may be dominant at any given time. Of course, this paradigm challenges the notion of absolute well-formedness proposed by OT purists, but offers a functional, practical and common sense approach to a topic on which most would agree; in free variation, no outcome can be the absolute *well-formed* output.

We illustrated that when DEP-I/Oμ is ranked dominantly to DEP, the former constraint will require the optimal output to avoid the creation of a word-final heavy syllable by penalizing the insertion of a surface level mora motivated by the direct alignment of {s} to the final tonic vowel. Conversely, when DEP dominates DEP-I/Oμ, the insertion of an epenthetic vowel [e] gravely violates this former constraint, meaning that the best strategy to resolve the conflict is to violate DEP-I/Oμ by creating a heavy word-final syllable.

On a more profound level, in this chapter we have seen that onsets and codas exist in a somewhat symbiotic state. In all of the cases we have examined, a trend has emerged in which conflict resolution has been resolved by the complementary relationship between these two positions. In the first analysis on vowel epenthesis, we saw that onset well-formedness can actually prompt the creation of a coda. Thus we can assume that the creation of codas is a way to resolve internal ill-formedness in complex onsets, a claim we alluded to in the previous chapter. In our analysis of plural formation, we saw that by syllabifying the former word-final coda of the prosodic base as an onset, we could avoid a stringent ban on word-final complex codas.

In the following chapter, we will change our focus in order to treat the topic of prosodic stress and its impact in Spanish phonology. We will offer a general theory of stress application and offer a typology of Spanish stress patterns based on conflict resolution.

5

STRESS AND ITS EFFECTS IN SPANISH PHONOLOGY

5.0 AN INTRODUCTION TO STRESS AND FEET

This chapter discusses the topic of stress in Spanish and its relationship to a higher metrical category called the **foot**. Most speakers have a general idea of what stress is, but have never contemplated a structural organization, similar to that of phonemes into syllables, based on systematic patterns of stress application.

To better understand the notions of stress and feet, let us ponder them from the point of view of acquisition and the productive grammar. First, we could propose that stress application is strictly superficial, isolated from the production grammar and effectively immune to the constraints that shape words. If this is the case, then stress would have no lexical representation or phonological impact on syllabic or phonological well-formedness. The difficulty with this proposal, however, is that there is no way, *a priori*, to substantiate the uniform patterns of stress assignment which emerge in natural language, nor how learners are consistently capable of acquiring and producing them.

To the contrary, we could propose that stress is a programmed part of our internal language system, forming a separate compartment in our production grammar. In other words, speakers store stress patterns in their memory. Of course, this conception implies that divergent stress patterns which do not coincide with language specific stress templates must somehow be justified by an operation of the productive grammar. In OT, this divergence is expressed by constraint ranking.

We will see in the Spanish data that we present in the subsequent sections that the parsing of stress into feet is not always as predictable and systematic as the parsing of phonemes into syllables. Sometimes, dominant forces prevent perfectly parsed feet.

For this reason, the topic of stress application has benefited a great deal from research grounded in conflict resolution, since OT formally recognizes that optimality need not be perfect, and sometimes structural perfection is not necessarily always optimal.

We open our examination in §5.1 (page 246) with a brief introduction to the basic components of stress and feet. Subsequently in §5.2 (page 251), we discuss the distributional and intuitive evidence which supports this organization.

Next in §5.3 (page 256), we offer a general theory of the foot. We introduce the theoretic machinery with which we analyze Spanish-specific stress patterns of non-verbs in the following section. We pay special attention to both the shape and alignment of feet.

Later, §5.4 (page 264) provides a typology of stress in Spanish non-verbs based on the interaction of two varieties of constraints. We illustrate that the shape of Spanish stress patterns and foot structure can be explained by the conciliatory relationship between three principle constraints: PARSE-σ, FAITH-v̊ and FTBIN. Subsequently, foot alignment is explained by a similar paradigm of conflict resolution between three key constraints: NONFINALITY, PARSE-σ and RL.

Throughout the course of this chapter we will make special reference to two morphological units integral to our analysis of Spanish stress: **stem** and **word formative** (after Bermúdez-Otero, 2006). The word formative refers to the word-final vowels, [a], [o], and [e] which (1) align to the morphological word, (2) are, at least partially, associated to morpho-syntactic gender, and (3) are acutely connected to the Latin accusative case endings: *amì*:[cum] (Roca, 2006). In previous studies these have been called *word-markers, gender-markers,* or *desinence* among other names.

Crucially, we find that stress in Spanish is banned from applying over the word formative.

The other unit we will refer to often is the stem. Stem refers to the remaining portions of a monomorphemic word once the final vowel is precluded. Therefore, a word such as -*casa* (-*house*) is considered to be composed of a stem –*cas* and a word formative –*a*: *kás*]*a*. We will refer to the singular entity of stem and vowel combined using the general term prosodic word, or base.

5.1 STRESS AND FEET

Here, we define stress in terms of prominence in relation to the other syllables which are contained in the prosodic word. We should make explicit that stress may only apply over peaks in Spanish. So for example, in the disyllabic word –*pato* (duck) [pa.to] primary stress falls on the [a], denoted by the application of the acute accent mark " ´ " [pá.to]. Some words may also contain secondary stress, exclusive to the phonetic level. Consider the word –*mariposa* (butterfly). Apart from primary stress which applies over the penultimate vowel [o], this word also contains secondary stress over the first consonant [a], depicted using a grave accent mark " ` ", [mà.ri.pó.sa][1].

In the rest of this chapter we use the following terminology to express the syllable over which primary stress may apply:

[1] It is generally accepted that secondary stress has no phonological impact in Spanish.

(1)

Stress terminology	
Ultima	[…σ´]
Penult	[…σ´σ]
Antepenult	[…σ′σσ]
Preantepenult	[…σ´σσσ]

In most studies these types of stress models are often called by the following terminology:

(2)

Stress Patterns	
Oxytone	[σσ´]
Paroxytone	[σ´σ]
Proparoxytone	[σ´σσ]
Preproparoxytone	[σ´σσσ]
(henceforth O, PO, PPO, PPPO)	

Consider the primary stress in the following list of Spanish words:

(3)

Primary and secondary stress in Spanish words

	Stress over ultima syllable (oxytones –O#)		
a.	-balcón	[bal.kón]	(*balcony*)
	-tabú	[ta.βú]	(*taboo*)
	-sofá	[so.fá]	(*sofa*)
	-riñón	[ri.ɲón]	(*kidney*)
	-hostal	[os.tál]	(*hostal*)
	-pilar	[pi.láɾ]	(*pilar*)
	-liquidez	[li.ki.déθ]	(*liquidity*)

	Stress over penultima syllable (paroxytones –PO#)		
b.	-pato	[pá.to]	(*duck*)
	-nata	[ná.ta]	(*heavy cream*)
	-patata	[pa.tá.ta]	(*potato*)
	-zapato	[θa.pá.to]	(*shoe*)
	-resumen	[re.sú.men]	(*summary*)
	-examen	[ek.sá.men]	(*exam*)
	-germen	[géɾ.men]	(*germs*)
	-abdómen	[aβ.ðó.men]	(*abdomen*)
	-líder[2]	[lí.ðeɾ]	(*leader*)

[2] Although this word is a loan from English, its plural form, líderes, tells us that it is a *naturalized* loan and therefore is valid for our analysis.

	-tórax	[tó.ɾaks[3]]	(*thorax*)
	-lunes	[lú.nes]	(*Monday*)
	-túnel	[tú.nel]	(*tunnel*)

	Stress over antepenultima syllable (proparoxytones –PPO#)		
c.	-régimen	[ré.xi.men]	(*diet*)
	-espécimen	[es.pé.θi.men]	(*specimen*)
	-estímulo	[es.tí.mu.lo]	(*stimulus*)
	-ridículo	[ri.ði.ku.lo]	(*ridiculous*)
	-espectáculo	[es.pek.tá.ku.lo]	(*spectacle*)
	-músculo	[mús.ku.lo]	(*muscle*)
	-máximo	[mák.si.mo]	(*maximum*)
	-mínimo	[mí.ni.mo]	(*minimum*)
	-Wáshington	[wá.šin.ton]	(*Washington*)
	-Rémington	[re.min.ton]	(*type writer*)

Focus on the syllable which receives primary stress in monomorphemic words containing the alternating diphthongs [we] and [je]:

(4)[4]

Stress in words with alternating diphthongs		
-bueno	[bwé.no]	(*good*)
-abuelo	[a.βwé.lo]	(*grandfather*)
-huérfano	[wéɾ.fa.no]	(*orphan*)
-tuétano	[twé.ta.no]	(*marrow*)
-riesgo	[rjés.γo]	(*risk*)
-prieto	[prjé.to]	(*tight*)
-hierba	[jéɾ.ba]	(*grass*)

The generally accepted rule with regard to Spanish-specific accentuation is that native words ending in [r], *hablar* [a.βláɾ] (*to speak*) for example, [l], -*hotel* [o.tél] (*hotel*), [θ] –*perdiz* [peɾ.diθ] (*partridge*), and [d] -*bondad* [bon.dáð] receive primary stress over the last syllable, while those ending in [n] and [s] oblige primary stress over the penult syllable. Words that end in a vowel receive stress over the next to last

[3] Full realization of [k] is hypercorrect.
[4] The alternating diphthongs [je] and [we] are invariably stressed in monomorphemic words, while other rising diphthongs can remain unstressed, -*contiguo* [kon.tí.gwo] (-*contiguous*) for example. We will address this notion in §5.3.

syllable, unless otherwise expressed orthographically. Deviations from these rules result in an orthographic accent mark, as can observed in the data in (2).

As the data in (3) illustrate, stress in Spanish non-verbs may not appear beyond the third syllable from the rightmost edge of the prosodic word. Harris (1983) formalizes this generalization, asserting stress in Spanish is severely restricted to a three syllable window of sorts in which stress must apply[5]. Throughout the course of this chapter, we will see that this is one of few steadfast rules which is never violated by Spanish stress application.

In a majority of the cases, the assignment of primary stress coincides with the appearance of the alternating diphthongs [we] and [je], although this is not an altogether trustworthy generalization: -*arriesgar* [a.r(je)s.γár] (*to risk*), -*amueblar* [a.m(we).βlár] (*to furnish*), -*deshuevar* [des.we.βáɾ] (*to castrate*) (Alonso-Cortés, 1997).

The fact that stress may fall on any one of the final three syllables of a Spanish word does not mean that distribution is not, at least partially, predictable. Consider the following data extracted from Núñez Cedeño's and Morales-Front's (1999: 211) electronic examination of 91,000 Spanish words. Here we will organize the stress category according to the final segment:

(5)
Statistics from 91,000 Spanish non-verbs

Word typology and stress patterns	% of total words
V# O#	0.87%
V# PO#	88%
V# PPO#	11.10%
C# O#	97.80%
C# PO#	2.03%
C# PPO#	.05%

[5] Roca 2006 provides an OT constraint which expresses this detail.

There is general consensus in the phonological literature that Spanish is a **trochaic** language, meaning that stress can be described in terms of a disyllabic pattern, known as a foot, in which primary stress falls on the leftmost syllable. We see from the distributional data presented in (5) that this is a viable assertion. Additionally, the pronunciation of certain household products of foreign origin such as *–Colgáte* (-*Colgate* toothpaste) and -*Palmolíve* (-brand of soap), as well the distribution of stress in certain acronyms such as ÓNU, ÓTAN and ÚSA (U.N, NATO and U.S.A.) corroborate the claim that the default stress system in Spanish nominals is trochaic (Roca, 2006).

Although 97.8% of the Spanish non-verbs which end in consonants are oxytone, an overwhelming majority of total Spanish non-verbs in fact end in vowels, the most common word-final vowels being [a,o].

The more important data here illustrate that, of the total words which end in a vowel, 88% exhibit paroxytone (trochaic) stress. And since this category, words that end in a vocalic segment, constitutes the larger of the two categories, as opposed to words that end in a consonant, we can confirm that the preferred, and therefore unmarked, stress pattern in Spanish non-verbs is indeed trochaic. In past studies, this generalization has been captured by a constraint TROCHEE, which requires that stress apply over the leftmost syllable of a disyllabic foot:

(6)
TROCHEE
Feet are either monosyllabic or disyllabic. If the foot is disyllabic then the head is on the left.

Offering a further interpretation of the data in (5), we can make certain assumptions concerning the markedness values of the stress patterns which appear. First, we can assume that PPO# structures which end in a consonant are "*super* *marked*", while those ending in a vowel are simply *marked* (Roca, 2006). PO# and O# can be marked but are not necessarily so, depending on the final segment of the word.

Although not obvious from the data presented so far, we should also mention that stress in Spanish can be contrastive, meaning that minimal pairs occur according to the position of stress:

(7)

Minimal pairs as a result of stress application

Ultima	-especificó	[es.pe.θi.fi.kó]	(*he/she/it specified*)
Penultima	-especifico	[es.pe.θi.fí.ko]	(*I specify*)
Antepenultima	-específico	[es.pe.θí.fi.ko]	(*specific*)

The preceding data intimate a paradigm of indisputable interaction between stress assignment, syntactic affiliation and lexical access.

The systematic behavior of stress application has led phonologists to posit the notion of a higher stratum of stress interaction in which stressed and unstressed syllables are organized into a structural unit called a metrical *foot*. Below we will address the empirical evidence to support this view.

5.2 EVIDENCE FOR FEET AS A PROSODIC COMPONENT

As we can intuit thus far from the data in table (3), stress in Spanish is organized and emerges systematically, corroborating the argument that its distribution is governed by underlying universal principles of natural language. However, contrary to syllabic licensing, any paradigm favoring the systematic parsing of syllables into metric feet will have to formally recognize the fact that stipulations governing foot shape and position are plastic and not an absolute certainty.

In this unit we will briefly review the evidence which has been proposed in the phonological literature supporting the foot as a fundamental structure of prosody and augment these cases with specific evidence from Spanish.

As with the argument supporting syllabic parsing, poetry and language games provide sound evidence that foot structure plays an important role in prosodic structure. Let us consider the trochaic rhythm in the following poem by García Lorca. Underlined words indicate that the syllable should carry stress but does not:

(8)[6]

Verde que te quiero verde.
Verde viento. Verdes ramas.
El barco sobre la mar
y el caballo en la montaña…

[béɾ.ðe][ke] [te] [kjé.ɾo][βéɾ.ðe]
[béɾ.ðe][βjén̪.to]
[βéɾ.ðes][rá.mas]
[el][βáɾ.ko][só.βɾe][la][máɾ]
[jel][ka.βá.jo][en][la][mon̪.tá.ña]

As we can see, the restrictions that govern the lines of the preceding poem suggest a striking inclination toward the maintenance of foot structure.

Returning to our example of truncated names we proposed for the syllable in chapter 2, we also see that truncated names are almost always parsed into binary feet. Additionally, in an extraordinarily high number of the cases, truncated names represent trochaic feet, meaning that stress appears on the left side of a binary, or disyllabic, foot. Remarkably, this is even the case when stress is forced to shift to accommodate the trochaic structure. Let us consider again the truncated name forms we saw in chapter 2:

[6] Romance Sonámbulo, Federico García Lorca.

(9)[7]

Truncated forms of Spanish names		
Maite	[mái.te]	*María Teresa*
Semi	[sé.mi]	*José Miguel*
Juanma	[xwán.ma]	*Juan Manuel*
Juanra	[xuán.ra]	*Juan Ramón*
Jime	[xí.me] ~ [mé.na]	*Jimena*
Alfon	[ál.fon]	*Alfonso*
Fer	[fér]	*Fernando*
Fernan	[féɾ.nan]	*Fernando*
Nando	[nán̪.do]	*Fernando*
Josema	xo[sé.ma]	*Jose Manuel*
Chema	[ʧé.ma]	*Jose Manuel*
Manu	[má.nu]	*Manuel*

We observe a rather modern tendency to retain the trochaic structure in separated forms of compound names even when the second part of the compound name is precluded. For example, the name -*José Luis* is often pronounced -*Jóse Luis* in order to parse the first part of the compound name as a trochaic foot. Upon eliminating the second name, primary stress remains over the first syllable –*Jóse*, in effect creating a trochaic foot [xó.se], where originally there was not one.

Segment insertion in certain Spanish diminutive forms offers convincing distributional evidence supporting the foot as an autonomous, yet interdependent component of prosodic structure. In the following example, we offer a list of diminutive forms in which the adjunct segments [eθ] insert between the prosodic base and the diminutive suffix in order to adhere to a minimum foot requirement governing specific diminutive forms. Notice that in all the cases, the same result is obtained; all diminutive forms of disyllabic words containing penultimate diphthongs and monosyllabic words ending in a consonant **are uniformly parsed into two binary feet**:

[7] All the forms listed as truncated names are attested forms produced by Spanish speaking children.

(10)
Infixation in Spanish diminutive forms

-<u>huev</u>o	[<u>weβ</u>] + ito	-<u>hueve</u>cito	[<u>hwè.β</u>]<u>e</u>.θí.to
-<u>sol</u>	[<u>sol</u>] + ito	-<u>sole</u>cito	[<u>sò.l</u>]<u>e</u>.θí.to
-<u>rein</u>a	[<u>rein</u>] + ita	-<u>reine</u>cita	[<u>rèi.n</u>]<u>e</u>.θí.ta
-<u>mes</u>	[<u>mes</u>] + ito	-<u>mese</u>cito	[<u>mè.s</u>]<u>e</u>.θí.to

Detectably, the common factor which unites the cases of segment insertion is the fact that the stems, upon positioning the final vowels [o,a] to the right margin of the diminutive suffix, are all bimoraic monosyllables. The insertion of /eθ/ in these forms suggests the existence of a highly ranked constraint which requires stems to be thoroughly parsed into trochaic feet. At a subsequent stage, more sophisticated constraints are free to impose restrictions on the number of feet certain outputs must contain.

If we examine diminutive forms of trisyllabic stems with penultimate diphthongs, we see that insertion does not occur, essentially substantiating our last claim:

(11)
Lack of insertion with trisyllabic bases containing alternating diphthongs

-<u>abuel</u>o	[a.βwél] + ito	-abuelito	[<u>a.βwè.l</u>]í.to
-<u>huérfan</u>o	[hwéɾ.fan] + ito	-huerfanito	[hwèɾ.fan]í.to
-<u>cigueñ</u>a	[θi.gwéɲ] + ita	-cigueñita	[θì.gweɲ]í.ta

Upon reviewing the previous data, it is clear that a strong preference for syllables to be parsed into trochaic feet is intimately associated to segment insertion in Spanish diminutives.

Perhaps the most compelling evidence supporting the foot as an underlying unit comes from recent studies in language acquisition. Although studies in acquisition are much more complex than we portray them to be here, we do see a remarkable association between unstressed syllables and deletion by language learners in their primary years of acquisition (Allen & Hawkins, 1980; Blasdell & Jensen, 1970; Echols

& Newport, 1992; Wijnen, Krikhaar, & den Os, 1994). Importantly, we observe that in trochaic languages, Spanish being among them, there is a patent tendency toward deletion of *unfooted* syllables. So for example, in a word like –*zapato* [[θa.[pá.to]], the first syllable, /θa/, is left unfooted, and is therefore more susceptible to deletion by children in their formative stages of phonological acquisition, while the final two syllables, /pato/, form a trochaic foot, and are hence more impervious to deletion[8]. Lexicalized examples of this procedure such as *ñora* (from *señora,* Hisp. Am, Eng. *lady*) and *chacha* (from *muchacha*, Eng. *girl*) are also quite common. Although various hypotheses exist to justify this fact, there is a sizeable school of thought which proposes that the child forces her output to align to language specific stipulations regarding the shape and organization of metric feet, having deduced the constraints associated with foot structure from her input data (Demuth & Fee, 1995; Fikkert, 1994; Pater, 1997).

On a final note, a common *language* form similar to Pig Latin spoken by Spanish speaking children provides a persuasive argument espousing the organization of metrical units as a fundamental function of the Spanish grammar. The language is formed by inserting an extra syllable, composed of an onset [p] and the same vowel which appears in the preceding syllable, between each syllable which appears in the Spanish input. Hence, a word -*pelota* (-*ball*) becomes –*pepelopotapa*. Although many forms of this language exist, the data we will see in the following example comes from a *dialect* known as –*Sipisnopus* spoken by this author´s native Spanish speaking family from the island of Romblón in the Philippines:

[8] The astute reader will notice that insertion of extra syllables will satisfy this condition as well. In fact, my own daughter during her primary years of acquisition produced a form –zapatoto [θà.pa.tó.to].

(12)

Spanish: -Tiró la pelota contra la pared.
(*He/she threw the ball against the wall.*)
(ti.ɾó) la pe(ló.ta) contra la pa(ɾéð).

Sipisnopus: -Tipilopo lapa pepelopotapa conpotrapa lapa paparedpe.
(tí.pi)(ló.po)(lá.pa)(pé.pe)(ló.po)(tá.pa)(kóm.po)(trá.pa)(lá.pa)(pá.pa)(ɾéØ.pe).

Regardless of the stress patterns which emerge in the Spanish input, words in the Sipisnopus output always surface in perfectly parsed trochaic templates.

5.3 A FEW NOTES ON FOOT THEORY

In the following section we outline a basic theory for the foot from an OT perspective. Many of the components of foot theory that we will discuss here are the result of years of research by Hayes (1980, 1989, 1995, 1998), Halle and Vergnaud (1977, 1987), and Hammond (1999), as well as by advances made in the OT framework by Prince and Smolensky. Additionally, we call on Roca's (2006) study to provide vital data specific to Spanish stress application.

We must mention that, unlike syllabic parsing, the organization of syllables into feet is a more complicated system involving constraints which first require individual words to be footed, and once accomplished, restrictions that define the shape and size of these feet. Additionally, we must program some system which characterizes the way that this configuration is superimposed over syllabic structure.

A constraint PARSE-σ, dealing expressly with metrical feet, has been proposed in the literature:

(13)
PARSE-σ
Syllables must be footed.

We can already perceive a major difference between PARSE and this new constraint PARSE-σ, in that, as we have seen, the former is never violated in Spanish, whereas the second is often violated. We should consider two assumptions. Either PARSE-σ is not capable of accounting for the fact that syllables are often not parsed into metrical feet, or we must be able to justify nonconforming structures by hierarchical ranking alone. For the remainder of this chapter, we will substantiate the validity of PARSE-σ by offering a typology of Spanish stress assignment based on hierarchical ranking.

In theory, the dominant position of PARSE-σ will always choose footed syllables over unfooted ones:

(14)
Input: /pato/

	PARSE-σ
☞a. [páto]	
b. pato	*!

Although this constraint is capable of expressing the fact that footed words are preferred to unfooted ones, no stipulation is made which defines what type of foot is ultimately favored. In previous sections we provided distributional evidence that trochaic feet are by and large the most common foot structure in Spanish. This validates the claims which categorize Spanish as a trochaic language, accounted for by TROCHEE[9].

All divergent foot structures are eliminated by the interaction of PARSE-σ and TROCHEE:

9 In our analysis, we will consider all binary feet to be trochaic. As we shall see, monosyllabic feet are also possible in Spanish.

(15)
Input: /pato/

	TROCHEE	PARSE-σ
☞ a. [pá.to]		
b. [pa.tó]	*!	
c. pato		*!
d. [pá]to		*!
e. pa[tó]		*!

Tableau (15) illustrates that the dominant position of TROCHEE will always select binary feet which position stress over the leftmost syllable. Correspondingly, stress assignment in 88% of the vowel-final paroxytone words in Núñez-Cedeño's and Morales-Front's (1999) data can be justified by a similar model headed by TROCHEE.

Nevertheless, in order to arrive at a faithful typology of Spanish foot structure we must contemplate the fact that other types of feet are certainly possible. Consider the word *–balcón* in which primary stress falls over the rightmost final syllable. To explain this structural divergence, we must assume that some higher ranked constraint dominates TROCHEE.

Here we will consider two arguments to justify degenerate foot structure like the type mentioned above in *-balcón*. First, we will ponder a constraint based on quantity which requires heavy syllables to be stressed. Subsequently, we will contemplate a correspondence constraint which requires lexically accented syllables to be stressed in the output.

Numerous studies in Spanish Phonology have suggested an intimate correlation between syllable weight and stress application[10]. One of the most important, if not controversial, is Harris (1983), in which this author proposes a quantity sensitive analysis of productive stress application in Spanish. More recently, this concept has been incorporated into productive models of stress application from a constraint-based

[10] Alonso-Cortés (1997) gives a thorough review of these works. Holt's (1997) doctoral thesis as well provides an interesting perspective on the issue. We will not take this matter up at this point.

approach. And although different nuances of the same basic argument can be found in the literature to justify the emergence of stress over bimoraic syllables, all converge on the same essential point; heavy syllables must be stressed. Hammond (1999) proposes the following constraint:

(16)
Weight to Stress (WSP)[11]
Stress heavy (bimoraic) syllables. Hammond (1999)

If WSP were to occupy a dominant position, relative to a constraint which requires feet to be disyllabic, *Foot Binarity* (FTBIN), EVAL would be obliged to select the candidate which assigns stress over the final heavy syllable of a disyllabic word, even if this implies leaving the first syllable unparsed:

(17)
FTBIN
Feet must be disyllabic

Let us observe how this conflict would play out in the following tableau:

(18)
Input: /balkon/

	WSP	FTBIN
☞a. bal.[kón]		*
b. [bál.kon]	*!	

In this tableau, the optimal candidate, candidate (a) is chosen based on its satisfaction of WSP, which requires stress to fall on heavy syllables even at the cost of presenting a monosyllabic foot. Candidate (b) supplies a trochaic foot, but in this case the requirement to stress heavy syllables constitutes a dominant priority, rendering candidate (b) sub-optimal. Below, we will address the implications of an analysis based on quantity in Spanish.

[11] Myers (1982) and Riad (1992) provide a similar constraint called STRESS-to-WEIGHT which expresses that stressed syllables must be heavy. This constraint serves as one of the fundamental motivations for diphthongization in Spanish. See Holt (1997).

Although Harris (1983) purports that Spanish stress is weight sensitive, empirical evidence supporting this claim is quite weak (Alonso-Cortés, 1997). One only needs to consider the English loan words -*Wáshington*, -*Rémington*, and -*Bádminton*, as well as names such as -*Mánchester*, -*Róbinson* and *Thómas* to know that this claim is untrue. Bárkányi's (2002) experimental work proves that quantity is no longer a determining factor in stress assignment in Spanish. In her study, native Spanish speaking informants were asked to judge the fitness of stress application in a variety of tri-syllabic nonse words. Among the syllable patterns represented were closed medial syllables flanked on each side by open syllables. In these cases stress appeared over the first open syllable: CV´.CVC.CV. Only 27% of the informants rejected outright this type of stress pattern, while a surprising 31% accepted the form without hesitation. CV´C.CVC.CVC words were accepted by a surprising 30% of the informants while another 30% found them suspect but acceptable.

Trubetzkoy's universal, quoted in Roca (1988:417) opposes Harris' proposal, confirming that "in order for a VC rhyme to be counted as heavy, the language must also have V: rhymes". Since vowel length became neutralized in the transition between Latin and Spanish, the generalization that heavy syllables must be stressed was also lost.

It is true that in Latin stress was incontrovertibly sensitive to syllable weight. In the case that the penultimate syllable was heavy, stress appeared systematically over this syllable, while, in cases to the contrary, stress appeared over the syllable immediately preceding, the preantepenult. However, when this length contrast was lost in Romance, so too was the proclivity to systematically stress closed heavy syllables.

Burzio 1994 disputes that vowel length has been totally lost in Spanish, claiming that stressed vowels, like the [a] in –*zapáto* [θapáto] (shoe) is lengthened slightly due to stress application. Monroy's examination of these discreet phonetic details, however, disproves Burzio's claim. Basically, Monroy's experiments found no proof to support any correlation between stress application and vowel length.

Although, many heavy syllables in Spanish do, in fact, receive primary stress, here we will consider this as an inherited relic leftover from the Latin stress rule. In other words, stress-by-weight is an inactive concept in Modern Spanish. We can conclude then that if heavy syllables are stressed in Spanish, it is due to one of two factors: (1) the syllable is penultimate and stress applies by default in order to satisfy TROCHEE, or (2) stress has been lexicalized over the heavy syllable due to a once active quantity sensitive rule of stress application no longer valid in Modern Spanish.

In our analysis, we will consider all non-trochaic stress patterns to be the result of a highly ranked correspondence constraint which requires surface stress to coincide with an underlying lexical accent, FAITH-v̊, and not WSP.

The basis on which the alternative argument justifying the emergence of degenerate foot structure is founded is that certain words have an underlying accent programmed into their lexical categorization. These are always expressed orthographically in Spanish. So for example, we can consider that words like –*café* (-*coffee*), *rondó* (-*rondeau*), *menú*[12](-*menu*) and others, are lexically marked for an accent over the final vowel[13]. Stress application in trisyllabic words in which primary stress applies over the first syllable, -*médulo* (-*marrow*, -*spinal cord*), -*péndulo* (-*pendulum*), and –*pétalo* (-*petal*) for example, can also be justified by this same basic proposal.

[12] Other examples certainly exist. We chose these because they are of foreign origin and provide sound evidence that lexical accentuation forms part of the phonological essence of the word structure.
[13] In these cases, the underlying stressed vowels unquestionably form part of the stem (Roca, 2006).

Lexical accent is expressed by placing a " ˚ " over the accented vowel in the underlying representation. If we program a faithfulness constraint, FAITH-v̊, ranked dominantly to FTBIN, correspondence principles will require the emergence of stress over the corresponding vowel even though the result implies a monosyllabic accented foot:

(19)
FAITH-v̊
Accented vowels must be stressed.

The following tableau demonstrates this interaction:

(20)
Input: /menů/

	FAITH-v̊	FTBIN
☞a. me.[nú]		*
b.[mé.nu]	*!	

As we can see, the superior ranking of FAITH-v̊ overrules any desire expressed by FTBIN for feet to be disyllabic, and therefore trochaic.

5.3.1 Foot alignment

Now that we have defined the foot and offered a brief introduction as to how constraint interaction can produce a desired foot structure, we must now contemplate how this arrangement will be superimposed over the syllabic organization of the word. In an OT framework, this is generally accomplished by generalized alignment constraints, similar to the ones we introduced in §4.1.2.

In Spanish, feet are aligned to the rightmost word margin. This explains why penultima syllables are considerably more susceptible to stress assignment in Spanish:

(21)
-mariposa (butterfly)
[mà] [ɾi] [pó] [sa]

[F O O T]

We can express this idea with a constraint RL, which stipulates that the right edge of feet must align with the right word margin. Here, Σ is used to refer to *foot*:

(22)
RL (GENERAL ALIGNMENT)[14]
ALIGN (Σ, R, Word, R); the right edges of all feet are aligned with the right edge of the word.

Unranked, this constraint can already account for stress patterns in words such as –*zapato* (-*shoe*), in which primary stress is assigned over the penultima syllable. Observe:

(23)
Input: /θapato/

	RL
☞a. θa.[pá.to]	
b. [θá.pa.]to	*!

As we can see, RL forces all right edges of feet to align to the rightmost edge of the word. The divergent alignment in candidate (b) implies that stress must apply over the first syllable [θa], a sub-optimal strategy.

For polysyllabic words in which stress falls on the penultima syllable, RL is capable of rendering the correct output. Appreciably, though, not all tri- and polysyllabic Spanish words follow the same stress pattern exhibited in (23). If we consider a word such as -*estímulo* (-*stimulus*), we see that the right foot margin cannot possibly align with the right edge of the prosodic word since this would erroneously require stress to apply over the penultimate syllable: esti[mú.lo]. A constraint,

[14] This constraint is akin to ALL-FT-RIGHT presented by McCarthy and Prince (1993a). The difference between ALL-FT-RIGHT and RL is inconsequential.

NONFINALITY, has been suggested and examined[15] in the literature which penalizes candidates that align right edges of feet with the right edge of a word[16]:

(24)
NONFINALITY
* Σ |
Word|

The dominant ranking of NONFINALITY in relation to RL will yield the proper foot alignment for an input /estimulo/. Consider the following conflict resolution between RL and a dominant NONFINALITY:

(25)
Input: /estímulo/ N[17]

	NONFINALITY	RL
a. es.ti.[mú.lo]	*!	
☞b. es.[tí.mu]lo		*
c. [és.ti].mu.lo		**!

Upon ranking RL to a position in which its stipulations are only minimally binding, foot alignment is free to deviate from the right edge requirement, in effect justifying divergent foot positions in non-trochaic stress patterns in Spanish.

5.4 A TYPOLOGY OF SPANISH STRESS

Hammond (1999) formulates the hypothesis that all stress patterns in the entire inventory of world's languages can be described by ranking the previous Shape and Assignment constraints in language-specific paradigms. In response to this assertion, in this section, we offer a typology of stress in Spanish non-verbs based on the hierarchical

[15] See Hammond (1999) and Kager (1999) for a full review of NONFINALITY.
[16] Roca (2006) presents an argument that in Spanish, feet align not to the right *word* edge, but rather to the right *stem* edge. In our analysis, however, we find such a distinction unnecessary.
[17] We make explicit the fact that our input is a noun, since the verb form estimulo (1st pers. sing. *to stimulate*), in which stress falls over the penultimate syllable, also exists.

position of these few key constraints. We will illustrate that Hammond's assumption is correct for Spanish.

The constraints we have seen so far are illustrated in the following example:

(26)

Constraint sets[18]
Shape constraints: PARSE-σ, FTBIN, FAITH-v̊
Assignment constraints: PARSE-σ, RL/LR, NONFINALITY

Hammond (1999) proposes a schema of all possible rankings of shape constraints. These ranking hierarchies appear in the following example:

(27)

Logically possible rankings of shape constraints
PARSE-σ » FAITH » FTBIN
PARSE-σ » FTBIN » FAITH
FAITH » FTBIN » PARSE-σ
FAITH » PARSE-σ » FTBIN
FTBIN » FAITH » PARSE-σ
FTBIN » PARSE-σ » FAITH

All possible combinations of assignment constraints appear in the following:

(28)

Logically possible rankings of assingment constraints
RL/LR » NONFINALITY » PARSE-σ
NONFINALITY » RL/LR » PARSE-σ
RL/LR » PARSE-σ » NONFINALITY
PARSE-σ » RL/LR » NONFINALITY
PARSE-σ » NONFINALITY » RL/LR
NONFINALITY » PARSE-σ » RL/LR

[18] It is unclear the extent to which these constraint sets interact.

5.4.1 Analysis of Spanish non-verb data

The following data are divided by the number of syllables and the types of stress each group of like-numbered syllables will accept. We will begin with disyllabic words and increment progressively up to four syllable words. Like our analysis of syllables in chapter 3, we will restrict our study of stress to monomorphemic words. In order to break up the rather cumbersome and monotonous nature of the data set, we will present our analysis at the end of each sub-set, commencing each with the shape constraints followed by the stipulations expressed by assignment.

We intentionally consider assimilated loan words in the following data set. In the past, studies more concerned with Spanish philology have excluded such items, to the peril of presenting an incomplete data set. However, our study here is concerned with the productive Spanish grammar and how this grammar computes stress. Seen in this way, assimilated words provide us with a wealth of knowledge regarding how Spanish speakers process a new input, and the generalizations which shape the Spanish-accented output.

We must specify that our study examines non-verbs, or more specifically substantives and adjectives. This is an important distinction for our investigation since, contrary to Harris' (1989, 1995) claims, stress shape and assignment of verbs and non-verbs in Spanish entail vastly different competing forces. Stress application in Spanish verbs is morphologically generated and highly prescriptive, whereas the behavior of non-verb stress application is seemingly capricious and less systematic in nature (Roca, 2006).

On a final note, we consider that the default foot structure in Spanish to be trochaic. The natural consequence, as we will illustrate in the following section, is that any deviation from TROCHEE must be motivated by a dominant FAITH-v̊ constraint which justifies the maintenance of lexical accent in the surface form.

Consider the following data:

(29)

Disyllabic words [σσ]

	Nouns			Adjectives		
a. σσ´						
Closed accented syllables[19]						
	-balcón*	[bal.kón]	(*balcony*)	-truhán[20]	[tru.án]	(*shameless*)[21]
	-pared	[pa.réð]	(*goodness*)	-ardid*	[ar.ðið]	(*astute*)
	-vigor	[bi.γór]	(*vigor*)	-astur*	[as.túr]	(*From Asturias*)
	-hotel	[o.tél]	(*hotel*)	-atroz	[a.tróθ]	(*fierce*)
	-revés	[re.βés]	(*reverse*)	-sutil	[su.tíl]	(*subtle*)
	-perdiz*	[per.ðíθ]	(*partridge*)			
	-bazar	[ba.θár]	(*bazaar*)			
Open accented syllables						
	-sofá	[so.fá]	(*sofa*)	-hindú[22]	[in.dú]	(-hindu)
	-café	[ka.fé]	(*coffee*)			
	-carné	[kar.né]	(*permit, ID card*)			
	-tabú	[ta.bú]	(*taboo*)			
	-rondó	[ron.dó]	(*rondo*)			
b. σ´σ						
Closed accented syllables						
	-cisne	[θís.ne]	(*swan*)	-gordo	[gór.ðo]	(*fat*)
	-horno	[ór.no]	(*oven*)	-triste	[trís.te]	(*sad*)
	-compra	[kóm.pra]	(*purchase*)	-lento	[lén.to]	(*slow*)
	-susto	[sús.to]	(*fright*)	-zurdo	[θúr.ðo]	(*left handed*)
	-pasta	[fál.ta]	(*lack*)	-calmo	[kál.mo]	(*calm*)
	-cárcel	[kár.θel]	(*jail*)			
	-cóndor	[kón.dor]	(condor)			
Open accented syllables						
	-nata	[ná.ta]	(*heavy cream*)	-cojo	[kó.xo]	(*lame*)
	-globo	[gló.βo]	(*balloon*)	-majo	[má.xo]	(*nice*)
	-clase	[clá.se]	(*class*)	-fino	[fí.no]	(*elegant*)
	-taxi	[ták.si]	(*taxi*)	-mudo	[mú.ðo]	(*mute*)
	-tribu	[trí.bu]	(*tribe*)	-peno	[pé.no]	(*from Carthage*)
	-lunes	[lú.nes]	(*Monday*)	-útil	[ú.til]	(*useful*)
	-cutis	[kú.tis]	(*skin, complexion*)			
	-iris	[í.ris]	(*iris*)			

[19] Notice that some words have both syllables closed. These are marked with an asterisk.
[20] From French -*truand*
[21] The astute reader will notice that nearly all the adjectives which appear in this category are either rare glosses in Spanish, not commonly used in Modern Spanish, or of foreign origin. This theme is repeated in this category throughout all the data sets.
[22] From French -*hindou*

-crimen	[krí.men]	((*capital*) *crime*)
-cráter	[krá.teɾ]	(*crater*)
-túnel	[tú.nel]	(*tunnel*)
-líder	[lí.ðeɾ]	(*leader*)

Contrary to the proposal presented in Harris (1983) supporting a quantity sensitive analysis of Spanish stress, the open/closed contrast we supply in our data set is intended to highlight the distributional evidence which proves there is no functional correlation between stress and syllable weight in Modern Spanish. That is to say, light, open syllables can be stressed even when coinciding in words in which a heavy, closed syllable is left unstressed, confirming that a quantity sensitive analysis of productive stress application is not at all supported by the facts from Spanish. Sometimes, heavy syllables in Spanish do indeed attract stress, but it is not supplied productively by an operative function of the production grammar. In these cases stress emerges due to a strong proclivity to maintain lexical accent in the surface form, or by mere coincidence in heavy syllables which represent the leftmost syllable of a trochaic foot.

In order to justify the [σσ́] stress pattern in (29a), we have already mentioned that FAITH-v̊ must play a crucial role in determining the optimal output, but we have not considered what constraints are necessarily violated in order to satisfy this restriction. If we will notice, final stress implies an indisputable violation of PARSE-σ, since the first syllable is left unfooted. We can therefore assume that PARSE-σ will be ranked to the inferior position of the constraint hierarchy. Additionally, final stress violates FTBIN by not providing a binary foot. Consider the following constraint hierarchy. For now, we will consider the ranking of FTBIN, in relation to PARSE-σ to be inconsequential, since both must be violated to satisfy FAITH-v̊:

(30)
FAITH-v̊ » FTBIN , PARSE-σ

Let us observe this interaction in the following tableau. We will only display one example in tableau form, assuming that the rest of the words in the data set entail an identical paradigm of constraints:

(31)
Input: /pare̊d/

	FAITH-v̊	FTBIN	PARSE-σ
a. [pá.ɾeð]	*!		
b. [pá].ɾeð	*!	*	
☞c. pa[ɾéð]		*	*

Although candidate (c) incurs a violation of the two subordinate constraints, it does so in order to satisfy the requirement that lexical accents be maintained in the optimal output. Candidate (b) neither parses both syllables of the word into a binary foot nor applies stress over the lexically accented syllable. This is the least optimal strategy. Candidate (a) parses the word into a binary foot, but at the cost of not maintaining underlying stress over the final syllable, incurring a fatal violation to the superior constraint of the hierarchy.

Open syllables which receive final stress are treated in an identical way. This hierarchy is offered again in the following example:

(32)
FAITH-v̊ » FTBIN , PARSE-σ

These constraints interact in the following tableau:

(33)
Input /menů/

	FAITH-v̊	FTBIN	PARSE-σ
a. [mé.nu]	*!		
b. [mé].nu	*!	*	
☞c. me[nú]		*	*

Here, the monosyllabic stressed final foot proposed by candidate (c) is optimal since this strategy satisfies the dominant constraint of the hierarchy, FAITH-v̊. The logical side effect of satisfying FAITH-v̊, however, implies a necessary infraction of FTBIN and PARSE-σ, an acceptable concession given the present hierarchical organization of the constraints.

In turning to the examples provided in (29b), stress assignment coincides with the stipulations made by TROCHEE, our stress pattern by default in Spanish. That is not to say, however, that all examples from (29b) will receive the same treatment with regard to the hierarchical organization of the constraints that govern stress application.

In words such as *–nata* [ná.ta], *-gordo* [góɾ.ðo], *-pato* [pá.to] etc. in which trochaic stress emerges productively, FAITH-v̊ cannot, in principle, occupy an important position in the hierarchy since its effects are null in productive stress application. In fact for now, we will omit this constraint altogether.

In other cases, in words such as *-líder* [lí.ðeɾ] (-leader), *-túnel* [tú.nel] (*-tunnel*), and *-cráter* [kɾá.teɾ] (*-crater*), however, FAITH-v̊ must assume a dominant position since stress does not apply over the first syllable due to any specific penchant to maintain trochaic stress, but rather to maintain the underlying accent supplied by the input.

Let us consider the word *–nata* [ná.ta] (*-heavy cream*). Given that both syllables are of the type CV, stress applies *productively* over the first syllable, -[ná], by default to satisfy principles preferring trochaic stress. We could likewise obtain the same result by claiming that stress applies over this syllable to satisfy FAITH-v̊, implying that stress in these words is lexical. But the problem with this proposal is that the justification for trochaic stress in words that fit this, and similar, syllabic models would be reduced to simple maintenance of lexical accent at the surface level. Seeing that trochaic stress is one of few active processes in Spanish for which there exists consistent empirical evidence, the inclusion of FAITH-v̊ is unwarranted, since this would imply that there were no productive process governing stress application in Spanish. Essentially, we would have to assume then that all stress is memorized by the language learner, incurring an obvious and unfounded burden on the speaker's long-term memory.

We propose the following hierarchy to justify the emergence of productive trochaic stress. Notice that the ranking of FTBIN and PARSE-σ is inconsequential due to the disyllabic nature of the inputs in this data set:

(34)
FTBIN » PARSE-σ

(35)
Input: /gordo/

	FTBIN	PARSE-σ
☞a. [góɾ.ðo]		
b. [góɾ].ðo	*!	*
c. goɾ.[ðó]	*!	*

In this tableau, candidate (a) is the optimal output since it satisfies all the constraints in the hierarchy. All other candidates are eliminated by proposing outputs which contain monosyllabic feet.

In certain cases such as in the English loans *–póster, –máster, -túnel, -líder,* etc. we can make a reasonable case in favor of the maintenance of lexical accent as proposed by FAITH-v̊. We argue that the appearance of stress in these cases is not governed by any productive inclination to generate a trochaic output, but rather by the proclivity to maintain underlying accent in the output. The following hierarchy will capture this generalization:

(36)
FAITH-v̊ » FTBIN , PARSE-σ

The previous hierarchy expresses that only syllables which carry lexical accent in the input may surface with stress. Notice how this hierarchy predicts the proper output:

(37)
Input: /pv̊ster/

	FAITH-v̊	FTBIN	PARSE-σ
☞a. [pós.ter]			
b. [pós]ter		*!	*
c. pv̊s[tér]	*!	*	*

As we see, a hierarchy dominated by FAITH-v̊ is noticeably capable of justifying the exceptional maintenance of stress in unnaturalized loans, even if the cost implies a compulsory infraction of the usual tendencies which govern stress application in the receiving language.

Let us now turn our attention to our trisyllabic data. Markedly, the longer the word, the more diminished the quantity of monomorphemic examples becomes:

(38)
Trisyllabic words [σσσ]

Nouns		Adjectives
a. σσσ́[23]		
Closed accented syllables		
-capitán	[ka.pi.tán] (*captain*)	-
-neceser	[ne.θe.sér] (*toiletry case*)	-
-estrangul	[es.tran.gúl] (*mouth harp*)	-
-patatús	[pa.ta.tús] (*fainting fit*)	-
-aguarrás	[a.gwa.rás] (*paint thinner*)	-
-avestruz	[a.βes.trúθ] (*ostrich*)	-
-animal	[a.ni.mál] (*animal*)	

[23] As one will surely notice, the longer the words are becoming the more exceptional and/or odd the forms in this category seem. Meaning alone, discarding momentarily the form, indicates that a few of these forms are unknown even to Spanish speakers. Nevertheless, all forms here are registered with the Real Academia Española as Spanish words, some being *naturalized* Spanish words.

Open accented syllables[24]

-alajú	[a.la.xú]	(*type of sweet biscuit*)	-carmesí	[kaɾ.me.sí]	
-alamí	[a.la.mí]	(*small stone bench*)			

b. σσ́σ

Closed accented syllables

-recuerdo	[re.kwéɾ.ðo]	(*sounvenir*)	difunto	[di.fún.to]	(*difunct*)
-demanda	[de.mán.da]	(*demand*)	presunto	[pre.sún.to]	(*presumed*)
-suspenso	[sus.pén.so]	(*failure*)			
-asfalto	[as.fál.to]	(*asphalt*)			
-lagarto	[la.ɣáɾ.to]	(*lizard*)			

Open accented syllables

-zapato	[θa.pá.to]	(*shoe*)	-acates	[a.ká.tes]	(*loyal person*)
-patata	[pa.tá.ta.]	(*potato*)	-sensato	[sen.sá.to]	(*sensitive*)
-resumen	[re.sú.men]	(*summary*)	-hermoso	[eɾ.mó.so]	(*beautiful*)
-enchufe	[en.ʧú.fe]	(*electrical outlet*)	-caníbal	[ka.ní.βal]	(*cannibal*)
-artritis	[aɾ.tɾí.tis]	(*arthritis*)			
-hipnosis	[ip.nó.sis]	(*hypnosis*)			

c. σ́σσ

Closed accented syllables

-péndulo	[pén.du.lo]	(*pendulum*)	-plástico	[plás.ti.ko]	(*plastic*)
-lástima	[lás.ti.ma]	(*pity*)	-póstumo	[pós.tu.mo]	(*postumous*)
-máscara	[más.ka.ɾa]	(*mask*)			
-víspera	[bís.pe.ɾa]	(*eve*)			
-ómnibus	[óm.ni.βus]	(*omnibus*)			
-ángulo	[áŋ.gu.lo]	(*angle*)			
-ínterin	[ín.te.ɾin]	(*interim*)			
-Mánchester	[mán.ʧes.teɾ]	(*Manchester, U.K*)			

Open accented syllables

-régimen	[ré.xi.men]	(*diet*)	-lúcido	[lú.θi.ðo]	(*lucid*)
-ático	[á.ti.ko]	(*attic*)	-clásico	[klá.si.ko]	(*classic*)
-ácido	[á.θi.ðo]	(*tribe*)	-plácido	[plá.θi.ðo]	(*placid*)
-médula	[mé.ðu.la]	(*medula*)	-trágico	[trá.xi.ko]	(*tragic*)
-pétalo	[pé.ta.lo]	(*petal*)	-módico	[mó.ði.ko]	(*moderate*)
-módulo	[mó.ðu.lo]	(*module*)	-cómodo	[kó.mo.ðo]	
-época	[é.po.ka]	(*era*)			
-ómicron	[ó.mi.kɾon]	(*omicron*)			
-Wáshington	[wá.šin.ton]	(*Washington*)			
-Remington	[ré.min.ton]	(*Remington -typewriter*)			

One of the remarkable aspects of OT is its capacity to provide detailed theoretical justifications which engage a maximum amount of universal generalizations and phonological detail, while, at the same time, being abstract enough to unite many

[24] We draw attention to the fact that trisyllabic nouns and adjectives ending in stressed vowels are quite hard to come by, yet verbs regularly end in tonic [ó], [í], [é] depending on their thematic classification.

different processes under the same constraint hierarchy. As we shall soon see, this is the case with our analysis of stress application in trisyllabic words.

After a scrupulous examination of the data in (38a), we can begin to perceive a paradigmatic unity between stress application, and its constraint-based explanation, of trisyllabic oxytones and that of their disyllabic counterparts. In fact, no change at all to the original ranking schema we presented earlier to justify stress assignment in disyllabic oxytones is necessary to account for the foot structure presented in the new data set.

To recall, we based our explanation of oxytone stress around the notion that lexical accents must be retained in the output. Of course, the desire to maintain lexical accent in the surface form opposes the fundamental stipulations expressed by FTBIN, since satisfying FAITH-v̊ necessarily obliges the parsing of a monosyllabic final foot and incurs a critical violation of FTBIN. Indeed, this is the general development that we saw emerge in the examples from (29a) when we ranked FTBIN subordinate to FAITH-v̊. Naturally, this paradigm also posed certain challenges to PARSE-σ since the remaining syllables in the word were left unfooted.

The one negligible change we will have to make in this present analysis, however, is to explicitly rank PARSE-σ superior to FTBIN. Recall that in our hierarchy treating the emergence of final stress in disyllabic inputs (example 30, page 267), these constraints were interchangeable to a certain extent due to the disyllabic character of the inputs. Nevertheless, in this hierarchy, PARSE-σ must dominate FTBIN since this latter is violated by the optimal output while the former is not. We present our amended hierarchy in the following example:

(39)
FAITH-v̊ » PARSE-σ » FTBIN

Let us observe how this constraint hierarchy is capable of producing the desired results with two examples from (38a):

(40)
Input: /abestruθ/

	FAITH-v̊	PARSE-σ	FTBIN
a. [á.βes] tɾuθ	*!	*	
b. a[βés.tɾuθ]	*!	*	
☞c. [a.βes][tɾúθ]			*
d. [a][βés.tɾuθ]	*!		*
e. a.βes.tɾuθ	*!	***	
f. [a][βes][tɾúθ]			**!*

(41)
Input: /alami̊/

	FAITH-v̊	PARSE-σ	FTBIN
a. [á.la]mi	*!	*	
b. a[lá.mi]	*!	*	
☞c. [a.la][mí]			*
d. [a][lá.mi]	*!		*
e. a.la.mi	*!	***	
f. [a][la][mí]			**!*

Now we must program a paradigm of constraints to justify foot alignment. In our previous analysis of the data in (29), this was an inconsequential factor due to the disyllabic input structure. For the trisyllabic data in (38), however, it is quite necessary.

The fact that stress applies over the final syllable indicates that NONFINALITY cannot possibly occupy an important position in the assignment hierarchy. Conversely, we can assume that RL must rank dominantly since it is routinely satisfied by the optimal output. Finally, PARSE-σ will occupy the medial position in our new hierarchy.

We propose the following hierarchy of assignment constraints to justify foot alignment in trisyllabic oxytones:

(42)
RL » PARSE-σ » NONFINALITY

We can observe their interaction in the following tableau:

(43)
Input: /abestruθ/

	RL	PARSE-σ	NONFINALITY
a. aβestruθ		**!*	
b. (á) βestruθ	*!*	**	
c. (a.βés)truθ	*!	*	
d. (á).βès.truθ	*!*	**	
☞e. à.βes.(trúθ)		**	*

In this tableau, the optimal output, candidate (e), only completely satisfies RL. Its one fewer violation of this constraint is decisive in the determination of optimality. Identical results are obtained when we substitute a trisyllabic input with a stressed final vowel.

Next, we must turn our attention to the shape constraints which produce the optimal outputs found in (38b), in which stress is assigned over the middle syllable. Remember that in the hierarchy we presented in (34), FTBIN and PARSE-σ were interchangeable, since both were satisfied circuitously as a result of the disyllabic structure provided by the input. Let us observe how the hierarchy we programmed to justify paroxytone stress in disyllabic words will compute stress in our trisyllabic examples:

(44)[25]
FTBIN » PARSE-σ

Consider the following tableau:

[25] Words with no heavy syllable can be justified by TROCHEE.

(45)
Input: /asfalto/

	FTBIN	PARSE-σ
☞a. as[fál.to]		*
☞b. [ás.fal]to		*
c. [as.fal][tó]	*!	
d. [as][fál.to]	*!	
e. [as.fál.to]	*!	
f. asfalto		*!*

Although there is no programmed generalization which predicts the specific syllable which will ultimately be left unfooted, this hierarchy determines that one of the feet will not parsed, since doing so would result in a fatal violation of FTBIN, an inacceptable strategy. This is not an important predicament, however, since here we are only considering the shape of the foot. Later, our set of assignment constraints will account for the foot's alignment.

Candidates (a), and (b) satisfy the dominant two constraints while only incurring an insignificant violation to PARSE-σ, the inferior constraint of the hierarchy. Candidates (c) through (e) are all discarded by FTBIN, either by proposing a foot which is monosyllabic or by grouping the three syllables into one impossible foot.

Now, in considering the assignment constraints which justify the position of the foot in the words found in (38b), we notice that, again, NONFINALITY cannot occupy the dominant position since it is routinely violated by the optimal output. PARSE-σ as well is prohibited from occupying the superior position of the hierarchy since the first syllable is left unfooted. In this case, RL will assume the superior position and PARSE-σ will be demoted to the middle position. NONFINALITY will remain in the lowest rank since it is systematically violated by the optimal output. This hierarchy and its corresponding tableau appear in the examples that follow:

(49)
RL » PARSE-σ » NONFINALITY

(50)
Input: /θapato/

	RL	PARSE-σ	NONFINALITY
a. (θá) pàto	*!*		*
b. (θápa)to	*!	*	
☞ c. θa(páto)		*	*
d. (θàpa)(tó)	*!		*
e. (θa)(pa)(to)	**!*		*

Candidate (a) is eliminated by not aligning a foot to the right edge of the word. Candidate (b) as well ignores this stipulation and is accordingly eliminated from the evaluation process. Candidate (c) is the optimal candidate even though it violates the two inferior constraints of the hierarchy. Its satisfaction of the highest ranked constraint is enough to qualify this output as the winning candidate. Candidate (d) falls short of aligning a foot to the right margin of the word and is therefore deemed sub-optimal. Finally, candidate (e) is eliminated by RL for not aligning a binary foot with the right edge of the word.

To calculate the emergence of stress over the first syllable of the trisyllabic examples, interestingly, we find that our initial hierarchy we presented to justify the forms found in (29a) is already equipped with the proper theoretical mechanisms with which to predict the optimal outputs in (38c). Let us observe what happens when we present a token form from (38c) into the initial hierarchy we presented in (32). We provide this hierarchy a second time below:

(51)
FAITH-v̊ » FTBIN » PARSE-σ

(52)
Input: /pe̊ndulo/

	FAITH-v̊	FTBIN	PARSE-σ
a. [péndu][lo]		*!	
b. [pén][dulo]		*!	
c. pen[dúlo]	*!		*
☞d. [péndu]lo			*
e. [péndulo]		*!	
f. pendulo	*!		*!**

Candidate (d) emerges as the optimal output by satisfying the dominant two constraints while only violating the lowest ranked PARSE-σ. Candidates (a) (b) and (e) all parse mono- or poly- syllabic feet, committing a fatal infraction of FTBIN. Candidate (c) satisfies this constraint but does not align the foot with the correct syllables, which, in turn forces a fatal violation of FAITH-v̊.

In order to assign the foot to the correct syllables, we will need to make two minor provisions to the hierarchy we presented to justify the foot assignment of trisyllabic words with medial stress. We show this constraint hierarchy below:

(53)
RL » PARSE-σ » NONFINALITY

In our new hierarchy, however, NONFINALITY will be ranked dominantly since the optimal output never violates this constraint. RL, which in the prior case was ranked dominantly, in these cases must be demoted to the most inferior position of our hierarchy since the foot does not align to the right edge of the word in the optimal output:

(54)
NONFINALITY » PARSE-σ » RL

Let us observe their interaction in the next tableau:

(55)
Input: /reximen/

	NONFINALITY	PARSE-σ	RL
a. reximen		**!*	
b.(ré)ximen		**!	**!
c. re(xí.men)	*!	*	*
☞d. (ré.xi)men		*	*
e. (ré)(xì.men)	*!		*

Candidate (d) emerges as the optimal output by satisfying the dominant constraint, while committing fewer infractions of the inferior constraints than the other remaining candidates.

As for polysyllabic words, [σσσσ], we will only consider two different stress patterns, [σσ.σ́σ], [σσ́σσ], since these are the only two patterns which emerge in monomorphemic Spanish words, although some Americanisms do exist in which stress falls over the final syllable of a four-syllable word: -*maracuyá* (-*passion fruit*).

Observe the following data:

(56)

Polysyllabic words[26]			[σσσσ]
Nouns			**Adjectives**
a. σσσ́σ[27]			
Closed accented syllables			
-vagabundo [bà.γa.βún.do] (*vagabond*)			-estupendo [es.tu.pén.do] (*stupendous*)
Open accented syllables[28]			
-mariposa [mà.ɾi.pó.sa] (*butterfly*)			
-maravilla [mà.ɾa.βi.ja] (*marvel*)			
b. σσ́σσ			
Closed accented syllables			
-arándano [a.ɾán.da.no] (*blueberry*)			-romántico [ro.mán.ti.ko] (*romantic*)
-albóndiga [al.bón.di.γa] (*meatball*)			-fantástico [fan.tás.ti.ko] (*fantastic*)
			-espléndido [es.plénd.di.ðo] (*splendid*)
Open accented syllables			
-estímulo	[es.tí.mu.lo]	(*stimulous*)	-intrépido [in.tré.pi.ðo] (*intrepid*)
-escrúpulo	[es.kɾú.pu.lo]	(*scruple*)	-insípido [in.sí.pi.ðo] (*insipid*)
-obstáculo	[obs.tá.ku.lo]	(*obstacle*)	-ridículo [ri.ðí.ku.lo] (*ridiculous*)
-esdrújula	[es.ðɾú.xu.la]	(*proparaxytone*)	-metículo[me.tí.ku.lo] (*meticulous*)
-vestíbulo	[bes.tí.bu.lo]	(*vestibule*)	
-oxígeno	[ok.sí.xe.no]	(*oxygen*)	

As we can presume by now, the parsing of the polysyllabic syllables into binary feet is easily expressed using an identical paradigm of constraints which we have used

[26] We limit our discussion here to four syllable words because stress can only maximally appear up to the third syllable. Words with more syllables, though, are certainly possible, such as –*albaricoque* (apricot). However, the quantity of syllables does not constitute a new stress *pattern*. That is to say that stress may still only appear within the three syllable window as proposed by Harris (1983) and later interpreted by Roca (2006).

[27] As one will surely notice, the longer the words are becoming the more exceptional and/or odd the forms in this category seem. Meaning alone, discarding momentarily the form, indicates that a few of these forms are unknown even to Spanish speakers. Nevertheless, all forms here are registered with the Real Academia Española as Spanish words, some being *naturalized* Spanish words.

[28] We draw attention to the fact that trisyllabic nouns and adjectives ending in stressed vowels are quite hard to come by, yet verbs regularly end in tonic [ó], [í], [é] depending on their thematic classification.

to justify all the trochaic forms in this section. To begin with the forms in (56a), we must rank a dominant FTBIN constraint which mandates that all feet be composed of two syllables. Later, PARSE-σ requires all syllables to be parsed into feet. These constraints are presented in hierarchical form below:

(57)
FTBIN » PARSE-σ

Observe their interaction in the following tableau:

(58)
Input: /bagabundo/

	FTBIN	PARSE-σ
☞a. [bà.γa][βún.do]		
b. [bá.γa]βun.do		*!*
c. ba[γá.βun]do		*!*
d. ba.γa[βún.do]		*!*
e. [ba][γa.βun][do]	*!*	

Candidate (a) emerges optimal by satisfying all constraints in the hierarchy. Its closest competition came from candidates (b), (c) and (d) which fall short of optimality by not parsing all the syllables into feet, for which these candidates accrue two violation marks each for PARSE-σ. Candidate (e) was eliminated by the dominate constraint, FTBIN, by presenting two monosyllabic feet.

Alignment of the feet is a fairly straightforward matter. We know that NONFINALITY assumes an inferior position in this hierarchy since it is routinely violated by the optimal output. RL must occupy the dominant position followed in middle position by PARSE-σ, since this latter constraint can only be satisfied if feet are perfectly aligned to the right word edge. Notice, however, that from a functional perspective, the ranking of RL in relation to PARSE-σ is inconsequential in this hierarchical organization:

(59)
RL » PARSE-σ » NONFINALITY

Observe the following tableau:

(60)
Input: /mariposa/

	RL	PARSE-σ	NONFINALITY
a. mariposa		**!**	
b. (má.ri)posa	*!*	**	
c. (ma.ri)(po)sa	*!**	*	
☞d. (màri)(pósa)			*
e. mari(pó.sa)		*!*	*

As we can observe, candidate (d) is the optimal output since it fully satisfies PARSE-σ and RL, the superior constraints of the hierarchy. All other candidates were eliminated by one or more violations of these two constraints.

Next, we must consider the shape constraints to justify the preantipenult stress in the polysyllabic examples found in (56b). We can assume that FAITH-v̊, plays a dominant role in our constraint hierarchy, followed by FTBIN and PARSE-σ in descending hierarchical order. By now we should recognize this hierarchy from the analyses above. We offer this hierarchy again to refresh our memories:

(61)
FAITH-v̊ » FTBIN » PARSE-σ

Contemplate the following tableau:

(62)
Input: /arån̊dano/

	FAITH-v̊	FTBIN	PARSE-σ
a. [àɾ.an][dá.no]	*!		
☞b. a[ɾán.da]no			**
c. a[ɾán][da.no]		*!	*
d. [a][ɾán][da.no]		*!*	
e. aɾandano	*!		****

As it would be expected, the assignment constraint hierarchy which aligns the foot to the prosodic base must be dominated by NONFINALITY since stress cannot simultaneously fall on the second syllable of a polysyllabic word and satisfy constraints which align the foot to the right edge of the word. Naturally, judging by the optimal output, RL must assume the inferior position of the hierarchy since it is systematically violated by the optimal output. This constraint will prove decisive, however, in determining the optimal output in spite of its subordinate ranking. Finally, PARSE-σ will assume the middle position. Consider the following hierarchy and tableau:

(63)
NONFINALITY » PARSE-σ » RL
(64)
Input: /bestîbulo/

	NONFINALITY	PARSE-σ	RL
a. bestiβulo		*!***	
b. (bés.ti)βulo		*!*	**
c. (bés.ti)(βu)lo		*	*!*
d. (bès.ti)(βú.lo)	*!		
☞ e. (bès)(tí.βu)lo		*	*

Here, candidate (e) results optimal by a slim margin, only one fewer violations of RL than candidate (c). Candidate (a) is eliminated by leaving all syllables unparsed, whereas candidate (b) is eliminated by leaving two unfooted syllables. Candidate (d) is excluded by a fatal violation of NONFINALITY.

We see that Hammond's predictions regarding syllable typology are corroborated by the data we present from Spanish. We made one modification to Hammond's original typology, which was to totally eliminate FAITH-v̊ from our hierarchy which situated productive stress over the correct syllable in trochaic patterns. As we illustrated above, there is no justifiable principle which requires the inclusion of FAITH-v̊ in determining productive trochaic stress. Of course, we could have demoted this constraint to the most inferior position of the hierarchy, nullifying its impact on the optimal output. Such a move, however, would have added an element of superfluity to our analysis with no perceivable advantage. We present our findings in condensed form in the following example:

(65)

Typology of stress in Spanish non-verbs

Syllable type	Hierarchical rankings	
	Shape	Assignment
a. σσ´	FAITH-v̊ » FTBIN , PARSE-σ	RL » PARSE-σ » NONFINALITY
b. σ´σ	FTBIN » PARSE-σ	RL » PARSE-σ » NONFINALITY
c. σσσ´	FAITH-v̊ » FTBIN , PARSE-σ	RL » PARSE-σ » NONFINALITY
d. σσ´σ	FTBIN » PARSE-σ	RL » PARSE-σ » NONFINALITY
e. σ´σσ	FAITH-v̊ » FTBIN , PARSE-σ	NONFINALITY » PARSE-σ » RL
f. σσσ´σ	FTBIN » PARSE-σ	RL » PARSE-σ » NONFINALITY
g. σσ´σσ	FAITH-v̊ » FTBIN , PARSE-σ	NONFINALITY » PARSE-σ » RL

Seen in table form, we can notice some remarkable generalizations with regard to stress patterns in Spanish. Concerning shape, we see that stress assignment in all monomorphemic nouns and adjectives in Spanish can by justified using only two different constraint schemata. We observe a similar paradigm with respect to assignment. This type of paradigmatic effectiveness represents an important advantage of OT.

For our language learner, this type of typological consistency presents a real benefit. If it is true, as we have claimed, that stress is in our heads, then learning algorithms must be simple enough for a child in her phonological acquisition stage to be able to deduce the restrictions from the input data of her linguistic environment and subsequently rank them in order to produce an optimal output. The typology which we have provided above would pose no problem for our language learner due to the simplistic nature of the hierarchical components and the systematic nature of their organization.

We proposed that all non-trochaic stress is the result of a dominant correspondence constraint, FAITH- v̊, which obliges surface level stress to coincide with lexical accent. The one drawback of this analysis is that there is no way to really predict nor justify the exact syllable over which stress must fall, meaning that the language learner must store a vast quantity of individual tokens, along with their corresponding lexical accents to memory. The resulting grammatical simplicity, though, which is gained by such a strategy provides a suitable and viable compensation for this extra burden on the memory.

5.5 PHONOLOGY, MORPHOLOGY AND STRESS

In this section we scratch a bit beyond the surface in order to expose the interaction between three heavy competitors; phonology, morphology and stress, with the primary objective of teasing out some important generalizations vis-à-vis the conciliation of the opposing conflicts which shape Spanish prosody. Unlike the other cases we have seen up to this point in the thesis, the processes we examine in this section involve not only internal conflict resolution, say between competing phonological forces, but rather involve the resolution of conflict between three major rivaling parties, all of which contributing a separate and distinct flavor to Spanish words. As we will see in the following cases, the consequences of each phonological, morphological and metrical procedure will have an effect on principles of well-formedness in the other competing linguistic categories. How these consequences are dealt with is of major importance to us here, since these cases have traditionally been a major source of debate in the phonological literature.

5.5.1 Stress shift?

In certain circumstances, stress can shift, or at least appear as if it does, due to morphological modification. Consider the stress shifts in the following examples:

(66)

Singular form	Plural form	
a.[29]		
-régimen	-regímenes	
-espécimen	-especímenes	
b.		
-ómicron	-omicrónes	
-Júpiter	-Jupitéros	
-hipérbaton[30]	-hiperbatónes	
		(Roca, 2006)

In the cases in (a), lexical stress shifts one syllable to the right upon being modified with the plural morpheme {s}, which, in conjunction with the epenthetic [e] which necessarily must insert to avoid violations to *COMPLEX^{CODA}, creates an additional syllable –C[es] in the output. The examples in (66b) manifest stress on the penult syllable upon being altered by -*e*{s}.

As we have seen, there is an interesting coincidence between the appearance of the alternating diphthongs, [je] and [we], and the emergence of primary stress. Up until now, however, we have not discussed how this relationship is best represented paradigmatically.

(67)

Primary stress over alternating diphthongs /we/, /je/

-bueno	[bwé.no]	(*good*)
-abuelo	[a.βwé.lo]	(*grandfather*)
-huérfano	[wéɾ.fa.no]	(*orphan*)
-tuétano	[twé.ta.no]	(*marrow*)
-riesgo	[rjés.ɣo]	(*risk*)
-prieto	[prjé.to]	(*tight*)

[29] Examples from non-standard speech in which stress does not shift are also attested: *régimen*→*régime*(n)*s*, indicating that the final consonant is extrametrical and can be precluded when a plural marker is added in order to avoid a final CC structure.

[30] *hipérbatos* is also an acceptable plural form. Again, the fact that the final /n/is extrametrical means that this consonant can be eliminated in order to satisfy bans on final CC clusters.

We see that in monomorphemic words stress applies over the alternating diphthongs in a vast majority of the cases, although certainly, exceptions do occur. In Romance, stress application over diphthongized syllables was a productive process. In Modern Spanish, however, this stress pattern is maintained by FAITH-v̊.

In words modified by a diminutive suffix (-*it*V), stress is prescriptive over the [i], whether by way of a lexical accent[31], which we do not advocate, or by adherence to RL and TROCHEE[32]:

(68)
Primary stress over diminutive forms with alternating diphthongs /we/,/je/

-buen[í]to	[bwe.ní.to]	(*good*)
-abuel[í]to	[a.βwe.lí.to]	(*grandfather*)
-huerfan[í]to	[weɾ.fa.ní.to]	(*orphan*)
-tuetan[í]to	[twe.ta.ní.to[33]]	(*marrow*)
-prietec[í]to	[prje.te.θí.to]	(*tight*)
-hierbec[i]ta	[jeɾ.be.θí.to]	(*grass*)

The stress shift involved in words modified by a diminutive suffix can be reduced to a paradigm shift between two distinct hierarchical organizations. Referring back to our typology we presented in the previous section, we claim that the emergence of stress over the alternating diphthongs in Modern Spanish is governed by a hierarchy headed by FAITH-v̊. However, the data we have seen from Spanish diminutive forms indicates that the maintenance of lexical accent is an impossible proposition since stress *always* applies over the initial vowel of the diminutive morpheme, rendering FAITH-v̊ totally irrelevant in the determination of stress in Spanish diminutive forms.

[31] Truncated forms of Spanish diminutive such as –*guapi* [gwá.pi] (for –*guapito/a*, -*pretty* or -*handsome*) and –*gordi* [góɾ.ði] (for –*gordito/a*, -*fatty/fatso* , endearingly) prove that stress is not programmed specifically over the peak [i] in diminutive forms, but rather is supplied productively by a hierarchical algorithm.

[32] Trochaic is the unmarked foot structure.

[33] This example sounds odd to most Spanish speakers due to the meaning of the base. Most agree that the phonological form, however, is acceptable.

Instead, the data we have from Spanish diminutive forms suggests a strong inclination toward the unmarked trochaic structure, implying a paradigmatic transformation from FAITH-v̊ » FTBIN » PARSE-σ to FTBIN » RL » PARSE-σ:

(69)

a. /wȇ.bo/ → [wé.βo] (FAITH-v̊ » FTBIN » PARSE-σ)

b. /wȇ.bo/ + {it} = [we.βe.θi.to] →[wè.βe].[θí.to] (FTBIN » RL » PARSE-σ)

More important than the actual shift itself, is the idea that a different typological organization is in charge of supplying stress over diminutive forms as opposed to the paradigm responsible for stress assignment on non-modified words. In non-modified words, stress is supplied over the diphthong in order to fulfill FAITH-v̊ whereas in diminutive forms, stress is always determined by the typological scheme FTBIN » RL » PARSE-σ[34].

5.5.2 How does stress shift?

The question posed with regard to how stress shifts is somewhat misleading. In fact stress does not shift, but rather the input shifts before constraint interaction governing stress shape and assignment is effectuated. Shift implies that plural forms are based on the output structure of singular forms, which is not altogether accurate.

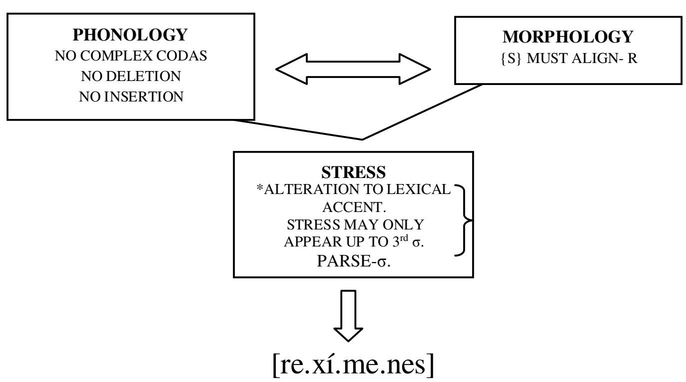
[34] Seen in this way then, arguments in favor of under- and overapplication of stress make no sense. These terms imply that stress either should apply in a context χ but does not, or should not apply in a context χ but does. However, this argument is only valid if we maintain that the typological paradigm which predicts stress in non-modified words and modified words is the same. However, we claim that stress shifts because there is a paradigm transformation between non-modified forms and modified forms such that stress in each form is determined exactly as it should be, by a separate paradigm, in accordance with the hierarchy which governs its application. In other words, stress appears over different syllables, justifiably, because the hierarchies which govern its distribution have changed.

Plural forms are based on underlying representations, which in many, if not most, cases are not marked for stress. Upon being morphologically modified in one way or another, stress is shaped and aligned over the new structure by way of conflict resolution, as with any other input. The deviation of stress position between the plural and singular forms may give the impression that the stress has *shifted* from one position to another, but in reality what we see is that the output is simply making concessions based on the new input structure and its satisfaction of key constraints.

In this section we address the constraint interaction that sparks the stress readjustments we have seen above in §5.5.1. Not unpredictably, we will see that our computational machinery is already deftly capable of accounting for such a dilemma.

Let us contemplate briefly the basic stipulations each linguistic category contributes to the production of the plural forms found in (66a):

(70)



As is clear, each category wants its stipulations expressed in the optimal output.

We shall begin with the morpho-phonological constraints which are responsible for producing an optimal plural form before proceeding to the constraints which govern stress assignment and foot alignment.

In addressing the morpho-phonological stipulations which must be expressed, naturally, we must program an alignment constraint which seeks to affix the plural indicator to the right edge of the prosodic base. We introduced ALIGN-{s}-R in the previous chapter to deal specifically with this procedure. But of course, direct alignment means that a complex coda will form if there is no interceding restriction which could prevent said formation. Consequently, *COMPLEX^{CODA} must figure high in the hierarchy since epenthesis occurs systematically, blocking absolute alignment, but preventing a double consonant cluster from surfacing word-finally.

Concurrently, DEP must figure low in the production hierarchy. Notice the relationship between *COMPLEX^{CODA} and DEP. For COMPLEX^{CODA} to be satisfied, DEP, or MAX, must be violated. For DEP to be satisfied, bans on complex codas must be sacrificed. Here the two constraints are irreconcilable. MAX as well must be ranked relatively high since deletion in these cases is never an optimal strategy.

The conciliation of *COMPLEX^{CODA}, DEP, MAX and ALIGN-{s}-R will produce an output [reximenes] (see chapter 4, §4.2.2, page 227 for further details of this interaction).

To justify the alignment of the foot in words such as -*regímenes* from (63a), we must contemplate a constraint which prevents stress from occurring outside of the final three syllables. Up to this point, we have not had to consider such a constraint since monomorphemic lexical items do not contest this ban. However, upon altering the forms with an additional [es], a new syllable is consequently formed and the maintenance of lexical accent becomes impossible if the three-syllable window is to be respected. Roca (2006), following Harris (1983) proposes the following constraint:

(71)
3σW(indow)
Stress cannot appear to the left of the preantepenult syllable. (adapted)

Logically, this ban will have to occupy a superior position in our new hierarchy since stress never surfaces outside of the three-syllable window in Spanish non-verbs. We can augment Roca's 3σW restriction with a complementary constraint which penalizes each divergent syllable between the lexical accent and surface level stress with a separate violation mark. So, for example, in an input such as *-ómicron* /o̊mikron/, if stress surfaces over the second [o], [o.mi.kró̲.nes], two violation marks would appear in this constraint's column of the tableau, since stress emerges two syllables to the right of where lexical accent originally falls. We formulate this constraint below:

(72)
STRESSCONDITION (STRCOND)[35]
Lexical accents must surface stressed. Each syllable which is between surface stress and lexical accent counts as one violation mark.

Of course, in our examples from (66), satisfying 3σW implies a mandatory infraction to FAITH-v̊ since stress cannot simultaneously be faithful and fulfill the markedness restrictions proposed by 3σW. The fact that surface level stress applies over a syllable other than that which carries lexical accent indicates a dominant position for 3σW. At the same time, STRCOND must be ranked highly enough to have an active role in the production of the optimal output, since 3σW can theoretically be satisfied by a number of suboptimal strategies. Finally, we can assume that RL and PARSE-σ will occupy the most inferior positions of our hierarchy since both constraints are systematically violated by the optimal output.

Now we can justify the appearance of stress in (66a) by a ranking schema dominated by 3σW. Observe the following hierarchy:

(73)
3σW» FAITH-v̊ » STRCOND » RL » PARSE-σ[36]

---

[35] This is similar to FAITH-v̊. However, FAITH-v̊ penalizes all divergent stress applications as one violation. STRCOND allows for a certain amount of leeway and gradient levels of well-formedness.
[36] Here we will not consider the interaction between stress and the morphonological constraints which produce the plural forms. However, the astute reader will notice that lexical stress could indeed be maintained if epenthesis of [e] did not occur, and by other means. Consider the plural of *–rémington*,

Consider their interaction in the following tableau:

(74)
Input /rе̊ximen/ [e]{s}

	3σW	FAITH-v̊	STRCOND	RL	PARSE-σ
☞a. re.(xí.me).nes		*	*	*	*
b. (ré.xi).me.nes	*!			*	*
c. re.xi.me.(nés)		*	*!**		*
d. (rè.xi).(mé.nes)		*	*!*		

Although our optimal candidate (a) incurred one violation to STRCOND by not applying stress to the syllable over which lexical accent is manifested, this candidate accrues one fewer violations of this restriction than the next closest eligible candidate, candidate (d), whose double violation of STRCOND renders this candidate suboptimal. Candidate (b) maintains perfect correspondence between lexical accent and surface level stress, but at the peril of violating 3σW, the dominant constraint of our hierarchy. Finally, candidate (c) assigns stress over the final syllable, incurring three violations to STRCOND and resulting as the least optimal outcome after candidate (b).

Now to justify the stress *shift* in the forms found in (66b), we must consider the idea that the addition of the extra syllable created by affixing [es] to the prosodic base produces a four syllable word, which, in theory and with the correct stress assignment, could result in a word containing two binary feet, of the type in –*mariposa* (-*butterfly*). By exhaustively parsing the syllables of the morphologically modified word into two separate binary feet, both feet may be trochaic, hence constituting an unmarked stress pattern. Roca (2006) hints that a strong penchant toward the emergence of the unmarked plays some role in this stress shift. Hence, the modification of stress in these

-*rémingtons* (brand of typewriter). In this word, the necessity to maintain lexical stress actually blocks epenthesis.

data can be understood as a consequence of a paradigm shift similar to the one we presented to justify stress assignment in diminutive forms in §5.5.1 (page 286):

(75)

/o̊mikron/→[ó.mi.kɾon] (FAITH-v̊ » FTBIN » PARSE-σ)

↓ ↓

/o̊mikron/ + [e]{s}→[o.mi.kɾó.nes] (3σW» FTBIN»RL»PARSE-σ»FAITH-v̊» STRCOND)

To program our production hierarchy, let us consider the competing constraints which must be ordered to produce the optimal output. First, our constraint, STRCOND which penalizes deviation between lexical accent and output stress must be demoted, since the optimal output incurs two violation of this constraint. Hypothetically this means that, if ranked dominantly, a form such as **Jupíteres* would fare better in the evaluation process than the actual optimal output. At the same time, PARSE-σ and FTBIN must be ranked fairly dominantly, since all syllables are parsed into binary trochaic feet in the optimal output. Again, 3σW must represent the dominant position. Consider the following hierarchy and tableau:

(76)
3σW» PARSE-σ » FTBIN » RL » FAITH-v̊ » STRCOND

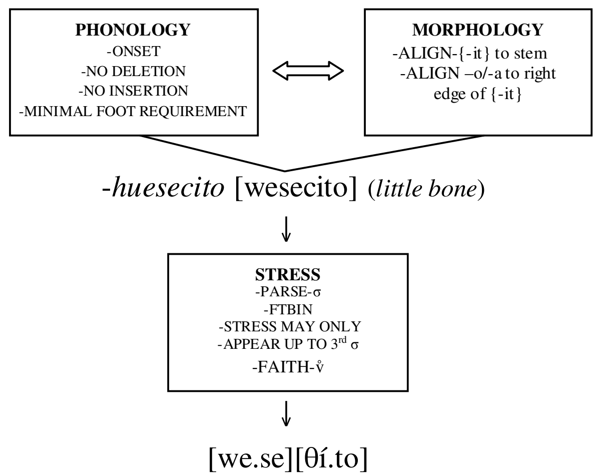
(77)
Input: /o̊mikron/ [e]{s}

	3σW	PARSE-σ	FTBIN	RL	FAITH-v̊	STRCOND
a. o.[mí.kɾo].nes		*!		*	*	*
b. [ó.mi].kɾo.nes	*!	*		**		
☞c. [ò.mi].[kɾó.nes]					*	**
d. o.mi.kɾo[nés]		*!	*		*	***

It is clear that the preference to parse all syllables into feet, programmed by ranking PARSE-σ to a relatively dominant position, is capable of justifying the stress shift in the examples from (66b). Here, candidate (c) emerges optimal since stress is contained in the three-syllable window and all syllables are parsed into binary feet. Of course, this strategy implies a necessary infraction to FAITH-v̊, but due to the inferior hierarchical position of this constraint, this is not a fatal violation.

To justify the systematic emergence of stress in the penultimate syllable of diminutive forms, we propose a similar schema. But first, let us consider the following stipulations made by each of the contributing components of the diminutive forms:

(78)[37] Input: /weso/ + -it



We mentioned in §5.5.1 that stress assignment in diminutive forms involves a paradigm shift between the non-modified and modified forms such that the original hierarchy headed by FAITH-v̊, which was responsible for the assignation of stress over the alternating diphthongs in non-modified forms, is replaced by a hierarchy dominated by 3σW, FTBIN, RL and PARSE-σ upon being modified morpho-phonologically:

[37] Here we will not program any constraints which align the diminutive suffix to the stem as they unnecessarily complicate the present hierarchy for stress application and their exclusion does not negatively affect the efficiency of the analysis.

(79)

/wȇ.bo/ → [wé.βo] (FAITH-v̊ » FTBIN » PARSE-σ)

↓

/wȇ.bo/ +it→[we.βe.θi.to]

↓

[we.βe.θi.to] →[wè.βe].[θí.to] (3σW » FTBIN » RL » PARSE-σ, FAITH-v̊, STRCOND)

In these forms, the alteration of stress can be explained as a typological shift. Effectively, stress in diminutive forms is supplied by the same basic hierarchy we provided for trochaic patterns in our typology of Spanish stress in §5.4, the only difference being that we made a few minor adjustments to account for the morpho-phonological processes involved in diminutive formation.

Before offering our production hierarchy which justifies stress application in diminutive forms, we must detain our study to present the morpho-phonological conditions which are responsible for producing the diminutive form, specifically disyllabic forms whose penultimate syllable is an alternating diphthong. First, the diminutive morpheme must be aligned to the stem, whereupon the final vowel of the stem must transfer to the right edge of the diminutive morpheme, {it}. The phonology imposes four important stipulations that (1) the diminutive morpheme must align to an onset (2) the diminutive form of disyllabic words containing penultimate diphthongs must contain two binary feet, (3) segment deletion is not an optimal strategy to satisfy the preceding two conditions, while (4) segment insertion is banned, but due to ranking, is an acceptable strategy to fulfill the aforementioned stipulations[38]. By stipulating a minimum foot requirement on diminutive forms of words with heavy monosyllabic stems and disyllabic words containing a penultimate diphthong, we simultaneously justify the emergence of the adjunct segments [eθ] in these diminutive forms:

[38] As the following chapter is dedicated exclusively to diminutive formation, we will not lose time here illustrating the interaction of the morphophonological constraints involved in this process.

(80)
MIN-FT-REQ (*Minimum Foot Requirement*)[39]
The minimum foot requirement of diminutive forms of heavy monosyllabic words and disyllabic words containing a penultimate diphthong is two[40].

Thus we can consider that the application of unmarked trochaic stress in diminutive forms of disyllabic words containing penultimate diphthongs is a natural upshot of satisfying the minimal foot requirement we proposed above. Basically, in order to satisfy MIN-FT-REQ, all four syllables of the diminutive form must be parsed into binary feet, meaning that trochaic stress will automatically apply unless some higher ranked constraint prohibits such an application.

To program our hierarchy of constraints which produces stress over the peak of the diminutive morpheme, once again 3σW must occupy an influential position, since this constraint is never violated by the optimal output. At the same time, the dominant ranking of 3σW implies a demotion of FAITH-v̊, which imposed stress over the diphthong in the non-modified form because satisfying 3σW means a necessary violation of FAITH-v̊. FTBIN, RL and PARSE-σ, the basic hierarchy we presented in our typology in §5.4, as well must rank dominantly since all are routinely satisfied by the optimal output. Contemplate the following hierarchy and tableau[41]:

[39] It is a well documented fact that some languages impose a minimum foot requirement on words. The basis for this argument was framed in McCarthy (1979), and later in Hayes (1995). Subsequent works have provided an abundant of cross-linguistic evidence to support this claim. Our proposal based on the Spanish data is slightly different in that we claim that the minimal foot requirement affects a sub-set of morphologically modified forms, instead of monomorphemic words.

[40] We claim that MIN-FT-REQ is an offshoot of a constraint which banned degenerate heavy syllables, which would otherwise occur if /eθ/ were absent from the optimal output: we.[βí.to]. Bans against degenerate or unfooted syllables are cross-linguistically substantiated in a variety of languages. For a complete discussion see Kager (1989, 1993), McCarthy and Prince (1990), and Hayes (1995).

[41] We will only consider stress over an input [we.βe.θi.to]. In chapter 6, we will illustrate the ranking of the morphophonological constraints which can produce alternative and attested outputs such as -*huevito*. The hierarchy of stress assignment we present here is capable of explaining stress application in all diminutive forms.

(81)[42]
3σW » FTBIN » RL » PARSE-σ » FAITH-v̊ » STRCOND

(82)[43]
Input: /weso/ + {it}

	3σW	FTBIN	RL	PARSE-σ	FAITH-v̊	STRCOND
a. we.se[θí.to]				*!	*	**
b. [wé.se]θi.to	*!	*	*	*		
☞c. [wè.se][θí.to]					*	**
d. we.[sé.θi]to			*!	*	*	*
e. we.se.θí.[tó]		*!		*	*	***
f. [wé.se][cì.to]	*!					

In this tableau, candidate (c) emerges as the optimal output by satisfying all the superior constraints while incurring only minor violations of FAITH-v̊ and STRCOND. PARSE-σ eliminates the next closest candidate, candidate (a), in which the initial two syllables are not associated with a foot. Candidates (b) and (f) are discarded from the evaluation process by allowing stress to surface outside of the three syllable window, violating the stipulations expressed by the dominant constraint of the hierarchy, 3σW. Candidate (e) presents stress over a monosyllabic final syllable, gravely violating FTBIN. Candidate (d) presents a binary foot, but fails to align it to the right margin of the prosodic word, provoking a serious infraction of RL.

[42] This should not be interpreted as a complete hierarchy justifying diminutive formation. We will offer an exhaustive account of these forms in the following chapter.
[43] We have not included MIN-FT-REQ for the simple reason that this constraint only affects the quantity of feet and not stress assignment. We will incorporate this constraint into our comprehensive analysis of Spanish diminutive formation in the following chapter.

5.6 CONCLUSIONS

In this chapter we have given an introductory survey of productive stress application in Spanish. We proposed that stress is best understood in relation to its function in metrical feet. Later, we illustrated the constraints which are responsible for stress shape and assignment and demonstrated the interaction necessary to produce the recurring and systematic stress patterns which surface in Spanish non-verbs.

Subsequently, we offered a basic typology of stress application in Spanish. Using a limited number of constraints, which made rigid stipulations on the structure and position of feet, we were able to account for the stress patterns in monomoprhemic Spanish substantives and adjectives. Of course, we purposefully avoided certain topics for clarity and brevity. For the subject of stress alone could occupy volumes. For this reason, we left the trickier issues of our survey unrefined, like the fact that many of our constraints overlap in their function, and the extent to which the constraints governing foot assignment and shape may interact in a single hierarchy. In addition, to avoid theoretical quagmires, we took a relatively neutral stance with regard to whether foot position is aligned to the prosodic word or, as Roca claims, to the morphological stem. We will remedy this in future studies dedicated more intensely to this topic. Notwithstanding the aforementioned shortcomings, however, the resulting study provides a sound base on which to ground future research.

Importantly, the Spanish data we presented corroborates Hammond's hypothesis regarding the justification of stress patterns based on a relative few shape and alignment constraints. Moreover, these constraints, in conjunction with additional morphological and phonological restrictions, served as the base for the analyses we presented in §5.5, in which we demonstrated the role that stress and foot structure assert in the production of optimal output.

6

SPANISH DIMINUTIVE FORMATION

6.0 INTRODUCTION TO DIMINUTIVE FORMATION IN SPANISH

Spanish diminutive formation provides a robust, if not to say daunting, corpora of data which reveals a great deal about the universal constraints which comprise the productive Spanish grammar, and the way in which the grammar prioritizes these restrictions. Here, we will offer a scrupulous reexamination of the pertinent data and formalize a set of constraints which first defines the necessary components involved in diminutive formation and later justifies their organization in optimal diminutive outputs.

Basically, diminutive forms are produced by aligning a diminutive morpheme {it} to a nominal, adjectival or adverbial stem. Sometimes universal markedness constraints prevent direct alignment due to some condition in the phonological environment. In this way, diminutive formation is acutely similar to the general schema we saw evolve in our analysis of plural formation in chapter four. And like our analysis of plural formation, in this chapter we will illustrate that Spanish diminutive formation can ultimately be reduced to one simple hierarchical typology: structural well-formedness » morphological alignment.

Before we delve into the data, however, it would behoove us to take a moment here to address some of the complications which our study is confronted with, and which we hope to resolve throughout the course of this analysis. Perhaps the greatest difficulty we face is the number of components involved in diminutive formation and their subsequent representation in a hierarchical model. In total, there can emerge as many as four structural components in an optimal diminutive form: (1) stem, (2) final vowel[1], (3) adjunct segments[2] (variable), and (4) diminutive morpheme:

(1)

Diminutive of –*huevo* (-*egg*)

[webo] + {it}
$[[_{word}[_{stem}[\text{we.}\beta_{(1)}]\ \text{e}\theta_{(2)}]\ \text{–it}_{(3)}]\ \text{o}_{(4)}]$

Adding to the perplexity, stems can be further categorized into one of four distinct stem classes: -a stems, -o stems, -e/Ø stems, and athematic stems (Bermúdez-Otero, 2006, in Martínez-Gil and Colina, 2006). In addition, each class of stem permits a highly limited set of pseudoplurals, which are lexically singular yet exhibit certain syntactic and morphological qualities more akin to plural substantives, in that their final segment is /s/: *-crisis*, *-dosis*, *-tesis* (*-crisis*, *-dose*, *-thesis*) (Bermúdez-Otero, 2006).

Traditionally there has been some discrepancy in the literature concerning the quantity of allomorphs the diminutive morpheme will permit. Some studies admit a total of three diminutive allomorphs; -it(o), -cit(o), -ecit(o),[3] while others claim that the only justifiable allomorph is the singular affix, -it(o), meaning that the emergence of /e/ and /θ/ in certain forms must be justified as a function of the grammar. It can be generally stated that studies from a purely morphological perspective tend to prefer this former argument while analyses of a more phonological ilk are likely to pursue the latter.

[1] We use the general term *final vowel* in order to describe the final vocalic segment of the diminutive form. In certain cases throughout the course of this chapter, we will refer to the final vowel segment of the stem as a word formative (Bermúdez-Otero, 2006).
[2] Since *adjunct segment* is not a formal morphological category, we take the liberty to refer to both segments as such. Nevertheless, we will propose that /e/ is a fully epenthetic vowel, constituting a case of emergence of the unmarked.
[3] Spanish has other diminutive morphemes such as –ill(o), -ic(o), -et(e), and ej(o). We will not address these alternative forms here, as they are basically interchangeable with –it(o) in the hierarchies we present.

The summary above offers a very initial sketch of some of the inherent complications concerning the structural components of diminutive formation. The alignment of these components in optimal outputs, nonetheless, can seem just as baffling to decipher. Customarily, there has been a rigorous debate surrounding the alignment of the diminutive affix to the stem. The crux of the debate is centered round the question as to whether the stem-final vowel forms part of the phonological, underlying representation, or if it is supplied post-lexically by way of the morphology. If we accept the phonological argument, then we must find some way of justifying why the affix falls short of aligning to the right margin of the stem in a vast majority of the cases. If, on the other hand, we accept the purely morphological argument, then we must formally represent the alignment of the final vowel as a process separate from that of affix alignment. There is no lack of empirical data supporting either argument.

Still yet, the diminutive morpheme can function in certain instances as a suffix, aligning directly to the stem, as in *-virus→virusito* (from *–virus*, Eng. *-virus*) (Bermúdez-Otero, 2006). Sometimes though, direct alignment is compromised in exchange for satisfying higher priorities of structural well-formedness: *-gato→ -gatito* (*-cat*/*-kitty*). Finally, but nonetheless bewildering, in other cases the behavior of the diminutive morpheme hints at a clear case of infixation, as in *azúcar →azuquillar*/*azuquitar* (*-sugar*), which we will characterize in this chapter as a general alignment failure in order to satisfy a ban against the resyllabification of the final stem consonant.

Finally, modeling the tendencies we uncover with respect to the emergence of /θ/ in determined diminutives presents a series of nettlesome obstacles which prohibit a straightforward justification from a single-tiered constraint-based framework. In this chapter, we will argue and illustrate that the emergence of /θ/ is phonologically conditioned. We will demonstrate that the specific condition which motivates its insertion is either provided directly by the input or derived from constraint interaction. While input-based phonological conditions do not challenge models built on the parallel interaction of constraints, the derived conditions which motivate /θ/ emergence in fact do, since the phonological condition is a necessary fallout of constraint interaction between the morphology and phonology in a prior stratum.

The organization of this chapter will be arranged as follows: Upon presenting all the data relevant to our study in the immediately following section (§6.1, page 302), we will elaborate on each of the aforementioned challenges. We commence in §6.2.1 (page 309) with a lengthy discussion of stems, followed by an examination of final vowels. Later, we look at the diminutive morpheme (§6.2.2, page 318) before discussing the alignment of the adjunct segments /e/ and /θ/ in §6.2.3 (page 320). In each section we introduce the individual constraints which impact the optimal output, before proposing in the following section (§6.3, page 337), the hierarchies we will employ to justify diminutive formation in Spanish.

6.1 DIMINUTIVE FORMATION: THE DATA

All nouns in Spanish pertain to one of four possible stem classes. Typically, stem class is defined by the final vowel which appears just to the right of the stem. It is generally accepted that no derivational suffix, save plural {s} and the adverbial suffix –*mente,* can appear outside of, or more precisely to the right side of the final vowel.

Observe the following examples of Spanish stem classes as proposed by Bermúdez-Otero (2006):

(2)

-o stems

Singular	Plural	
-gat<u>o</u>	gat-o-s	(*cat*)
-abuel<u>o</u>	abuel-o-s	(*grandfather*)
-lob<u>o</u>	lob-o-s	(*wolf*)
-huev<u>o</u>	huev-o-s	(*egg*)
-hues<u>o</u>	hues-o-s	(*bone*)

-a stems

-cas<u>a</u>	cas-a-s	(*house*)
-mes<u>a</u>	mes-a-s	(*table*)
-rein<u>a</u>	rein-a-s	(*queen*)
-ris<u>a</u>	ris-a-s	(*laugh*)
-blus<u>a</u>	blus-a-s	(*blouse*)

-e (/Ø) stems

-padr<u>e</u>	padr-e-s	(*father*)
-jef<u>e</u>	jef-e-s	(*boss*)
-clas<u>e</u>	clas-e-s	(*class*)
-rey<u>Ø</u>	rey-e-s	(*king*)
-pintor<u>Ø</u>	pintor-e-s	(*painter*)
-sol<u>Ø</u>	sol-e-s	(*sun*)

-athematic stems

-men<u>ú</u>	menú-s~menú-e-s	(*menu*)
-mam<u>á</u>	mama-s	(*mom*)
-caf<u>é</u>	café-s	(*coffee*)
-viru<u>s</u>	virus	(*virus*)
-dos<u>is</u>	dosis	(*dose*)
-cris<u>is</u>	crisis	(*crisis*)

In a majority of the cases, the final vowels –a/-o represent the morphosyntactic gender of the stem, although exceptions occur. To the contrary, words ending in –e/Ø never reveal the gender of the stem. Athematic stems are those in which the final vowel is accented, or in which the final sequence consists of a vowel and a final /s/.

In addition, each stem class has an extremely limited set of pseudoplurals (Bermúdez-Otero, 2006):

(3)
Pseudoplurals

-o stem	Carlos	[kár.l-o-s]
-a-stem	mecenas	[me.θé.n-a-s]
-e stem	Sócrates	[só.kra.t-e-s]
Athematic	análisis	[a.ná.li.si-s]

Psuedoplurals are, in fact, singular nouns which exhibit a morphosyntactic behavior more akin to plural nouns, probably due to a misclassification of the item by the language learner (Bermúdez-Otero, 2006). This miscategorization is a natural fallout of our hypothesis from chapter 3, which claims that these words are lexically underspecified for [plural]. Essentially, we argue that the phonological misclassification which leads to the deviant behaviour of the pseudoplural diminutives in Spanish is a direct consequence of the lexical underspecification for [plural] that we proposed earlier.

In normal contexts, diminutives in Spanish are formed by affixing a morpheme {it} to the final consonant of a stem. In –a/-o stems in which the unstressed final vowel corresponds to the morphosyntactic gender of the stem, the final vowel aligns to the right edge of the morpheme, creating the following forms. For the remainder of this chapter we will refer to these as *regular* diminutives:

(4)

Regular diminutive forms				
-gat<u>o</u>	→	-gat<u>i</u>to	[gá.to]→[ga.tí.to]	(*cat*)
-cas<u>a</u>	→	-cas<u>i</u>ta	[ká.sa]→[ka.sí.ta]	(*house*)
-lob<u>o</u>	→	-lob<u>i</u>to	[ló.βo]→[lo.βí.to]	(*wolf*)
-abuel<u>o</u>	→	-abuel<u>i</u>to	[a.βwé.lo]→[a.βwe.lí.to]	(*grandfather*)

We can observe that in disyllabic items from the –a/-o stem class which contain a penultimate diphthong, the adjunct segments /e/ and /θ/ insert systematically to interrupt the alignment of the derivational suffix {it} to the final consonant of the stem:

(5)

Diminutives of disyllabic forms with diphthongs in penultimate syllable:				
-huevo	→	-huevecito	[wé.βo]→[we.βe.θí.to]	(*egg*)
-hueso	→	-huesecito	[wé.so]→[we.se.θí.to]	(*bone*)
-reina	→	-reinecita	[réj.na]→[rej.ne.θí.ta]	(*queen*)

Forms ending in a diphthong [j+vowel] also insert two adjunct segments between the semiconsonant and the diminutive suffix:

(6)

Diminutives of disyllabic forms with final diphthong				
-bestia	→	-bestiecita	[bés.tja] →[bes.tje. θí.ta]	(*beast*)
-(el) radio	→	-radiecito	[rá.djo] →[ra.dje. θí.to]	(*spoke of a wheel*)
-patio	→	-patiecito	[pá.tjo] →[pa.tje. θí.to]	(*playground*)

In a similar way, /e/ and /θ/ emerge in diminutive forms of monosyllabic words from the –e/(Ø) stem class which end in a consonant:

(7)

Monosyllabic forms				
-solØ	→	-solecito	[sól]→[so.le.θí.to]	(*sun*)
-panØ	→	-panecito	[pán]→[pa.ne.θí.to]	(*bread*)
-mesØ	→	-mesecito	[més]→[me.se.θí.to]	(*month*)
-reyØ	→	-reyecito	[rej]→[re.je.θí.to]	(*king*)

Additionally, the adjunct segment /θ/ may appear autonomously of /e/ in certain diminutive forms from the –e/(Ø) stem class. Words ending in /r/ and /n/ containing more than one syllable affix an adjunct segment /θ/ between the final stem segment and the derivational suffix:

(8)

Diminutives of disyllabic forms ending in /n/ and /r/				
-pintorØ	→	-pintorcito	[pin.tóɾ]→[pin.toɾ.θí.to]	(*painter*)
-CarmenØ	→	-Carmencita	[káɾ.men]→[kaɾ.men.θí.ta]	(*proper name*)

Other items from the same stem class, -e/(Ø), exhibit a parallel behavior:

(9)[4]

-e/(Ø) stem diminutives				
-padre	→	-padrecito	[pá.ðre]→[pa.ðre.θí.to]	(*father*)
-jefe	→	-jefecito	[xé.fe]→[xe.fe.θí.to]	(*boss*)
-clase	→	-clasecita	[klá.se]→[kla.se.θí.ta]	(*class*)

There is very little regularity with regard to diminutive formation of the athematic stem nominals. Consider the following examples:

(10)

Athematic stem diminutives		
-sofá	→	-sofacito (*sofa*)
-mamá	→	-mamita/mamacita/mamaíta (*mom*)
-papá	→	-papito/papacito/papaíto (*dad*)
-virus	→	-virusito[5] (*virus*)
-brindis	→	-brindisito (*toast*, *when raising a drink to someone or something*)

As we can see in examples (7) – (9), in the event that the final vowel is not –a/-o, the vowel which aligns to the right edge of the derivational suffix invariably corresponds to the morphosyntactic gender of the stem.

In the past examples, the morpheme {it} functions as a suffix. However, in certain exceptional cases, {it} may also act as an infix (Bermúdez-Otero, 2006):

(11)

Cases of morpheme infixation				
a. –azúcar	→	-azuquítar/azuquillar	[a.θú.kar] → [a.θu.kí.yar]	(*sugar*)
b. (el) –problema	→	-problemita	[pro.βlé.ma] →[pro.βlé.ma]	(*problem*)
c. (el) –cura	→	-curita	[kú.ra] →[ku.rí.ta]	(*priest*)
d. (la) –moto	→	-motito	[mó.to] →[mo.tí.to]	(*motorcycle*)

The vowels which emerge to the right side of the diminutive morpheme in the examples (11b), (11c) and (11d) do not correspond to the morphosyntactic gender of the stem, but rather represent the final vowel provided by their bases (Bermúdez-Otero, 2006), suggesting a persuasive case of infixation. In example (11a), there is no coherent dispute; {it} is an infix.

[4] Traditionally there has been some discussion as to whether the /e/ which surfaces in these diminutive forms is that which is contained in the stem, or an adjunct segment [e]. Here we consider it as part of the stem.

[5] This is a somewhat strange diminutive form in that most speakers would never use the diminutive with this lexical item. Bermúdez-Otero (2006) offers the explanation that when speaking of a computer *virus,* however, this term is quite acceptable. Our informants agree that in this context, the diminutive is possible.

Finally, pseudoplurals exhibit a rather curious behavior with regard to their diminutive counterparts. Let us consider the diminutive forms of the following pseudoplurals:

(12)

Pseudoplural diminutives			
-crisis	→	crisecita	[krí.si-s] →[kri.se. θí.ta] (*crisis*)
-dosis	→	dosecita	[dó.si-s] →[dó.se.θí.ta] (*dose*)
-Sócrates	→	Socratito	[só.kra.t-e-s] → [só.kra.t-ít-o] (*Socrates*)
-análisis	→	analisito	[análisis] → [a.ná.li.s.ít-o] (*analysis*)

The difference between the diminutive forms of athematic stems ending in /s/ in (10) and the diminutive forms of the pseudoplurals in (12) is that the derivational morpheme does not align to the stem-final /s/ in this latter category, but rather aligns to the consonant which directly precedes /i/. This strategy makes sense if we consider that the ending /is/ is misinterpreted as a thematic vowel and plural marker by the speaker, which, Bermúdez-Otero (2006) explains, is the result of a learnability disparity. Essentially, according to this argument, the pseudoplural items are misclassified with regard to the stem class to which they pertain[6]. This claim is plausible given that (1) all pseudoplurals are exceptionally infrequent, constituting a scarce percentage of total words in Spanish, (2) they are peculiar items in that their plural forms never align the plural morpheme {s}, and (3) they are all assimilated words of foreign origin (Greek).

In English, we see a similar situation with the misclassification of these same items of Greek origin. In the English cases, plurality is exhibited by the conversion of the final /ɪ/ to /i/. In an informal way, we asked ten native English speaking informants of various age groups to tell us the plural forms of the words –*crisis*, -*thesis* and -*analysis*. None was able to give a correct response, indicating that morphologically,

[6] Other forms as well can be explained by Bermúdez-Otero's hypothesis. Consider the diminutive forms -*monjita*>*monja* (-*nun*)/*monjecito*> *monje* (-*monk*); *juececita*>*jueza* (-*female judge*) / *juezecito*>*juez* (-*male judge*); *jefecita*>*jefa* (-*female boss*) /*jefecito*>*jefe* (-*male boss*). The words –*monje* and –*monja* must be classified to the stem class that corresponds with their respective stem-final vowel, whereas the diminutives of –*jueza* and –*jefa* suggest that although a final –a appears as the stem-final vowel, these words are in fact classified as –e(Ø) stems, as in their masculine counterparts.

there is some ambiguity as to how these words should be classified, corroborating, at least superficially, Bermúdez-Otero's claim.

At first glance, there seems to be a general lack of uniformity in the diminutive forms appearing in examples (4)-(12). Notwithstanding, we can draw the following generalizations:

(13)

Generalizations for diminutive formation

1. The vowel initial suffix always aligns to an onset[7]
2. With regard to the derivational suffix, -it are the only segments which emerge in all forms.
3. All forms end in [o] or [a], either in accordance with their morpho-syntactic gender, or by infixation of the morpheme *–it* in the morphological stem which ends in [o] and [a], and in which these segments do not reflect morpho-syntactic gender; /problema/→problem-it-a (masculine nominal from Greek, -*problem*)[8].
4. The diminutive morpheme appears predictably in the penultimate syllable of all diminutive forms in Spanish.
5. The only segments which may appear to the right edge of the diminutive morpheme are /a,o,s/.

Remarkably, we can also extract some generalizations from the *irregularities* of Spanish diminutive forms. If we notice, the alignment of the diminutive affix to the stem is subject to a certain amount of variation. In forms such as the diminutive of –virus [bí.rus], -[bi.ru.s]-it-o, the suffix aligns directly to the right edge of the stem, whereas in the regular forms from example (4), the suffix falls short of aligning to the right edge of the stem. In other forms, the adjunct segments /e/ and /θ/, or /θ/ prevent perfect alignment. As we will see, in OT these discrepancies will be explained by constraint ranking. In other words, divergent configurations can be explained by the fact that some other principle must dominate the stipulations made by the constraints which govern morpheme alignment.

[7] There are a few exceptions to this generalization but none which challenge the veracity of the analysis.

[8] There are few exceptions such as *–azuquítar*. However, these forms can be explained by constraint ranking and do not pose any particular challenge to the generalization.

6.2 THE COMPONENTS

In the following section we examine the shape and alignment of the components which comprise Spanish diminutive forms. We begin with a detained discussion of stems and their final vowel. As we will see, the way in which we define these two elements will have a profound impact on our ranking schemata. Later, we identify the diminutive morpheme and discuss the constraints which align this unit to the nominal, adjectival or adverbial stem. Subsequently, we address the phonological and prosodic conditions which govern the insertion of the adjunct segments /e/ and /θ/.

6.2.1 Stems and final vowels

There are two basic arguments in the literature to explain the relationship between the morphological stem and the word-final vowels, -o, -a, and –e, which align to them[9]. Although a thorough report of both proposals is beyond our scope here, we will offer an abbreviated version of the issues based in large part on the arguments proposed in Bermúdez-Otero (2006)[10].

The purely morphological argument purports that stem-class vowels do not form part of the phonological representation, but rather are supplied post-lexically by the morphology. Therefore when a derivational suffix aligns to a stem, as in diminutive formation for example, a morphological rule is in charge of aligning the vowel to the right edge of the suffix:

[9] Only these vowels can be word formatives. All other word-final vowels are a homologous part of the stem.
[10] For thorough reviews of these arguments see: Pensado (1999), Peperkamp (1995), Harris (1983, 1985, 1991, 1992, 1996, 1999), Roca (1990, 1991, 2006), Bermúdez-Otero (2006).

(14)

UR	[libɾ]
Affixation	[libɾ] -it-
Morphological rule to align final -o	[libɾ] –it-o

(Bermúdez-Otero, 2006)

The morphophonological proposal, on the other hand, is founded on the central notion that the stem-final vowel forms part of the base, and thus logically part of the phonological, underlying representation of the word. Upon being modified by a derivational suffix, a rule must transfer the final vowel to the right edge of the new affix:

(15)

UR	[libɾo]
Affixation	[libɾo] -it-
Morphophonological rule for Stem-final vowel deletion $-o \rightarrow \emptyset / \underset{\perp}{\sigma_w}\ _{stem}]\ [_{suffix} V$	[libɾ] –it-o

(Bermúdez-Otero, 2006)

Of course, the morphophonological proposal obliges a necessary violation of any constraint which seeks to situate the diminutive morpheme directly to the right margin of the stem, since the vowel-initial diminutive suffix always aligns to an onset and not a stem-final vowel. Accordingly, this argument entails the compulsory subordination of ALIGNMENT in order to justify its violation in a hierarchical framework.

Purely morphological rules such as that in (14) easily explain the alignment of the derivational diminutive suffix to the stem since the left edge of the suffix affixes directly to the right word margin. Therefore from an OT perspective, if we consider that the stem-final vowel is provided post-lexically, as the rule in (14) envisages, there would be no implicit violation of a constraint ALIGN{-it}-R, which positions the suffix directly to the right margin of the stem, since this process is carried out flawlessly. Conversely, if we accept the rule in (15), which we do based on the evidence presented in Bermúdez-Otero (2006), then an optimal output which positions the affix to the final stem consonant, which occurs systematically in the diminutive forms, obligatorily incurs at least one violation of the alignment constraint which seeks to situate the affix to the rightmost stem margin. Naturally, in OT this is an acceptable concession but there must be some higher ranked constraint whose satisfaction warrants the infraction of ALIGN-{-it}-R.

In our analysis of regular diminutive forms, we argue that this dominant constraint is ONSET[11]. Observe the following hierarchy in which ONSET dominates ALIGN-{-it}-R in the following tableau. For ease, we will only consider the alignment of the diminutive morpheme {it}:

(16)
Input: /gato/ + {it}

	ONSET	ALIGN-{it}-R
☞a. gat-it-o		*!
b. gato-it	*!	

Candidate (a) commits a minor violation of ALIGN-{it}-R in order to ensure that the condition requiring peaks to align to onsets is satisfied, whereas candidate (b) prefers to faithfully align the suffix to the stem, even if this means a fatal violation of ONSET.

Now, let us suppose for a moment that the final vowel is supplied post-lexically, as rule (14) proposes. In this case, the model needed to predict an optimal output is simpler, since ALIGN-{-it}-R is the only active constraint:

(17)
Input: /gat/ + {it}

	ALIGN-{-it}-R
☞a. gat-it-v	
b. gat-v-it	*!

[11] The individual constraint in each case will vary depending on the stem class. However, we will illustrate that all dominant constraints are based on principles of structural well-formedness.

In tableau (17) the optimal output (a) satisfies the only constraint. Since the final vowel does not appear until a subsequent phonological stratum, the left side of the suffix is free to affix directly to the right edge of the stem.

Perceptibly, the model presented in (17) is much more austere than the hierarchy in (16), which could tempt one to believe that the morphological argument presented in (14) is favorable to the morphophonological rule proposed in (15). The inherent downfall to the schema presented in (17) though is that we must dismiss a vital characteristic of diminutive formation; **diminutive affixes always align to an onset**.[12]

The alignment of the stem-final vowel to the right edge of the diminutive morpheme as well can be expressed in two fundamentally contrary ways. One approach to treat this process could be to program a distinct alignment constraint which is specifically responsible for aligning the vowel to the right suffix margin. Or, we could represent this process as a secondary effect of suffix alignment, in effect, permitting the procedure to be carried out without having to order any single constraint to regulate its emergence in optimal outputs. We will discuss each option below.

Ostensibly, the first option above may seem attractive since the alignment of the stem-final vowel would effectively be programmed instead of passively obtained. The programming of a highly ranked alignment constraint might properly capture this nuance of diminutive formation. After all, only an exceptionally few number of optimal outputs would ever violate such a constraint.

A more cultivated examination on the other hand reveals that such a proposal is unreservedly incompatible with the hypothesis which comprehends the final vowel as an underlying structural unit, the argument on which the rule in (15) is based. If we contemplate a hypothetical interaction between two constraints, ALIGN-{o/a}-R and

[12] There are a few exceptions to this generalizations: *-mamaíta* (*-mommy*), for example. These can be explained by demoting ONSET to an inferior position and do not challenge the veracity of our claim.

ALIGN-{-it}-R, in which this former constraint dominates the latter, which it must in order to correctly reflect the competing processes involved in Spanish diminutive formation, then we will see that this paradigm is incapable of choosing the correct diminutive output. Observe the following tableau:

(18)
Input: /gato/ + {it}

	ALIGN-{o/a}-R	ALIGN-{-it}-R
☞a. gato-it-o		
b. gat-it-o		*!
c. gatoit	*!	

Since /o/ forms part of the phonological representation, there is no violation of the inferior constraint if the diminutive morpheme is aligned to the stem-final vowel. In other words there is perfect alignment. However, the superior constraint is satisfied by supplying a supplementary segment to the right edge of the suffix. Even though with further refinement we could arrive at an accurate output, the result is a model which is based on very little solid phonological justification. Effectively, we would be forced to incorporate superfluous constraints which only focus on the alignment of one segment. Such a model is reminiscent of the ordered-rule paradox which plagued generative phonology.

On the other hand, we can account for the alignment of the final vowel to the right edge of the diminutive suffix as a secondary effect of the conflict resolution between ALIGN-{-it}-R and ONSET. An additional constraint MAX-V, which prohibits the deletion of any input vowel from the output, ranked dominantly will produce the desired output:

(19)
MAX-V
Assign one violation mark to every deleted input vowel in the output.

Considering that vowel deletion does not normally occur in most diminutive forms, we can contemplate this strategy as a means by which to amplify our model with a greater quantity of universal phonological generalizations. Consider the following hierarchy and tableau:

(20)
MAX-V » ONSET » ALIGN-{-it}-R

(21)
Input: /gato/ + {it}

	MAX-V	ONSET	ALIGN-{-it}-R
a. gato-it-o		*!	
☞b. gat-it-o			*!
c. gatoit		*!	
d. gatoto	*!		

In this tableau, the optimal candidate violates the inferior constraint ALIGN-{it}-R in order to satisfy ONSET. Notice that perfect alignment of the two structural components would yield an output *-*gato-it*. We see this development in candidates (a) and (c), which result sub-optimal due to their fatal violations of ONSET. Candidate (d) is phonologically feasible, but upon deleting the initial vowel of the diminutive morpheme commits a fatal infraction to MAX-V, the dominant constraint.

Appreciably, the previous hierarchy aptly justifies the alignment of the final vowel in regular diminutive forms from the –a/-o stem classes, but now we must shift our attention to the emergence of the final vowel in diminutives originating from the –e/(Ø) stem class. A casual reading of the data in (9) illustrates an undeniable connection between the stem-final vowel and the morphosyntactic gender of the base. In these diminutives, morphosyntactic gender is always expressed with a phonological cue. We can capture this regularity in an OT constraint which requires that (1) diminutive forms of stems which do not end in /a/ or /o/ must attach one of these vowels to the right edge of the diminutive suffix, and (2) these vowels must always correspond to the morphosyntactic gender of the base[13]:

(22)
GENDERMARKER (preliminary)
Diminutive forms of –e (Ø) stem nominals must affix /o/ or /a/ to the right side of the diminutive morpheme in accordance with the morphosyntactic gender of the stem.

This constraint, when ranked dominantly in relation to the constraints presented in the previous hierarchy, is decidedly capable of producing an optimal form in which /o/ or /a/ align to the right edge of the diminutive suffix. Consider the following hierarchy:

(23)
GENDERMARKER » MAX-V » ONSET » ALIGN-{-it}-R

To not prematurely overburden our hierarchy, we will only present candidates which diverge on the final vowel. Consider the interaction in the final tableau:

(24)
Input: /nube/ + {it} (-*cloud*)

	GENDERMARKER	MAX-V	ONSET	ALIGN-{-it}-R
a. nubeθ-it-o	*!			*
☞b. nubeθ-it-a				*

Since -*nube* is a feminine nominal, the diminutive form must end in /a/, the feminine marker by default[14]. Candidate (b) aligns /o/ and is accordingly discarded from the evaluation process.

We can justify the segment which appears to the right side of the diminutive morpheme in athematic stems by altering GENDERMARKER to include a concession for athematic stems:

[13] This has traditionally been a controversial topic due to the copious amount of irregularities that exist. However, for this analysis, we consider –a to be the default feminine gender marker and –o to be the default masculine marker. For a thorough justification, see Bermúdez-Otero (2006).
[14] See Bermúdez-Otero (2006)

(25)
GENDERMARKER (revised)
Diminutive forms of –e (Ø) stem and athematic stem nominals must affix /o/ or /a/ to the right side of the diminutive morpheme in accordance with the morphosyntactic gender of the stem.

Let us observe how this hierarchy justifies the emergence of /a/ and /o/ in the diminutive forms of athematic stems. Again, we will only pay attention to the segment which materializes to the right edge of the diminutive affix:

(26)
Input: /birus/ + {it}

	GENDERMARKER	MAX-V	ONSET	ALIGN-{-it}-R
a. bi.rus-it-a	*!			
☞b. bi.rus-it-o				

As we can see, candidate (b) surfaces as the optimal candidate since –*virus* is a masculine nominal and therefore must end in /o/.

Alignment of the diminutive morpheme in forms such as –*Carlitos* or -*Merceditas* (from the proper names -*Carlos* and –*Mercedes*), which end in /s/ but are singular nouns, can be accounted for by the conciliation of two predominant constraints. First ALIGN-{-it}-R requires the diminutive morpheme to align to the right margin of the base. In theory, this should not violate any principle of phonological well-formedness since the final segment in these cases is a consonant, /s/. However, if ALIGN-{-it}-R were outranked by another constraint which stipulates that phonological domain boundaries must coincide with syllable boundaries, there is conflict, since the satisfaction of one of these constraints necessarily implies a violation of the other. As we saw in chapter 4, the constraint which makes such requirements on phonological domain boundaries is ALIGN(PD):

(27)
ALIGN(PD)
Every phonological domain boundary must coincide with a syllable boundary. (No resyllabification)

Let us consider the following hierarchy headed by ALIGN(PD)

(28)
ALIGN(PD) » ALIGN-{-it}-R

Observe their interaction in the following tableau:

(29)
Input: /karlos/ + {it}

	ALIGN(PD)	ALIGN-{-it}-R
☞a. kaɾ.li.tos		*!
b. kaɾ.lo.si.to	*!	

In this tableau, a violation of ALIGN(PD) is circumvented by infixing the diminutive morpheme, though at the cost of violating ALIGN-{it}-R. If we allocate one violation mark for every syllable to the left of the right word margin in which the diminutive morpheme appears, then an output [kar.li.tos] will always result more harmonic than *[ka.ɾit.los] or *[kit.aɾ.los] without having to program any particular constraint to specifically ban such structures. Subsequently, if we specify that segment deletion and insertion are prohibited in the optimal output, then the only possible modification to the input will be the infixed morpheme. Observe the following hierarchy:

(30)
ONSET » ALIGN(PD) » MAX » DEP » ALIGN-{it}-R

Observe the interaction of these constraints in the following tableau:

(31)
Input: /karlos/ + {it}

	ONSET	ALIGN(PD)	MAX	DEP	ALIGN-{it}-R
a. kaɾl-it-o			*!		*
☞b. kaɾl-it-os					*
c. karlos-it-o		*!		*	
d. kaɾ-it-los					*!*
e. k-it-aɾ.los					*!**

In this tableau, candidate (b) satisfies all the superior constraints while committing only an arbitrary infraction to ALIGN-{-it}-R by not aligning the diminutive morpheme to the right word margin. This strategy proves optimal since the only way to satisfy ALIGN(PD) is by violating ALIGN-{-it}-R. Candidates (d) and (e) also satisfy all the highly ranked constraints, but are deemed sub-optimal for accruing superfluous violations of ALIGN-{-it}-R upon situating the diminutive morpheme two and three syllables away, respectively, from the right word margin. Candidate (a) is rejected by MAX for capriciously deleting segments with no grammatical benefit, while candidate (c) is discarded by ALIGN(PD) for resyllabifying the word-final consonant in order to satisfy the lowly ranked ALIGN-{-it}-R.

6.2.2 Diminutive affix

We can characterize the diminutive affix by one of two ways. The first approach entails the conception of three allomorphs, *–it*, *-cit*, and *–ecit*, which align to a specific stem type. This scheme is most common in morphological studies of diminutive forms (see Elordieta and Carriera, 1996) and supposes the adjunct segments to be morphologized units which form part of the diminutive allopmorph.

Alternatively, the second, phonological approach maintains that the only diminutive allomorph is *-it*, and that any segments which surface between the stem and allomorph are supplied by the grammar, productively, to satisfy some condition of phonological well-formedness.

The principle difference between the two proposals mentioned above is that the first implies a greater burden for the memory since the learner must store three allomorphs in her memory. The advantage is that the grammar is relieved from having to compute particularized diminutive forms. To the contrary, the second argument entails a greater tax on the production grammar but at the same time alleviates the burden on the memory, since the learner must store only one allomorph.

In order to demarcate our particular orientation, let us consider the diminutive affix which appears in the following example:

(32)

Diminutive forms of different stem class nominals					
-it					
	-gato	→	-gatito	[gá.to]→[ga.tí.to]	(*cat*)
	-casa	→	-casita	[ká.sa]→[ka.sí.ta]	(*house*)
-/eθ/-*it*					
	-huevo	→	-huevecito	[wé.βo]→[we.βe.θí.to]	(*egg*)
	-hueso	→	-huesecito	[wé.so]→[we.se.θí.to]	(*bone*)
	-(el) radio	→	-radiecito	[rá.djo] →[ra.dje. θí.to]	(*spoke of a wheel*)
	-patio	→	-patiecito	[pá.tjo] →[pa.tje. θí.to]	(*playground*)
	-solØ	→	-solecito	[sól]→[so.le.θí.to]	(*sun*)
	-panØ	→	-panecito	[pán]→[pa.ne.θí.to]	(*bread*)
	-mesØ	→	-mesecito	[més]→[me.se.θí.to]	(*month*)
	-reyØ	→	-reyecito	[rej]→[re.je.θí.to]	(*king*)
-/θ/-*it*					
	-pintorØ	→	-pintorcito	[pin.tóɾ]→[pin.toɾ.θí.to]	(*painter*)
	-CarmenØ	→	-Carmencita	[káɾ.men]→[kaɾ.men.θí.ta]	(*proper name*)
	-padre	→	-padrecito	[pá.ðɾe]→[pa.ðɾe.θí.to]	(*father*)
	-jefe	→	-jefecito	[xé.fe]→[xe.fe.θí.to]	(*boss*)
	-clase	→	-clasecita	[klá.se]→[kla.se.θí.ta]	(*class*)
-*it*/-/θ/-*it*					
	-sofá	→	-sofacito	[so.fá]→[so.fa.θí.to]	(*sofa*)
	-mamá	→	-mamita/mamacita	[ma.má]→[ma.mí.ta]~[ma.ma.θí.ta]	(*mom*)
	-papá	→	-papito/papacito	[pa.pá]→[pa.pí.to]~[pa.pa.θí.to]	(*dad*)
	-virus	→	-virusito	[bí.ɾus]→[bi.ɾu.sí.to]	(*virus*)
	-brindis	→	-brindisito	[bɾín.dis]→[bɾin.di.sí.to]	(*toast*)
	-azúcar	→	-azuquítar/azuquillar	[a.θú.kar] → [a.θu.kí.yar]	(*sugar*)

Observably, the only segments which emerge systematically with respect to the diminutive affix are {it}, meaning that the notion of diminutiveness can be fully expressed with these two segments. With fewer segments, a speaker would not be able to effectively communicate the notion of diminutiveness to another speaker. Importantly, the inclusion of more segments does not increment this concept, meaning that the previous argument which proposes three allomorphs is ultimately one of ease and opportunity. Essentially, this argument presents a vision of diminutive formation which is considerably easier to model, but at the cost of omitting a copious amount of phonological information concerning the shape and alignment of the diminutive components, and more importantly the universal principles that motivate their organization.

We propose a constraint which defines the diminutive affix:

(33)
DIM-MORPH
There is one diminutive morpheme/affix {it}, which must affix to a nominal, adjectival or adverbial stem in Spanish diminutive forms.

Unranked, this constraint stipulates that diminutive forms must contain the diminutive morpheme {it}.

Observe the following:

(34)
Input: /gato/ + {it}

	DIM-MORPH
☞a. gat-it-o	
b. gato	*!

This tableau chooses the diminutive form which contains the diminutive suffix, candidate (a).

6.2.3 Adjunct segments

In this section we examine the facts related to the insertion of /e/ and /θ/ in specific diminutive forms. We will postulate a constraint schema which formally defines the adjunct segments which surface in these forms and present a ranking order of alignment and well-formedness constraints to justify their insertion. We propose that the difficulties that unfold upon attempting to justify segment insertion radiate from the idea that diminutive formation in a handful of cases can be cyclical, meaning that an optimal output cannot be derived by constraint interaction in a single hierarchy.

The adjunct segments which may appear in Spanish diminutives are /e/ and /θ/. Neither segment forms part of the underlying representation of the stem or diminutive morpheme, and neither is associated, independently or jointly, with any lexical meaning. In some cases both segments are inserted, while in others, only the latter surfaces. Their role is essentially to satisfy some requirement made by a highly ranked markedness constraint. That is to say, they are **phonologically motivated**.

Let us consider the adjunct segments along with their phonological contexts in the following examples:

(35)

	Diminutive forms with adjunct segments				
(a)					
/eθ/	-huevo	→	-huevecito	[wé.βo]→[we.βe.θí.to]	(*egg*)
	-hueso	→	-huesecito	[wé.so]→[we.se.θí.to]	(*bone*)
	-reina	→	-reinecita	[réj.na]→[rej.ne.θí.ta]	(*queen*)
(b)					
/eθ/	-bestia	→	-bestiecita	[bés.tja] →[bes.tje. θí.ta]	(*beast*)
	-(el) radio	→	-radiecito	[rá.djo] →[ra.dje. θí.to]	(*spoke of a wheel*)
	-patio	→	-patiecito	[pá.tjo] →[pa.tje. θí.to]	(*playground*)
(c)					
/eθ/	-solØ	→	-solecito	[sól]→[so.le.θí.to]	(*sun*)
	-panØ	→	-panecito	[pán]→[pa.ne.θí.to]	(*bread*)
	-mesØ	→	-mesecito	[més]→[me.se.θí.to]	(*month*)
	-reyØ	→	-reyecito	[rej]→[re.je.θí.to]	(*king*)
(d)					
/θ/	-pintorØ	→	-pintorcito	[pin.tór]→[pin.tor.θí.to]	(*painter*)
	-CarmenØ	→	-Carmencita	[kár.men]→[kar.men.θí.ta]	(*proper name*)
(e)					
/e/Ø-θ/	-padre	→	-padrecito	[pá.ðre]→[pa.ðre.θí.to]	(*father*)
	-jefe	→	-jefecito	[xé.fe]→[xe.fe.θí.to]	(*boss*)
	-clase	→	-clasecita	[klá.se]→[kla.se.θí.ta]	(*class*)
(f)					
/θ/	-sofá	→	-sofacito	[so.fá]→[so.fa.θí.to]	(*sofa*)
	-mamá	→	-mamita/mamacita	[ma.má]→[ma.mí.ta]/ [ma.ma.θí.ta]	(*mom*)

(g)

/eθ/	-crisis	→	cris<u>ec</u>ita	[krí.si-s] →[kri.se. θí.ta]	(*crisis*)
	-dosis	→	dos<u>ec</u>ita	[dó.si-s] →[dó.se.θí.ta]	(*dose*)

The previous data indicate that insertion of the adjunct segments in Spanish diminutives is systematic and prescriptive. It is evident that the phonological condition which governs the insertion of /e/ is distinct from that which motivates the emergence of /θ/, meaning that both will have to be justified hierarchically. And although we will refer to both units here as *adjunct segments*, we will treat /e/ as fully epenthetic, constituting a case of emergence of the unmarked.

The examples in (35a), (35c) and (35g)[15] all indicate that insertion of /e/ is motivated by a constraint which stipulates that diminutive forms of certain stem types be comprised of two binary feet. Once this requirement is satisfied, however, /θ/ must surface to provide an onset between /e/ and the initial vowel of the diminutive morpheme /i/: [we.βe][(θ)í.to]. Other studies examining Spanish diminutive forms have suggested a similar proposal, conjecturing a minimal syllable requirement instead of one based on metrical feet (See Elordieta and Carreira, 1996 and Crowhurst, 1992).

In the forms found in (35b), the emergence of /e/ seems to be motivated by the fact that direct alignment of the diminutive morpheme to a stem ending in /j/ would result in a diminutive form in which an illicit diphthong [jí] surfaces in the output: [patj]-e {-it} -o. We illustrated in chapter three that this sequence violates the *Obligatory Contour Principle* (OCP, OT constraint) and is strictly banned in Spanish. The result of /e/ insertion, however, means that the initial vowel of the diminutive morpheme cannot align to a prenuclear consonant, providing the proper phonological environment to warrant the insertion of /θ/.

[15] We maintain that the data from (g) are misclassified in the lexicon such that the stem is interpreted as [[kris]is], [[dos]is], constituting a monosyllabic heavy stem.

The appearance of the adjunct segment /θ/ in the forms found in (35d) suggests a strong proclivity toward maintaining the moraic structure of the unmodified nominal form, while segment insertion in the forms found in (35f) is likely motivated by a phonological tendency for peaks to be syllabified with onsets.

With respect to the classification of /θ/, we illustrated in chapter 4 that the emergence of this segment cannot be justified as a simple case of epenthesis. If epenthesis were required, we should expect to observe the insertion of /t/ in optimal diminutive forms. Theoretically, we could restructure the coronal internal ranking scheme we presented in chapter 4 (page 213) in order to justify the emergence of /θ/ and not /t/, but there are no justifiable phonological grounds on which to base this proposal.

We have also demonstrated that these segments do not constitute part of the diminutive morpheme. We could effectively postulate them as stem augmentatives, which in certain cases they are, but this explanation does not explain why in other cases their role is strictly phonological. A more general term *floating segment* appears frequently in the literature to describe a segment which is both connected yet disassociated from a determined morpheme, but we will not pursue this explanation here on the grounds that the argument supporting such units is uncorroborated and unscientific. In a first instance, we will classify them as **phonologically conditioned infixes** and clarify this nomenclature throughout the immediately following paragraphs.

Before explaining the infix itself, we must define the term *phonological condition* which will represent a vital cornerstone of our model. Here we will organize the phonological conditions which prompt adjunct segment insertion into one of two basic categories: (1) input-based conditions and (2) derived conditions which result from constraint interaction. As the name implies, input-based conditions are those which are present in the phonological representation at the time that a determined process must be effectuated. Conversely, those conditions which are not present in the underlying level, but rather emerge at a non-descript point between input and output as a result of constraint interaction will be referred to as derived conditions.

The term *phonologically conditioned affix* is noticeably and purposefully ambiguous, reflecting the difficult intricacies of the segment's emergence in optimal outputs. The very notion implies a relationship between the phonology and morphology that is often times ignored, and not totally understood. We base our classification on the argument that the insertion of /θ/ cannot be entirely governed by the morphology, since morphological association must precede phonological and/or prosodic intervention. If it were merely a question of morphology, /θ/ would emerge before the phonological condition which motivates its insertion. Incidentally, this argument differs only trivially with the morphological proposal supporting the three distinct allomorphs we mentioned earlier. An argument for /θ/ insertion based solely on phonological principles, on the other hand, would imply that /θ/ insertion is specifically determined by the grammar, a claim we know not to be true because /t/ is the preferred epenthetic segment in Spanish.

In essence, our claim that /θ/ is a phonologically conditioned affix means that segment insertion can be predicted by the phonology, but that the segment itself belongs to the morphology. Our claim holds that /θ/ is morphologically and lexically associated with the underlying morpheme but it may not surface until the proper phonological conditions are in place to trigger its emergence. Of course, this vision implies that faithfulness under certain circumstances is not unconditional, but rather must be activated by a higher ranked constraint. The inherent offshoot of this proposal is that we can justify the emergence of /θ/, specifically, by way of input identity, that is faithfulness, yet still maintain that its emergence is governed by principles of structural well-formedness by way of markedness.

Let us consider the forms from (35a) and (35c) which we propose are cases in which the phonological condition motivating /θ/ insertion is derived from constraint interaction. The data illustrate that disyllabic words which contain a penultimate diphthong and monosyllabic words ending in a consonant routinely insert both adjunct segments between the stem and the diminutive morpheme:

(36)

-huevo	[wé.βo]→[<u>we.β</u>]-it-o]→[we.βe.θí.to]	(*egg*)
-hueso	[wé.so]→[<u>we.s</u>]-it-o]→[we.se.θí.to]	(*bone*)
-pan<u>Ø</u>	[pán]→[<u>pan</u>]-it-o]→[pa.ne.θí.to]	(*bread*)
-mes<u>Ø</u>	[més]→[<u>mes</u>]-it-o]→[me.se.θí.to]	(*month*)

We have claimed that certain optimal diminutives must be parsed into two binary feet. This claim is based in large part on the notion of minimality expounded in McCarthy (1979), which proposes that languages can place strict size restrictions on the number of syllables, feet, and moras that a well-formed word must minimally contain. There is a rich tradition of cross-linguistic research to substantiate this claim. In Yaminahua, an Amerindian language spoken in Peru, for example, [ti] aligns to the left margin of a suffix /tai/ in order to produce a weak, non-prominent syllable between two prominent syllables (González, 2005): /pi–tai–fa–i/ [(pi.ti) (tai.fa.) i] (eat–always–aux.–prog.). Parker and Hayward (1985) demonstrate that word minimality may play some role in the affixation of the indefinite genitive suffix in Quafar, a Cushitic language spoken in Ethiopia (Paster, 2006). Biggs (1961) provides similar evidence in favour of word minimality in forms taking the inceptive prefix in New Zealand Maori (Paster, 2006). Spanish itself even provides further evidence in other contexts of minimality stipulations on nominalized forms. Observe how the selection of the nominalizing suffix, –ez and –eza, is determined in the following examples (Aranovich et al. 2005):

(37)
Spanish nominalized forms

Adjective form	nominalized form
-rígido	-rigidez
-estúpido	-estupidez
-vil	-vileza
-franco	-franqueza
-gentil	-gentileza

The data above seem to provide strong evidence corroborating a three syllable size requirement on nominalized forms. Notice that independently of the quantity of syllables in the unmodified adjective, the nominalized form never has fewer than three syllables, even if this means sacrificing paradigmatic uniformity.

Returning now to our diminutive cases, let us review the succession of phonological procedures that derive the conditions prompting /θ/ insertion. In §6.2.1 we illustrated that the situation of the final vowel to the right margin of the diminutive suffix is a consequence of constraint interaction between a phonological principle that requires peaks to align to an onset and a tendency which seeks to align the left margin of a determined suffix to the right margin of a base. This basic schema is essential to diminutive formation since we have not programmed any special constraints which deal specifically with the alignment of the final vowel. We demonstrated that if ONSET dominates ALIGN-{it}-R, then direct alignment can be sacrificed in order to provide a prenuclear segment for a peak: /webo/→[we.βí.to]. At the same time, a double binary foot requirement on optimal outputs would mean that some phonological process will have to occur in order to supply an extra syllable to the stem: [wè.β( )] [í.to]. Vowel epenthesis can satisfy the minimality stipulation effortlessly: [wè.β(e)] [í.to]. In so doing, however, a phonological condition is created in which two contiguous vowels are joined, which in organic diphthongs is quite acceptable, yet is not across morpheme boundaries. Insertion of a fully epenthetic /t/ can resolve this problem, yet is shunned in exchange for /θ/ infixation, superficially corroborating our claim of a morphological and lexical association between /θ/ and {it}, probably due to a case of diachronic reanalysis. Consequently, [wè.β(e)] [í.to] becomes [wè.β(e)] [θ̲í.to] and not [wè.β(e)] [t̲í.to], as it would were these segments provided solely by the phonological grammar. It is manifestly clear that the phonological context which motivates /θ/ in these cases is derived from constraint interaction.

The difficulty with this explanation though is that a minimal foot requirement cannot interact in a single hierarchy with alignment because there would be no principled mechanism by which to exclude sub-optimal candidates such as *[we.βo.θí.to], since this candidate would equally satisfy the dominant stipulations pertaining to the quantity of binary feet as well as incur identical violations of alignment. The only way to derive and justify an optimal form such as [we.βe.θí.to] is to propose separate cycles for the alignment of the diminutive suffix and the minimal size imposition which activates /θ/ insertion.

For the sake of curiosity, let us observe the output which results from an input /webo/ in a single-tiered model in which ALIGN-{it}-R interacts with MIN-FT-REQ. First, ONSET must dominate ALIGN-{it}-R in order to position the final vowel to the right margin of the diminutive suffix. We can assume that MIN-FT-REQ would also dominate ALIGN-{it}-R since the optimal diminutive output will be parsed into two binary feet. Later, ADJ-SEG must dominate ALIGN-{it}-R since the stem/suffix alignment is interrupted by /θ/ and an epenthetic [e]. No segments are deleted, meaning that MAX will occupy a position inferior to ADJ-SEG yet inferior to ALIGN-{it}-R. DEP must be programmed inferior to MAX since it is routinely violated by the insertion of an epenthetic [e]. Observe the following hierarchy and tableau:

(38)
DIM-MORPH » MIN-FT-REQ »ADJ-SEG » ONSET » MAX » DEP » ALIGN-{-it}-R

(39)
Input: /webo/ {it}

	DIM-MORPH	MIN-FT-REQ	ADJ-SEG	ONSET	MAX	DEP	ALIGN-{-it}-R
a. we.(β-ít-o)		*!	*				*
b. (wè.βe)(θí.to)						*	**
☞c. (wè.βo).(θí.to)							*
d. (we.βe)(tí.to)			*!			**	**
e. (βí.to)		*!	*		**		*
f. (wé.βo)	*!	*	*				*

This hierarchy predicts a sub-optimal candidate *[we.βo.θí.to]. If all constraints interact in a single pass, ONSET is circuitously satisfied by ADJ-SEG without having to align the final vowel of the stem to the right edge of the diminutive suffix. Remember, this process was merely a side effect of the ONSET»ALIGN hierarchy. However, if ONSET is satisfied by other means, then there is no reason for the stem-final vowel to transfer to the right margin of the suffix. Thus the [o] which attaches to the right side of the diminutive suffix in (c) would violate DEP, but no more so than the insertion of an epenthetic [e] to the rightmost consonant of the stem in order to satisfy MIN-FT-REQ in (b). Note that DEP cannot discern between licit and illicit epenthetic segments. The fact that the final stem vowel is not forced to transfer to the word-final position implies that the only obstruction prohibiting a direct stem/suffix alignment in candidate (c) is /θ/ since /o/ is a phonological constituent of the input. Indeed, this does incur a violation of

ALIGN-{it}-R, but candidate (b), the real optimal output, incurs two violations of this constraint by inserting a fully epenthetic [e] and an adjunct segment [θ] between the stem and suffix. Fundamentally, this tableau proves that morphological alignment and certain operations of prosodic well-formedness **cannot interact in a single-tiered hierarchy**.

Now, let us turn our attention to a case in which the phonological condition which motivates /θ/ insertion is supplied by the input. In the cases in which /θ/ inserts between a final stem segment /n/ or /r/ and the diminutive morpheme, the emergence of /θ/ seems to be governed by a tendency to maintain the syllabic/moraic structure of the unmodified stem in the diminutive form. Observe the following data:

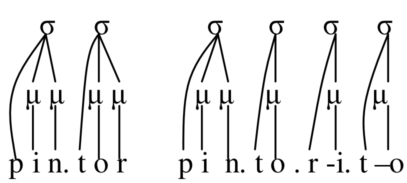
(40)

-pintor	→	pintor[θ]-it-o
-joven	→	joven-[θ]-it-o
-Carmen	→	Carmen[θ]-it-a
-examen	→	examen[θ]-it-o

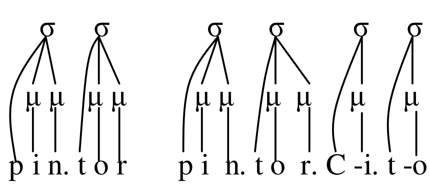
It is clear that in these cases the adjunct consonant inserts in order to avoid the resyllabification of the phonological constituents:

(41)

Resyllabification with no insertion



Blocking of resyllabification by inserting adjunct segment[16]



[16] Again, we claim this to be a residual effect leftover from historical hierarchies carried over into Modern Spanish.

Perceptibly, the main difference between the phonological condition which prompts /θ/ insertion in the disyllabic examples with penultimate diphthongs and the diminutives of non-monosyllabic forms ending in /r/ or /n/ is that the context in these latter cases is supplied by the input itself, while /θ/ insertion in the former cases must arise from constraint interaction in a preceding phonological stratum. Since the final vowel of the diminutives in (38) is ordered specially by a constraint which situates a gender marker to the right edge of the diminutive suffix in accordance with the morphosyntactic gender of the stem, it is logical to assert then that the phonological condition motivating /θ/ insertion in these forms can interact with alignment in a single hierarchy. Notice there is no conflict involved in supplying a stem-final vowel to the right margin of the diminutive suffix.

Still and yet, in cases in which the final underlying vowel of the stem is /e/, (see 35e), /θ/ inserts to satisfy the tendency for peaks to align to a prenuclear consonant. As we have seen in past chapters, this process is profusely documented in the phonological literature. Similar to our last case, the input of these diminutive forms provides the phonological condition which activates the insertion of /θ/. Again, as in our last case, there is no reason to believe that insertion and alignment cannot interact in a single phonological cycle.

Finally, we must consider the phonological condition which motivates the insertion of /θ/ in the forms such as those found in (35b), which are disyllabic and end in a rising diphthong. Observe once again the following data set:

(42)

-bestia	→	-bestiecita	[bés.tja] →[bes.tje. θí.ta]	(*beast*)
-(el) radio	→	-radiecito	[rá.djo] →[ra.dje. θí.to]	(*spoke of a wheel*)
-patio	→	-patiecito	[pá.tjo] →[pa.tje. θí.to]	(*playground*)

First, alignment of the final vowel to right margin of the diminutive suffix is determined by a hierarchy in which ONSET dominates ALIGN-{it}-R, producing an intermediary form [[[patj]-it]-o]. Subsequently, /e/ infixation is motivated by a dominant well-formedness constraint which prohibits peaks from surfacing with a diphthong [ji] in optimal outputs, *PEAK/[ji]. If *PEAK/[ji] interacted with ALIGN-{it}-R in a single hierarchy than a sub-optimal output *[patjoθíto] would be unavoidable. It is evident that the insertion of /e/, therefore, functions as a strategy whereby to supply a viable nucleus for the stem-final segment [j], and at the same time, allow the stem-final vowel to be displaced to the right margin of the diminutive suffix: [patj]-e{it}–o. Of course, this strategy incurs an incidental violation of DEP by inserting a segment which does not form part of the phonological representation, and simultaneously leaves the initial vowel of the diminutive suffix without a prenuclear segment to which it may align, thus providing the proper phonological condition to justify the insertion of /θ/. Noticeably, the phonological context which prompts the surfacing of /θ/ in these cases must be derived from constraint interaction.

All of the data we have seen up to this point can be configured into the following hypotheses:

(43)

Hypotheses pertaining to adjunct segment insertion in Spanish (/θ/).

1. The output segment [θ] which emerges in Spanish diminutive forms corresponds to an underlying element /θ/.
2. The insertion of /θ/ is phonologically conditioned.
3. /θ/ is morphologically and lexically associated with the diminutive morpheme {it}, due to a process of diachronic reanalysis, but does not constitute a formal part of the stem or morpheme.
4. The shape of the segment is justified by faithfulness principles while its insertion is conditioned by markedness.

We formalize the following provisional constraint to justify the insertion of /θ/ in optimal diminutive outputs. For now, we will maintain that /θ/ emergence is produced by input/output correspondence, although some revisions may be needed for future research. Basically, we maintain that /θ/ is associated with the diminutive morpheme at the underlying level, meaning that its emergence in optimal outputs can be justified as a function of correspondence.

(44)

ADJ-SEG (IDENT)
An input adjunct segment must appear in the output.

Modelling the generalizations that we have seen up to this point is not such a straightforward matter. We have claimed that the insertion of the adjunct segment /θ/ is conditioned by the phonological environment, a seemingly innocuous assertion. In some cases, examples (35d), (35e) and (35f), we have claimed that the phonological environment is a product of the input structure. In other cases, examples (35a), (35b), (35c) and (35g) we proposed that the phonological condition is derived in an intermediary pass as a result of constraint interaction.

One of the obvious difficulties our model faces is that OT does not permit multi-tiered processing. That is to say that all phonological generalizations must be processed in one step between the input and the output. In OT terminology, this is what is known as a one-step mapping. The facts we have examined concerning the insertion of the adjunct segments in certain diminutive forms, nevertheless, all insinuate that the formation of determined forms is cyclical. Up until this point we have not had to contemplate any other strategy by which to justify a phonological generalization since all of the processes we have examined in this thesis could be easily explained in one pass between the underlying and surface representations. Now, however, we must seriously consider the idea that certain diminutive forms cannot be justified in a single-tiered paradigm. Among these forms are those in which the phonological context motivating segment insertion is not a product of input structure.

To recall, we have claimed that the shape of the adjunct segment is defined by input identity, requiring a direct correlation of a morphologically and lexically associated underlying segment /θ/ with its output counterpart. Naturally, the shape of the segment is irrelevant if the demands made by prosody/phonology do not emerge dominant.

If we focus on insertion of the segment in a single-tiered hierarchy, then a demand on the minimal size of words, in conjunction with ONSET, would merely produce sub-optimal strategies such as productive epenthesis. Neither, however, can we simply program a correspondence relationship between the input and output adjunct segment because without the effects induced by the dominant prosodic constraint, there is no contextual justification for which to maintain this type of correlation. The dilemma is that prosody cannot make demands until the morphology supplies the affix, challenging any rationale for a one-step justification.

We base our justification of segment insertion in the examples found in (35a), (35b) and (35c) on a concept which we will call here *context conditioned faithfulness*.

Basically, this concept proposes that faithfulness in certain cases is not context-free, but rather can be activated when a higher ranked well-formedness constraint creates an environment which provokes a dormant faithfulness correspondence to surface. Although much of the hypothesis on which we will base our concept is related in spirit to the notion of *Positional Faithfulness* (Beckman, 1997)[17], the conception we espouse here has been specifically developed to treat the interaction of prosodic, phonological and morphological principles at morpheme boundaries and across morphophonological cycles.

As we shall soon see, one of the inherent benefits of the model we will propose and justify throughout the rest of this chapter is that it makes important concessions to the phonology that purely morphological studies dismiss. For example, let us compare the justification we propose with one based on allomorphy, taking into account an input *–/pan/* (*-bread*). Our argument asserts that a minimal requirement of two binary feet for optimal diminutive forms creates a phonological environment in which two vowels appear contiguously: [pa.ne][í.to]. In this context, /θ/ inserts to provide an onset for /i/. But as we have mentioned, /θ/ does not so much emerge as it is simply retained in the optimal output by way of identity correspondence, which is activated by MIN-FT-REQ.

The morphological argument however purports that a monosyllabic input /pan/ must align to an allomorph *–ecito*, effectively ignoring any and all prosodic and phonological stipulations made by the grammar. For this reason, morphological arguments are detrimentally challenged by the allomorph alternations *–cit*/*-ecit* that we

[17] The notion of positional faithfulness is indirect contrast to contextual markedness. Essentially, this concept maintains that certain phonological contexts are more susceptible to certain phonological processes, and the syllabic position a phoneme occupies may prevent certain processes. Consider place assimilation of lateral /l/ in coda position. This consonant assimilates the place of articulation of the preceding onset, as many codas do, in order to satisfy AGREE. The fact that onsets most often do not acquiesce to the place of codas implies that phonemes in certain syllabic positions, in this case onsets, require a fully faithful segment representation in the surface level. In other words, a specific process is not banned from taking effect on specific segments, but rather the phonological position of the consonant can determine if a segment may undergo a structural change.

observe in certain Hispano-American diminutive forms, *-pan**ec**ito/-pan**c**ito* (Ambadiang, 1999), since no concession is ever made which recognizes the role that prosody and phonology play in the optimal output. Our model, though, easily explains this alternation as a consequence of the relegation of minimality principles which govern optimal diminutive outputs, while faithfulness, for one reason or another, is retained.

Perceptibly, if insertion of /θ/ is governed by faithfulness correspondence as we propose, then there is no inherent violation of DEP, as there would be with simple epenthesis, because /θ/ interacts with the morpheme {it} at the underlying level. At the same time, the fact that this segment is paradigmatically disassociated from the morpheme means that we would not be justified in proposing a violation of MAX in cases in which the segment does not surface, since technically the segment is not deleted, but rather is simply not provoked to emerge in these contexts.

Let us schematicize the relationship between prosodic/phonological well-formedness and identity with a concrete example: *-hueso→huesecito* (*-bone*). Effectively, a diminutive suffix {it} must align to the right edge of the input stem /weso/. We have seen that when ONSET dominates ALIGN-{it}-R, the diminutive suffix aligns to the final stem consonant while the final vowel affixes to the right margin of the diminutive suffix, leaving a degenerate foot [we]: we[sí.to]. In the following cycle, a dominant constraint which imposes a minimal foot size of two binary feet on diminutive forms of disyllabic stems containing penultimate diphthongs, represented here by MIN-FT-REQ, would provoke /e/ epenthesis to the right edge of the stem, leaving the initial vowel of the suffix with no prenuclear segment to which to align. Faithfulness correspondence, represented by ADJ-SEG, would essentially require the underlying /θ/ to surface in order to fill this position and vacuously satisfy a constraint requiring peaks to align to onsets:

(45)

Input: /weso/ θ-----{it}

1st cycle ONSET»ALIGN-{it}-R

↓

we[bí.to][18]

2nd cycle MIN-FT-REQ » ADJ-SEG » DEP

↓

Output: [wè.se][θí.to]

This model implies an inherent correlation between the adjunct segment and certain stem types, indicating that a speaker should be intuitively aware that /θ/ is connected to specific inputs. By virtue of the fact that the adjunct segment is morphologically and lexically related to the diminutive morpheme, hypothetically, the adjunct segment can appear independently of the phonological condition which motivates its insertion. Interestingly we see evidence corroborating this claim in Ambadiang's (1999) Hispano-American variant forms *–pancito*/*-panecito*. In essence, we claim that MIN-FT-REQ and ADJ-SEG are intimately connected paradigmatically yet contextually independent.

Characterizing the paradigmatic correlation between MIN-FT-REQ and ADJ-SEG is clearly a foremost priority for our study. It is obvious from the schema above that the former constraint must dominate the latter in order to produce an optimal diminutive output. What is not clear from the schema above however is that MIN-FT-REQ must *always* dominate ADJ-SEG, according to our context conditioned approach, since ADJ-

[18] The notion of minimality in these examples is intimately related to a ban which prohibits degenerate feet in certain outputs.

SEG essentially provides the phonological solution to the condition provoked by MIN-FT-REQ. In a similar way, ADJ-SEG must in turn dominate alignment, since placement of the adjunct segment always interrupts a perfect stem/morpheme alignment.

Focus of the following hierarchy and tableau which represent the second of a two-cycle process:

(46)
MIN-FT-REQ»ADJ-SEG»DEP

(47)
Input 2nd cycle: wes-it-o

	MIN-FT-REQ	ADJ-SEG	DEP
☞a. wesecito			*
b. wescito	*!		
c. wesito	*!	*	

As we can see, candidate (a) turns out optimal since the output is parsed into two binary feet and the adjunct segment is retained between the suffix and the epenthetic /e/. Candidate (b) is eliminated by the dominant constraint for ignoring the stipulation that diminutive forms of monosyllabic consonant-final stems be parsed into two binary feet. Candidate (c) violates the dominant two constraints in order to satisfy ALIGN-{it}-R, a sub-optimal strategy.

6.3 OUR ANALYSIS

In the past sections we have addressed individually the key issues concerning diminutive formation in Spanish. In this section, however, our objective is to rank the generalizations we have discovered, in addition to programming other intervening constraints, in order to offer an integral model of Spanish diminutive formation. We will first present all the data and later examine each form separately. Where two diminutive forms are possible, we will include alternative rankings in a foot note at the bottom of the page. We do this in order to maintain a certain organization and to not detain our study unnecessarily on trivial rankings. Subsequently, we will discuss some less frequent forms of Spanish diminutives and offer an analysis based on conflict resolution.

In §6.2.3 we claimed that some optimal diminutive forms cannot be predicted by way of constraint interaction in a single cycle. Our rationale was that certain phonological operations cannot apply until after alignment of the diminutive suffix is effectuated. To justify these forms we proposed a two cycle paradigm in which ONSET and ALIGN-{it}-R interact in the first cycle to situate the diminutive suffix to the stem-final consonant, simultaneously satisfying ONSET while forcing the final vowel of the stem to be displaced to the right margin of the diminutive suffix. Later, well-formedness requirements prompt a series of changes which result in the insertion of an epenthetic /e/ followed by /θ/ in the desired output. Although various models exist in the literature to handle this type of serialism, it is not our intention in this section to favor one over the other. For this reason, in our justifications of certain forms in which the adjunct segments surface, we will represent each cycle as a separate tableau.

Consider once more the data of Spanish diminutive formation:

(48)

(a)

Regular forms				
-gato	→	-gatito	[gá.to]→[ga.tí.to]	(*cat*)
-casa	→	-casita	[ká.sa]→[ka.sí.ta]	(*house*)
-lobo	→	-lobito	[ló.βo]→[lo.βí.to]	(*wolf*)
-abuelo	→	-abuelito	[a.βwé.lo]→[a.βwe.lí.to]	(*grandfather*)

(b)

Diminutives of disyllabic forms with diphthongs in penultimate syllable:				
-huevo	→	-huevecito	[wé.βo]→[we.βe.θí.to]	(*egg*)
-hueso	→	-huesecito	[wé.so]→[we.se.θí.to]	(*bone*)
-reina	→	-reinecita	[réj.na]→[rej.ne.θí.ta]	(*queen*)

(c)

Diminutives of disyllabic forms with final diphthong				
-bestia	→	-bestiecita	[bés.tja] →[bes.tje. θí.ta]	(*beast*)
-(el) radio	→	-radiecito	[rá.djo] →[ra.dje. θí.to]	(*spoke of a wheel*)
-patio	→	-patiecito	[pá.tjo] →[pa.tje. θí.to]	(*playground*)

(d)

Monosyllabic forms ending in a consonant				
-solØ	→	-solecito	[sól]→[so.le.θí.to]	(*sun*)
-panØ	→	-panecito	[pán]→[pa.ne.θí.to]	(*bread*)
-mesØ	→	-mesecito	[més]→[me.se.θí.to]	(*month*)
-reyØ	→	-reyecito	[rej]→[re.je.θí.to]	(*king*)

(e)

Diminutives of non-monosyllabic forms ending in /n/ and /r/				
-pintorØ	→	-pintorcito	[pin.tór]→[pin.tor.θí.to]	(*painter*)
-CarmenØ	→	-Carmencita	[kár.men]→[kar.men.θí.ta]	(*proper name*)

(f)

-e(Ø) stem diminutives				
-padre	→	-padrecito	[pá.ðre]→[pa.ðre.θí.to]	(*father*)
-jefe	→	-jefecito	[xé.fe]→[xe.fe.θí.to]	(*boss*)
-clase	→	-clasecita	[klá.se]→[kla.se.θí.ta]	(*class*)

(g)

Athemetic stem diminutives		
-sofá	→	-sofacito (*sofa*)
-mamá	→	-mamita/mamacita (*mom*)
-papá	→	-papito/papacito (*dad*)
-virus	→	-virusito (*virus*)
-brindis	→	-brindisito (*toast*)

(h)

Cases of morpheme infixation		
-azúcar →	-azuquítar/azuquillar	[a.θú.kar] → [a.θu.kí.yar] (*sugar*)
-problema→	-problemita	[pro.βlé.ma] →[pro.βlé.ma] (*problem*)
-cura →	-curita	[kú.ra] →[ku.rí.ta] (*priest*)
-moto →	-motito	[mó.to] →[mo.tí.to] (*motorcycle*)

(i)

Pseudoplural diminutives		
-crisis →	crisecita	[krí.si-s] →[kri.se. θí.ta] (*crisis*)
-dosis →	dosecita	[dó.si-s] →[dó.se.θí.ta] (*dose*)
-Sócrates→	Socratito	[só.kra.t-e-s] → [só.kra.t-ít-o] (*Socrates*)
-análisis →	analisito	[análisis] → [a.ná.li.s.ít-o] (*analysis*)

6.3.1 Regular forms

The forms presented in (48a) present few theoretical difficulties for our constraint-based paradigm. Basically, our model must express the fact that perfect alignment of the diminutive morpheme, {it}, is subordinate as a priority to the requirement that peaks be adjoined to onsets. In OT, we have seen that this manifestation is carried out by constraint ranking. Regardless of the quantity of minor intervening constraints, in our model, ONSET[19] must dominate ALIGN-{it}-R.

Our correspondence constraints DEP and MAX must assume medial positions since segment deletion and insertion are unwarranted in these regular forms. There is no need to program a constraint requiring that a gender marker align to the right edge of the suffix since the regular forms always end in the default vowel of their respective morpho-syntactic gender. Consider the following hierarchy and tableau:

(49)
DIM-MORPH » ONSET » MAX-V » DEP » ALIGN-{it}-R

[19] We could modify ONSET to only take effect across morphological domains, the result being a more accurate description of the process involved in diminutive formation. Recall that V syllables are perfectly permissible in Spanish. By programming ONSET to a dominant position, stem syllables of the type V would also be forced to supply the peak with an onset in order to satisfy ONSET, a process which does not normally occur. However, for our analysis, such an alteration is not needed since we will present no input which contains onset-*less* syllables.

(50)
Input: /gato/ + {it}

	DIM-MORH	ONSET	MAX-V	DEP	ALIGN-{it}-R
a. gato-it-o		*!		*	
☞b. gat-it-o					*
c. gato-it		*!			
d. gato	*!				
e. gat-it			*!		*
f. gato-t			*!		*
g. gato-[t]-it				*!	*

In this tableau, candidate (b) emerges optimal as it only commits a minor violation of the most inferior constraint of this particular hierarchy. Candidates (a) and (c) fatally violate ONSET by not providing a prenuclear consonant for the initial vowel of the diminutive suffix. Candidate (d) is eliminated by DIM-MORPH for proposing a diminutive candidate which does not contain the diminutive morpheme {–it}. Candidates (e) and (f) commit important infractions to MAX-V by eliminating underlying vowels from the output. Finally, candidate (g) inserts an epenthetic [t] in order to supply an onset for the initial vowel of the diminutive suffix, but in so doing fatally violates DEP, which bans segment insertion.

6.3.2 Diminutives of disyllabic stems with penultimate diphthongs and consonant-final monosyllables

The diminutive forms of disyllabic words which contain a penultimate diphthong and consonant-final monosyllabic words found in (48b) and (48d) respectively, insert an epenthetic /e/ and an adjunct segment /θ/ between the stem and diminutive morpheme. We explained in the previous section that the insertion of /e/ provides the phonological condition which prompts the insertion of /θ/, hence supplying a necessary onset for the initial vowel of the diminutive suffix. We claimed that the phonological condition activating the insertion of /θ/ is a product of a cyclic paradigm in which alignment of the diminutive morpheme must first apply before the prosodic constraint establishing a minimal foot requirement for optimal outputs may take effect.

If our claim of cyclicity is correct, then we should expect to see alternative forms in the data record which have failed, for one reason or another, to complete both cycles. Indeed we do find that many of the forms which insert the adjunct segments in a second cycle have perfectly acceptable alternative forms in which the adjunct segments do not appear: *-huevecito*/*-huevito*, *-huesecito*/*-huesito* (disyllabic stems with penultimate diphtongs), *Juanecito*/*Juanito* (monosyllable stems ending in a vowel), *-rubito* (from –rubio, blonde) but not **rubiecito*. If we look closely, all of the alternative forms look strikingly similar to how we might expect the outcome of the first cycle of our model to appear, providing vital evidence for our claim.

We claimed that alignment of the diminutive suffix is determined in the first cycle. A secondary effect of this alignment was that the stem-final vowel was forced to align to the right edge of the suffix. We have shown that we can achieve this by way of constraint interaction between ONSET, ALIGN-{it}-R and MAX-V. The ranking schema we offered in §6.2.1 to justify this procedure is offered again in the following example:

(51)
Hierarchy justifying alignment in first cycle of diminutive formation

MAX-V » ONSET » ALIGN-{it}-R

However, we must program a constraint which prohibits segment insertion, DEP, since this strategy could hypothetically satisfy ONSET, producing an illicit output in the first cycle:

(52)
MAX-V » ONSET » DEP » ALIGN-{it}-R

Observe their interaction in the following tableau:

(53)
Input 1st cycle: /webo/ {it}

	MAX-V	ONSET	DEP	ALIGN-{it}-R
☞a. we.βí.to				*
b. we.βo.it		*!		
c. we.βit	*!			*
d. we.βo.tit			*!	*

In this tableau, the candidate that provides an onset for the initial vowel of the diminutive suffix while not deleting any segments from the input is that which results optimal, candidate (a). Candidate (b) aligns the suffix directly to the right margin of the stem, but in so doing fatally violates ONSET. Candidate (c) eliminates the stem-final vowel, incurring a fatal violation of MAX-V, while candidate (c) provides an onset for the initial vowel of the diminutive suffix by way of productive epenthesis, a sub-optimal strategy.

Now in the second cycle, MIN-FT-REQ imposes a minimal size requirement of two binary feet on optimal outputs. Of course, the satisfaction of the minimal foot requirement implies that a restriction banning segment insertion, DEP, must be violated, meaning that this constraint will occupy an inferior position of our second cycle hierarchy. Finally, the insertion of /θ/ is regulated by a correspondence constraint ADJ-SEG. Consider the following hierarchy:

(54)[20]
MIN-FT-REQ » ADJ-SEG » DEP

Observe the predictions this hierarchy makes in the following hierarchy:

[20] We have not programmed any constraint which governs the alignment of epenthetic /e/ to the rightmost consonant of the stem. Technically, an output *[e.we.bí.to] would satisfy our minimal foot requirement. This could be avoided by programming a dominant ONSET, in conjunction with other prosodic constraints, which force the epenthetic segment to align to the rightmost consonant of the stem.

(55)
Input 2nd cycle: webito

	MIN-FT-REQ	ADJ-SEG	DEP
☞a. we.βe.θí.to			*
b. we.βí.to	*!	*	
c. we.βe.tí.to		*!	**

In this tableau, the winning candidate is (a) since the diminutive form contains two binary feet and the adjunct segment is retained in the surface form. Candidate (b) is eliminated by not meeting the minimal foot requirement for optimal outputs while candidate (c) is eliminated for inserting a fully epenthetic [t], instead of [θ], between the epenthetic vowel and initial vowel of the diminutive suffix.

In the first formation cycle of the diminutive forms of consonant-final monosyllabic stems, it is necessary to program a specific constraint which situates a final vowel to the right edge of the diminutive morpheme in accordance with the morphosyntactic gender of the stem. In the following hierarchy we will represent this procedure with the constraint GENDERMARKER that we presented in §6.2.1 (example 22, page 314). The fact that the final consonant of the stem may serve as the onset for the initial vowel of the diminutive suffix implies a perfect stem/morpheme alignment. At the same time, the syllabic restructuration motivated by the alignment of the diminutive suffix incurs an obvious infraction to ALIGN(PD), which requires syllable boundaries to coincide with phonological boundaries. We will assume, therefore, that ALIGN(PD) must be ranked subordinately in relation to ALIGN-{it}-R since the stipulations made by this former constraint are routinely violated in optimal outputs. Focus on the following first cycle hierarchy and tableau:

(56)
GENDERMARKER » ONSET » DEP » MAX » ALIGN-{it}-R » ALIGN(PD)

(57)
Input 1st cycle: /sol/ + {it}

	GENDERMARKER	ONSET	DEP	MAX	ALIGN-{-it}-R	ALIGN(PD)
☞a. so.lí.to						*
b. so.le.θí.to			*!		**	*
c. sol.θí.to					*!	
d. so.lít	*!					*

In the first cycle, candidate (b) turns out optimal. This candidate incurs only a minor violation of ALIGN(PD) by allowing the stem-final consonant to resyllabify as the onset of the following syllable. Although candidate (b) is the optimal candidate in the second cycle, in this round it results sub-optimal due to its fatal violation of DEP for inserting an unwarranted epenthetic /e/. Candidate (c) is the only candidate to satisfy ALIGN(PD), but in doing so fatally violates ALIGN-{it}-R. Candidate (d) is eliminated by GENDERMARKER for not aligning a final vowel to the diminutive form compliant with the morpho-syntactic gender of the stem.

Not surprisingly, the second cycle hierarchy in these monosyllabic cases is the same hierarchy we employed to justify the second cycle of the disyllabic forms above. Consider this hierarchy once more:

(58)
MIN-FT-REQ » ADJ-SEG » DEP

Consider the following tableau:

(59)
Input 2nd cycle: solito

	MIN-FT-REQ	ADJ-SEG	DEP
☞a. so.le.θí.to			*
b. so.lí.to	*!	*	
c. so.le.tí.to		*!	**

Again this hierarchy is capable of predicting the correct output, candidate (a). The only infraction this candidate commits is to DEP, the inferior constraint. Candidate (b) is phonologically viable, but is eliminated in this hierarchy for not presenting an output comprised of two binary feet. Candidate (c) proposes the insertion of a fully epenthetic /t/, forcing a fatal violation of our identity constraint, ADJ-SEG.

6.3.3 Diminutives of disyllabic words with final diphthongs

Contrary to the stimulus which provoked adjunct segment insertion in the previous forms, the motivation behind the insertion of the adjunct segments in diminutive forms of disyllabic stems with final diphthongs is strictly phonological. Essentially, a highly ranked constraint*PEAK/[ji] in the second cycle prohibits the surfacing of a nucleus containing [j] and a high front vowel [i]. In Spanish, this generalization is true in all contexts.

To account for the alignment of the diminutive suffix and the subsequent alignment of the final vowel to the right margin of the suffix, we can recycle the same hierarchy we proposed to justify diminutive forms of disyllabic stems containing penultimate diphthongs. Consider the following hierarchy and tableau:

(60)
MAX-V » ONSET » DEP » ALIGN-{it}-R

Consider the following tableau:

(61)
Input 1st cycle: /patjo/ {it}

	MAX-V	ONSET	DEP	ALIGN-{it}-R
☞a. pa.tjí.to				*
b. pa.tjo.it		*!		
c. pa.tjit	*!			*
d. pa.tjo.tit			*!	*

The second cycle hierarchy as well looks remarkably familiar to the hierarchy we proposed to justify the forms in (48b), although in this current hierarchy we must replace the minimal foot requirement with a stipulation banning peaks that contain a sequence [ji]. Additionally, we must also make a provision which penalizes segment deletion, since this is a viable strategy to avoid the illicit [ji] sequence in the nucleus. Observe the following hierarchy and tableau:

(62)
*PEAK/[ji] » ADJ-SEG » MAX » DEP

(63)
Input 2nd cycle: pajito

	*PEAK/[ji]	ADJ-SEG	MAX	DEP
☞a. pa.tje.θí.to				*
b. pa.tjí.to	*!	*		
c. pa.tje.tí.to		*!		**
d. pat.it.o			*!	

The winning candidate is that which avoids the illicit nucleus by way of vowel epenthesis and adjunct segment insertion, candidate (a). Candidate (b) permits a wholly impermissible sequence to surface in the output and is accordingly eliminated by PEAK/[ji]. Candidate (c) presents an output which is similar to the output in (a). The difference between these two outputs, however, is that candidate (c) allows an unlicensed segment to interrupt the vowel hiatus instead of the segment prescribed by ADJ-SEG. Finally, candidate (d) eliminates [j] from the stem, thus circumventing a fatal violation of the superior constraint, but at the detriment of violating MAX.

6.3.4 Diminutive forms of non-monosyllabic stems ending in /n/ and /r/

As we mentioned previously, the insertion of /θ/ in the diminutive forms found in (48e) is necessary in order to prevent the resyllabification of the phonological constituents upon being modified by the vowel-initial diminutive suffix. Since the phonological condition which activates /θ/ emergence is present in the input, we have no reason to assume that the formation process involved in producing these forms is cyclical. Earlier, we proposed a paradigm in which a constraint ALIGN(PD) mitigated against resyllabification of the stem-final consonant by requiring that phonological domain boundaries coincide with syllable boundaries. In this model, ADJ-SEG was a dependent of ALIGN(PD). Essentially, ADJ-SEG provided the solution to the stipulation proposed by ALIGN(PD).

Of course, both constraints must dominate ALIGN-{-it}-R, since the adjunct segment interrupts a direct stem/morpheme alignment. MAX will occupy a medial position since deletion is never an optimal strategy by which to arrive at the desired output in these forms. Observe the following hierarchy and tableau:

(64)
GENDERMARKER » ALIGN(PD) » ADJ-SEG » MAX » DEP » ALIGN-{-it}-R

(65)
Input: /pintor/ + {it}

	GENDERMARKER	ALIGN(PD)	ADJ-SEG	MAX	DEP	ALIGN-{-it}-R
a. pin.to.ɾ-í.to		*!	*			
☞b. pin.toɾ.θí.t-o						*
c. pin.ti.to		*!	*	**		**
d. pin.to.ɾe-θ-í.to		*!			*	**
e. pin.toɾ.t-í.to			*!		*	*

In this tableau, the optimal output, candidate (b), inserts one adjunct segment /θ/, preventing the stem-final consonant from being resyllabified as the onset of the newly formed syllable. Candidate (e), the closest alternative form, receives one violation mark in ADJ-SEG for inserting an unlicensed segment /t/, and not /θ/ as our identity constraint requires. Candidates (a), (c) and (d) are all eliminated by ALIGN (PD) because the edge of the phonological domain does not coincide with the syllable edge.

6.3.5 Diminutives of stems ending in /e/

Similar to the cases in the past section, the phonological condition which prompts the surfacing of /θ/ in these forms is input-based. A careful inspection of the forms in (48f) reveals that all the phonological constituents of the stem appear adjacently to the left of the diminutive suffix. A final vowel is ordered to the right margin of the diminutive suffix in accordance with the morphosyntactic gender of the stem. An adjunct segment /θ/ intervenes between the stem and diminutive suffix in order to supply an onset for the vowel-initial suffix.

Traditionally, there has been some debate in the literature as to whether the /e/ which precedes /θ/ in the diminutive forms found in (48f) is the stem-final vowel /e/, or the epenthetic segment /e/ which accompanies /θ/ in other cases. If we accept the second argument, then we must program a constraint by which the stem-final vowel is deleted, before being replaced by epenthesis. If, on the other hand, we accept the first argument, which we do, then we only need to program a constraint which justifies the insertion of a single adjunct segment /θ/ since the phonological condition which activates /θ/ insertion is already supplied by the input itself. Aside from being the simpler of the two arguments to justify, here, we accept the first argument on the basis that there is no concrete phonological evidence of any deletion process which eliminates the vowel, only to have it replaced. We claim, as in past chapters, that such a paradigm presents major problems of learnability for our language learner. In this analysis, we will not penalize the presence of /e/ with a violation mark for DEP, as we have done in past analyses, since we claim that the language learner has no way of knowing if the /e/ which precedes /θ/ in these forms is the stem-final vowel or an epenthetic segment.

To rank our production hierarchy, again we can assume that ALIGN-{-it}-R will occupy an inferior position since direct alignment of the diminutive suffix to the right margin of the stem is averted by /θ/. ONSET, supported by ADJ-SEG, will occupy an important position since the initial vowel of the diminutive morpheme always aligns to an onset, the adjunct segment /θ/. CONTIGUOUS, in accordance with MAX will ensure that all constituents of the stem surface contiguously in the surface form. Let us contemplate the following hierarchy and tableau:

(66)
DIM-MORPH » GENDERMARKER » ONSET » ADJ-SEG » CONTIGUOUS » MAX » DEP » ALIGN-{-it}-R

(67)
Input: /nube/ + {it}

	DIM-MORPH	GENDERMARKER	ONSET	ADJ-SEG	CONTIGUOUS	MAX	DEP	ALIGN-{-it}-R
a. nu.βe –it		*!	*	*				
b. nu.β-ít-a				*!	*	*		*
☞c. nu.βe.θ-ít-a								*
d. nu.β-ít –e		*!		*	*			*
e. nu.βe-t-ít-a				*!			*	*
f. nu.βeθ-ít-o		*!						*

In this tableau the winning candidate, candidate (c), is that which satisfies ONSET by retaining the underlying adjunct segment /θ/, as the hierarchy stipulates. Candidate (a) is eliminated for ignoring the well-formedness requirements made by GENDERMARKER, ONSET, and ADJ-SEG. Candidates (b), (d) and (e) all satisfy ONSET but are eliminated for not inserting an adjunct segment. Candidate (f) is eliminated for not affixing the default vowel for feminine nominals, /a/, to the right edge of the diminutive suffix.

6.3.6 Diminutives of athematic stems

As in the previous cases in §6.3.5, the entire stem of the athematic examples appears to the left of the diminutive morpheme. Consequently, a gender marker is needed to affix to the right edge of the diminutive suffix in accordance with the morphosyntactic gender of the stem. In vowel-final items from the athematic stem class, *-sofá* (*-sofa*) for example, an adjunct segment inserts between the stem and diminutive morpheme in order to supply an onset for the initial vowel of the affix. In consonant-final items, ONSET is satisfied vacuously by the final consonant of the stem, signaling that ADJ-SEG will not be programmed hierarchically in these cases.

Since the phonological condition motivating /θ/ insertion in vowel- final stems is supplied by the input, we can reuse the hierarchy we proposed in the past section to justify the desired output. Consider once again the following hierarchy and tableau:

(68)
DIM-MORPH » GENDERMARKER » ONSET » ADJ-SEG » CONTIGUOUS » MAX » DEP » ALIGN-{-it}-R

(69)
Input: /sofå/ + {it}

	DIM-MORPH	GENDERMARKER	ONSET	ADJ-SEG	CONTIGUOUS	MAX	DEP	ALIGN-{-it}-R
a. so.fa –it		*!	*	*				
b. so.f -ít-a		*!		*	*			*
☞c. so.fa .θ-ít-o								*
d. so.f -ít –o				*!	*	*		*
e. so.fa -t-ít-o				*!			*	*
f. so.fa θ-ít-a		*!						*

Again, this tableau has predicted the correct output, candidate (c). This candidate received one violation mark for inserting an adjunct segment /θ/, which impeded a perfect stem/morpheme alignment. This strategy, however, enabled candidate (c) to satisfy the dominant constraints of the hierarchy, yielding an optimal output. Candidate (a) is eliminated for neglecting to provide an onset for the initial vowel of the diminutive suffix, fatally violating ONSET. Candidates (b), (d) and (e) either did not insert any adjunct segment at all, or inserted an erroneous segment not licensed by ADJ-SEG, both of which prove to be sub-optimal strategies. Once again, candidate (f) is eliminated for aligning a final vowel which does not represent the morpho-syntactic gender of the stem.

In order to account for the diminutive forms of sibilant-final items from the athematic stem class, we must retire ADJ-SEG from the present hierarchy since the phonological condition which activates segment insertion in optimal outputs is not present. The fact that the stem-final consonant is permitted to resyllabify as the onset of the following syllable indicates that ALIGN(PD) will have to occupy an inferior position of our hierarchy. Observe the following hierarchy and tableau which account for the diminutive forms of athematic stem items ending in a consonant /s/:

(70)
DIM-MORPH » GENDERMARKER » ONSET » CONTIGUOUS » MAX » DEP » ALIGN-{-it}-R » ALIGN(PD)

(71)
Input: /birus/ + {it}

	DIM-MORPH	GENDERMARKER	ONSET	CONTIGUOUS	MAX	DEP	ALIGN-{-it}-R	ALIGN(PD)
a. bi.ɾus –it		*!						
☞ b. bi.ɾus -ít-o								*
c. bi.ɾ-ít –o				*!	**		**	*
d. bi.ɾus -t-ít-o						*!	*	
e. bi.ɾe θ-ít-o				*!	**	*	**	*
f. bi.ɾ-it-us		*!		*			**	*

Here, candidate (b) emerges optimal since it satisfies all the constraints excluding ALIGN(PD), which it violates by allowing the stem-final consonant to be incorporated as the onset of the following syllable. Candidates (c), (e) and (f) incur infractions to CONTIGUOUS upon presenting outputs in which the integrity of the stem is compromised in order to satisfy ONSET. Candidates (a) and (f) are eliminated for not affixing a gender marker, while candidate (d) is eliminated by DEP for inserting a superfluous and unwarranted epenthetic segment /t/.

6.3.7 Diminutives of pseudoplural stems

Pseudoplurals do not form a natural stem class in Spanish, but rather pertain to one of the other groups we outlined at the beginning of this chapter. It is reasonable therefore that there is not one singular hierarchy governing the diminutive forms of these items, but various, depending on the stem class to which they pertain. Essentially, each pseudoplural follows the production hierarchy we have given for the specific stem class with which the word is associated.

The distributional evidence indicates that diminutive forms of pseudoplurals which retain their stem-final sibilant always proceed from the –o/-a stem classes (Bermúdez-Otero, 2006). It is believed that this stem class allows the diminutive morpheme in certain instances to function as an infix. The morpheme in diminutive forms from the –e/(Ø) and athematic stem classes, conversely, must operate as a suffix, meaning among other things that the stem-final sibilant in these cases will be precluded in optimal outputs: thus in –a/-o stems, –*Carlos*→*Carl-it-os*, but in athematic stems, -*crisis*→–*cris-ec-it-a* (Bermudez-Otero). In this section, we will justify this deviation as a consequence of the conflict resolution between phonological well-formedness and alignment.

We can arrive at a paradigm which accounts for the infixation of the diminutive morpheme in items proceeding from the –o/-a stem classes by programming a constraint ALIGN(PD) to a hierarchical position superior to ALIGN-{it}-R. Again, ONSET must play an important role, since the optimal output systematically aligns the vowel-initial morpheme to a prenuclear segment. Finally, CONTIGUOUS must occupy the most inferior position of this hierarchy since there is no way to simultaneously satisfy ALIGN(PD) and the requirement that adjacent input segments be represented contiguously in the output. Focus on the following hierarchy and tableau which account for diminutive infixation in –o/-a pseudoplurals:

(72)
DIM-MORPH » ONSET » ALIGN(PD) » DEP » MAX-C » MAX-V » ALIGN-{-it}-R » CONTIGUOUS

(73)
Input: /karl-os/ + {it}

	DIM-MORH	ONSET	ALIGN(PD)	DEP	MAX-C	MAX-V	ALIGN-{it}-R	CONTIGUOUS
a. kár.l –it-o					*!		*	*
☞b. kár.l –it-os							**	*
c. kár.lo.s –it-o			*!	*				
d. kár.lo.s-it-o-s			*!	**				
e. kár.l-it					*!	*	*	*
f. kár.los.t-it-o				*!*			*	
g. ka.ɾ-it-los							*!**	*
h. k-it-aɾ.los							**!**	*

In this tableau, candidate (b) emerges as the optimal output due to its satisfaction of the highly ranked constraints, while only minimally violating the inferiorly ranked ALIGN-{-it}-R and CONTIGUOUS. Candidate (a) is eliminated by MAX-C for deleting the stem final /s/. Candidates (c) and (d) violate ALIGN(PD) by allowing the stem-final segment to resyllabify as the onset of the new syllable [si], fatally violating

ALIGN(PD). Candidate (e) is eliminated by MAX-C for deleting the stem-final consonant. Candidate (f) avoids a violation of ALIGN(PD) upon inserting an extra segment /t/, which in turn fatally violates DEP. Candidates (g) and (h) are eliminated by ALIGN-{-it}-R for situating the diminutive morpheme two and three syllables, respectively, from the right word margin.

Let us consider another diminutive form of a pseudoplural in which the stem-final segments appearing in the unmodified form are precluded in the diminutive context: *-crisis*→*-crisecita* [[kɾis-i]-s]→[[[[kɾis]-eθ]-ít]a] (*-crisis*). We mentioned earlier that this is only possible in diminutive forms of pseudoplurals from the –e(Ø) and athematic stem classes, since the diminutive morpheme in these cases must function as a suffix. Observably, the phonological condition which prompts adjunct segment insertion in these forms is derived from constraint interaction in separate cycles.

In the case of *–crisis*/*-crisecita*, our language learner categorizes the stem of –*crisis* as /kɾis/ *-is*, a monosyllabic consonant-final stem. Given this categorization then, it is completely predictable that the adjunct segments /e/ and /θ/ will surface in the second cycle in order to fulfill the minimal foot requirement. In this way, the diminutive form of *-crisis* is produced as any other monosyllabic gloss from the –e(Ø) stem class would be.

In order to represent this process hierarchically, we will take advantage of the ranking scheme we presented in §6.3.2 to justify diminutive forms of monosyllabic consonant-final stems. We present this hierarchy again for ease:

(74)
GENDERMARKER » ONSET » DEP » MAX » ALIGN-{it}-R » ALIGN(PD)

(75)
Input 1st cycle: /kris/-is + {it}

	GENDERMARKER	ONSET	DEP	MAX	ALIGN-{-it}-R	ALIGN(PD)
☞a. kɾi.sí.ta						*
b. kɾi.se.θí.ta			*!		**	*
c. kris.θí.ta					*!	
d. kɾi.sít	*!					*

Candidate (a) is the optimal candidate in this cycle. The only violation mark this candidate accrues is to ALIGN(PD), the inferior constraint of the hierarchy. Candidate (b) is eliminated for a fatal violation of DEP, while candidate (c) is eliminated by ALIGN-{it}-R for inserting an unwarranted segment between the stem and diminutive suffix. Candidate (d) does not align a final vowel to the right margin of the diminutive suffix and is consequently discarded by GENDERMARKER.

The second cycle hierarchy appears as the following:

(76)
MIN-FT-REQ » ADJ-SEG » DEP

Consider the following tableau:

(77)
Input 2nd cycle: kɾisita

	MIN-FT-REQ	ADJ-SEG	DEP
☞a. kɾi.se.θí.ta			*
b. kɾi.sí.ta	*!	*	
c. kɾi.se.tí.ta		*!	**

Predictably, this hierarchy again chooses the correct output, candidate (a). Although this candidate incurs a violation of DEP for inserting non-underlying segments in the output, this strategy is still deemed optimal due to the inferior ranking of this constraint. Candidate (b) presents an output with only one binary foot, violating the superior constraint of the hierarchy. Candidate (c) satisfies the minimal foot requirement but inserts an epenthetic /t/ to interrupt the vowel hiatus between /e/ and the initial vowel of the diminutive suffix.

6.3.8 Infixation in non-pseudoplural forms

In the previous section, we based our argument explaining divergent diminutive forms of pseudoplurals around the notion that, in certain cases, the diminutive morpheme can operate as an infix, while in other cases, the morpheme functions unquestionably as a suffix. Let us consider further data of infixation in Spanish diminutive forms:

(78)
Morpheme infixation in non-pseudoplural diminutive forms

a. –azúcar	→-azuquítar/azuquillar		[a.θú.kar] → [a.θu.kí.yar] (*sugar*)
b. –problema	→	-problemita	[pro.βlé.ma] →[pro.βlé.m-ít -a] (*problem*)
c. –cura	→	-curita	[kú.ra] →[ku.r-ít -a] (*priest*)
d. –moto	→	-motito	[mó.to] →[mo.t-ít -o] (*motorcycle*)

Observably, the final vowels of the examples presented in (78b), (78c) and (78d) do not correspond with the default vowel associated with their respective gender classes. That is, all the words that end in /a/ in this particular data set are actually masculine nouns, whereas all the words that end in /o/ are feminine nouns.

We see that in the diminutive forms of these items, the stem-final vowel is always maintained. This is in contrast to the diminutive forms of nominals from the –a/-o stem classes, in which the gender of the stem is always manifest in the final default vowel associated with feminine and masculine nouns. This represents a structural and paradigmatic rupture from the diminutive forms of the –e(Ø) stem class as well, in the sense that in these cases a specific constraint obliged the appearance of a word-final vowel which coincided with that of the morphosyntactic gender of the stem.

From the modeling perspective, this detail does not pose any threat to our constraint-based model. In fact, as we will soon see, these forms entail the least cumbersome hierarchy of all our forms. Basically, ALIGN-{-it}- R[21] must occupy an inferior position of the hierarchy since it is routinely violated by the optimal output. Again, ONSET must occupy one of the dominant positions, followed by MAX and DEP. Consider the following hierarchy and tableau:

(79)[22]
DIM-MORPH » ONSET » MAX » DEP » ALIGN-{-it}-R

(80)
Input: /problema/ + {it}

	DIM-MORPH	ONSET	MAX	DEP	ALIGN-{-it}-R
a. pro.βle.ma.θ-ít-o				*!*	
☞b. pro.βle.m-ít-a					*
c. pro.βle.m-eθ-ít-o			*!	***	**
d. pro.βle.ma-it		*!			

This tableau produces an optimal output in which the diminutive morpheme is forced to align to the closest onset available, the last consonant of the stem. As deletion and insertion are strictly forbidden, there is no other choice. Candidate (b) results optimal since the diminutive morpheme aligns to the final consonant of the stem, serving as an onset for the initial vowel of the morpheme. Candidate (d) aligns the morpheme directly to the right edge of the stem, violating ONSET, while candidates (a) and (c) are eliminated for inserting and deleting segments, respectively.

Now, we must make a minor modification to this basic hierarchy in order to justify the irregular forms such as *–azuquí<u>t</u>ar*/*-azuquí<u>ll</u>ar* (dim. of *–azúcar*, Eng. -*sugar*)

[21] In order to justify the infixation of the diminutive suffix, it would be possible, maybe even desirable, to alter our alignment constraint, ALIGN-{-it}-R such that it stipulates that the diminutive morpheme must align to a stem internal constituent. As it is, the morpheme already does this by constraint ranking. However, the astute reader will notice a slight incongruence in our paradigm. On one side we claim that the morpheme is a programmed infix, but in the hierarchy we represent this infixation as a lack to align to the right edge of the stem. We have done this for clarity, and to maintain a certain regularity in our analysis. The end result is a discrepancy of implementation and not any underlying problem with the analysis itself.

and –*Victítor* (dim. of -*Victor*), since ONSET and ALIGN-{-it}-R can both be satisfied by direct alignment of the diminutive morpheme to the rightmost word margin. Since the stem-final segment in these cases is a consonant, there is no infraction to well-formedness by aligning the diminutive morpheme to the rightmost margin of the stem.

The alignment of the diminutive morpheme to the right margin of the word-final consonant, however, would produce an output which seriously violates the ban requiring phonological domain boundaries to align to syllable boundaries. By ranking ALIGN(PD) to a superior position in relation to ALIGN-{-it}-R, we can once again justify morpheme infixation as a strategy by which to avoid the misalignment of the phonological domain boundary to a corresponding syllable boundary. Notice that in vowel-final bases, there is no logical way to violate this ban since vowels will always constitute the nucleus of any syllable. Let us consider the following hierarchy:

(81)
DIM-MORPH » ONSET » ALIGN(PD) » MAX » DEP » ALIGN-{-it}-R
CONTIGUOUS

This hierarchy expresses that (1) the diminutive morpheme must align to a prenuclear consonant other than that which appears stem-finally, (2) neither segment deletion nor insertion are viable strategies by which to satisfy ONSET and, (3) if possible, the adjacent elements of the input should appear contiguously in the output. Let us observe how this conflict is resolved in the final tableau:

(82)
Input: /aθůkar/ + {it}

	DIM-MORPH	ONSET	ALIGN(PD)	MAX	DEP	ALIGN-{-it}-R	CONTIGUOUS
a. a.θu.ka.ɾ-it-			*!				
b. a.θú.ka.ɾ-i.t-o			*!		*		
☞c. a.θu.k-í.t-aɾ						**	*
d. a.θ-i.t-u.kaɾ						*!**	*
e. –i.ta.θu.kaɾ		*!				**!**	*

Not surprisingly, our model is again capable of predicting the desired output, candidate (c). This candidate accrues violations of the inferior two constraints, but due to the present ranking in this hierarchy these do not count as fatal violations. Candidates (d) and (e) are eliminated by proposing diminutive forms in which the morpheme infixes three and four syllables, respectively, from the right word margin, provoking flagrant violations of ALIGN-{-it}-R. Candidates (a) and (b) align the morpheme to the right margin of the stem, and in so doing, incur fatal violations of ALIGN(PD).

6.4 CONCLUSIONS

In this chapter, we have offered an exhaustive analysis of Spanish diminutive formation based on the conciliation of a few key universal constraints governing structural well-formedness and morphological alignment. We illustrated that a paradigm headed by principles of prosodic and phonological well-formedness is capable of yielding the desired diminutive form in all stem classes. Although our model has varied in each instance with regard to the specific well-formedness constraints and their subsequent ranking, one aspect has remained constant; the optimal output is always produced by the following typology: phonological shape » morphological alignment.

That is not to say, however, that all forms have satisfied these conditions in the same fashion. In fact, each form that we have seen has offered its own unique interpretation of the constraints, taking into account the other limitations that each form has on hand.

One of the major contributions of our model based on context conditioned faithfulness is the formalization of the adjunct segment /θ/ as a phonologically conditioned affix. This classification allowed us to justify /θ/ as a formal constituent of diminutive formation without having to postulate this segment as a productive epenthetic unit. In so doing, we were able to justify the productive insertion of /θ/ as an operation of the grammar without having to hypothesize separate diminutive allomorphs. One of the secondary side effects of our model is that we were able to circuitously illustrate the efficiency and effectiveness of Bermúdez-Otero's stem class categorization and this taxonomy's impact on morphologically derived forms.

The facts we examined lead us to propose that the formation of certain diminutives may be cyclical. We claimed that the phonological conditions motivating segment insertion may fall into one of two categories. We illustrated that the phonological condition prompting the insertion of /θ/ in certain forms is not available at the underlying level, and may only be derived as a fallout of constraint interaction in a previous cycle. For these cases, we demonstrated that a stratified justification was necessary in order to account for the fine nuances of segment insertion. We mentioned that in strictly parallel models of OT, this type of serialism is not an option due to the notion of a one-step mapping paradigm. However, such claims have become so commonplace in the contemporary OT literature that this minor detail seems to represent a mere question of implementation instead of a major challenge to OT's validity as a unified theory of grammar.

7

CONCLUSIONS, DISCUSSION AND REFLEXIONS

7.0 CONCLUSIONS

Optimality Theory forces us, in a formal way, to ponder the grammar internally, in terms of a polysystemic network dominated by two principal competing forces: faithfulness and markedness. This represents an important theoretical rupture from Generative architectures which envisaged the production grammar as little more than a schematic catalog of linear rules, which only served to induce some structural alteration, leaving unformulated any explanation as to why certain changes may not occur in a given context. A natural result of OT's constraint-based framework is the obligatory incorporation of a multiplicity of phonological information in order to justify a determined form, and to discard sub-optimal ones. Of course, the study of Spanish phonology has prospered exponentially as a direct consequence of this theoretical movement based on conflict resolution.

Chapter 1 of this thesis exposed the phonemic and allophonic inventory of the Spanish spoken in Madrid, Spain. We illustrated that phonemes can be described using a finite set of underlying binary features which ultimately determine the interaction of the phonological constituents.

Phonemes, however, are but one facet of the meaning-to-sound mapping. In order for communication to occur, some process must occur by which the mental representation of sounds, phonemes, materialize into concrete acoustic units, allophones. We showed that one way to formally capture this process is by way of a phonological generalization, which induces a feature transformation between the two levels of representation. The way in which a generalization may be carried out by the production grammar has been one of the main focuses of this thesis.

We considered the idea that phonological generalization can be effectuated by an ordered rule, of the generative type. Implicit to this argument is the idea that our language learner, during her formative years, must be able to deduce individual rules from the linguistic environment, and subsequently order these rules, linearly, to produce a desired form. Although capable of yielding the desired output, we illustrated that rule ordering is intrinsically opaque, limited in scope and effectively indiscriminate, in the sense that rules can only identify desired outputs, omitting any calculation as to why other viable forms may be discarded.

As an alternative, we based our analyses on conflict resolution. We addressed several gaps left by generative frameworks such as the formal preclusion of sub-optimal forms, its incapacity to model cross-linguistic data into one succinct hierarchy which treats the process itself, and not a particular language's reaction to it, and, crucially, how to rectify the inherent theoretical asymmetries between input-oriented frameworks and the empirical and quantitative output data.

An important part of this first chapter was the idea that the context in which a phoneme appears can have a major impact on the surface form. When sibilant /s/ and the interdental fricative /θ/ appear in coda positions preceding another consonant marked for [+voice], the positive feature value of the second consonant extends leftward, motivating the transformations, /s/→[s̬] and /θ/→[ð]. When vowels precede nasal consonants, the positive feature value for [nasal] affects the preceding nucleus, creating nasalized vowels. Similarly, we saw that when the voiced stops /b,d,g/ follow a vowel, the inherent [+continuous] condition of the vowel extends rightward inflicting a feature conversion of [-cont.] to [+cont.], producing the lenited allophones [β,ð,γ].

We alluded to the idea that onsets and codas are subjected to different types of phonotactic processes. If we observe closely, we will notice that in onsets, there is no feature transformation in which a positive value for any given trait converts to negative. The process of spirantization in syllable initial position, for example, implies the transformation of [-cont] to [+cont], but we do not find cases of [+continuous] converting to [-continuous]. As well we saw that in word-internal two consonant clusters, onsets in Spanish never assimilate place of articulation, while codas often in fact do. Codas, on the other hand, may undergo processes in which an underlying positive feature value transforms to negative at the surface level. Word-final voiced stop devoicing is one of these processes.

One of the important benefits to our analysis based on conflict resolution is that we could model the fact that the position where a phoneme occurs can be subjected to a series of phonotactic constraints governing phonological well-formedness. OT obligated us to do this because, not only must we justify optimal forms, but also encode in our analysis by way of constraints and ranking the reasons why sub-optimal forms cannot surface. Though the notion that phonemes in certain syllabic contexts may undergo position- specific processes did not escape generative frameworks, there was no programmed mechanism by which to include this information into the analysis.

Recall our discussion of the blocking of spirantization of /d/ after /l/. As a direct result of constraint interaction and ranking, we were able to encode the generalizations into our hierarchy that (1) minimal articulatory exertion is desirable (2) contiguous consonants in certain phonological contexts share one place of articulation, (3) codas must change instead of onsets and (4) retention of the underlying feature values in the output is paramount.

Now compare these universal tendencies with the universal generalizations formalized in the generative models: /d/→/ð/ / V___. As we can see, there is no comparison between the two justifications with regard to the amount of universal phonological information we can include in our paradigm. OT requires this phonological information in order to discern between optimality and sub-optimality. The natural result of the focus on conflict resolution is that the production grammar becomes a system, or set of intertwined micro-systems which work symbiotically to convert form into function. Generative models never arrived to this level of sophistication.

We opened the scope of our examination, in the following chapter 2, to treat the distribution of phonemes into syllables. We considered the concept that all words must be exhaustively parsed in syllables, proposed originally in Itô (1989) and discussed in numerous works since then. We compared the data from Spanish to Itô's hypothesis which proposed that word-initial and word-final segments are also syllable-initial and syllabl-final. The results from our study show that Itô's hypothesis is corroborated by the Spanish data.

One of the major contributions we provided in this chapter was the statistical evidence from Spanish related to position-specific distribution across syllables. Concretely, our data showed that singleton onsets are unquestionably favored in Spanish, both word-initially and medially. Complex codas appear in Spanish, but their dissemination is far from being substantial. Additionally, our data illustrated that codas are tolerated in Spanish, but their distribution is much more restricted than that of onsets. And although we found that syllable-internally, there is greater flexibility with regard to the permissible segments which may appear in coda position, the statistics we exposed in chapter 2 exhibit a patent proclivity toward the continuous coronals in coda position. In other words, the word-final and word-internal distribution of coda consonants is much more interrelated than we might expect after only an initial glance.

These quantitative data are significant from the point of view of acquisition. Our statistics indicated that nearly 90% of all syllables in Spanish, both at word-margins and internally, begin with a singleton onset. If we suppose acquisition to be intrinsically associated to frequency, then it would stand to reason that CV syllables are acquired first, since this is the most common syllabic structure that emerges in the language learner's environment. Lleó's (2006) results provide convincing proof to support this claim.

Chapter 3 examined the specific consonant sequences which could appear in Spanish syllables. We formulated a set of shape constraints which was capable of predicting desired outputs while simultaneously eliminating sub-optimal forms. Aside from further corroborating Itô's syllabic licensing hypothesis, our facts from Spanish led us to propose the hypothesis that Spanish syllable structure was governed by onset well-formedness, and the inclusion of specific constraints treating coda well-formedness was ultimately superfluous and redundant in our constraint-based model.

Later in chapter 4 we entertained the idea that inputs do not always provide parseable structures due to stipulations made by well-formedness principles that govern certain prosodic positions. We saw that sometimes repairs are necessary in order to prevent a highly marked structure from surfacing at the phonetic level. We concentrated the bulk of our research round one central repair strategy, epenthesis.

We opened our study by offering a rigorous examination of vowel insertion in unassimilated English loan words, provoked by a highly ranked constraint governing the shape of Spanish complex onsets. We illustrated that in the event the input supplies a complex onset of the type /s/C in word-initial position, /e/ must align to the left edge of the sibilant in order to resyllabify /s/ as the onset of the new syllable [es], while the second consonantal segment becomes the onset of the following syllable. In this case, onset well-formedness was the stimulus which prompted the addition of the surface level vowel.

Subsequently we examined cases of consonant epenthesis. We demonstrated that consonants insert in morphologically derived conditions in order to provide an onset for an onset-*less* nucleus. We mentioned that epenthetic segments, by and large, tend to be selected from the least marked major [place] class of a particular language's phonological inventory, although exceptions occur. In the case of Spanish, this is of course, [coronal].

Nevertheless, there has been some discrepancy in the data as to precisely which segment from [coronal] should be considered the truly productive epenthetic segment in Spanish. We contemplated two close competitors, /t/ and /θ/. We offered a diachronic explanation for /θ/ insertion in Spanish diminutive forms and substantives that take the suffix *-ión* and claimed that the /θ/ which appears in those forms is a historical relic leftover in Modern Spanish after two distinct processes of diachronic spirantization.

As a result, our justification of /t/ as the productive epenthetic segment in Modern Spanish seems quite feasible. We then illustrated that by ranking the members of [coronal] into a hierarchy in which a constraint */t/ occupies the inferior position, we can model our conclusions into a computational paradigm which is capable of predicting the desired epenthetic segment in Spanish.

Afterward, we opened the scope of our investigation to consider plural formation in Spanish. Crucially, the models we offered illustrated the deftness of OT's constraint-based framework at properly accounting for the regular and divergent patterns which emerge in Spanish plural forms.

Later in chapter 5, we proposed that stress application in Spanish can be reduced to two basic typologies: FAITH-v̊ » FTBIN , PARSE-σ and FTBIN » RL » PARSE-σ; effectively faithfulness » markedness and markedness » faithfuleness. The model we proposed constitutes a significant advantage from the perspective of acquisition since our language learner only needs to program two basic grammatical hierarchies in order to be able to properly apply stress.

We proposed that all non-trochaic stress is the result of a dominant correspondence constraint, FAITH- v̊, which obliges surface level stress to coincide with lexical accent. The one drawback of this analysis is that there is no way to really predict nor justify the exact syllable over which stress must fall, meaning that the language learner must store a vast quantity of individual tokens, along with their corresponding lexical accents to memory. The resulting grammatical simplicity, though, which is gained by such a strategy provides a suitable and viable compensation for this extra burden on the memory.

Subsequently, chapter 6 examined the topic of Spanish diminutive formation. We offered a model based on the stem classification offered in Bermúdez-Otero (2006), which categorizes Spanish nominals as one of four basic stem types. We illustrated that optimal diminutive outputs are ultimately governed by the conciliation of two competing forces; a desire to align the diminutive morpheme to the right edge of the stem and ONSET, which requires peaks to align to a prenuclear segment. Sometimes, both of these constraints could be fulfilled at the same time, as in *–virus*/*-virusito*. But more often than not, conflict resolution required some constraint to be violated since, as we know, there was no way to satisfy all dominant constraints simultaneously. We demonstrated the results of this conciliation in our constraint-based models.

Throughout the course of the preceding six chapters, we have exalted the advantages of OT's constraint-based paradigm. We have shown that conflict resolution requires a maximum amount of phonological generalization in order to produce a desired output. The result is a model which is not only capable of selecting the desired output, but also explains why sub-optimal forms are discarded. Nevertheless, we have intentionally withheld any discussion addressing the functional shortcomings of conflict resolution until now. Here, we will focus on two main difficulties which OT is currently faced with. Subsequently, we will briefly discuss some of the resolutions proposed in the contemporary literature with which to confront these complications from an OT framework.

We have illustrated that constraint conflict engages two types of constraints. Markedness constraints seek to modify some aspect of the input structure in order for the output to coincide with language-specific norms of well-formedness. Faithfulness, on the other hand, seeks to prevent any feature deviation between the phonological and phonetic levels. In our analyses, these two types of constraints were exceptionally competent at motivating the surface level modifications necessary for our outputs to satisfy Spanish-specific stipulations on surface level well-formedness.

As the astute reader will have noticed, all the phonological generalizations we have seen in this study involved transformations of concrete binary feature values: [-cont.]→[+cont.], [-voice]→[+voice], /s/→[z], /n/→[m], /θ/→[ð] , /d/→[θ], to name but a few examples.

Now, however, we must consider how to deal with surface level processes which involve highly discreet and gradient phonetic variation. Let us consider the near neutralized forms of coda consonant aspiration in Eastern Andalusian Spanish discussed in Gerfen and Hall (2001). As we have mentioned in previous chapters, certain consonants in coda position lose their oral features by way of a phonetic level lenition process known as debuccalization. Therefore, a phoneme string such as /rekto/ becomes [re^{ɦ}to]. Sometimes, near neutralization occurs, producing minimal pairs: /resto/→[re^{ɦ}to],/rekto→[re^{ɦ}to.]. As Gerfen and Hall's spectrographic data illustrates, the only aspect which prohibits total neutralization of these forms is that the duration of [^{ɦ}] in words such as *–recto*, in which [^{ɦ}] corresponds to an underlying /k/, is shorter than in words in which [^{ɦ}] corresponds to underlying /s/. Even more interesting is that the duration of [^{ɦ}] in forms associated with underlying /k/ corresponds to the duration of [k]. In forms in which [^{ɦ}] correlates to /s/, we see that the duration of [^{ɦ}] is extraordinarly parallel to that of [s].

Theoretically, we could program a correspondence constraint encoded with this sort of gradient information in order to explain the correlation of duration between the two forms. The problem with this proposal, however, is that underlying units are not specified with this type of fine-grained phonetic detail[1].

Surface level segments, on the other hand, do contain these types of discreet temporal details. However, OT's input/output mapping forbids correspondence between two surface level components. Kager and others have sought to remedy this discrepancy with a set of powerful Output/Output constraints which link two surface level forms, one serving as the functional base of the other. Therefore, in the cases we

[1] Cases such as these form part of the growing body of research which seek to discard the concept of the phoneme, the main argument being that phonemes are not capable of representing the abstract underlying information while at the same time explaining the systematic emergence of fine phonetic details such as the ones mentioned above.

mentioned above, the base of [re^{h}to] would not be an underlying /rekto/, but rather a surface form [rekto], which is tied to the underlying form. The downside to this model is that the underlying representation becomes utterly arbitrary, and a large amount of phonological information is left unformalized, since there is no direct association between certain surface forms and the phonological representation. Ultimately, as illustrative as the phonetic information is, at one point these systematic details must be modelled *phonologically*, a notion which both challenges and is challenged by O/O correspondence.

Another impediment to the efficacy of OT is the topic of variation. Specifically, the type of variation we will refer to here is *free variation* in which an individual input can be mapped onto two or more divergent outputs.

Variations of this type surface profusely in natural language. In Spanish, a common case of free variation is that of coda aspiration of /s/ that we just discussed above. And although this is not a commonly defining feature of the Spanish spoken in Madrid, the phenomenon does exist in certain socio-cultural pockets throughout the Spanish capital (see Gibson, 2004):

(1)

/susto/	su[s]to	su[^{h}]to	(-*fright/scare*)
/obispo/	obi[s]po	obi[^{h}]po	(-*bishop*)
/mesas/	mesa[s]	mesa[^{h}]	(-*tables*)
/libros/	libro[s]	libro[^{h}]	(-*books*)

We have already hinted above that the choice to aspirate /s/ to [^{h}] or maintain full input specification cannot be exclusively governed by a deterministic operation of the grammar itself, since for all intents and purposes both forms are *grammatical*. Most importantly, free variation implies that the form which surfaces is not produced in a deterministic fashion, but is negotiated by paralinguistic factors such as socio-linguistic and pragmatic variables as well as extragrammatical conventions such as the style and rate of speech. In addition, it is likely that a number of other intervening factors play some role as well, both grammar internally and externally, involving not only aspects of language, but cognitive ones as well.

Before we discuss the impact of free variation on the grammar itself, and the effect that this has on our study concerning optimality, let us briefly contemplate how a language learner is capable of acquiring, classifying and later producing divergent forms.

In her primary stages of phonological acquisition, our language learner classifies the forms she perceives in a phonological representation. That much we have already discussed throughout the course of this thesis. In the case of, say, vowel nasalization, or any other case we examined in the first chapter, the phonological context determined which allophonic form emerged. Therefore, even if the language learner perceives a difference in nasalized and oral vowels, she will surely deduce that only one may surface in a specific context. In contexts preceding nasal consonants, *all* vowels emerge nasalized. In contexts to the contrary, *all* vowels surface as oral vowels. The language learner is easily capable of deducing from the linguistic environment that one is an allophonic dependent of the other, and more importantly, determining which form must be lexicalized.

In the case of free variants, this is not always a straight-forward process. Observe the data related to the frequency of occurrence of [s] and [^{h}] in determined dialects of Iberian and American Spanish:

(2)

Syllable-final /s/ aspiration in standard speech of Córdoba

	/s/→[h] /___/t/	**/s/→[h] /___/p/**	**/s/→[h] /___C**
Global use	95.6%	92%	91%
Males	95.8%	90.3%	90.4%
Females	95.3%	93.5%	92.2%

Uruburu (1988)

Retention of [s] in syllable-final position in American dialects

	___C	___V	___ pause
Buenos Aires	11%	88%	78%
Habana	2%	18%	61%
San Juan (PR)	4%	22%	46%
Panama	5%	20%	34%

(Terrell, 1980)

Here the data indicate that [$^{\hbar}$] enjoys a more ample distribution in their respective dialectal regions. The language learner, however, is forced to choose one as the underlying form, and consequently choose one as the allophonic dependent.

Let us suppose that the language learner chooses an underlying representation /s/, though a strong case could be made in favour of /h/. In the case that /s/ is lexicalized, two variant forms must be produced by the grammar. If faithfulness, by way of IDENT dominates markedness, underlying /s/ will produce an allophone [s]. If markedness, in the form of LAZY, dominates faithfulness, [h] will surface:

(3)

/s/	/s/
↓	↓
Faithfulness » Markedness	Markedness » Faithfulness
↓	↓
[s]	[$^{\hbar}$]

The dilemma this scheme implies for the grammar is that there is no one dominant constraint for any given context. In other words, if we have proof that faithfulness can dominate markedness in syllable-final position, then it should stand to reason then that faithfulness will always be dominant in identical phonological contexts. This is known as strict domination of constraints and is a linchpin of standard parallel OT.

But, the quantitative data we revealed in (2) show that this is not necessarily the case. In fact we see that [s] only emerges faithfully in about 5% to 10% of the total cases for the same phonological context. In terms then of the grammar, we must ask why it is that faithfulness does not *always* dominate markedness or vice versa, if we already know that it can in a certain number of cases? How can a model based on the *deterministic* selection of surface forms produce two optimal outputs? Afterall, there is no possible stipulation which specifies "usually", or "in 90% of the cases". If both outputs [s] and [ʰ] are distinguished by grammatical means, then this generalization must be reflected as a programmed operation of some constraint. If the optimal status of the outputs [s] and [ʰ] must be determined by way of violation and satisfaction of a given constraint set, then logically *one* will always be more harmonic than the other.

Let us consider more closely the case we presented in chapter 1 concerning voiced stop spirantization. To recall, underlying /b,d,g/ have two allophonic dependents, [b,d,g] and [β,ð,γ], just as in our aspiration examples. In the spirantization case, a hierarchy which required faithfulness of place features while stipulating that minimal articulatory exertion was desirable was able to produce spirantized forms of the underlying segments in a systematic and absolute way for all similar contexts: $\text{IDENT}_{(\text{place})}$» LAZY » $\text{IDENT}_{(\text{continous})}$.

The ranking of these constraints is stagnant for all contexts in which the voiced stop followed a vowel. That is IDENT strictly dominates LAZY which strictly dominates IDENT, always. In different phonological contexts, the hierarchy can be restructured, but because the context requires a distinct surface form and the learner has solid empirical proof that such an alteration is warranted. As follows, each output is determined by a separate operation of the grammar. In our examples of aspiration, however, this is not the case.

As we can see, this is no small misgiving for OT, and all deterministic frameworks, since the very essence of the theoretical model is called into question. In other words, free variation implies that there is no such thing as optimality.

One way to resolve this predicament is to abandon the idea of strict domination. In certain cases it seems, constraints operate freely from one hierarchical position to the next. Prince and Smolensky (1993), predicting the difficulty posed to OT by free variation, proposed a model of *free ranking* which Kager (1999) interprets in the following way:

> (4)
> Interpretation of free ranking of constraints C_1, C_2.
> Evaluation of the candidate set is split into two subhierarchies, each of which selects an optimal output. One subhierarchy has $C_1 \gg C_2$, and the other has $C_2 \gg C_1$.

The benefit of this model is that variant outputs are intrinsically correlated, avoiding drastic changes to form. The problem though is that there is no operative function hardwired into this schema which provides any sort of probabilistic determination of constraint ranking and, therefore optimal outputs. According to this view, the odds that a certain candidate will surface optimally is 2 to 1. The data in (2), however, show that distiribution of the variant form is actually much higher than 50%, revealing a significant hitch related to predictability in the hypothesis of freely ranked constraints.

There is promising research being done by Boersma, Hayes and many others, which takes a more functional approach to variation. Boersma (1997) proposes the idea that variation is an upshot of the *robustness requirement of learning* governed by the grammar. Boersma (1997, page 43) writes:

> "If every constraint in an Optimality-Theoretic grammar has a ranking value along a continuous scale, and the disharmony of a constraint at evaluation time is randomly distributed about this value, the phenomenon of optionality in determining the winning candidate follows automatically from the finiteness of the difference between the ranking values of the relevant constraints; the degree of optionality is a descending function of this difference".

Boersma (1997) illustrates that the frequency of variant forms can be predicted by a *symmetrized maximal gradual learning algorithm*, which proposes that constraint movement is bidirectional, or based on both demotion and promotion, challenging, of course, traditional learning models of constraint ranking, especially that of Tesar and Smith. Essentially, by incorporating a random stochastic element into the constraint evaluation, we can justify variable outputs as an upshot of grammatical robustness and that a learner's production grammar is capable of adapting to the inherent irregularities produced by the distribution of variants (Boersma, 1997). This is of utmost importance since, as we have seen throughout this thesis, the viability of a justification is based in large part on whether a learner can actually deduce the constraint ranking from her linguistic environment.

To conclude, the last two cases that we have discussed here pose significant challenges to OT's constraint-based framework. We have seen throughout the course of this study that constraint hierarchies are relatively simple to compose, and optimal outputs are equally simple to justify. Most of the time, we see that a process does not only occur in one language, but in complete language families or in totally different languages. We should expect then that a theory whose mechanical framework is based on the prescribed ranking of universal constraints will not be challenged by individual processes in individual languages.

But the last two cases do challenge the veracity and longevity of OT. If a theory is incapable of expressing the variable nature of a languages phonological grammar and accounting for the emergence of *systematic* fine phonetic detail, then a major part of what our grammars are capable of producing is ultimately left unformalized. The result is the threat of obsoleteness for OT if no explanation is attained. The resolutions we have examined to these drawbacks seem promising, and, in our opinion, should represent the future bulk of OT research.

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FONOLOGÍA DEL ESPAÑOL: ENFOQUE DESDE LA TEORÍA DE OPTIMIDAD

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ÍNDICE

FONOLOGÍA DEL ESPAÑOL: ENFOQUE DESDE LA TEORÍA DE OPTIMIDAD

INTRODUCCIÓN GENERAL

Esta tesis ofrece un análisis de la fonología del español de Madrid desde un enfoque de la Teoría de Optimidad (TO) (Prince y Smolensky, 1993). Básicamente, esta teoría se basa en la propuesta general de que una forma deseada, es decir óptima, se produce mediante un paradigma jerárquico compuesto de dos tipos de restricciones que están continuamente en conflicto. El educto (inglés -*output*) que resulta óptimo es aquel que satisface las restricciones superiores de una jerarquía e infringe mínimamente las restricciones inferiores.

A lo largo de esta tesis, examinamos algunos de los procesos comunes que surgen en la fonología del español de Madrid y tratamos algunas de las dificultades que se han presentado en los estudios previos respecto a sus justificaciones teóricas, sobre todo desde el marco generativista. Basamos nuestros análisis en el marco global de la resolución de conflicto y, donde es preciso, expondremos las ventajas que aporta la TO con respecto al enfoque generativo. Demostramos que la incorporación obligatoria de un mayor número de generalizaciones universales para poder determinar la optimidad de una forma dada, hace que el modelo que aporta la TO ofrezca justificaciones más profundas, y a la vez más transparentes, de todos los procesos que tratamos.

La organización de esta tesis se desarrolla de la siguiente manera: el primer capítulo expone el inventario fonológico del español de Madrid. Enfocamos nuestro estudio en los dos niveles de representación y sus componentes: el fonológico, o subyacente y el fonético, o patente. A continuación, ofrecemos una introducción breve de los principios más destacados de la TO antes de examinar cuatro generalizaciones fonológicas que surgen en esta variedad del español: la sonorización/desonorización consonántica en posición final de sílaba, la nasalización espontánea vocálica, la espirantización de las oclusivas sonoras y la asimilación del punto de articulación . A lo largo de este apartado, revelamos las ventajas que aporta la TO, y su paradigma de resolución de conflicto frente al marco generativo, basado en la aplicación de reglas para producir una forma determinada.

El segundo capítulo introduce el concepto de sílaba. Analizamos las pruebas intuitivas y de distribución que apoyan la incorporación de esta unidad en los estudios teóricos fonológicos. Más adelante exponemos los datos específicos del español respecto a las restricciones que determinan las consonantes que pueden ocupar las distintas posiciones silábicas. Presentamos la hipótesis de Itô (1989) que propone una correlación entre los segmentos que ocupan las posiciones marginales de la palabra y los segmentos que aparecen en el interior de la palabra, lo cual, explica Itô, es una consecuencia de que las palabras están gobernadas primordialmente por unos principios universales que exigen que las palabras se tengan que dividir en sílabas bien formadas. La consecuencia de este argumento implica que la organización fonológica de las palabras no es casual, y que podemos formalizar las regularidades que observamos en las palabras españolas en un modelo funcional que es capaz de predecir un educto óptimo por la satisfacción de unas restricciones que tratan la organización de los segmentos fonológicos en una posición específica.

El tercer capítulo profundiza en la división silábica de las palabras mediante la descripción de la buena formación posicional. Empezamos este apartado con un análisis de los ataques (en inglés *onsets*) simples, seguido por un estudio de los ataques complejos. Formalizamos los datos en un paradigma computacional que no sólo es capaz de determinar la forma óptima que resulta del modelo propuesto, sino también de ofrecer una justificación acertada respecto a los motivos por los cuales se eliminan los ataques no permitidos. A continuación examinamos las consonantes, y secuencias de consonantes que pueden ocupar la posición final de sílaba (coda) y/o final de palabra. Proponemos una hipótesis que expone que las únicas consonantes óptimas en posición final de sílaba en español son las coronales marcadas por el rasgo [+continuo]. No obstante, esta hipótesis está puesta en duda por las irregularidades que existen entre las consonantes que aparecen en posición final de sílaba final de palabra y las que aparecen en el interior de palabra en esta misma posición silábica: tratamos estas irregularidades en la siguiente sección, en la que examinamos las secuencias de consonantes en el interior de palabra. Ofrecemos una justificación para esta incongruencia que se basa en una noción de identidad y en la correspondencia entre el aducto y el educto. Afirmamos que la flexibilidad respecto a las consonantes permitidas en posición final de sílaba en el interior de palabra es una consecuencia de la modificación morfológica y la identidad subyacente de las formas fonológicas. Ofrecemos datos cuantitativos del español que apoyan esta afirmación y demostramos que, en la gran mayoría de palabras patrimoniales del español, las predicciones producidas por la hipótesis de Itô que presentamos en el último capítulo 2 se corroboran por nuestros datos.

Recogiendo estos datos, pues, proponemos un modelo computacional que es capaz de predecir la distribución de consonantes en español. Nuestro modelo se basa en la hipótesis de que la organización de sílabas españolas está dominada por las restricciones que condicionan los ataques. Proponemos la idea de que las codas están toleradas en español pero que sería superfluo representar la buena formación de las codas en un modelo jerárquico, debido a que su posición dentro de la jerarquía sería tan inferior que sus efectos nunca podrían tener un impacto en la forma óptima.

En el cuarto capítulo examinamos los recursos que tiene el español para arreglar una forma contraria a la norma lingüística antes de que tenga la oportunidad de surgir en el nivel fonético. Primordialmente, estudiamos un solo proceso, la inserción de segmentos, en tres contextos derivados: (1) la inserción vocálica en palabras préstamos del inglés que empiezan por una secuencia encabezada por la sibilante /s/ seguida por otra consonante, (2) la inserción de una consonante entre una raíz que termina en vocal y un sufijo que empieza con un segmento vocálico, y (3) la inserción del segmento vocálico [e] en las formas plurales.

En el primer análisis demostramos que tanto la elección del segmento que se inserta como la alineación del segmento se pueden justificar mediante un paradigma de restricciones que se encargan de elegir la vocal y luego, utilizando un tipo de restricción de alineamiento, se encarga de su posicionamiento prosódico.

El segundo análisis, que trata el proceso productivo de epéntesis consonántica, presenta una mayor gama de dificultades por las irregularidades que hay respecto al segmento que se inserta en contextos en los que se requiere una consonante para romper el hiato vocálico. Por un lado, vemos en determinados contextos la inserción de /θ/ como en las formas diminutivas de ciertas raíces: rey→reye/θ/ito; dominar→domina/θ/ión; en otros casos, es la /t/ la que aparece: tu→tu/t/ear.

Nuestro estudio revela que (1) los segmentos /θ/ que aparecen en contextos fonológicos parecidos al de los ejemplos rey→reye/θ/ito o dominar→domina/θ/ión son etimológica y fonológicamente distintos, (2) están bien restringidos a determinados contextos fonológicos y, más importante, (3) no proceden de la gramática productiva, sino que son reliquias históricas que se han quedado fonologizadas en el español moderno.

Expuesto esto, presentamos una justificación teórica que se basa en la resolución de conflictos, es decir desde la TO, para la inserción y alineamiento productivos de /t/.

Manifestamos que la consonante, junto con la vocal /e/, que aparece en las formas diminutivas, es una parte formal y programada de las formas diminutivas, lo cual permite la incorporación de una restricción específica que expresa que esta consonante es un componente predecible y formal en la formación de los diminutivos. Esto es significativo porque los análisis generativos nunca han podido ofrecer una justificación coherente para el surgimiento de esta consonante en las formas diminutivas y a la vez justificar la apariencia de /t/ en los casos productivos de epéntesis en español.

Por último, ofrecemos un análisis de las formas plurales en español. Demostramos que se puede justificar la inserción de /e/ entre el morfema plural {s} y la raíz al programar una restricción *COMPLEX^{CODA}, que prohíbe la emergencia de codas complejas, a una posición superior relativo a una restricción de fidelidad DEP, que prohíbe cambios del aducto. Naturalmente, para satisfacer *COMPLEX^{CODA}, algún cambio es necesario. Este conflicto entre *COMPLEX^{CODA} y DEP sirve como la base de todos los análisis que presentamos en este último apartado del capítulo 4.

Subsiguientemente en el capítulo 5, investigamos la interacción de las restricciones que rigen la aplicación del acento prosódico en el español y su relación con los pies métricos. Consideramos una restricción PARSE-σ que requiere que todas las sílabas se agrupen en pies. Cuando esta restricción es dominante, todas las sílabas se tienen que agrupar en pies. Sin embargo, hay contextos en español en los que las sílabas no se juntan en pies de este tipo. Esto se explica mediante la ordenación dominante de otras dos restricciones, FAITH-v y WSP, que requieren que el acento fonológico debe aparecer sobre la misma sílaba en el educto, y que las sílabas pesadas, es decir bimoraicas, deben llevar el acento prosódico. Discutimos la validez de esta última restricción, WSP, en un modelo que justifica la aplicación del acento tónico en el español moderno y proponemos, mostrando datos empíricos, que la aplicación del acento prosódico basada en el peso de la sílaba es un proceso inactivo en el español moderno.

A continuación, ofrecemos una tipología de las restricciones que gobiernan la aplicación del acento prosódico en el español. Demostramos que se puede justificar este proceso mediante un esquema que se basa en la conciliación de las restricciones antesmencionadas en dos modelos jerárquicos. Esto representa una ventaja significativa desde el punto de vista de la adquisición, ya que propone de forma inherente que el niño en su etapa de adquisición fonológica sólo tenga que aprender dos paradigmas básicos para poder producir el acento prosódico en español. Así, la gramática está menos cargada, aunque implica una carga mayor para la memoria.

Una de las consecuencias que tiene nuestro modelo es que los cambios del acento en palabras modificadas morfológicamente, como *régimen* / *regímenes*, se pueden justificar mediante un cambio paradigmático que involucra una restructuración de la jerarquía básica que presentamos en el apartado anterior.

Finalmente, el capítulo 6 se ocupa de ofrecer un estudio exhaustivo de la formación de los diminutivos en español. Basamos nuestro analisis en la clasificación de las raíces nominales que expone Bermúdez-Otero (2006). Básicamente, esta categorización manifiesta que existen cuatro clases de sustantivos en español: (1) clase –o/-a, (2) clase –e, (3) clase –e/Ø y (4) raíces atemáticas. Estas clasificaciones determinan la alineación del sufijo y los segmentos adjuntos que están involucrados en la formación de los diminutivos.

Abrimos nuestro estudio con una definición de los componentes. Primero investigamos las propuestas de Bermúdez-Otero (2006) relacionadas con la clasificación de los sustantivos y su relación con la vocal temática. Luego examinamos la inserción de los segmentos /eθ/ que aparecen en ciertas formas y su formalización teórica dentro del modelo que ofrecemos en nuestro análisis. En estos apartados, consideramos tanto la clasificación de los componentes como su alineación en los diminutivos. Finalmente, aportamos un análisis riguroso que se basa en las generalizaciones que vamos exponiendo a lo largo de este capítulo.

El propósito del presente trabajo es definir los procesos que estudiamos en la tesis, exponer los datos relacionados con estos procesos y ofrecer una justificación teórica que se fundamenta en el marco global de la TO. A lo largo de esta memoria, expondremos los puntos más destacados de la tesis y consideraremos las conclusiones que se pueden sacar de los análisis que ofrecemos. Sin embargo, debemos mencionar que el presente estudio en castellano, por ser una síntesis del documento original, sólo puede ofrecer una vista panorámica de los procesos que tratamos en la tesis y llamar la atención del lector de aquello puntos más interesantes cuyo desarrollo habrá de consultarse en su versión inglesa.

Por tanto, los números de los apartados de este documento no siempre coinciden con los del documento original. Apuntamos con una nota al pie de la página las omisiones de aquellas partes significantivas o relevantes que el lector querrá referenciar de manera completa en la tesis. Asimismo, debemos añadir que no hemos traducido los nombres de las restricciones del inglés al español por la simple razón de facilitar la lectura y la comprobación de los análisis y los datos en el documento original.

CAPTÍTULO I

LOS SONIDOS DEL ESPAÑOL

1.0 INTRODUCCIÓN

Este primer capítulo se ocupa de exponer los inventarios fonético y fonológico del español normativo de Madrid, España. Basamos en gran parte nuestras clasificaciones en el *Manual de pronunciación española* de Navarro Tomás (1932). Donde hemos creído necesario, hemos matizado esta categorización para que nuestro análisis refleje las modificaciones que han surgido en la lengua española desde la primera publicación de este manual.

1.1 LOS SONIDOS DEL ESPAÑOL

Empezamos nuestro trabajo con un repaso de los componentes fonológicos del español de Madrid. Primero, consideremos los alófonos que aparecen en la siguiente tabla:

(1)
Los alófonos consonánticos del español de Madrid

[m]	mano	[n]	no	[ɲ]	leña	[k]	cama
[p]	pan	[t]	tú	[tʃ]	trucha	[g]	gama
[b]	beso	[d]	diciembre	[j]	tienes	[ɣ]	lago
[β]	lobo	[ð]	sed	[ʝ/d͡ʝ]	pollo	[x]	Jimena
[f]	fonología	[θ]	zapato			[w]	huevo [we.βo]
		[s/s̬]	siempre/ des̬de			[ŋ]	tango
		[s̬]	mis̬mo				
		[r]	rey				
		[ɾ]	pero				
		[l]	tela				

Definimos estos segmentos según los siguientes criterios clasificatorios:

(2)

	LAB	COR	COR	COR DOR	DOR	LAB DOR
Oclusiva						
Sonora	[b]		[d]		[g]	
Sorda	[p]		[t]		[k]	
Fricativa						
Sonora	[β]	[ð]	[ş]	[ʝ]	[ɣ]	[w]
Sorda	[f]	[θ]	[s]			[x]
Africada						
Sonora				[d͡ʝ]		
Sorda				[t͡ʃ]		
Nasal						
Sonora	[m]		[n]	[ɲ]	[ŋ]	
Lateral						
Sonora			[l]	[ʎ][1]		
Sonora		[ɾ]	[r]			

La primera fila de esta tabla expresa el punto de articulación principal del segmento: labial, coronal y dorsal. La columna a la izquierda define los rasgos tales como la sonoridad y su grado de constricción.

El inventario vocálico consta de los siguientes segmentos:

(3)

	Anterior		Posterior
Alta	i		u
Media	e		o
Baja		a	

La posición de la lengua, expresada como alta, media y baja en términos descriptivos, describe la ubicación de la lengua en relación de la cavidad oral y del paladar a la hora de vocalizarse. La vocal alta [i], por ejemplo, se denota como tal porque la lengua se sitúa más hacia el paladar. El término *anterior* se refiere a la posición de la raíz de la lengua a la hora de realizar la vocal. En esta posición la lengua se sitúa al dorso de la cavidad oral. En cambio, el término *posterior* se refiere al movimiento de la raíz de la lengua hacia los dientes.

Las vocales pueden aparecer solas o como parte de un diptongo o triptongo. El español dispone de seis diptongos descendentes y ocho ascendentes:

(4)

Diptongo	**Ejemplo**
Descendentes	
[ej]	rey
[aj]	aire
[oj]	hoy
[ew]	neutro
[aw]	pausa
[ow]	bou

Diptongo	**Ejemplo**
Ascendentes	
[je]	tierra
[ja]	hacia
[jo]	radio
[ju]	viuda
[wi]	fuimos
[we]	fuego
[wa]	cuadro
[wo]	cuota

Los segmentos que hemos ido exponiendo representan el componente fonético del inventario de los sonidos del español. El inventario fonológico, sin embargo, es más reducido, ya que muchos de los segmentos que aparecen en (2) forman pares mínimos con otros segmentos. Es decir, en muchos casos, a dos alófonos les corresponde a la misma representación fonológica. Observemos los segmentos fonológicos, es decir fonemas, que aparecen en el español de Madrid:

(5)

Los fonemas del español

b	d	g
p	t	k
m	θ	x
f	s	
	r	
	l	
	n	
	ɲ	
	t͡ʃ	
	ʝ	
	d͡ʝ	

Se pueden clasificar según los siguientes rasgos binarios:

(6)

Rasgos distintivos de fonemas

C = consonante
S = sonorante
c = continuo
P = punto de articulación (L = labial, C = coronal, D= dorsal)
a = anterior (+ = +ANT, - = -ANT, A = ANT)
d = distribuido
ret. = retraído
s = sonoro
N = nasal
L = lateral

Consideremos la siguiente categorización fonológica de los fonemas en español:

(7)

	m	n	ɲ	l	ʝ	r	p	b	f	t	s	θ	d	t͡ʃ	d͡ʝ	k	g	x
C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
S	+	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-
c							-		+	-	+	+				-		+
P	L	C	C	C	C	C	L	L	L	C	C	C	C	C	C	D	D	D
a		+	-	+	-	+				A	+	A	A	-	-			
d											-	+						
ret																		
S					+		-	+	-	-	-	-	+	-	+	-	+	-
N	+	+	+															
L				+		-												

(Alonso-Cortés, 2002)

Se puede apreciar que en esta tabla aparecen tres distinciones importantes respecto a la clasificación que se ofrece en Alarcos Llorach (1959, 1964). Primero, consideramos que /s/ en el español moderno es una consonante dental, es decir [+ant]. Tomamos como prueba el comportamiento de esta consonante en alternancias morfofonológicas con /t/ y /d/ y el hecho de que sea la única sibilante en el inventario fonológico del español, lo cual, según Maddiesson (1984), implicaría que esta consonante fuese clasificada como dental, ya que los inventarios fonológicos que disponen de una sola sibilante, en la gran mayoría de los casos, suelen preferir consonantes dentales (para más pruebas véase Alonso-Cortés en prensa). Conjuntamente, consideramos que los alófonos [ʝ] and [d͡ʝ] se correlacionan con un segmento fonológico / d͡ʝ /. Así, al contrario de lo que afirma Alarcos Llorach, se puede justificar el surgimiento de [ʝ] como un caso de lenición consonántica, el cual es un proceso del que existen abundantes pruebas en el español moderno. Por último, nuestras investigaciones indican que sólo existe una representación fonológica para la lateral vibrante, /r/, la cual produce dos dependientes alofónicas [r], vibrante múltiple y [ɾ] vibrante simple.

1.2 LAS GENERALIZACIONES FONOLÓGICAS

1.2.1 La nasalización vocálica

Las vocales en español son fonológicamente orales. En ciertos contextos fonológicos, sin embargo, pueden resultar nasalizadas si son precedidas por una consonante nasal. Fijémonos en los siguientes casos:

(8)

Vocales orales			Vocales nasalalizadas	
[a]	papá	[papa]	pan	[pãn]
[e]	vete	[bete]	vente	[bẽn te]
[i]	fiscal	[fiskal]	fin	[fĩn]
[u]	susto	[susto]	asunto	[asũnto]
[o]	mosto	[mosto]	monton	[mõntõn]

Está claro que las vocales orales y nasalizadas interactúan en un estado de distribución complementaria. Es decir que una vocal nasalizada sólo puede aparecer en contextos en los que la precede una consonante nasal. En este contexto, la realización de vocales orales no es posible debido a una apertura del velo que permite que el aire se escape por la cavidad nasal.

1.2.2 Espirantización de las oclusivas sonoras

El español dispone de tres oclusivas sonoras /b, d, g/. En un contexto post-vocálico, estos fonemas se realizan como fricativas [β, ð, γ]. Desde el punto de vista clasificatorio, esta conversión implica una transformación de [-continuo] a [+continuo]. Observemos los datos relacionados con este proceso:

(9)

	contexto 1	contexto 2	contexto 3	contexto 4	contexto 5
	#___	n(asal)___	V___	___V	___#
[b]	✓	✓	—	—	—
[β]	—	—	✓	✓	✓
[d]	✓	✓	—	—	—
[ð]	—	—	✓	✓	✓
[g]	✓	✓	—	—	—
[ɣ]	—	—	✓	✓	✓

De nuevo, se aprecia que las oclusivas sonoras y las fricativas sonoras interactúan en un contexto de distribución complementaria. Las fricativas sólo pueden aparecer precedidas por una vocal, mientras que las oclusivas aparecen en posición inicial de palabra después de una pausa, y cuando van precedidas por una nasal. Además la consonante [ð] no puede surgir en contextos en los que la consonante que precede es /l/:

(10)

	#___	V____	N____	[l]____
[b]	[b]eso	-	em[b]utido	-
[β]	-	lo[β]o	-	el [β]eso
[d]	[d]edo	-	duen[d]e	alcal[d]e
[ð]	-	de[ð]o	-	-
[g]	[g]uante	-	an[g]ula	-
[ɣ]	-	a[ɣ]ua	-	el [ɣ]amo

Asimismo, Alarcos Llorach (1964) aporta asimismo ejemplos de este proceso en las oclusivas sordas, un rasgo no estándar del habla de Madrid:

(11)
Espirantización de las oclusivas sordas

cápsula	[káβsula]	atlas	[áðlas]
atleta	[aθléta]	ritmo	[ríðmo]
eclipse	[eklíβse]	étnico	[éðniko]
inepcia	[inéβθja]	atmósfera	[aðmósfera]
apto	[áβto]	actor	[aɣtór]
acción	[aɣθjón]		
examen	[eɣsámen]		

(Alarcos Llorach, 1964)

Los ejemplos en esta última referencia (11) representan un caso de la neutralización fonológica. En cada ejemplo, el alófono que surge no es dependiente de /p,t,k/ sino de /b,d,g,/. Se puede decir, pues, que las distinciones subyacentes entre estas consonantes se han perdido en el nivel fonético, dejando que los rasgos contrastivos se neutralizaran.

Para concluir, damos por sentado aquí que la explicación fonológica para tratar la espirantización de tanto las oclusivas sonoras como las oclusivas sordas se debe al hecho de estar situadas a la derecha de una vocal. Básicamente, las vocales son inherentemente marcadas por [+continuo]. Este rasgo se extiende a la consonante que sigue, motivando una conversión de [-continuo] a [+continuo] entre la representación subyacente y la representación patente.

1.2.3 Sonorización y ensordecimiento

El español tiene una sibilante en su repertorio fonológico, /s/. Las sibilantes se realizan al dirigir el flujo del aire por el tracto vocal antes de escaparse por una apertura entre los dientes y la lengua. Se puede apreciar en la clasificación fonológica que ofrecemos en (7) que esta consonante es una sibilante **sorda** [es decir, sin vibración de las cuerdas vocales].

La sonorización es un proceso por el cual una consonante marcada con el rasgo [-sonoro] adquiere el rasgo [+sonoro] en la representación fonética. Es generalmente aceptado que este proceso está motivado por una consonante marcada con el rasgo [+sonoro] que aparece en el entorno fonológico. El valor positivo del rasgo [sonoro] se extiende a la consonante que precede, creando en efecto una consonante [+sonoro]. Consideremos los siguientes ejemplos:

(12)

La sonorización de /s/

/s/ precediendo consonantes [-sonoro]		/s/ precediendo consonantes [+sonoro]	
susto	[sústo]	desde	[dés̬ðe]
atmósfera	[atmósfera]	mismo	[mís̬mo]
espejo	[espéxo]	cisne	[θís̬ne]
escena	[esθéna]	resbalar	[res̬βalár]
mosca	[móska]	resguardar	[res̬ɣwarðáɾ]
		más leve	[más̬léβe]
		Israel	[is̬raél]

En estos ejemplos está claro que el proceso de sonorización de /s/ está motivado por la consonante [+sonora] que sigue.

El mismo proceso ocurre también con /θ/ en el mismo contexto fonológico:

(13)

La sonorización de /θ/

/θ/ precediendo consonantes [-sonoro]		/θ/ precediendo consonantes [+sonoro]	
mízcalo	[míθkalo]	gaznápiro	[gaðnápiɾo]
mezquita	[meθkíta]	pazguato	[paðgwáto]
izquierda	[iθkjérda]	jazmín	[xaðmín]
mozcorra	[moθkórra]	juzgar	[juðɣáɾ]
pizpireta	[piθpiréta]	maznar	[maðnáɾ]
		lezna	[léðna]

En cambio, ciertas consonantes en posición final de palabra pierden su valor positivo [sonoro], llegando a ser [-sonoro] en la representación fonética:

(14)

Ensordecimiento de /d/ en posición final de palabra

Madrid	[madɾíθ]	*[madɾið]
libertad	[liβertáθ]	*[liβertáð]
virtud	[birtúθ]	*[birtúð]
usted	[us̬téθ]	*[us̬téð]

Se puede observar que estos últimos ejemplos son casos de neutralización fonológica, ya que los valores subyacentes de /d/ y /θ/ ya no se distinguen en el nivel fonético, mientras que las alternancias que aparecen en las tablas (12) y (13) son ejemplos de la distribución complementaria, ya que el entorno fonológico determina la consonante que debe surgir en aquel contexto.

1.2.4 La asimilación del punto de articulación

Se oponen las consonantes nasales /m,n, ɲ/ en posición entrevocálica: -ca[m]a, -ca[n]a, ca[ɲ]a. Por tanto, se clasifican como tres fonemas distintos. No obstante, en el nivel fonético observamos que las nasales se neutralizan en ciertas secuencias de consonantes tanto dentro de la palabra como en los márgenes, [+nasal] + [+cons], asimilando el punto de articulación de la consonante que sigue:

(15)

Asimilación de punto de articulación en las nasales

un beso	u[m] b̲eso	[n] se convierte en [m] antes de la bilabial [b].
un peso	u[m] p̲eso	[n] se convierte en [m] antes de la bilabial [p].
un faro	u[ɱ] f̲aro	[n] se convierte en [ɱ] antes de la labial-dental [f].
un tiro	u[n̪] tiro	[n] se dentaliza antes de [t].
un yate	u[ɲ] yate	[n] se convierte en [ɲ] antes de la palatal [ʝ/d͡ʝ].
un gato	u[ŋ] gato	[n] se convierte en [ŋ] antes de la dorsal [g].

De una manera parecida, /l/ también asimila el punto de articulación de la consonante que sigue. Se puede apreciar que este proceso es más restringido en /l/:

(16)

Asimilación de /l/

el tío	e[l̪] [t̪]ío	[l] se convierte en dental antes de [t̪].
el día	e[l̪] [d̪]ía	[l] se dentaliza antes de [d].
el niño	e[l] niño	[l] se convierte en alveolar antes de [n].
el llavero	e[λ] llavero	[l] se palatiza antes de [ʝ].

Estos ejemplos que aparecen en (15) y (16) muestran dos puntos interesantes. Primero, las nasales y la lateral /l/ cambian de punto de articulación para que haya un sólo punto de articulación para las dos consonantes en la secuencia. Segundo, muestran una correlación entre la asimilación del punto de lugar y el impedimento del proceso de espirantización de las oclusivas sonoras que examinamos previamente. Recordemos que cuando /d/ sigue /l/ y las nasales no es posible la espirantización: puesto que /l/ en español está subespecificada por el rasgo [continuo], al juntarse con /d/, consonante [-continua], /l/ recoge el valor [-continuo] en el estrato fonético, y la conversión /d/→[ð] resulta fonológicamente imposible de efectuar.

1.3 LA TEORÍA DE OPTIMIDAD

El marco fundamental de la TO propone que se produce un educto óptimo mediante la conciliación de dos tipos de restricciones que están continuamente en conflicto. El primer tipo de restricción, las restricciones de *marcadez*, sirve para prohibir que surja una estructura marcada subyacente en el educto. El segundo tipo, las restricciones de *fidelidad*, sirve para retener los contrastes léxicos que existen en el educto al nivel fonológico. Las restricciones de marcadez surten un efecto sobre la representación patente, mientras que las restricciones de fidelidad manifiestan una correspondencia entre la representación subyacente y la representación patente.

En todas las lenguas hay formas preferidas sobre otras; las sílabas abiertas frente a las sílabas cerradas, por ejemplo. Se supone que, en la medida que sea posible, todas las lenguas evitan las estructuras marcadas. Por otro lado, en algunos casos, estas estructuras quedan terminantemente prohibidas. Se puede afirmar, pues, que el concepto de marcadez es, por tanto, inherentemente asimétrico.

Kager (1999) propone que los factores que determinan el valor marcado de una estructura están influidos por motivos que no están vinculados exclusivamente a la fonología. Tanto los sistemas articulatorios como los de la calidad perceptiva desempeñan un papel al determinar si un sonido, o secuencia de sonidos, es favorecido en una lengua. Sin embargo, no se pueden basar las relaciones de marcadez exclusivamente en conceptos fonéticos. En primer lugar, los factores fonéticos son gradientes mientras que los factores fonológicos son categóricos. Por eso, la interacción de los factores fonéticos no produce una asimetría en los paradigmas fonológicos. En segundo lugar, la relevancia que ocupan los factores de marcadez no es igual en todas las lenguas, lo cual implica la necesidad de tener un sistema que pueda evaluar estos factores.

Las restricciones de fidelidad, en cambio, pretenden que se retengan todos los componentes subyacentes de una estructura en el educto. Así, las restricciones de fidelidad procuran evitar los cambios que pueden surgir entre el nivel fonológico y la representación patente. Y mientras la fidelidad constituye una correspondencia entre la representación subyacente y la representación patente, las restricciones de marcadez se ocupan de modo exclusivo del educto, lo cual implica una orientación innegable en el nivel fonético.

La función primordial de las restricciones de fidelidad es mantener el contraste léxico entre la representación subyacente y la representación patente. En cualquier lengua, para expresar una oposición entre dos formas, tiene que haber un sistema operacional que produzca esa oposición.

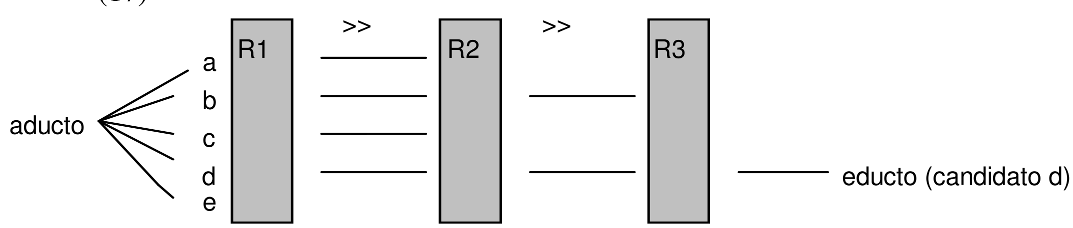
Se ha observado que cuanto más capaz sea una lengua de poder exponer un contraste léxico, más complejo resultará su sistema articulatorio, en términos de complejidad de los segmentos, o en las posibilidades de combinaciones plausibles entre los segmentos (Kager, 1999). Una lengua puede mantener una plena fidelidad solamente si se incrementa la marcadez fonológica. En cambio, una lengua puede reducir la cantidad de marcadez fonológica al perder la capacidad de expresar los contrastes léxicos.

Si consideramos una lengua hipotética que consista en cincuenta consonantes y treinta vocales (la cantidad total de segmentos que se encuentran en las lenguas del mundo) que no imponga ninguna restricción de marcadez, una permutación de estos 80 segmentos en unidades que tienen tan sólo dos sílabas producirá unos 6.400 nuevas secuencias. Sin embargo, sin ninguna fórmula que restrinja la cantidad de segmentos, es decir la marcadez, no hay por qué no aceptar entidades que tienen 113 o 23.584 segmentos, o aún más. En este último caso, la cantidad de unidades léxicas se multiplicaría de modo exponencial por 80 de tal manera que, con tan sólo seis sílabas, la cantidad de unidades léxicas en esta lengua llegaría a unos 300 millones de unidades léxicas (Kager, 1999). Por supuesto, tal sistema resultaría superfluo, ya que ninguna lengua requiere tantas unidades léxicas. Por tanto, se puede afirmar que la función que cumple la marcadez es predecible en lenguas naturales, ya que restringe la proliferación exagerada e innecesaria de unidades léxicas.

Por otro lado, una lengua que otorgara prioridad a las restricciones de marcadez se vería limitada a una estructura silábica de tan sólo dos sílabas cuya distribución consistiría en una secuencia C(onsonante)V(ocal) $C \in \{p,t,k\}$, $V \in \{i,a\}$. La cantidad máxima de entidades disilábicas (lo no marcado) sería 36 (pipi, papi, titi, tati, kiki, kaki....). El resultado sería una lengua cuyo léxico se limitara a unas 36 unidades léxicas (Kager, 1999).

Expuesto lo cual, pues, la TO considera que el educto que surge de una gramática que se basa en la satisfacción de restricciones es inherentemente óptimo en el sentido de que incurre en menos infracciones de las restricciones superiores del juego de restricciones. La gramática, en efecto, genera un juego de candidatos posibles que se evalúan en función de su satisfacción de las restricciones superiores y, al mismo tiempo, infringe de una manera insignificante las restricciones inferiores. Ambos tipos de restricciones son capaces de eliminar cualquier educto que no cumpla los requisitos expuestos por dicha restricción, pero la condición de optimidad de un candidato se decide por la posición jerárquica de la restricción que queda infringida. Fijémonos en el siguiente esquema:

(17)



El candidato (a) satisface la primera restricción pero infringe la segunda, por lo que es eliminado del proceso de evaluación. El candidato (b) satisface la primera y segunda restricción pero infringe la tercera, de modo que resulta no óptimo. El candidato (e) infringe la primera restricción, perdiendo así la posibilidad de avanzar a la segunda por haber infringido la restricción superior de la jerarquía. El candidato (d) satisface todas las restricciones y, en consecuencia, resulta óptimo.

Como se puede percibir, el conflicto entre restricciones es inevitable ya que, por un lado, hay un juego de restricciones que requieren una réplica exacta del aducto en el educto (las restricciones de fidelidad) y, por otro, existe una fuerza que exige que los aductos se adhieran a las normas de buena formación en una lengua especificada (las restricciones de marcadez). En este sentido, entonces, es lógico dar por supuesto que todas las restricciones de la jerarquía no pueden satisfacerse a la vez, ni siquiera por el candidato óptimo. Por tanto, la noción de optimidad es un concepto relativo. Aunque el candidato óptimo incurrirá en una, o varias infracciones de las restricciones de una jerarquía dada, las restricciones que infringe este candidato ocuparán una posición tan inferior de la jerarquía que no impedirán que el candidato resulte óptimo.

Las restricciones de marcadez le imponen un requisito al educto para que cumpla las normas de buena formación que están establecidas en una lengua especificada. Anteriomente, hemos visto que el concepto de marcadez implica varios tipos de estructuras: (a) la clase de segmentos, (b) las estructuras prosódicas, y (c) las posiciones que un segmento puede ocupar. Se pueden formalizar estas generalizaciones de dos maneras. Se pueden representar como prohibiciones de una estructura marcada como en los siguientes ejemplos (Kager, 1999):

(18) Restricciones de marcadez (prohibiciones)
- (a) Las vocales no son nasales, o *V(nasal)
- (b) Una sílaba no puede llevar una coda, o *CODA
- (c) Los oclusivas no son sonantes, o *C(oclusiva, sonante)

O bien, se pueden expresar mediante una frase afirmativa como en el siguiente ejemplo (19):

(19) Restricciones de marcadez (afirmaciones)
- (d) Las vocales son sonantes, o V(sonante)
- (e) Una consonante tiene que ocupar
  la posición prenuclear de una sílaba, o SÍL-(CV)

Hemos expuesto que la función básica de las restricciones de fidelidad es la retención de los elementos del aducto en el educto, lo cual correlaciona las dos representaciones. Las restricciones que siguen en el ejemplo (20) sirven para mantener esta correspondencia de propiedades fonológicas:

(20) Las restricciones de fidelidad
- (a) El educto debe preservar todos los segmentos que aparezcan en
  el aducto, o **MAX.**

(b) El educto debe preservar el orden lineal de todos los segmentos del aducto, o **CONTIG.**
(c) Los elementos del educto deben tener elementos correspondientes en el aducto, o **DEP**.
(d) Los rasgos de un elemento en el aducto deben repetirse en el educto, o **IDENT(ico)$_{\textbf{(rasgo)}}$** .

La TO, en principio, no dispone de ninguna restricción que funcione exclusivamente en el nivel léxico. Este hecho supone que la Teoría de Optimidad se desvía de una manera importante de la fonología generativa, ya que este modelo implicaba la representación subyacente como la base funcional de los análisis.

Los dos tipos de restricciones son universales. Sin embargo, esto no quiere decir que todas las restricciones ocupen la misma posición jerárquica en todas las lenguas. Dependiendo de la jerarquía particular de una lengua, una restricción se puede infringir siempre en un contexto específico en una lengua y satisfacerse siempre en el contexto correspondiente en otra lengua.

Cualquier restricción se puede infringir mientras se infrinja mínimamente. No se infringe una restricción sin motivo de manera caprichosa, siendo la única razón admisible la satisfacción de otra restricción que ocupa una posición superior. Esto supone una ruptura importante con la gramática generativa, ya que este marco no permitía nunca que se infringiera una regla.

En una jerarquía de dos restricciones, la restricción más importante impone una dominancia estricta sobre la restricción menos importante. Este concepto de dominancia define la jerarquía e influye así el candidato que resulta óptimo.

Las restricciones y los juegos de *candidatos* se expresan mediante una tabla. Veamos el siguiente gráfico para concretar esta idea:

(21)

Tabla

a. Juego de restricciones

b. Juego de candidatos

Aducto:	Restricción χ	Restricción ψ
a. Candidato A		
b. Candidato B		
c. Candidato C		

Las restricciones superiores están organizadas de tal manera que la restricción superior de la jerarquía es la que se sitúa en el extremo izquierdo del juego de restricciones. Las sucesivas restricciones siguen hacia la derecha según su valoración en la jerarquía, siendo siempre la restricción en el extremo derecho la que menos se valora. El candidato óptimo será aquel que satisface plenamente las restricciones en el extremo izquierdo indiferente a cuantas infracciones se provocan en las restricciones inferiores. Un candidato óptimo puede infringir todas las restricciones de la jerarquía menos la superior, y aún así ganar al candidato que satisface todas las restricciones menos la superior. Los candidatos no están organizados de una manera particular con referencia a su prioridad en la columna más hacia la izquierda de la tabla. El '*' denota una infracción de una restricción dada. El '!' denota una infracción grave, que hace que el candidato que cometa esta infracción sea necesariamente sub-óptimo. La mano ' ☞ ' indica el candidato óptimo. La siguiente tabla demuestra la secuencia de dominancia de las restricciones:

(22)

	R_1	R_2
☞ a. *candidato a*		*
b. *candidato b*	*!	

Se puede apreciar que el candidato (a) resulta óptimo aunque infringe la restricción (R_2). El candidato (b) infringe la restricción (R_1), la restricción dominante, y resulta así no óptimo.

La organización de la gramática que produce un candidato óptimo se divide en cuatro componentes básicos. Estos componentes se ofrecen en el siguiente ejemplo (23):

(23)

LÉXICO- contiene las representaciones subyacentes de los morfemas.
GEN(ERADOR)- genera infinitos candidatos para una representación subyacente.
EVAL(UADOR)- evalúa el juego de candidatos en relación a su satisfacción o infracción de las restricciones, **RES(tricción),** de fidelidad o marcadez que están programados por el autor.

Hemos mencionado anteriormente que no hay ninguna imposición estructural al aducto en la Teoría de Optimidad. Por tanto, en principio, no existe ninguna imposición sobre qué candidatos se puedan presentar por **LÉXICO**. Las generalizaciones gramaticales se manifiestan de modo exclusivo en el educto. La noción de que un rasgo sea contrastivo en una lengua depende directamente de la interacción de las restricciones en el nivel patente al mantener u omitir alguna estructura que se presente en el aducto.

GEN(erador) entonces se encarga de producir todas las posibles representaciones patentes de una representación subyacente para ser evaluada por el juego de restricciones. Estos posibles eductos forman el *juego de candidatos.* Las posibles formas que **GEN** es capaz de producir son universales e infinitas. Sin embargo, por razones de tiempo, sólo serán considerados los candidatos que lógicamente tienen la posibilidad de resultar óptimos. La siguiente tabla muestra esta organización funcional:

(24)

LEX: ninguna restricción domina el aducto.

RES: presenta las restricciones específicas del análisis.

GEN: presenta un juego infinito de candidatos.

Aducto: pan	Restricción χ	Restricción ψ
a. pan		
b. pãn		
c. paŋ		
d. pa^{n}		
e. pəm		
f. ṗæ		
g. bḁm		

EVAL(uación) determina, según los candidatos expuestos por **GEN**, cuál de ellos será la forma óptima, basándose en la satisfacción del juego de restricciones que se ha generado por **RES**. Se supone que **EVAL** está programado para ser completamente universal y no consta de generalizaciones producidas al nivel de lenguas individuales. Veamos la proyección visual de **CON**, **GEN** y **EVAL** que está ofrecida en el siguiente ejemplo (25) (Archangeli, 1997):

(25)

aducto: /iN.ber.tir/ ($_{\text{verbo}}$ *invertir*)

↓

GEN

↓

(im.ber.tir) (in.ber.tir) (i.ber.tir) (i.mer.tir) (ib.ber.tir) etc.

↓

EVAL

(restricciones)

↓

[im.ber.tír]

La única restricción que se impone sobre la cantidad de candidatos plausibles que **GEN** es capaz de producir es que todos los candidatos sean compuestos de elementos que aparecen en los vocabularios universales de las representaciones lingüísticas en cuanto a su estructura del segmento, la estructura prosódica, la morfología y la sintaxis (Kager, 1999). Es decir que **GEN,** en sí, no se encarga de determinar si un candidato cumple las restricciones que imponga la lengua, sino que ofrece un inventario de posibilidades que se evalúan en la siguiente etapa del modelo.

En principio, **GEN** ofrece todos los eductos lógicos para un aducto dado sin tener en cuenta el juego de restricciones. Por tanto, resulta superflua una secuencia de reglas que expone los procesos por los que una representación subyacente tendría que experimentar para llegar a un educto óptimo. Esto constituye una ruptura con la fonología generativa en el sentido de que la Teoría de Optimidad no pretende imponer cambios estructurales predeterminados sino que el educto que resulta óptimo simplemente satisface las restricciones más importantes de la jerarquía. De esta manera, la Teoría de Optimidad es capaz de ofrecer un candidato óptimo mediante un paradigma que proyecta la representación patente en una etapa sencilla. Se supone que esta proyección constituye uno de las ventajas más importantes de la TO.

El proceso de evaluación se encarga de elegir las representaciones patentes que surgen en una lengua y así se considera que es el componente más trascendental de la gramática. Hemos visto que la cantidad de eductos plausibles que **GEN** puede ofrecer es infinita, pero hasta ahora no hemos mencionado cómo la gramática determina el educto óptimo ni, más importante, cómo se prescinde de los eductos no óptimos. Esto es el dominio de **EVAL**.

EVAL está programado para eliminar representaciones no óptimas. Aparte de los demás principios fundamentales ya mencionados, **EVAL** se compone de otras tres propiedades básicas que le sirven a la hora de determinar la calidad de buena formación en una lengua.

La **Transitividad de la evaluación** sostiene que, dentro de la jerarquía, las relaciones de dominancia son transitivas (Kager, 1999). Esto quiere decir que, si una restricción β domina a una restricción ε, y esta última domina a una restricción σ, sería lógico presumir que la β dominara a la σ. (β>>ε>>σ).

Con referencia a las infracciones que comete un candidato dado, cada infracción constituye una marca en la tabla de evaluación. Si un candidato comete dos veces una infracción de la misma restricción, se reflejarán en la tabla dos marcas en su contra y así sucesivamente. Sin embargo, aunque en principio **GEN** puede presentar cualquier candidato para evaluarse, en ningún caso sería práctico presentar un candidato que no pueda resultar óptimo, ya que se supone que se infringe una restricción exclusivamente para satisfacer una prioridad dominante. A priori, no existe ningún componente programado de la gramática que restrinja que **GEN** presente un educto [mesa] para un aducto /tenedor/. Sin embargo, este candidato, bajo ninguna circunstancia puede surgir como el óptimo, indiferente a la jerarquía de restricciones, ya que se desvía tanto de la representación subyacente, infringiendo gravemente los principios de fidelidad, sin aportar ningún beneficio en lo que se refiere a la reducción de marcadez fonológica.

La satisfacción de una restricción inferior no puede remediar una infracción de una que ocupa una posición superior. Esto implica que la dominancia es estricta. En este sentido la TO no permite concesiones entre las restricciones que ocupan distintas posiciones de superioridad. Del mismo modo, la suma de las infracciones de dos, tres, o un millón de restricciones inferiores no puede rectificar la infracción de una sola restricción superior. Se expone esta última noción en el siguiente ejemplo (26):

(26)

	R_1	R_2	R_3	R_4	R_5
☞ a. *candidato a*		*	*	*	*
b. *candidato b*	*				

Aunque el candidato (b) satisface la cantidad superior de restricciones en la tabla anterior, la infracción de la restricción superior de la jerarquía hace que se elimine por **EVAL**. En cambio, el candidato (a), que sólo satisface una restricción, resulta óptimo aunque infringe una cantidad superior de restricciones.

La transformación de una representación subyacente en una representación patente resulta en una etapa única. Esta proyección sencilla, principio fundamental de la Teoría de Optimidad, contradice de manera directa el paradigma generativa en el que una secuencia de reglas ordenadas, una tras otra, produce una representación patente. Según Kager (1999) y otros, este tipo de *paralelismo* es el componente de la TO que hace que interactúen las restricciones de fidelidad y las de marcadez en una sola jerarquía. Así, se pueden explicar con una mayor claridad los fenómenos que dependen mutuamente de las propiedades tanto fonológicas como de otras categorías lingüísticas, es decir, los procesos que surgen en la interfaz fonología/morfología, sintaxis, etc. Esto supone una facilidad significativa a la hora de expresar una transformación formal entre la representación subyacente y la representación patente.

Una oposición entre dos alófonos en la representación patente se decide por la resolución de conflictos entre las restricciones de fidelidad y las de marcadez. Si una restricción de fidelidad domina a una restricción de marcadez en la jerarquía, el resultado es un contexto en el que se realizan los contrastes que están presentes en su representación subyacente a costa de permitir que surja la representación patente con algún componente que sea relativamente marcado. En cambio, cuando una restricción de marcadez ocupa una posición superior de la jerarquía en relación a la posición de una restricción de fidelidad, lo que surge es un educto insignificantemente marcado a costa de neutralizar los contrastes léxicos:

(27)
(a) Marcadez>>Fidelidad = neutralización de contrastes léxicos.
(b) Fidelidad>>Marcadez= los contrastes léxicos se manifiestan en la representación patente.

En esta sección, hemos ofrecido una introducción de los principios básicos de la TO. En el apartado que sigue, estudiamos cuatro procesos de la fonología del español. A lo largo de estos análisis, exponemos las ventajas de la resolución de conflicto.

1.3.1 Las nasalización vocálica

Nuestro objetivo en este apartado es ofrecer una justificación fonológica para el proceso de nasalización vocálica desde un enfoque de la OT. Hemos visto que este proceso implica una conversión de [-nasal] a [+nasal] en una vocal cuando precede una consonante marcada con el rasgo [+nasal]. Es generalmente aceptado que este proceso se debe a la realización de una apertura entre el velo y paladar en anticipación de la consonante nasal que sigue, lo cual permite que parte del flujo del aire se escape por la cavidad nasal. Observemos cómo el marco generativa formalizaba este proceso con una regla:

(28)
V [+sonante,-consonante]→ V [+sonante,-consonante, +nasal]/__C [+nasal]

Esta justificación expresa que una vocal oral se hace nasal en un contexto en el que precede a una consonante marcada con el rasgo [+nasal].

Como hemos expuesto anteriormente, la TO no programa cambios específicos. La forma óptima es la que satisface la mayor cantidad de las restricciones superiores de una jerarquía mientras que infringe mínimamente las restricciones inferiores. En nuestro análisis, proponemos el siguiente juego de restricciones que, al ser ordenadas, son capaces de producir una vocal nasalizada:

(29)
$*V_{ORAL}N$
Las vocales orales no pueden preceder una consonante nasal.

$*V_{nasal}$
Las vocales nasales son prohibidas.

IDENT-(nasal)
No se permite ninguna desviación del rasgo [nasal] entre el aducto y el educto.

La siguiente ordenación es capaz de producir una vocal nasalizada en un contexto concreto:

(30)
$*V_{ORAL}N$<<[2]$*V_{NASAL}$<< IDENT-(nasal)

Observemos la interacción de estas restricciones en la siguiente tabla:

(31)
Aducto: /flan/

	$*V_{ORAL}N$	$*V_{NASAL}$	IDENT-(nasal)
a. flan	*!		
☞ b. flãn		*	*

Esta tabla expresa que (1) las vocales orales no pueden preceder una consonante marcada con el rasgo [+nasal], (2) las vocales nasales son prohibidas, y (3) no puede haber ningún cambio respecto al valor del rasgo [nasal] entre el aducto y el educto. Esencialmente, la ordenación de estas restricciones exige que una vocal resulte marcada por [+nasal] cuando precede una consonante nasal.

El candidato (b) resulta óptimo por haber satisfecho la restricción superior al presentar una vocal nasalizada. Incurre en dos infracciones de las restricciones inferiores, pero se cometen estas infracciones para satisfacer la restricción superior, una estrategia óptima. El candidato (a), sin embargo, decide satisfacer las restricciones inferiores a cambio de incurrir en una infracción grave de la restricción superior, produciendo una forma no óptima.

Hemos visto que esta jerarquía es capaz de justificar la producción de una vocal nasalizada cuando la consonante que sigue es marcada por [+nasal]. No obstante, un punto notable de la TO es que esta jerarquía se puede aprovechar también para justificar el surgimiento de una vocal no nasalizada en casos en los que se requiere una vocal oral. Si nos fijamos bien en esta jerarquía, vemos que la restricción superior sólo prohíbe que las vocales resulten orales cuando van seguidas por una consonante nasal. Pero observemos lo que ocurre en esta jerarquía si sustituimos este aducto por uno en el que la vocal no aparece antes de una consonante nasal:

(32)
Aducto: /sal/

	$*V_{ORAL}N$	$*V_{NASAL}$	IDENT-(nasal)
☞ a. sal			
b. sãl		*!	*

Como se puede observar, el hecho de que /a/ no preceda una consonante nasal significa que queda injusticado el surgimiento de una vocal nasalizada en este contexto. Esto implica que la restricción de esta jerarquía será inactiva, ya que sus efectos sólo pueden surtir cuando aparece una consonante nasal.

En esta tabla, el candidato (a) resulta óptimo por satisfacer todas las restricciones de la jerarquía. El hecho de que /a/ resulte oral implica que no infringe las dos restricciones superiores de la jerarquía. Ya que mantiene el valor del rasgo [nasal] que aparece en el aducto, tampoco puede incurrir en una infracción de la restricción inferior. El candidato (b), no obstante, infringe la segunda restricción que prohíbe las vocales nasales al presentar una vocal [ã] en el educto, resultando así no óptimo.

El beneficio que tiene nuestro análisis es que se puede explicar muchos procesos con el mismo modelo jerárquico. Aquí hemos justificado tanto el surgimiento de la vocal nasalizada en contextos en los que, por preceder una consonante nasal, se requiere una vocal nasalizada, como el surgimiento de una vocal oral en casos en los que no aparece ninguna consonante nasal. Esto representa una gran ventaja sobre los modelos generativistas ya que estos paradigmas sólo son capaces de explicar las transformaciones, dejando opaca la razón por la que no se efectúa una conversión en un contexto dado.

Fijémonos de nuevo en la regla que presentamos previamente:

(33)
V [+son,-cons]→ V [+son,-cons, +nasal]/__C [+nasal]

Esta regla sólo puede explicar que cuando una vocal va seguida por una consonante marcada por [+nasal], la vocal debe recibir una marca para [+nasal]. En caso contrario, es incapaz de comunicar la proclividad expresada por los principios de fidelidad hacia el mantenimiento de ciertos rasgos entre el aducto y el educto. En la última jerarquía, esta correlación entre los segmentos en los dos niveles de representación está programada directamente en nuestro análisis.

1.3.2 Espirantización de las oclusivas sonoras

La TO entiende todos los procesos de lenición como el resultado de un paradigma jerárquico dominado por un principio universal fonotáctico que prefiere que se articule una consonante con el mínimo esfuerzo posible. Por supuesto, esto constituye un gran conflicto para las restricciones de fidelidad, que pretenden prohibir cualquier cambio estructural entre el aducto y el educto. En términos descriptivos, la espirantización consiste en la conversión del valor negativo del rasgo [-continuo] a un valor positivo, [+continuo]. Y aunque restringimos nuestro análisis aquí a los datos del español, debemos mencionar que la espirantización es un proceso que surte efecto en una amplia cantidad de lenguas, tanto en lenguas de la misma familia lingüística como en lenguas no relacionadas.

Las reglas generativistas son incapaces de expresar esta última afirmación. Fijémenos en la siguiente regla:

(34)
d→ð/V___
([+C,-S, +sonoro]→[+C,-S, +sonoro, **+continuo**] / V___)

Aunque correcta, esta regla omite una abundante cantidad de generalizaciones fonológicas, la más importante de las cuales es el mantenimiento del rasgo [-continuo] en contextos en los que la espirantización no puede surtir efecto por el contexto fonológico. Básicamente, esta regla explica la transformación sin considerar los principios de fidelidad que prohíben el cambio en ciertos contextos fonológicos.

Desde el punto de vista de la TO, la espirantización se justifica por la interacción de dos restricciones básicas. Primero, una regla fonotáctica se encarga de requerir que las consonantes se produzcan con el mínimo esfuerzo articulatorio posible, LAZY (Krichner, 1998). En segundo lugar, una restricción de fidelidad, IDENT-I/O$_{(cont)}$, expresa que no se permite ninguna permutación respecto al rasgo [continuo] entre el aducto y el educto. Formalizamos estas restricciones en el siguiente ejemplo:

(35)
LAZY
Reducir el esfuerzo articulatorio.

IDENT-I/O$_{(cont)}$
No se permite ninguna desviación del rasgo [continuo] entre el aducto y el educto.

Cuando LAZY domina a IDENT-I/O$_{(cont)}$, se lenifica la consonante. En caso contrario, no ocurre ningún cambio:

(36)

/d/	LAZY	IDENT-I/O$_{(cont)}$
a.[d]	*!	
☞ b.[ð]		*

(37)

/g/	LAZY	IDENT-I/O$_{(cont)}$
a.[g]	*!	
☞ b.[ɣ]		*

(38)

/b/	IDENT-I/O$_{(cont)}$	LAZY
☞ a. [b]		*
b.[β]	*!	

En las dos primeras tablas (36) y (37), LAZY es el principio dominante. Los eductos óptimos que resultan de estas jerarquías son los que presentan un educto lenificado, los candidatos (b). En la tercera tabla (38), sin embargo, es el principio más importante el mantenimiento de rasgos subyacentes en el educto. Por tanto, resulta óptimo el candidato que no presenta ninguna permutación del rasgo [continuo] en el educto, el candidato (a).

Como vemos, esta jerarquía es capaz de predecir un educto lenificado. Sin embargo, la jerarquía que hemos presentado sólo funciona en un contexto libre. Para llegar a un esquema funcional que explica el proceso de espirantización en las oclusivas sonoras, habrá que matizar nuestra jerarquía para que los efectos de LAZY sólo puedan surtir en las oclusivas sonoras, ya que, tal y como aparece, LAZY puede debilitar cualquier consonante en cualquier posición.

Para restringir los efectos de LAZY, debemos programar una restricción de fidelidad tal que deje expresado el hecho de que se tenga que mantener el punto de articulación del aducto en la representación fonética. Esto se expresa mediante una restricción $\text{IDENT}_{(\text{punto})}$, que se encarga de crear una correspondencia que especifica el mantenimiento del punto de articulación entre los dos niveles de representación:

(39)
$\text{IDENT}_{(\text{punto})}$
No se permite ninguna desviación del rasgo [lugar] entre el aducto y el educto.

La siguiente jerarquía es capaz de predecir el educto óptimo en un contexto específico:

(40)
$\text{IDENT}_{(\text{place})}$»$\text{LAZY}_{[\text{voiced stops}]}$» $\text{IDENT-I/O}_{(\text{cont})}$

Consideremos la interacción de estas restricciones en las siguientes jerarquías:

(41)
Aducto: /kada/

/kada/	$\text{IDENT}_{(\text{punto})}$	LAZY	$\text{IDENT}_{(\text{cont})}$
a.[kada]		*!	
☞b.[kaða]			*
c.[kaØa]	*!		

(42)
Aducto: /lago/

/lago/	$\text{IDENT}_{(\text{punto})}$	LAZY	$\text{IDENT}_{(\text{cont})}$
a.[lago]		*!	
☞b.[laγo]			*
c.[laØo]	*!		

(43)
Aducto: /kaba/

/kaba/	$\text{IDENT}_{(\text{punto})}$	LAZY	$\text{IDENT}_{(\text{cont})}$
a. [kaba]		*!	
☞b.[kaβa]			*
c.[kaØa]	*!		

Ahora bien, hemos ofrecido una explicación que se basa en la resolución de conflicto del proceso de espirantización en español, pero queda por explicar la justificación teórica del mantenimiento del valor negativo para el rasgo [continuo] en ciertos contextos fonológicos.

Hemos visto que las consonantes oclusivas sonoras se lenifican en todos los contextos salvo cuando van precedidas por una nasal, y, en el caso de /d/, cuando va precedida por /l/. Este último caso se puede expresar por el hecho de que /l/ está subespecificada por el rasgo [continuo] en la representación subyacente, significando que puede recoger tanto el valor negativo como el positivo por el rasgo [continuo] en un nivel post-léxico. Al juntarse con /d/, /l/ debe resultar marcada por [-continuo], lo cual prohíbe que se extienda el rasgo [+continuo] de /l/ a /d/.

Podemos formalizar este detalle en un modelo jerárquico al programar una restricción de marcadez que requiere que ciertas secuencias de consonantes compartan el mismo valor para un rasgo determinado. En nuestro caso, habrá que programar una restricción que requiere que se comparta el valor positivo del rasgo [continuo]:

(44)
AGREE-CONT(inuo)
Las secuencias de consonantes contiguas [nasal+consonante] y [lateral+consonante] deben compartir el valor del rasgo [continuo].

Esta restricción en sí no es capaz de producir los resultado deseados, que la primera consonante de la secuencia asimile el valor del rasgo [continuo] de la segunda consonante. Para obtener esto, debemos programar una función que prohíbe que los ataques (*onsets*) modifiquen su valor del rasgo para [continuo]:

(45)
ONSET-IDENT(continuo)
Las consonantes que aparecen en posición inicial de sílaba precedidas por una nasal o /l/, en el caso de /d/, deben retener sus especificaciones subyacentes para el rasgo [continuo] en el educto.

Estas restricciones expresan que una secuencia simple de ciertas consonantes tienen que compartir un valor para el rasgo [continuo], y que no puede ser la segunda la que modifica este valor.

Consideremos la siguiente jerarquía:

(46)
AGREE-CONT » ONS-IDENT(cont.) » [ONS-COND » IDENT$_{(punto)}$ » LAZY » IDENT$_{(continuo)}$

Observemos su interacción en la siguiente tabla:

(47)
Aducto: /alkalde/

/alkalde/	AGREE-CONT	ONS-IDENT(cont.)	IDENT$_{(punto)}$	LAZY	IDENT-I/O$_{(cont)}$
☞ a.[alkal̪de]				*	
b.[alkal̪ðe]	*!	*			*
c.[alkalØe]			*!		

(48)
Aducto: /angula/

/angula/	AGREE-CONT	ONS-IDENT(cont.)	IDENT$_{(punto)}$	LAZY	IDENT-I/O$_{(cont)}$
☞ a.[aŋgula]				*	
b.[aŋɣula]	*!	*			*
c.[aŋkula]				*!	

En estas tablas (47) y (48), resultan óptimos los candidatos que retienen el valor negativo para el rasgo [continuo], los candidatos (a). Los candidatos (b) presentan una consonante lenificada, resultando así no óptimos. Los candidatos (c) satisfacen las restricciones más superiores de la jerarquía, pero cometen una infracción grave de LAZY al proponer una consonante ya lenificada, como en la tabla (47), ya fortificada, como en la tabla (48).

1.3.3 Sonorización y ensordecimiento

La sonorización es un proceso por el cual una consonante sorda se hace sonora mediante la extensión del rasgo [+sonoro] motivada por otro segmento en su entorno fonológico. En nuestro análisis, examinamos la sonorización de /s/ y /θ/ en contextos en los que preceden una consonante marcada por [+sonora]. Desde el punto de vista teórico, podemos justificar este proceso al programar una restricción, $\text{AGREE}_{[\text{sonoridad}]}$ que requiere que ciertas secuencias compartan el mismo valor del rasgo [sonoridad]. Cuando esta restricción domina a una restricción de fidelidad que prohíbe la modificación de valores subyacentes de un rasgo dado entre el aducto y el educto, $\text{IDENT}_{[\text{sonoridad}]}$, se puede extender el valor positivo de la consonante [+sonoro] a la consonante [-sonoro]:

(49)
$\text{AGREE}_{[\text{sonoridad}]} » \text{IDENT}_{[\text{sonoridad}]}$

(50)
Aducto: /desde/

/desde/	AGREE(voice)	$\text{IDENT}_{(\text{voice})}$
a. de[s]de	*!	
☞b.de[s̬]de		*

(51)
Aducto: /xaθmin/

/xaθmin/	AGREE(voice)	$\text{IDENT}_{(\text{voice})}$
a. xa[θ]min	*!	
☞b. xa[ð]min		*

En estas tablas (50) y (51), el candidato que presenta una consonante sonora es el que resulta óptimo, es decir, los candidatos (b). Al mantener el valor negativo para el rasgo [sonoridad], los candidatos (a) resultan no óptimos ya que esto implica una infracción grave de la restricción superior de la jerarquía.

La pérdida de sonoridad en posición final de palabra se puede justificar con el siguiente juego de restricciones:

(52)

*CODAS SONORAS$_{\text{(OCLUSIVAS)}}$]
Están prohibidas las oclusivas sonoras en posición final de palabra.

LAZY-CODA
Reducir el esfuerzo de los segmentos en posición final de sílaba.

IDENT$_{\text{(sonoridad)}}$
No se permite ninguna desviación del rasgo [sonoridad] entre el aducto y el educto.

IDENT$_{\text{(punto)}}$
No se permite ninguna desviación del punto de articulación entre el aducto y el educto.

Consideremos su ordenación en la siguiente jerarquía:

(53)

*CODAS SONORAS$_{\text{(OBSTRUYENTES)}}$]» LAZY-CODA» IDENT$_{\text{(sonoridad)}}$ » IDENT$_{\text{(punto)}}$

Veamos su interacción en la siguiente tabla:

(54)

Aducto: /birtud/

/biɾtud/	*CODAS SONORAS$_{\text{(OBSTRUYENTES)}}$]	LAZY-CODA	IDENT$_{\text{(sonoridad)}}$	IDENT$_{\text{(punto)}}$
☞ a.[biɾtuθ]			*	*
b.[biɾtud]		*!	*	
c.[biɾtuð]	*!			*

El candidato (a) satisface las dos restricciones superiores al presentar una consonante insonora en posición final de palabra, resultando óptimo. El candidato (b) prefiere mantener máxima fidelidad al aducto a cambio de infringir la segunda restricción más importante de la jerarquía, LAZY, al no debilitar la consonante. El candidato (c) es el que resulta menos óptimo ya que, al mantener el valor positivo para el rasgo de [sonoridad], incurre en un infracción grave de la restricción superior de la jerarquía.

1.3.4 La asimilación del punto de articulación

Las consonantes nasales y, en menor grado, /l/ asimilan el punto de articulación de la consonante que sigue. Hemos visto que son estas consonantes las que prohíben el proceso de espirantización en las oclusivas sonoras. La fonología generativa explica el proceso de asimilación mediante una regla que obliga la extensión del punto de articulación a otra consonante en su entorno fonológico. Harris (1984a) propone la siguiente regla:

(55)

$$[+\text{nasal}] \rightarrow \begin{bmatrix} \alpha\ \text{coronal} \\ \beta\ \text{anterior} \\ \mu\ \text{distribuido} \\ \delta\ \text{back} \end{bmatrix} \;/\; \underline{\quad} \begin{bmatrix} +\text{consonante} \\ \alpha\ \text{coronal} \\ \beta\ \text{anterior} \\ \mu\ \text{distribuido} \\ \delta\ \text{back} \end{bmatrix}$$

Como se puede observar, esta regla expresa poco más de lo que hemos expuesto hasta este punto en nuestro análisis. Esto es, la consonante nasal asimila el punto de articulación de la consonante que sigue. El problema con este tipo de regla es que no ofrece explicación alguna del proceso en sí, sino una demostración de lo que ocurre en un contexto dado.

Nuestro análisis propone una explicación que se basa en la resolución de conflicto entre la marcadez y la fidelidad. Consideremos el siguiente juego de restricciones que proponemos para justificar el proceso de asimilación en nasales:

(56)

AGREE-PA
Las secuencias de consonantes contiguas [nasal+consonante] deben compartir el mismo punto de articulación.

ONSET-IDENT(pa)
Las consonantes que aparecen en posición inicial de sílaba deben retener las especificaciones subyacentes para el punto de articulación del aducto en el educto.

IDENT-PA
Se deben retener todas las especificaciones subyacentes para el punto de articulación en el educto.

Nuestra jerarquía aparece en el siguiente ejemplo:

(57)
AGREE-PA » ONSET-IDENT(pa) » IDENT-PA

Observemos su interacción en la siguiente tabla:

(58)
Aducto: /un+policia/

	AGREE-PA	ONSET-IDENT(pa)	IDENT-PA
☞ a. u[m+p]olicía			*
b. u[n+p]olicía	*!		
c. u[ŋ+p]olicía	*!		*
d. u[n+t]olicía		*!	*

El candidato (a) resulta óptimo al presentar un educto en el que se extiende el punto de articulación de /p/, consonante bilabial, a la consonante nasal alveolar que precede. Los candidatos (b) y (c) incurren en una infracción de la restricción superior de la jerarquía al presentar eductos en los cuales la nasal no asimila el punto de articulación de /p/. El candidato (d) satisface la restricción superior de la jerarquía, pero resulta no óptimo ya que la consonante que se cambia de punto de articulación es /p/, y no la nasal, tal como queda estipulado por la segunda restricción más importante de la jerarquía.

Para justificar la asimilación de /l/, hace falta programar dos restricciones que expresan que las laterales dorsales y las laterales labiales son segmentos inviables en el español. Este hecho sirve para restringir los efectos de AGREE-PA:

(59)
*DOR-LAT
Las laterales dorsales son imposibles.

*DOR-LAB
Las laterales labiales son imposibles.

Nuestra jerarquía que justifica el proceso de asimilación del punto de articulación en laterales aparece en el siguiente ejemplo:

(60)
*LAB-LAT»*DOR-LAT»AGREE-PA»ONSET-IDENT(pa)»IDENT-PA

Consideremos la siguiente tabla:

(61)
Aducto: /alkalde/

	*LAB-LAT	*DOR-LAT	AGREE-PA	ONSET-IDENT(pa)	IDENT-PA
☞ a.[alká̪l̪d̪e]					*
b.[aɫká̪l̪d̪e]		*!	*		
c.[alkáld̪e]			*!		

En esta tabla, el candidato (a) es el candidato óptimo, ya que satisface todas las restricciones importantes de la jerarquía al dejar que /l/ se convierta en dental para asimilar el punto de articulación de /d/, consonante marcada por [+anterior]. El candidato (b) asimila el punto de articulación tanto de /d/ como de /k/, por lo cual resulta no óptimo al infringir *DOR-LAT, la segunda restricción más importante de la jerarquía. El candidato (c) prefiere conservar la máxima fidelidad al aducto, por lo cual resulta no óptimo, ya que esto lleva a la infracción de AGREE-PA, que requiere que /l/ y /d/ compartan el mismo punto de articulación.

1.4 CONCLUSIONES

En este capítulo inicial hemos ofrecido un repaso de los sonidos del español y su clasificación fonológica. Hemos examinado cuatro procesos fonológicos que ocurren en el español y su justificación desde el marco global de la TO. Todos los análisis que hemos expuesto en este primer capítulo se pueden reducir a un esquema principal: los cambios fonológicos surgen cuando los principios de marcadez dominan a los principios de la fidelidad, marcadez » fidelidad.

Empezamos con un análisis de la nasalización de las vocales en contextos en los que una vocal precede una consonante marcada por [+nasal]. El valor positivo de la nasal se extiende a la izquierda, creando en efecto una vocal nasalizada. Su justificación teórica involucraba la resolución de conflicto entre una restricción de marcadez que prohibía que surgieran vocales orales en contextos que preceden una consonante nasal, y una restricción de fidelidad que prohibía cualquier divergencia entre aducto y educto. La gran ventaja de este análisis que se basa en la resolución de conflicto es que no sólo se justifican los eductos óptimos, sino que se ofrece una justificación programada para la preclusión de los eductos no óptimos. Además, la orientación a la representación patente de la TO hace que la justificación que hemos ofrecido para el proceso de nasalización también sirva para justificar los casos en los que ningún cambio está requerido en un contexto determinado. Esto representa una gran ventaja sobre los modelos generativistas, ya que las reglas sólo pueden justificar los cambios.

Más adelante, examinamos el caso de espirantización de las oclusivas sonoras. Propusimos un análisis que se basaba en la idea de que ciertas consonantes se debilitan en determinados contextos fonológicos por la extensión del rasgo [+continuo] de otro segmento que aparece en el entorno fonológico. Cuando la restricción de marcadez, LAZY, domina la restricción de fidelidad, IDENT, el educto óptimo debe presentar un segmento que requiere un mínimo esfuerzo articulatorio.

En la siguiente sección ofrecimos un análisis del proceso de la sonorización de ciertos segmentos en posición final de sílaba. Hemos presentado una justificación que se basaba en la idea de que ciertas secuencias de consonantes deben compartir ciertos rasgos comunes, en este caso el de [sonoridad]. Al programar una restricción superior que obligaba a que las secuencias /s/+C[+sonora] y /θ/+C[+sonora] compartieran un valor para el rasgo [sonoridad], pudimos explicar este proceso de forma más satisfactoria que otros análisis previos, ya que nuestro análisis aporta una cantidad superior de generalizaciones universales.

Finalmente, aportamos un análisis de la asimilación del punto de articulación de las nasales y /l/. Hemos demostrado que se puede justificar este proceso por la ordenación superior de una restricción superior, AGREE, que requería que las secuencias C[+nasal]C, y /l/+C[+coronal, -cont.] compartieran un valor para el rasgo [continuidad]. Al estipular que las consonantes que aparecen en posición inicial de sílaba tienen que retener su valor para [-continuo] en el educto, hemos podido producir una jerarquía que era capaz de predecir el educto óptimo sin que impusiéramos ningún cambio específico. En este sentido, pues, hemos tratado el proceso de asimilación en términos generales y universales en vez de exponer la reacción de una lengua individual hacia el proceso, que es lo que propone el marco generativo.

A lo largo de este capítulo inicial hemos expuesto las ventajas que aporta la TO. Hemos mostrado que la TO ofrece una explicación de la generalización en lugar de una descripción del proceso, lo cual procede de la necesidad de programar no sólo las restricciones que eligen un educto óptimo, sino las restricciones que descartan las formas no óptimas asimismo. La consecuencia lógica de esto es la formalización de una cantidad superior de datos relacionados con un proceso determinado. Estas ventajas, en conjunto con la orientación fonética de la TO, aportan un análisis superior de las generalizaciones que hemos visto en este capítulo comparado con las explicaciones expuestas por el modelo generativo.

CAPÍTULO II

LAS SÍLABAS

2.0 INTRODUCCIÓN

En este capítulo examinamos la agrupación de sonidos en la unidad llamada la "sílaba". Específicamente analizamos los datos sacados de la distribución de segmentos fonológicos del español y ofrecemos un análisis preliminar que se basa en la resolución de conflicto. Introducimos las restricciones universales que determinan los segmentos que pueden ocupar ciertas posiciones silábicas y su interacción e impacto en la fonología del español.

Este es un capítulo de transición en el que introducimos el concepto de la agrupación de sonidos y vemos la distribución de segmentos en las sílabas españolas. Las ideas que presentamos en este capítulo sirven como la base para los análisis que ofrecemos en el siguiente capítulo 3.

2.1 LAS SÍLABAS

La sílaba tiene tres componentes básicos: el ataque (ing. *onset*), el núcleo, y la coda (ing. *coda*). De estos tres, sólo el núcleo es obligatorio en el español. Los ataques y las codas son prescindibles. Consideremos las cifras que se obtuvieron de nuestro recuento de mil sílabas sacadas de un texto español[3] respecto a la frecuencia de los distintos patrones silábicos:

[3] Periódico *20 Minutos* del 20 de enero de 2009.

(1)
La frecuencia de ataques en las sílabas en español

	Ataques	Simples en interior de palabra	Simples en inicial de palabra	Complejas en interior de palabra	Complejas en inicial de palabra
% de todas las sílabas	97.6%	55.2%	35.3%	7.1%	0%
% de todos los ataques	100%	56.5%	36%	7.27%	0%
% de ataques en interior de palabra	-	77%	-	12.8%	
% de ataques en inicial de palabra	-	-	100%	-	0%
Números reales	976	552	353	71	0

(2)
La frecuencia de codas en las sílabas en español

	Codas	Simples en interior de palabra	Simple final de palabra {s}	Compleja interior de palabra	Compleja final de palabra	Simples interior de palabra /rsdnlθ/	Simples interior de palabra no /rsdnlθ/
% de todas las sílabas	33%	18%	13%	1%	0%	17%	1%
% de todas las codas	100%	56.25%	41%	6.25%	0%	54.8%	3.2%
% de codas en interior de palabra	-	90%	-	11%		94.4%	7.6%
% de codas en final de palabra	-	-	100%	-	0%	-	-
Números reales	330	180	130	20	0	170	10

Estas cifras revelan una preferencia patente para los onsets. Sólo un 2.4% de todas las sílabas que aparecían en nuestro recuento no tenían onset, mientras que un 67% de las sílabas no tenían coda.

El español impone unas restricciones rígidas sobre los segmentos fonológicos, y la cantidad de segmentos, que pueden ocupar cada posición silábica. Además, el español también tiene una serie de restricciones que delimitan las secuencias de segmentos en cada posición. Fijémonos en los datos sobre las consonantes que pueden aparecer en posición inicial de palabra en español:

(3)
Onsets simples en posición inicial de sílaba.

[m]	[máno]	[n]	[no]	[ɲ]	[ñóño]	[k]	[káma]
[p]	[pan]	[t]	[tú]	[t͡ʃ]	[t͡ʃiβáto]	[g]	[gáma]
[b]	[béso]	[d]	[diciémbɾe]				
				[d͡ʝ/ʝ]	[ʝáno]	[x]	[xiména]
[f]	[fonoloxía]	[θ]	[θapáto]			[w]	[wé.βo]
		[s]	[sjémpɾe]				
		[r]	[rey]				
		[l]	[láta]				

Ahora, consideremos los últimos segmentos de las siguientes secuencias de dos consonantes que aparecen en el interior de la palabra:

(4)

Secuencias de dos consonantes en el interior de la palabra (C[…])

[b]	a<u>mb</u>os			[d]	bo<u>nd</u>að			[g]	a<u>ŋg</u>ustja		
[p]	ca<u>sp</u>a			[t]	antena			[k]	a<u>ɾk</u>o		
[β]	ba<u>ɾβ</u>a	[ð]	be<u>ɾð</u>að	[s̬]	*	[d͡ʝ/ʝ]	i<u>ɲd͡ʝ</u>ektar	[ɣ]	a<u>ɾɣ</u>uiɾ	[w]	de<u>zw</u>esaɾ
[f]	e<u>ɱf</u>ɾiaɾ	[θ]	ak<u>θj</u>on	[s]	a<u>βs</u>oluto					[x]	a<u>ŋx</u>el
						[ʧ]	inʧaɾ				
[m]	e<u>sm</u>eralda			[n]	e<u>tn</u>iko	[ɲ]	*	[ŋ]	*		
				[l]	a<u>tl</u>eta						
		[ɾ]	pa<u>ðɾ</u>e	[r]	e<u>nr</u>ollar						

Como cabe esperar, si una consonante puede ocupar la posición inicial de palabra, puede también aparecer en posición inicial de sílaba dentro de la palabra. Esta congruencia de distribución queda explicada por la hipótesis de la división silábica (Syllabic Parsing Hypothesis en inglés) expuesta en Itô (1989), según la cual todas las palabras se tienen que dividir en sílabas y la distribución de segmentos está determinada por unas restricciones fonológicas que establece la buena formación en una lengua dada. Entendido esto, esta hipótesis también predice que si un segmento no es admisible en una posición específica, digamos en posición final de palabra, será inadmisible no sólo en esa posición, sino también en posición coda en el interior de la palabra.

Ahora bien, veamos la distribución de segmentos en codas simples en posición final de palabra:

(5)

Codas simples en posición final de palabra	
[ð]	[θju.ðáð]
[s]	[mes]
[n]	[xó.βen]
[l]	[mal]
[ɾ]	[maɾ]
[θ]	[peθ]

Los siguientes ejemplos muestran la distribución de codas simples en posición interior de palabra:

(6)

Secuencias de dos consonantes en el interior de la palabra ([…]C)

[b]	*			[d]	*			[g]	*		
[p]	apto			[t]	atmosfeɾa			[k]	aktor		
[β]	oβteneɾ	[ð]	aðβeɾtiɾ	[s̬]	mis̬mo	[ʝ]	*	[ɣ]	doɣma	[w]	*
[f]	afɣano	[θ]	biθkotʃo	[s]	resto					[x]	*
						[t͡ʃ]	*				
						[d͡ʝ]	*				
[m]	ambos			[n]	djente	[ɲ]	iɲd͡ʝektar	[ŋ]	aŋxel		
				[l]	aldea						
		[ɾ]	paɾto	[r]	perla						

Se puede observar que la hipótesis de Itô (1989) está corroborado por los datos del español respecto a los ataques, pero la incongruencia entre la distribución de segmentos en posición final de sílaba y los que pueden aparecer en posición final de palabra causa ciertas dificultades teóricas para esta hipótesis. Tratamos esta incongruencia en el capítulo 3.

Consideremos un ejemplo concreto de la distribución silábica: *-esmerar* [es̬meɾáɾ]. En teoría, la secuencia [s̬m] se puede dividir de tres maneras. Se podría proponer que estas consonantes representan un ataque complejo. Sin embargo, esta opción no es viable, ya que esta secuencia no aparece nunca en posición inicial de palabra, como cabría de esperar si aceptáramos la hipótesis de división silábica expuesta en Itô (1989). Además, se observa en la tabla (4) que [s̬] no está permitida como ataque en español, pues, sólo puede aparecer en posición final de sílaba cuando va precedida por una consonante [+sonora].

Otra opción es afirmar que la secuencia representa una coda compleja de la primera sílaba [es̬m]. Esta opción se puede descartar no sólo por las restricciones que tiene el español sobre las consonantes que pueden aparecer en posición final de sílaba, sino también por la tendencia universal de que los núcleos siempre prefieren juntarse con un ataque siempre que sea fonológicamente posible (Kager, 1999). Al manifestar que [s̬m] representaran la coda de la primera sílaba, el núcleo [e] (-esm<u>e</u>rar), quedaría sin ataque, lo cual infringe de una manera grave la generalización universal expuesta en Kager (1999) respecto a la proclividad de que los núcleos prefieren alinearse a un ataque siempre que sea fonológicamente viable.

La tercera estrategia es dividir la sílaba entre [s̬] y [m], tal que [s̬] representa la coda de la primera sílaba y [m] aparece como el ataque de la sílaba que sigue. Esta opción es la correcta.

Podemos formalizar lo que hemos visto hasta este punto con las siguientes restricciones:

(7)
PARSE
Las palabras deben estar exhaustivamente dividas en sílabas.

ONSET (Kager, 1999)
$*[_\sigma$ V (Los núcleos deben tener ataques)

NoCODA (Kager, 1999)
*C]$_\sigma$ (Las sílabas tienen que ser abiertas)

Indiferente a su orden jerárquico, estas restricciones son capaces de captar la generalización de que las consonantes intervocálicas siempre se silabifican como el ataque del núcleo que sigue. Consideremos la siguiente tabla:

(8)
Aducto: /esmerar/

	PARSE	ONSET	NoCODA
☞ a. es̬.me.ɾáɾ			*
b. es̬meɾáɾ	*!		
c. es̬m.e.ɾáɾ		*!	*

Esta jerarquía básica expresa que las palabras se tienen que dividir en sílabas y que los núcleos siempre prefieren tener un *onset*. El candidato (a) satisface las dos primeras estipulaciones, pero se ve obligado a infringir la inferior para satisfacerlas, una estrategia óptima. El candidato (b) infringe la resticción superior al permitir que los segmentos aparezcan sin divididirse en sílabas, resultando así el candidato menos óptimo. El candidato (c) presenta una coda compleja en la primera sílaba, obligando el segundo núcleo a aparecer sin *onset* donde es fonológicamente posible. Esto resulta en una infracción importante de ONSET, por lo cual el candidato (c) está eliminado.

2.2 CONCLUSIONES

En este capítulo hemos aportado una introducción de la distribución de segmentos en sílabas. Hemos presentado tres restricciones que son capaces de predecir la división sílabica en palabras del tipo CVCV. En el capítulo que sigue, profundizamos en este tema, analizando los datos relacionados con la distribución de segmentos en secuencias de dos, tres, y cuatro segmentos, tanto en los márgenes como en el interior de la palabra. Demostraremos que se puede justificar y predecir la distribución de segmentos en sílabas al aprovechar y refinar las tres restricciones básicas que hemos introducido aquí. También justificaremos la incongruencia entre la distribución de segmentos permisibles en posición final de sílaba y final de palabra. Mostraremos que se puede programar esta justificación en un modelo que se basa en la resolución de conflicto entre la marcadez y la fidelidad.

CAPÍTULO III

LAS SÍLABAS EN ESPAÑOL

3.0 INTRODUCCIÓN A LAS SÍLABAS EN ESPAÑOL

En este capítulo examinamos la estructura interna de las palabras en español. Profundizamos en el tema de la división silábica que presentamos en el capítulo anterior. Comenzamos nuestro trabajo con un estudio de los ataques en español, empezando con los ataques simples antes de estudiar las secuencias de consonantes que pueden formar ataques complejos. Más adelante estudiamos los segmentos permisibles que pueden aparecer como codas, tanto en posición final de palabra como en el interior de palabra. El tercer apartado analiza las secuencias de dos, tres, y cuatro consonantes en el interior de palabra.

Formalizamos los datos que exponemos en un modelo que se basa en la satisfacción de restricciones. Nuestros datos indican que el proceso de silabificación en español está dominado por la buena formación de los ataques, lo cual queda programado en nuestro modelo. Básicamente, proponemos el argumento de que, aunque las codas están permitidas en español, nunca son preferibles, pues a veces son simplemente el resultado de alguna modificación morfológica. Como consecuencia, nuestro modelo explica la asimetría que se observa entre los segmentos que aparecen en posición coda final de palabra y los que surgen en el interior de palabra en esta misma posición silábica. Demostramos que la inclusión programada de la buena formación de codas es redundante y superflua, ya que esta posición no puede ejercer dominancia sobre la buena formación de ataques debido a su posición jerárquica inferior.

Finalmente, ofrecemos un análisis de los núcleos en español y presentamos una jerarquía que es capaz de producir un educto óptimo, al mismo tiempo que explica la razón por la que los eductos no óptimos resultan descartados.

3.1 LOS ONSETS

3.1.1 Los onsets simples

En el capítulo anterior, ofrecimos ejemplos de los segmentos que pueden aparecer en posición inicial de palabra. Volvemos a presentarlos en el siguiente ejemplo (1):

(1)

[m]	[máno]	[n]	[no]	[ɲ]	[ñóño]	[k]	[káma]
[p]	[pan]	[t]	[tú]	[tʃ]	[tʃiβáto]	[g]	[gáma]
[b]	[béso]	[d]	[diciémbre]				
				[j̬/d͡j̬]	[j̬/d͡j̬áno]	[x]	[xiména]
[f]	[fonoloxía]	[θ]	[θapáto]			[w]	[wé.βo]
		[s]	[sjémpre]				
		[r]	[rej̬]				
		[l]	[láta]				

Como se puede observar, ninguna palabra española puede empezar con los segmentos [ŋ], [ɾ] o [s̬]. Esta prohibición es debido a la buena formación posicional y no representa una restricción universal en contra de los segmentos en sí, pues, aparecen con cierta frecuencia como codas. Esta prohibición se puede expresar con la siguiente restricción:

(2)
*ONSET/[s̬,ŋ,ɾ]
Un onset (en español) no puede contener los segmentos [s̬,ŋ,ɾ].

Esta restricción en una posición jerárquica dominante prohíbe el surgimiento de estos segmentos en la posición onset.

3.1.2 Los onsets complejos

Los siguientes ejemplos representan todas las secuencias permisibles en onsets complejos en español. Se puede observar que los ejemplos son escasos, dado que hay unas 361 posibles combinaciones de segmentos, si se calcularan todas las posibles secuencias de dos consonantes de los diecinueve segmentos consonánticos que aparecen en el español:

(3)

/pl/	playa	[plá.ʝa]
/pr/	primo	[pɾí.mo]
/bl/	blusa	[blú.sa]
/br/	brazo	[bɾá.θo]
/tr/	trapo	[tɾá.po]
*/tl/[4]		
/dr/	droga	[dɾó.ɣa]
*/dl/		
/kl/	clavo	[klá.βo]
/kr/	credo	[kɾe.ðo]
/gl/	globo	[gló.βo]
/gr/	grúa	[gɾú.a]
/fl/	flojo	[fló.xo]
/fr/	frúta	[fɾu.ta]

El punto más destacado de estos ejemplos es que sólo las obstruyentes y líquidas pueden juntarse para formar onsets complejos en español.

[4] La Real Academia Española (1992) reconoce unas cuantas palabras de origen indio americano en las que aparece secuencia /tl/, como por ejemplo *tlaco* (*tipo de moneda*), *tlacote* (*-tumor*), o *náhuatl* (*lengua indígena de Méjico*).

El hecho de que surjan los onsets complejos en español implica la infracción de una restricción que prohíbe el surgimiento de onsets complejos:

(4)
*COMPLEX^{ONSETS}
Los onsets complejos no están permitidos.

Los datos que hemos visto hasta ahora indican la existencia de un sistema de restricciones estrictas que determinan los segmentos, y la cantidad de segmentos, que pueden ocupar la posición onset en español. De acuerdo con ellos, el español sólo permite una máxima de dos segmentos en los onsets complejos. Asimismo, aunque hemos visto que sólo las secuencias de obstruyentes/líquidas están permitidas en onsets complejos, se observa en los últimos ejemplos de (3) que no todas las combinaciones de estas consonantes forman onsets admisibles. Además, se observa que ningún segmento que no está permitido como onset simple puede aparecer en un onset complejo. Estas generalizaciones se resumen en el siguiente esquema:

(5)
Generalizaciones de onsets complejos en español

i. Una obstruyente debe ocupar la posición inicial de un onset complejo.
ii. Una líquida debe ocupar la segunda posición de un onset complejo.
iii. Cada componente de un onset complejo debe ser un segmento permitido como onset simple.
iv. No se admiten las secuencias de coronales oclusivas seguidas por una /l/.
v. Las secuencias /s/+consonante no son admisibles.
vi. /θ/ no se admite en onsets complejos.
vii. Las fricativas dorsales no pueden aparecer en onsets complejos.

En el siguiente ejemplo estas generalizaciones aparecen en la forma de restricciones:

(6)
Restricciones que dominan la formación de onsets complejos

i. OL (obstruyente + líquida) (Hammond, 1999)
ii. *ONSET/[ʂ,ɾ,ŋ]
iii. *ONSET/[sC]
iv. *ONSET/[θC]
v. *ONSET/[d,t+l] (Hammond, 1999)
vi. *ONSET/[affricate]α (Hammond, 1999)
vii. *ONSET/[x+l/ɾ]

Antes de ofrecer un modelo que explica la formación de onsets en español, hemos de considerar la idea de que cada clase de segmento tiene un valor abstracto de sonoridad. En los onsets complejos, el grado de sonoridad debe ir incrementando desde el margen izquierdo hasta el núcleo. Harris (1989b) ofrece los siguientes valores abstractos de sonoridad para las consonantes españolas:

(7)

		Valores de sonoridad
obstruyentes	oclusivas	1
	fricativas	
nasales		2
líquidas		3
deslizantes		4
vocales		5

Un repaso breve de los ejemplos que expusimos en el ejemplo (3) revela que la distancia obligatoria de sonoridad en los onsets en español es dos. Consideremos los valores de sonoridad en los siguientes onsets:

(8)

/pl/	$p_{(1)}l_{(3)}$aya	[plá.ʝa]
/pr/	$p_{(1)}r_{(3)}$imo	[pɾí.mo]
/bl/	$b_{(1)}l_{(3)}$usa	[blú.sa]
/br/	$b_{(1)}r_{(3)}$azo	[bɾá.θo]
/tr/	$t_{(1)}r_{(3)}$apo	[tɾá.po]
*/tl/		
/dr/	$d_{(1)}r_{(3)}$oga	[dɾó.ɣa]
*/dl/		
/kl/	$k_{(1)}l_{(3)}$avo (*clavo*)	[klá.βo]
/kr/	$k_{(1)}r_{(3)}$edo (*credo*)	[kɾe.ðo]
/gl/	$g_{(1)}l_{(3)}$obo	[gló.βo]
/gr/	$g_{(1)}r_{(3)}$úa	[gɾú.a]
/fl/	$f_{(1)}l_{(3)}$ojo	[fló.xo]
/fr/	$f_{(1)}r_{(3)}$úta	[fɾu.ta]

En el siguiente ejemplo, se recogen estas congruencias en la forma de restricciones:

(9)
MSD-2^{ONS}
La distancia mínima de dos segmentos contiguous en un onset complejo en español es 2.

(10)
SONSEQ
Los onsets incrementan en sonoridad hasta el núcleo. A partir del núcleo, la sonoridad se disminuye hasta el segmento final de sílaba.
(Kenstowicz 1994)

En el siguiente ejemplo, se ofrece una jerarquía para justificar la formación de onsets complejos en español:

(11)
M-PARSE » PARSE » ONSET » *ONSET-V » SONSEQ»MSD2^{ONS} » *ONSET/[s̬, ɾ,ŋ], *ONSET/[sC],*ONSET/[d,t+l],*ONSET/[θC],*ONSET/[x+l/ ɾ],*ONSET/[affricate]α» *OL » *COMPLEX^{ONSET}» FAITHFUL

Fijémonos en la siguiente tabla que muestra la interacción de esta jerarquía:

(12)

	M-PARSE	PARSE	ONSET	*ONSET-V	SONSEQ	MSD-2^{ONS}	*ONSET/[ʂ,ɾ,ŋ]	*ONSET/[NC]	*ONSET/[sC]	*ONSET/[d,t+l]	*ONSET/[θC]	*ONSET/[x+l/ɾ]	*ONSET/[affricate]α	*OL	*COMPLEX^{ONSET}	FAITHFUL
{Nasal+consonante}	*!							*!							*	
☞ Obstruyente+líquida														*	*	
☞ [pl]														*	*	
☞ [pr]														*	*	
☞ [bl]														*	*	
☞ [br]														*	*	
☞ [fl]														*	*	
☞ [fr]														*	*	
[tl]	*!						*			*				*	*	*
☞ [tr]														*	*	
[dl]	*!						*			*				*	*	*
☞ [dr]														*	*	
☞ [kl]														*	*	
☞ [kr]														*	*	
☞ [gl]														*	*	
☞ [gr]														*	*	
{xl}	*!											*		*	*	*
{xr}	*!											*		*	*	*
{θ+consonante}	*!										*			*	*	*
{/s/+consonante $_{[-liquid]}$}	*!								*					*	*	*
{sl}	*!								*					*	*	*
{sr}	*!								*					*	*	*
{[ʂ,ɾ,ŋ]+consonante}	*!						*								*	*
{Líquida+consonante}	*!				*	*									*	*
{Africada+ consonante}	*!												*		*	*
{semivocal+consonante}	*!				*	*									*	*
{Onset-V}	*!			*											*	*

Como se puede observar, esta tabla es capaz de determinar los eductos óptimos al mismo tiempo que elimina los eductos no óptimos. En este sentido, esta tabla no simplemente ofrece una justificación acertada de la buena formación de los onsets óptimos, sino que ofrece una explicación teórica respecto a por qué se eliminan los onsets no óptimos. Por tanto, se puede afirmar que los análisis desde la TO son explicativos. Por supuesto, este hecho representa una gran ventaja sobre los análisis generativistas, ya que esos modelos sólo pueden describir una forma óptima, sin poder discernir la razón por la que quedan no elegidos los eductos no óptimos.

3.2 CODAS EN POSICIÓN FINAL DE PALABRA

Las codas en español son más restringidas que los onsets en cuanto a los segmentos que pueden aparecer en esta posición final. Esto es particularmente observable en posición final de palabra. Consideremos de nuevo los segmentos que están permitidos en palabras patrimoniales en español:

(13)
Codas simples en posición final de palabra

[d]	[θju.ðáð]
[s]	[mes]
[n]	[xó.βen]
[l]	[mal]
[ɾ]	[maɾ]
[θ]	[peθ]
[x][5]	[re.lóx]

Se puede observar que se excluyen más segmentos de los que se permiten en posición final de palabra. Este hecho se puede reflejar paradigmáticamente al programar un juego de restricciones con la información de que ciertos segmentos no pueden aparecer en determinadas posiciones silábicas, como en el modelo que ofrecimos para justificar la formación de los onsets. Veamos las siguientes restricciones pertinentes a la formación de las codas:

(14)
Restricciones que gobiernan la distribución de segmentos en posición final de palabra

*CODA/m]
*CODA/p]
*CODA/b]
*CODA/f]
*CODA/t]
*CODA/ʎ]
*CODA/ɲ]
*CODA/ʧ]
*CODA/j]

[5] Esta consonante aparece en muy pocas palabras en español y lo habitual es que se elimine en el habla normal: [re.lóx]→[re.ló]

*CODA/d͡ʝ]
*CODA/ŋ]
*CODA/k]
*CODA/g]
*CODA/x]
*CODA/d]
*CODA/r]
*CODA/l]
*CODA/s]
*CODA/θ]
*CODA/n]

Para llegar a un esquema que justifica los segmentos permitidos, y a la vez descartar los segmentos prohibidos, debemos ordenar estas restricciones tal que las restricciones que prohíben el surgimiento de segmentos permisibles asuman las posiciones más inferiores de la jerarquía, mientras que las restricciones que prohíben segmentos que nunca aparecen en posición final de palabra ocupan posiciones superiores. Consideremos la siguiente jerarquía:

(15)
*CODA/m], *CODA/p], *CODA/b], *CODA/f], *CODA/t], *CODA/λ], *CODA/ɲ], *CODA/ʧ], *CODA/j], *CODA/d͡ʝ *CODA/ŋ], *CODA/k], *CODA/g], » *CODA/x], *CODA/d], *CODA/r], *CODA/l], *CODA/s], *CODA/θ], *CODA/n]

Hay aquí una sola división jerárquica. Las restricciones que prohíben segmentos permitidos en posición final de palabra están dominadas por las restricciones que prohíben segmentos ilícitos: *[m, p, b, f, t, λ, ɲ, ʧ, j, d͡ʝ, ŋ, k, g] » *[r, s, d, n, l, θ, x].

Esta jerarquía aparece en la siguiente tabla:

(16)

	*CODA/[m]	*CODA/[p]	*CODA/[b]	*CODA/[t]	*CODA/[λ]	*CODA/[f]	*CODA/[ɲ]	*CODA/[tʃ]	*CODA/[j]	*CODA/[d͡ʝ]	*CODA/[ŋ]	*CODA/[k]	*CODA/[g]	*CODA/[x]	*CODA/[d]	*CODA/[r]	*CODA/[l]	*CODA/[s]	*CODA/[θ]	*CODA/[n]
a. [m]	*!																			
b. [p]		*!																		
c. [b]			*!																	
d. [t]				*!																
e. [λ]					*!															
f. [f]						*!														
g. [ɲ]							*!													
h. [tʃ]								*!												
i. [j]									*!											
j [d͡ʝ]										*!										
k. [ŋ]											*!									
l. [k]												*!								
m. [g]													*!							
☞o. [x]														*						
☞p. [d]															*					
☞q. [r]																*				
☞r. [l]																	*			
☞s. [s]																		*		
☞t. [θ]																			*	
☞u. [n]																				*

Esta jerarquía es capaz de predecir los segmentos que surgen en posición final de palabra y a la vez justifica los segmentos que se excluyen de esta posición[6].

3.2.1 Codas complejas en posición final de palabra

Están terminantemente prohibidas las codas complejas en posición final de palabra. Está corroborada esta afirmación por la prueba de la inserción de /e/ epentética entre una raíz acabada en consonante y el morfema de pluralidad {s} en la formación de los plurales en español. Sin embargo, hay unos cuantos ejemplos excepcionales de codas complejas en posición final de palabra que trataremos ahora.

[6] Debido a las restricciones que tenemos aquí, no profundizamos en las excepciones que existen respecto a los segmentos que pueden aparecer en posición final de palabra. Estas, sin embargo, están bien justificadas en las páginas 140-144 de la versión original de la tesis.

En muchos casos de palabras no naturalizadas de origen inglés, una {s} puede agregarse a una consonante final de palabra para formar un plural:

(17)
Codas complejas en palabras no naturalizadas de origen inglés.

póster	[pós.ter]	[pósters]	*pósteres
club	[klub]	[klubs] ~ [klú.βes]	
coñac	[koɲak]	[koɲáks]	*coñaques
máster	[máster]	[másters]	*másteres
boicot	[boicot]	[boicóts]	*boicotes
complot	[komplot]	[komplóts]	*komplotes

También, surgen codas complejas en escasas palabras fonologizadas de origen latino y en palabras extranjeras:

(18)
Codas complejas en palabras de origen latino o en palabras de origen extranjero

		Formal o hipercorrecto	Forma habitual
-tórax	/toraks/	[tó.ɾaks]	[tó.ɾas]
-Félix	/felix/-/felis/	[fé.liks]	[fé.liɣs] /[fé.lis]
-bíceps	/biceps/	[bí.θeps]	[bí.θes]
-vals	/bals/	[bals]	[bals]
-fórceps	/forθeps/	[fóɾ.θeps]	[fóɾ.θeps]

Para justificar las codas complejas que aparecen en los ejemplos de (18), podemos programar una restricción de fidelidad dominante que prohíbe la modificación estructural de los segmentos que componen la coda compleja final de sílaba/palabra. Si esta restricción domina a *COMPLEX^{CODA}], que prohíbe la formación de una coda compleja, el educto óptimo resultará con una coda compleja. Consideremos este esquema en la siguiente tabla:

(19)
Aducto: /bals/

/bals/	IDENT	*COMPLEX^{CODA}]
a. bal[Ø]	*!	
b. bas	*!	
☞ c. bals		*
d. bales	*!	

Esta jerarquía expresa que la retención de los segmentos de una coda compleja es más importante que la restricción fonotáctica que prohíbe el surgimiento de una coda compleja. Como observamos, esta tabla elige como óptimo el candidato que retiene la coda compleja, el candidato (c). Los demás eductos infringen de una manera grave la restricción dominante de la jerarquía y, por tanto, no pueden resultar óptimos.

Los ejemplos que aparecen en (17) muestran casos de palabras acabadas en consonante modificadas con el morfema {s} en las que no surge ninguna /e/ epentética entre la raíz y el morfema, proceso que sí ocurre en los casos de palabras patrimoniales y préstamos naturalizados. Se puede formalizar este hecho en un paradigma jerárquica al programar una restricción dominante que prohíbe el surgimiento de segmentos que no forman parte de la representación subyacente, DEP. Cuando esta restricción es dominante sobre *COMPLEX^{CODA}], el resultado es un educto que tiene una coda compleja por la agregación de {s} a una raíz acabada en consonante:

(20)

Aducto: /poster/

/poster/+ {s}	DEP	*COMPLEX^{CODA}]
☞ b. pósters		*
c. pósteres	*	

Debido a que la inserción epentética está prohibida como estrategia para prevenir la formación de una coda compleja, la única opción que tiene el educto óptimo es dejar que se forme una coda compleja en posición final de palabra. Y ya que la restricción que prohíbe esto ocupa una posición inferior de la jerarquía, esto no representa una infracción grave[7].

[7] Véase las páginas 149-154 para la justificación completa.

3.3 SECUENCIAS DE CONSONANTES EN EL INTERIOR DE PALABRA

3.3.1 Secuencias de dos consonantes

En nuestro análisis, consideramos todas las secuencias de dos consonantes en palabras patrimoniales monomorfémicas en español. La siguiente tabla muestra todas las combinaciones de segmentos en secuencias de dos consonantes que aparecen en el interior de palabra. Los segmentos que aparecen en la columna a la izquierda representan la primera consonante, mientras que los segmentos que aparecen en la fila arriba son las segundas consonantes. Consideremos las siguientes secuencias:

(21)

	m	p	b	f	n	t	d	θ	S	r	L	ɲ	ʧ	ʝ	k	g	x
m	*			*		*	*	*	*	*	*	*	*	*	*	*	*
p	*	*	*	*			*					*	*	*	*	*	*
b	*	*	*	*								*	*		*	*	
f	*	*	*	*	*		*	*	*			*	*	*	*		*
n		*	*	*	*							*					
t		*	*	*		*	*	*	*			*	*	*	*	*	*
d		*		*		*	*	*	*			*	*	*		*	
θ			*	*				*	*	*	*	*	*	*			*
s									*			*	*	*			*
r												*		*			
l											*	*		*			*
ɲ	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
ʧ	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
ʝ	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
k		*	*	*	*		*					*	*	*	*	*	*
g		*	*			*		*	*			*	*	*	*	*	*
x	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

codas geminadas *secuencis no admisibles* *secuencias admisibles* *onsets complejos* *latinas*

A continuación, se ofrece una lista completa de ejemplos:

(22)

Secuencias de dos consonantes en el interior de palabra

	Secuencias empezadas por coronales		
-n	[nt]	die[nt]e	diente
	[nd]	due[nd]e	duende
	[nθ]	ra[nθ]io	rancio
	[ns]	de[ns]o	denso
	[nr]	ho[nr]ar	honrar
	[nl]*	ma[nl]evar	manlevar
	[nʧ]	ma[nʧ]a	mancha
	[ng]	ra[ng]o	rango
	[nk]	arra[nk]ar	arrancar
-t	[tm]*	a[tm]ósfera	atmósfera
	[tn]*	e[tn]ia	etnia
	[tr]	ma[tr]iz	matriz
	[tl]	a[tl]ántico	atlántico
-d	[dr]	e[dr]edón	edredón
	[dl]		
-θ	[θm]*	gu[θm]án	guzmán
	[θt]*	Ga[θt]ambide	Gaztambide
	[θp]*	Lega[θp]i	Legazpi
	[θn]*	le[θn]a	lezna
	[θk]	bi[θk]ocho	bizcocho
	[θg]	pa[θg]uato	pazguato
-s	[sm]	mi[sm]o	mismo
	[sp]	ra[sp]ar	raspar
	[sb]	re[sb]alar	resbalar
	[sf]*	fó[sf]oro	fósforo
	[sn]	a[sn]o	asno
	[st]	ga[st]ar	gastar
	[sd]	de[sd]e	desde
	[sθ]	pi[sθ]ina	piscina
	[sr]	I[sr]ael	Israel
	[sl]	i[sl]a	isla
	[sk]	ra[sk]ar	rascar
	[sg]	ra[sg]o	rasgo
-r	[rm]	a[rm]a	arma
	[rp]	a[rp]a	arpa
	[rb]	ba[rb]a	barba
	[rf]*	hué[rf]ano	huérfano
	[rn]	u[rn]a	urna
	[rt]	ha[rt]o	harto
	[rd]	ca[rd]o	cardo
	[rθ]	a[rθ]e	arce
	[rs]	cu[rs]i	cursi
	[rr]	ca[rr]o	carro
	[rl]	pe[rl]a	perla

	[rʧ]	co[rʧ]o	corcho
	[rk]	ba[rk]o	barco
	[rg]	ama[rg]o	amargo
	[rx]	u[rx]ente	urgente
-l	[lm]	a[lm]a	alma
	[lp]*	A[lp]es	Alpes
	[lb]	a[lb]a	alba
	[lf]*	de[lf]ín	delfín
	[ln]*	a[ln]a	alna
	[lt]	a[lt]o	alto
	[ld]	ca[ld]o	caldo
	[lθ]	ca[lθ]ar	calzar
	[ls]	sa[ls]a	salsa
	[lr]	a[lr]ededor	alrededor
	[lʧ]	co[lʧ]ón	colchón
	[lk]	ca[lk]ular	calcular
	[lg]	a[lg]o	algo

Secuencias empezadas por labiales

-m	[mp]	lá[mp]ara	lámpara
	[mb]	tu[mb]ar	tumbar
	[mn]	alu[mn]o	alumno
-p	[pn]	a[pn]ea	apnea
	[pt]	ca[pt]ar	captar
	[pθ]	ine[pθ]ia	inepcia
	[ps]	la[ps]o	lapso
-b	[br]	que[br]ar	quebrar
	[bl]	ro[bl]e	roble
-f	[ft]*	ca[ft]án	caftán
	[fr]	ci[fr]a	cifra
	[fl]*	ri[fl]e	rifle
	[fg]*	a[fg]ano	afgano

Secuencias empezadas por dorsales

-k	[ks]	ta[ks]i	taxi
	[kr]	mi[kr]ófono	micrófono
	[kl]	re[kl]uso	recluso
-g	[gm]	do[gm]a	dogma
	[gn]	incó[gn]ito	incógnito
	[gd]*	ma[gd]alena	magdalena
	[gr]	sue[gr]a	suegra
	[gl]	re[gl]a	regla

Palabras derivadas de origen latino

Secuencias empezadas por coronales en palabras de origen latino

-n	[nm]	co[nm]emorar	-conmemorar
	[nʝ]	i[nʝ]ectar	-inyectar
-d	[dm]	a[dm]itir	-admitir
	[db]	a[db]ertir	-advertir
	[dn]	a[dn]ato	-adnato
	[dk]	a[dk]irir	-adquirir
	[dx]	a[dx]unto	-adjunto

Secuencias empezadas por labiales en palabras de origen latino

-b	[bn]	su[bn]ormal	-subnormal
	[bt]	o[bt]ener	-obtener
	[bθ]	o[bθ]ecación	-obcecación
	[bd]	a[bd]omen	-abdomen
	[bs]	o[bs]ervar	-observar
	[bʝ]	o[bʝ]ecto	-obyecto
	[bx]	o[bx]eto	-objeto

Secuencias empezadas por dorsales en palabras de origen latino

-k	[kt]	a[kt]uación	-actuación	
	[kθ]	a[kθ]ión	-acción	
	[km]*	a[km]é	-acmé	
	[kn]*	a[kn]é	-acné	
	[gn]*	a[gn]óstico	-agnóstico	(*del griego* ἄγνωστος)

En estos ejemplos, parece que las coronales /r, s, d, l, n, θ/ tienen una mayor difusión que las demás consonantes en la primera posición de las secuencias. Nuestro recuento de mil sílabas que expusimos en el capítulo 2 confirma este hecho. Asimismo, se puede observar que las codas geminadas no aparecen en palabras monomorfémicas. Finalmente, se verifica que algunas secuencias forman onsets complejos, mientras que ninguna secuencia forma una coda compleja, dejando que el núcleo que sigue aparezca sin onset.

Aunque estos ejemplos presentan una distribución que es bastante sencilla de explicar, debemos detenernos un momento para contemplar la manera más económica de formalizar estos datos. Teóricamente, podríamos idear dos jerarquías distintas para justificar la formación tanto de los onsets como de las codas. Debido a la cantidad de segmentos, y secuencias de segmentos, que pueden aparecer estas posiciones, sin embargo, esta opción no es económica. Otra opción sería formalizar una jerarquía que elija un educto óptimo por su satisfacción de un juego de restricciones referidas a la buena formación de codas. Esta opción es viable dado que las codas son más restringidas en español que los onsets. Sin embargo, dadas las irregularidades que existen entre los segmentos que aparecen en codas en posición final de palabra y los que aparecen en codas en el interior de la palabra, tendríamos que crear dos jerarquías distintas para tratar cada posición, complicando innecesariamente nuestro modelo.

En lugar de estas opciones, proponemos un modelo que se basa en la jerarquía que presentamos para justificar la buena formación de onsets en el ejemplo (15). Una inspección rigurosa de esta jerarquía revela que no sólo es capaz de rechazar los onsets prohibidos, sino también es capaz de tratar la distribución fonológica de las codas en el interior de la palabra. Veamos cómo esta jerarquía divide en sílabas el siguiente aducto [sl]:

(23)
Aducto: [sl]

	M-PARSE	PARSE	ONSET	SONSEQ	MSD-2^{ONS}	*ONSET/[ʂ̌,ɾ,ŋ]	*ONSET/[NC]	*ONSET/[sC]	*ONSET/[d,t+l]	*ONSET/[θC]	*ONSET/[affricate]α	*OL	*$COMPLEX^{ONSET}$	FAITHFUL
a. [.sl]								*!				*	*	
☞ b. [s.l]														
c. [sl.]			*!											

Como vemos, la única opción que permite esta jerarquía es que los dos segmentos se separen en sílabas distintas. [s] debe ser la coda de la sílaba anterior, mientras que [l] ha de representar el onset de la sílaba siguiente. Esta jerarquía revela un aspecto muy importante respecto a la distribución de segmentos en codas en el interior de la palabra:

(24)
Hipótesis de distribución para los segmentos que aparecen en codas en el interior de la palabra
La distribución fonológica de codas en el interior de la palabra es una consecuencia secundaria de la buena formación de los onsets en español.

A continuación, aprobamos esta hipótesis con los datos que presentamos sobre la distribución fonológica en secuencias de tres y cuatro segmentos.

Antes de avanzar a la siguiente sección, debemos justificar la incongruencia entre los segmentos permitidos en codas en posición final de palabra y los que están permitidos en esta misma posición en el interior de la palabra. Los datos que hemos visto hasta ahora pertinentes a la distribución de segmentos en posición final de sílaba, junto con las cifras que expusimos en nuestro recuento, indican que los únicos segmentos preferidos en posición final de sílaba en español son las coronales marcadas por [+continuo]. Formalizamos esta hipótesis en el siguiente ejemplo:

(25)
Codas preferidas en español
Los únicos segmentos preferidos en posición final de sílaba, sea final de palabra o en el interior de la palabra, son las coronales marcadas por [+continuo].

Los segmentos divergentes que aparecen en esta posición en el interior de la palabra son la consecuencia de alguna modificación morfológica o el resultado de una correlación de fidelidad entre el aducto y el educto. El aspecto que debe extraerse de este análisis es que la distribución de segmentos en posición final de palabra no está dominada por principios de la buena formación de los onsets. Esto explica en gran parte la irregularidad de distribución que se observa entre los segmentos permitidos en posición final de palabra y los que sólo pueden aparecer en el interior de la palabra.

Una anáisis detenido del modelo de la buena formación de codas que expusimos en (16) revela que este modelo ya tiene programada la generalización pertinente a la hipótesis sobre las codas preferidas que expusimos en (25), ya que la ordenación jerárquica inferior está relacionada de manera intrínseca con la alta frecuencia de infracciones. Hay, sin embargo, ciertas dificultades que prohíben su incorporación en un modelo que trata la distribución de segmentos que aparecen en el interior de la palabra. Dada la distribución profusa de segmentos marcados por [+cont.] en codas en el interior de la palabra, sería justificable programar un juego de restricciones del tipo*CODA/segment]σ, que tratan la difusión de coronales continuas en esta posición. Sin embargo, la TO no admite ninguna manera de ordenar jerárquicamente dos o más segmentos permisibles en relación a sí mismos. Es decir, si dos segmentos son admisibles, una restricción que prohíbe el surgimiento de uno de ellos no puede, a priori, dominar la restricción que prohíbe el otro. Este esquema provocaría una carga exagerada para la gramática sin ninguna ventaja, debido a que la buena formación de codas nunca puede influir en el proceso de silabificación, a causa de que la buena formación de codas siempre asumirá una posición subordinada en relación con la buena formación de los onsets en español.

Hipotéticamente, podríamos proponer un juego de restricciones que deja manifestado que ciertos segmentos son prohibidos tanto en posición final de sílaba como en posición final de palabra: *[ɲ, d͡ʝ, r̄, t͡ʃ, ʝ, λ]. Sin embargo, estas restricciones tendrían que ocupar una posición jerárquica inferior con relación a las restricciones que gobiernan la buena formación de onsets por el hecho de que la silabificación dependa de la formación de onsets y no codas. Por lo cual, la distribución de los segmentos ya estaría determinada antes de que las restricciones que prohíben los segmentos ilícitos en codas tuviera la oportunidad de surtir efecto.

Para concretar esta noción, consideremos el siguiente aducto hipotético, *V[ɲt]V, y su educto correspondiente. Emplearemos la siguiente jerarquía que está programada con la generalización de que ciertos segmentos son prohibidos en posición final de sílaba:

(26)
M-PARSE» PARSE» ONSET» SONSEQ» MSD-2^{ONS} »*ONSET/[NC]» *OL»
*CODA[ɲ, d͡ʝ, r̄, t͡ʃ, j, ʎ] » *$COMPLEX^{ONSET}$» FAITHFUL

(27)
Aducto: *V[ɲt]V

	M-PARSE	PARSE	ONSET	SONSEQ	MSD-2^{ONS}	*ONSET/[NC]	*OL	*CODA[ɲ, d͡ʝ, r̄, t͡ʃ, j, ʎ]	*COMPLEXONSET
☞ a. V[ɲ.t]V								*	
b. V[.ɲt]V				*!	*	*			*
c. V[ɲt.]V			*!		*	*		*	

En esta tabla, el candidato (b) resulta no óptimo al presentar un onset complejo cuyos componentes no van incrementando su sonoridad desde el margen izquierdo de la palabra hacia el núcleo, lo cual representa una infracción grave de SONSEQ. El candidato (c) junta los dos segmentos como una coda compleja que deja sin onset el segundo núcleo, incurriendo en una infracción de ONSET y ciertos principios universales de la tipología silábica. El candidato (a) divide la secuencia en dos sílabas distintas, resultando así óptimo.

El punto significativo de esta tabla no es su capacidad de dividir los segmentos en sílabas distintas, sino que ya está determinada la distribución de los segmentos antes de que los efectos de la restricción que prohíbe los segmentos en posición final de sílaba tenga la oportunidad de ejercer un efecto sobre el educto óptimo. Es decir, la incorporación de esta restricción es redundante y superflua, ya que su ausencia no supondría ninguna modificación respecto a la optimidad y su inclusión no supone ninguna ventaja a la hora de elegir el educto óptimo. En algún estrato fonológico subsiguiente, una generalización fonológica tendría que surtir efecto para modificar el segmento proporcionado por el aducto, [ɲ], pero esto no afectaría la distribución del segmento en sí.

3.3.2 Secuencias de tres consonantes

En esta sección exponemos los datos del español respecto a la distribución de segmentos en secuencias de tres consonantes y demostramos la eficacia de nuestro modelo que se basa en la buena formación de onsets a la hora de predecir la silabificación correcta de estos segmentos. Como se puede apreciar, la cantidad de posibles combinaciones de segmentos está más restringida en secuencias de tres consonantes comparada con la cantidad de combinaciones permitidas en las secuencias de dos segmentos. Consideremos los siguientes ejemplos de secuencias de tres consonantes en el interior de la palabra:

(28)

Secuencias de tres consonantes empezadas por coronales			
-*n*	[nkl]	a[nkl]a	-ankla
	[nkr]	co[nkr]eto	-concreto
	[ngl]	i[ngl]és	-inglés
	[ngr]	co[ngr]eso	-congreso
	[nfl]**	i[nfl]ar	-inflar
	[nfr]**	i[nfr]ingir	-infringer
	[nsf]**	tra[nsf]erir	-transferir
	[ntr]	de[ntr]o	-dentro
	[ndr]	a[ndr]oide	-androide
	[nst]	co[nst]ar	-constar
-*l*	[lkl]	fo[lkl]ore	-folclore
-*r*	[rsp]	pe[rsp]icaz	-perspicaz
-*s*	[str]	clau[str]o	-claustro
	[sdr]**	e[sdr]újula[8]	-esdrújula

[8] del italiano –*sdrucciolo*.

	[sgr]**	e[sgr]imir[9]	-esgrimir

Secuencias de tres consonantes empezadas por labiales

-*m*	[mbr]	ha[mbr]e	-hambre
	[mbl]	e[mbl]ema	-emblema
	[mpl]	a[mpl]io	-amplio
	[mpr]	sie[mpr]e	-siempre
-*b*	[bst]	o[bst]etricía	-obstetricía
	[bsθ]	o[bsθ]eno	-obsceno

Secuencias de tres consonantes empezadas por dorsales

-*k*	[kst]**	te[kst]o	-texto
	[ksk]**	e[ksk]usa	-excusa
	[ksp]**	e[ksp]osición	-exposición
	[ksθ]**	e[ksθ]epción	-excepción
	[ksb]**	e[ksb]oto	-exvoto

En todos estos ejemplos, hay dos posibilidades en cuanto a su división silábica: o bien C.CC, o bien CC.C. Para justificar la primera división silábica, C.CC, debemos programar en nuestro modelo una restricción que requiere la formación de un onset complejo siempre que haya dos consonantes contiguas que se pueden juntar para formarlo:

(29)

ONSET CLUSTER IMPERATIVE (ONS-IMP)
Todos los onsets complejos permisibles se tienen que silabificar como onsets complejos.

Es decir, los onsets complejos siempre resultarán favorecidos con relación a las codas complejas. Debemos dar por sentado que esta restricción ocupará una posición jerárquica superior en nuestro modelo, ya que nunca se infringe por el educto óptimo. Consideremos la predicción que hace nuestro modelo. De nuevo, hemos omitido las restricciones inactivas en la siguiente tabla:

[9] del provenzal –*escremir*.

(30)
Aducto: [nkl]

	M-PARSE	PARSE	ONSET	ONS-IMP	SONSEQ	MSD-2^{ONS}	*ONSET/[NC]	*OL	*COMPLEXONSET
a. [nk].[l]				*!					
☞ b. [n].[kl]								*	*
c. [.nkl]				*!	*	*	*		*
d. [nkl.]			*!	*	*				

Aunque esta jerarquía no tiene en cuenta la buena formación de codas, es totalmente capaz de predecir la silabifiación correcta de secuencias de tres consonantes. El candidato (a) prefiere silabificar [k] como el segundo segmento de una coda compleja en lugar de formar un onset complejo permisible [kl], lo cual infringe de una manera grave la restricción ONS-IMP que requiere, donde sea posible, que se forme un onset complejo. El candidato (c) también incurre en una infracción grave de esta restricción, por lo cual queda eliminado. El candidato (d) presenta una coda compleja, dejando que el núcleo que sigue [l] aparezca sin onset, lo cual infringe ONSET, y por tanto resulta no óptimo. El candidato (b) silabifica [n] como una coda y [kl] como un onset compleja, satisfaciendo todas las restricciones superiores, mientras que infringe de manera arbitraria las dos restricciones inferiores de la jerarquía.

Antes de tratar la silabificación alternativa, CC.C, hemos de justificar el surgimiento de /s/ en posición final de sílaba que aparece de manera sistemática en las palabras que constan de este esquema de silabificación. Una revisión de los datos en (28) indica que /s/ es el único segmento que puede aparecer en palabras que contienen secuencias de tres consonantes con una silabificación CC.C.

Para formalizar esta regularidad en nuestro modelo, tenemos dos opciones viables. La primera sería incluir un juego de restricciones que tratara la formación de codas complejas. Ya hemos visto que el problema con esta justificación es que estas restricciones tendrían que ocupar una posición tan inferior en la jerarquía que no tendrían ningún impacto en el proceso de elegir un educto óptimo. Por muy sistemático que sea el surgimiento de /s/ en esta posición, a priori, ninguna restricción que trate la formación de codas puede ser ordenada a una posición más importante que las restricciones que dominan la formación de onsets.

Como segunda opción, proponemos que el surgimiento de /s/ en posición final de sílabas en estos casos ya está programado en nuestra jerarquía, debido a que SONSEQ no sólo requiere que la sonoridad de los segmentos vaya incrementándose hasta el núcleo, sino que también, a partir del núcleo, la sonoridad de los segmentos se disminuya hasta el margen derecho de la sílaba. De esta manera, el programar una restricción que trata de manera específica el surgimiento de /s/ en esta posición sería redundante, ya que SONSEQ ya elimina los eductos que no satisface la organización de segmentos en función de sus valores de sonoridad.

Fijémonos en las predicciones que propone nuestro modelo:

(30)

Aducto: [nst]

	M-PARSE	PARSE	ONSET	ONS-IMP	SONSEQ	$MSD\text{-}2^{ONS}$	*ONSET/[sC]	*OL	*COMPLEXONSET
☞ a. [ns].[t]									
b. [n].[st]				*!	*	*	*		*
c. [.nst]				*!	*	*	*		*
d. [nst.]			*!	*					

Esta tabla deja claro que la única opción viable para la distribución de los segmentos en sílabas es silabificar [n] y [s] como una coda compleja, ya que la silabificación de [st] como onset complejo infringe de manera grave los principios universales vinculados con las restricciones superiores de la jerarquía. Los candidatos (b) y (c) cometen infracciones irrevocables de ONS-IMP ya que [st] no forman un onset admisible. La distribución de todos los segmentos en una coda compleja infringe ONSET, ya que esto implica que el núcleo que sigue [t] se tiene que silabificar sin onset.

3.3.3 Secuencias de cuatro consonantes

A diferencia de la distribución de segmentos en secuencias de dos y tres consonantes, las secuencias de cuatro consonantes sólo se pueden silabificar de una sola manera; tanto los onsets como las codas deben ser complejos, CC.CC. Asimismo, es importante mencionar que hemos relajado nuestro criterio de la condición monomorfémica de los datos que examinamos, ya que, salvo en muy escasos casos, todas las palabras que contienen este tipo de silabificación son morfológicamente modificadas, o por alguna función productiva de la gramática o por algún proceso diacrónico que se ha fonologizado a lo largo del tiempo. Observemos los datos:

(31)

Secuencias de cuatro consonantes

-b	[bstr]	a[bstr]acto	-abstracto
	[bskr]	su[bskr]ibir	-subscribir[10]
-d	[dskr]	a[dskr]ito	-adscrito
	[dstr]	a[dstr]ato	-adstrato
-n	[nskr]	i[nskr]ibir	-inscribir

[10] [bs] sólo se retiene en la ortografía. En habla normal, la palabra es –*suscribir*. Tanto el diccionario como la ortografía académicas indican la forma sin <b> como la preferible, por la consabida reducción de los grupos cultos en el habla

	[nstr]	co[nstr]eñir	-constreñir
	[nsfl]	tra[nsfl]orear	-transflorear
	[nsfr]	tra[nsfr]etano	-transfretano
	[nsgr]	tra[nsgr]edir	-transgredir
-*k*[11]	[kskl]	e[kscl]uir	-excluir
	[kskr]	e[kskr]eción	-excreción
	[kspl]	e[kspl]orar	-explorar
	[kspr]	e[kspr]esar	-expresar
	[kstr]	e[kstr]aer	-extraer

Probamos estos datos en nuestro modelo que está dominado por los principios de buena formación de onset:

(32)
Aducto: /bstr/

	M-PARSE	PARSE	ONSET	ONS-IMP	*ONSET/[sC]	SONSEQ	MSD-2^{ONS}	*OL	*COMPLEXONSET
☞ a. [bs].[tr]								*	
b. [b].[str]				*!	*	*	*	*	*
c. [.bstr]				*!	*	*	*	*	*
d. [bstr.]			*!	*		*			
e. [bst.r]				*!					

De nuevo, nuestro modelo es totalmente capaz de predecir la distribución de los segmentos sin que especifiquemos restricciones especiales para tratar la formación de codas. En esta tabla, el candidato (a) resulta óptimo, ya que [bs] forman una coda compleja que permite que [tr] se junten como un onset complejo. Los candidatos (b), (c) y (e) incurren todos en una infracción de ONS-IMP al omitir la estipulación de que dos consonantes están obligadas a formar un onset complejo, siempre que sea fonológicamente plausible. El candidato (d) presenta una coda de cuatro segmentos, lo cual infringe ONSET, que requiere que todos los núcleos tengan un onset.

[11] Realizado fonéticamente como [ɣ] en la mayoría de los casos.

3.4 CONCLUSIONES

En este capítulo hemos demostrado que la organización de los segmentos que aparecen en sílabas está dominada por ciertas tendencias fonológicas universales. La extensión de esta afirmación es que la organización interna de palabras españolas no es casual, sino que las palabras están organizadas de una manera programada y sistemática. La TO ofrece un marco teórico que nos ha permitido demostrar esta afirmación en un paradigma que requiere una máxima cantidad de información fonológica para poder predecir el educto óptimo.

Hemos propuesto un modelo de silabificación que manifiesta que la distribución de segmentos y, por tanto, la forma de la sílaba en sí, está dominada por principios de la buena formación de los onsets. Demostramos que la distribución de segmentos en posición final de sílaba, salvo en posición final de palabra, es la consecuencia de que dicho segmento no puede aparecer como onset, o parte de un onset complejo. Visto así, pues, se pueden entender los segmentos en posición final de sílaba en el interior de la palabra como elementos residuos, que sobran después de que se forme el onset. Se toleran para satisfacer los principios de fidelidad que prohíben su erradicación, pero nunca serán elementos vitales de la sílaba.

Nuestro modelo incorpora esta base en su jerarquía al prescindir de las restricciones que tratan la formación de codas. Hemos afirmado que su posición jerárquica, con relación a la posición de las restricciones que dominan la formación de onsets, tendría que ser tan inferior que sus efectos no pudieran determinar la optimidad de un educto. Por lo tanto, su inclusión en nuestra jerarquía sería, en el mejor de los casos, redundante y superflua.

Hemos mostrado que nuestro modelo es capaz de procesar cualquier tipo de aducto y predecir el educto óptimo que resultaría, haciendo que sea un paradigma tanto eficiente como eficaz. Además, explica a priori los motivos por los que un educto no óptimo se descarta, lo cual representa una gran ventaja teórica sobre los modelos generativos.

Para concluir, el limitar nuestro modelo a un esqueleto que sólo tiene en cuenta la buena formación de onsets aporta ciertas ventajas relevantes para la adquisición. Un aspecto menos obvio de nuestro análisis es que excluir las restricciones que dominan la formación de codas significa una carga menor para la gramática. Y puesto que se puede determinar la distribución correcta de los segmentos sin que se ordenen estas restricciones, su exclusión en la jerarquía constituye una simplificación de la gramática sin desventaja alguna.

CAPÍTULO IV

LA BUENA FORMACIÓN Y LA ESTRUCTURA SILÁBICA EN ESPAÑOL

4.0 INTRODUCCIÓN

Este capítulo ofrece una justificación teórica de la inserción de segmentos en tres contextos derivados. Primero presentamos dos jerarquías que determinan los segmentos epentéticos, y a continuación ofrecemos un análisis de la formación de los plurales en español. Demostramos que la inserción de /e/ epentética en las formas plurales se puede justificar mediante un modelo dominado por ONSET, que requiere que los núcleos tengan onsets, en relación con una restricción de alineación, que requiere que un sufijo se alinee al margen derecho de una raíz.

4.1 ESTRATEGIAS DE REPARACIÓN

4.1.1 La prótesis vocálica

Damos por supuesto que el segmento no marcado en español es /e/ y que se inserta de una manera productiva en varios contextos fonológicos. Consideremos los siguientes datos de inserción en préstamos no naturalizados del inglés al español:

(1)
Inserción de /e/ en posición inicial de palabra en préstamos no naturalizados del inglés

Palabra inglesa	Adaptación al español	
[st]op	[e]stop	/s/ + coronal obstruyente
[str]ess	[es]trés	/s/ + coronal obstruyente/vibrante simple
[spr]ay	[es]pray	/s/ + labial obstruyente/vibrante simple
[spr]int	[es]prin(t)[12]	/s/+ labial obstruyente/vibrante simple
[sm]art[13] (coche)	[e]smart	/s/ + labial obstruyente

[12] La /t/ final no se articula en el habla normal.

[13] Marca de coche.

[sk]anner	[e]scáner	/s/ + dorsal obstruyente
[sp]eech	[e]spich	/s/ + labial obstruyente
[sl]ogan	[e]slogan	/s/ + lateral obstruyente
[sm]oking	[e]smoquin	/s/ + nasal obstruyente

En estos ejemplos, se inserta una /e/ para reparar una estructura impermisible, /s/C, antes de que tenga de la oportunidad de surgir en el nivel fonético.

Para justificar el surgimiento del segmento, /e/, se pueden ordenar todos los posibles segmentos en una jerarquía en la que una restricción *[e] ocupa la posición inferior:

(2)
*[i], *[u] » *[a],*[i] » *[e]

Fijémonos en su interacción en la siguiente tabla:

(3)

	*[o], *[u]	*[a],*[i]	*[e]
☞ a. [e]stop			*
b. [o]stop	*!		
c. [u]stop	*!		
d. [a]stop		*!	
e. [i]stop		*!	

Esta tabla predice que el segmento que surge en contextos de epéntesis en español será [e], ya que la infracción de *[e] no constituye una infracción grave, dada su posición inferior de la jerarquía.

Para justificar el posicionamiento del segmento, habrá que programar una restricción que prohíbe el surgimiento de onsets compuestos de /s/ más una consonante: *[sC. Asimismo, debe haber una restricción que prohíbe la eliminación de segmentos, MAX, ya que, teóricamente, esta estrategia también puede producir un educto óptimo, *[top], *[sop]. Una restricción CONTIG requerirá que se respete la contigüidad de los segmentos que aparecen dentro de la base prosódica. PARSE dominará nuestra jerarquía, ya que esta restricción siempre resulta satisfecha en español. Consideremos la siguiente jerarquía y su interacción en la tabla que sigue:

(4)

PARSE » *[sC» CONTIG» MAX» DEP

(5)

	PARSE	*[sC	CONTIG	MAX	DEP
☞ a. estop					*
b. top				*!	
c. sop				*!	
d. setop			*!		
e. stop		*!			
f. s{t}op	*!		*		
g.{s}top	*!		*		

En esta tabla, el candidato (a) resulta óptimo ya que sólo incurre en una infracción de la restricción inferior de la jerarquía, lo cual se comete para satisfacer las restricciones superiores, una estrategia óptima. Los candidatos (b) y (c) infringen MAX al eliminar uno de los segmentos de la representación subyacente, lo cual satisface *[sC, pero a cambio de infringir otra restricción importante. El candidato (d) resulta no óptimo al situar el segmento epentético dentro de la base. Aunque esta estrategia también satisface *[sC, se obliga una infracción grave de CONTIG. El educto (e) presenta un educto que es máximamente fiel a la representación subyacente, pero infringe de una manera significativa una restricción fonotáctica importante del español, *[sC. Los candidatos (f) y (g) están eliminados por PARSE ya que [t] y [s] no se incorporan en ninguna sílaba.

Este análisis presenta un esquema transparente de las restricciones que están involucradas en el proceso de epéntesis. Al contrario de los esquemas que se basan en reglas, aquí vemos que una vocal epentética surge mediante la conciliación de varias fuerzas que están constantemente en conflicto. Todos los candidatos (b)-(g) que aparecen en la tabla anterior representan candidatos válidos. Las estrategias que emplean para evitar el surgimiento de un educto que tiene la estructura /s/C en posición inicial de sílaba son viables y bien documentadas en otros muchos idiomas. La jerarquía que presentamos nosotros simplemente muestra cómo el español trata esta estructura, y por qué los demás candidatos resultan así no óptimos. Esto representa una gran ventaja esquemática sobre los análisis generativos, ya que estos estudios nunca han podido formalizar la abundante cantidad de tendencias universales en un paradigma que se basa en reglas. Además, estos trabajos nunca han podido producir un esquema que justifica el educto correcto mientras que, simultáneamente, explica la razón por la que los demás se descartan.

4.1.2 La epéntesis consonántica

Aquí consideramos que /t/ es el único segmento que aparece en contextos de epéntesis productiva en español[14]. Veamos los siguientes datos del español:

(6)

La inserción consonántica (epentética) en contextos derivados en español

Base	**Forma derivada con epéntesis**	**Consonante epentética**
-hombre	*-hombre*[t]***ón***[15]	[t]
-reggae	*-raggae*[t]***ón***	[t]
-puño	*-puñe*[t]***azo***	[t]
-pistola	*-pistole*[t]***azo***	[t]
-pico	*-pico*[t]***azo***	[t]
-pico	*-pico*[t]***ada***	[t]
-café	*-café*[t]***ería***	[t]
-café	*-café*[t]***ín***	[t]
-té	*-te*[t]***era***	[t]
-tu	*-tu*[t]***ear***	[t]
-golpe	*-golpe*[t]***ear***	[t]
-pico	*-pico*[t]***ear***	[t]
-chispa	*-chisporro*[t]***ear***	[t]

[14] Justificamos esta afirmación controversial en las páginas 202-214 de la tesis.
[15] La forma *–hombrón*, sin el segmento epentético, también existe. De momento no trataremos este detalle. Véase la página 217 para una justificación.

-tiro	*-tiro*[t]***ear***	[t]
-pata	*-pata*[t]**ús**	[t]

Presentamos la siguiente jerarquía interna de [coronal] para justificar su surgimiento en contextos de epéntesis productiva:

(7)
Jerarquía interna de [coronal]
*[r], *[s], *[n], *[l], *[d], *[θ] » *[t]

Veamos su predicción en la siguiente tabla:

(8)
Input V]__[V

	*[r]	*[s]	*[n]	*[l]	*[d]	*[θ]	*[t]
a. V]_[r]_[V	*!						
b. V]_[s]_[V		*!					
c. V]_[n]_[V			*!				
d. V]_[l]_[V				*!			
e. V]_[d]_[V					*!		
f. V]_[θ]_[V						*!	
☞ g. V]_[t]_[V							*

Esta tabla presenta un esquema simple, y a la vez sofisticado, que justifica el surgimiento de [t] en contextos de epéntesis consonántico en español.

Su situación entre dos vocales se puede explicar mediante la conciliación de tres restricciones predominantes. Por un lado, una restricción ALIGN-[sufijo]-R requiere que un sufijo se alinee directamente al margen derecho de una base. Por otro lado, ONSET, requiere que todos los núcleos se sitúen a la derecha de un onset. En caso de que un sufijo que empieza con vocal tiene que alinearse al margen derecho de una palabra cuyo elemento final es vocálico, surge un conflicto. Este conflicto se resuelve con la siguiente jerarquía. Fijémonos en la ordenación de MAX, que prohíbe la eliminación de segmentos subyacentes, ya que la eilisión de segmentos también es viable para producir un educto óptimo:

(9)
ONSET»MAX-I/O» ALIGN-[suffix]-R

Observemos el educto óptimo que esta jerarquía predice:

(10)
Aducto: hombre, {ón}

	ONSET	MAX-I/O	ALIGN-[suffix]-R
☞a. hombre[t]ón			*
b. hombreón	*!		
c. hombrón		*!	

Siempre que ONSET domine a ALIGN, y que MAX esté ordenada en una posición relativamente importante, la epéntesis actuará para reparar una estructura marcada antes de que surja en el nivel fonético. En esta tabla, el candidato (a) satisface todas las restricciones superiores al insertar una consonante epentética para romper el hiato vocálico que se crea al alinear un sufijo que empieza con vocal a una base acabada en vocal. El candidato (b) prefiere una máxima fidelidad a la representación subyacente pero a cambio de que incurra en una infracción grave de la restricción superior de la jerarquía. El candidato (c), aunque representa un educto viable, está eliminado por esta jerarquía por su infracción de MAX, que prohíbe la eliminación de segmentos subyacentes. La democión de esta restricción permitiría que el candidato (c) resultara óptimo.

En ambos casos que hemos examinado, los principios universales que dominan la formación de onsets han tenido un impacto muy importante. En nuestros análisis, este hecho aparece de modo programado y transparente al ordenar las restricciones pertinentes que gobiernan la formación de onsets a las posiciones superiores de la jerarquía. En el primer caso que analizamos, la prohibición de una estructura /s/C en posición inicial de sílaba era la motivación del proceso de inserción vocálica. En el segundo caso, el proporcionar un onset para romper el hiato vocálico era la estrategia óptima para reparar una estructura desfavorecida en español. Estos dos casos apoyan nuestra afirmación a favor de la supremacía de onsets en la fonología del español que presentamos en el capítulo anterior.

4.2 LA FORMACIÓN DE LOS PLURALES EN ESPAÑOL

En este apartado tratamos la formación de los plurales. Presentamos un modelo de formación de plurales que presenta la inserción de /e/ entre una raíz acabada en consonante y el morfema de pluralidad {s} como el resultado de la conciliación de dos fuerzas que están en conflicto. Por un lado, {s} debe alinearse al margen derecho de una raíz para expresar la noción de pluralidad en español. En varios casos, sin embargo, la alineación de {s} directamente al margen derecho de la palabra motiva la formación de una coda compleja en posición final de palabra, lo cual representa, en la mayoría de los casos, una estructura no permisible en español.

La TO entiende esto como un conflicto entre dos restricciones principales. Por un lado, ALIGN-{s}-R requiere que el sufijo de pluralidad se alinee al margen derecho de la raíz. Por otro lado, *COMPLEX^{CODA} previene la formación de codas complejas. Si esta última restricción domina la primera, algún cambio con respecto a la representación fonológica tiene que efectuarse. Al programar una restricción que prohíbe la eliminación de segmentos fonológicos en este esqueleto básico, se puede llegar a un esquema que explica la inserción de /e/ epentética en las formas plurales sin ordenar directamente tal proceso. A continuación, expondremos los datos del español y su justificación desde el marco global de la TO.

Consideremos los siguientes datos pertinentes a la formación de plurales en español:

(11)

(a)
Alineación de {s} a raíces acabadas en vocal [a], [o] y [e]):

Singular	Plural
-libro	-libro[s]
-casa	-casa[s]
-enchufe	-enchufe[s]
-llave	-llave[s]
-lobo	-lobo[s]
-anillo	-anillo[s]
-pulsera	-pulsera[s]
-disco	-disco[s]
-clase	-clase[s]
-tribu	-tribu[s]
-boli* (< bolígrafo)[16]	-boli[s]
-espíritu	-espíritu[s]
-peli* (< película)	-peli[s]
-taxi	-taxi[s]

(b) Alineación de [e]{s}a formas cuyo segmento final es consonántico, aparte de /s/, monosílabas acabadas en /s/, o palabras acabadas en /s/ con una sílaba tónica en la última sílaba:

-ciudad	-ciudad[es]
-avión	-avion[es]
-ángel	-ángel[es]
-actor	-actor[es]
-as	-as[es]
-mes	-mes[es]
-japonés	-japones[es]
-país	-país[es]

(c) Alineación de [Ø] a formas no monosilábicas acabadas en /s/ en las que la sílaba final es átona:

-lunes	-lunes[Ø]
-virus	-virus[Ø]
-dosis	-dosis[Ø]
-análisis	-análisis[Ø]
-tesis	-tesis[Ø]

(d) Alineación de [e]{s} a raíces acabadas en vocal tónica:

-rondó	-rondó[es]/[s]
-tabú	-tabú[es]/[s]

-menú	-menú[es]/[s]
-jabalí	-jabalí[es]/[s]
-sofá	-sofá[es]/[s]
-colibrí	-colibrí[es]/[s]
-sí	-sí[es]/[s]

(e) Alineación de [Ø] a raíces con codas complejas presentadas por el aducto:

-bíceps	-bíceps
-tórax	-tórax
-fórceps	-fórceps
-Félix	-Félix

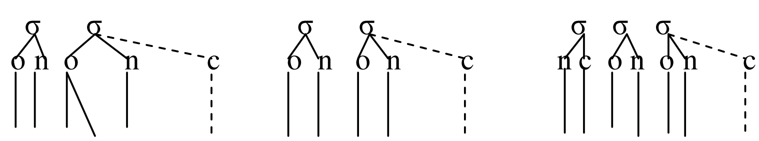
(f) Alineación de {s}, en vez de [e]{s}, a raíces no naturalizadas acabadas en consonante:

póster	pósters	*pósteres	-*póster*(s)
club	clubs ~ clubes		
coñac	coñacs	*coñaques	
máster	master	*másteres	
boicot	boicots	*boicotes	
complot	complots	*komplotes	

4.2.1 Formas regulares

Como se puede apreciar, las formas regulares que aparecen en (11a) no suponen ninguna dificultad teórica, ya que el morfema de plural se alinea directamente al margen derecho de la vocal final de la raíz:

(12)



[l i. b r o] + {s} [k a. s a] + {s} [e n.t͡ʃ ú. f e] + {s}

Debido a que {s} constituye una coda permisible en español, no se infringe ningún principio de buena formación al agregar esta consonante al margen derecho de la raíz. Podemos expresar este proceso de alineación con la siguiente jerarquía:

(13)
PARSE » PLUR-MORPH, ALIGN{s}-R » MAX » DEP » NOCODA

PARSE requiere que todos los segmentos se silabifiquen. PLUR-MORPH se encarga de definir el morfema {s}, mientras que ALIGN-{s}-R expresa que esta consonante debe aparecer pegada al margen derecho de la raíz. MAX prohíbe la eliminación de segmentos fonológicos en el educto óptimo. DEP, en cambio, previene la inserción de segmentos no presentes en la representación subyacente, aunque en estos casos esto no es una opción viable. NOCODA expresa que las codas no son permitidas. Veamos su interacción en la siguiente tabla:

(14)
Aducto /kasa/ + {s}

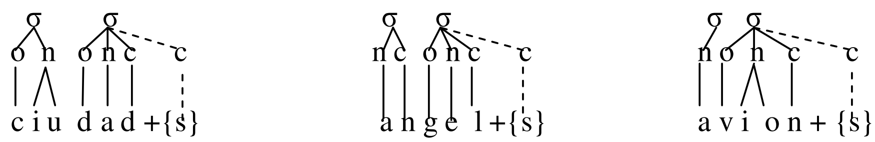
	PARSE	PLUR-MORPH	ALIGN{s}-R	MAX	DEP	NOCODA
☞ a. [ka][sas]						*
b. [ka.s]				*!*		
c. [ka][sa]		*!	*	*		
d. [ka][sa][se]		*!	*		*	
e. [ka][sa] [s]	*!					

La ventaja que tiene esta justificación es su base de restricciones universales. El candidato (e) infringe de modo grave la restricción superior, PARSE, que requiere que se distribuyan todos los segmentos en sílabas. Los candidatos (c) y (d) presentan eductos que no acaban en {s}, lo cual incurre en una infracción de PLUR-MORPH, que define el morfema plural y requiere su surgimiento en los nominales y adjetivos marcados para [+plural]. El candidato (b) elimina de forma gratuita el segmento final de la raíz y {s}, motivando así una infracción doble de MAX. El candidato (a) alinea el morfema {s} al margen derecho de la vocal final y satisface así todas las restricciones superiores, incurriendo tan solo en una infracción mínima de NOCODA.

4.2.2 Sustantivos y adjetivos acabados en consonante

Los sustantivos y adjetivos acabados en consonante presentan ciertas dificultades a la hora de formar un plural, ya que la afijación directa al margen derecho de la consonante final obliga a la creación de una coda compleja, una estructura no permitida en español:

(15)



Aunque existen varias opciones para evitar esta estructura, los datos que hemos visto muestran que el español prefiere insertar una vocal epentética entre la consonante final y el morfema de pluralidad.

Podemos justificar esta inserción con la siguiente jerarquía:

(16)
PARSE » PLUR-MORPH » MAX-I/O » *COMPLEX^{CODA} » DEP-I/O»
ALIGN{s}-R

Esta jerarquía expresa, mediante la ordenación superior de COMPLEX^{CODA} relativo a ALIGN{s}-R, que el evitar la coda compleja es más importante que la alineación directa del morfema plural al margen derecho de la raíz. La posición relativamente superior de MAX significa que la eliminación de segmentos no es una estrategia óptima para evitar la formación de una coda compleja. Al mismo tiempo, DEP prohíbe la inserción de segmentos post-léxicos, aunque su posición inferior de la jerarquía significa que su infracción es menos grave que la infracción de MAX, por lo cual se favorecerá la inserción en lugar de la eliminación para reparar la estructura defectuosa.

Observemos esta jerarquía en la siguiente tabla:

(17)
Aducto: /anxel/ + {s}

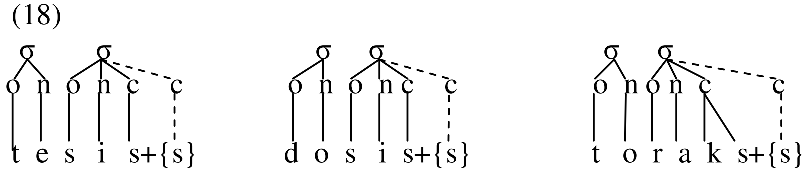
	PARSE	PLUR-MORPH	MAX	*COMPLEX^{CODA}	DEP	ALIGN{s}-R
☞ a. [an].[xe].[les]					*	*
b. [an].[xel]		*!				*
c. [an].[xels]				*!		
d. [an].[xes]			*!			*
e. [an].[xe].[le]		*!			*	
f. [an].[xel][s]	*!					

El candidato (f) está eliminado por PARSE al dejar sin silabificar el morfema plural {s}. Los candidatos (b) y (e) están excluidos al presentar eductos plurales que no llevan el morfema plural. El candidato (d) elimina un segmento de la representación fonológica, infringiendo así MAX, que prohíbe la eliminación de segmentos fonológicos. El candidato (a) no consigue a alinear el morfema plural al margen derecho de la raíz, incurriendo en una infracción de ALIGN. Sin embargo, la infracción de esta restricción hace que se satisfaga la restricción superior, *COMPLEX^{CODA}, resultando así óptimo.

4.2.3 Formas excepcionales con [Ø]

Esta sección aporta una explicación de la formación de los plurales que aparecen en los ejemplos (11b) y (11e) cuyas raíces acaban en /is/ o /s/. Como se puede apreciar, los plurales de estas palabras no divergen de la forma singular.

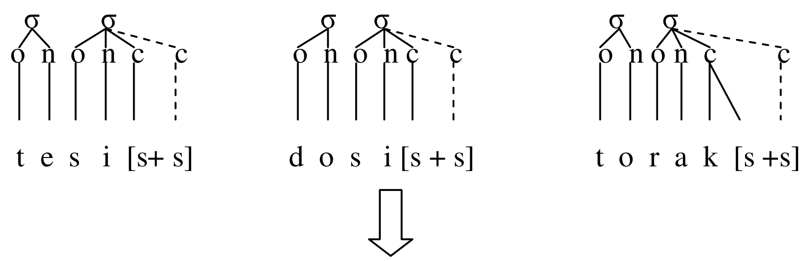
(18)



Foley (1967) ofrece una explicación que primero sitúa el morfema plural {s} al margen derecho de la raíz por una regla morfológica, y que en una etapa posterior, se elimina por una regla asimilatoria:

(19)

Explicación que aparece en Foley (1967):



regla asimilatoria

-tesi[s] -dosi[s] -torak[s]

Harris (1980), en cambio, ofrece una justificación no concadenado que se basa en la satisfacción de un patrón silábico. Este autor afirma que palabras como –*tesis*, y -*dosis* son complejas, compuestas de dos morfemas, /tes|is/, /dos|is/. El último segmento de la forma singular acaba satisfaciendo el patrón de pluralidad aunque no se alinea ningún morfema.

Por supuesto, estas explicaciones presentan una serie de dificultades teóricas que debemos exponer antes de ofrecer nuestro modelo. Primero, las justificaciones que ofrecen Foley y Harris no están apoyadas por los datos empíricos, ya que los dos se basan en explicaciones enfocadas en el nivel fonológico, un nivel al que no podemos acceder directamente. En efecto, no se puede ni probar, ni descartar ninguno de los argumentos.

Al mismo tiempo, estos argumentos tampoco son viables desde el punto de vista de la adquisición. Con respecto a la regla propuesta en Foley (1967), hay que preguntar: ¿cómo es posible que un niño deduzca una regla cuyos efectos nunca son perceptibles en el entorno lingüístico? Si ponderamos un educto ψ, cuya forma singular es ψ, y cuya forma plural también es ψ, sin excepción, ¿qué prueba tiene un niño en su etapa de la adqusición de que se haya efectuado alguna regla? Básicamente, el argumento que propone Foley es circular en el sentido de que la propuesta básica implica que alguna función de la gramática se encarga de motivar algún proceso cuyos efectos nunca surgen en el nivel fonético, lo cual produce un modelo que no se puede aprender.

Nuestro modelo propone que los ejemplos en (11c) y (11e) son subespecificados en el léxico para [plural]. Basamos esta propuesta en la idea de que, en el nivel de palabra sin ningún indicio sintáctico, un hablante nativo del español simplemente no sabe si estas formas son singulares o plurales. Lo mismo ocurre en inglés en palabras cómo *fish* (‘pez’/ ‘peces’) o *sheep* (‘oveja’/‘ovejas’).

Para justificar estas formas, en efecto, lo único que hay de hacer es prohibir cualquier modificación del aducto en el educto. Es decir, idear un esquema encabezado por la fidelidad. En particular, debemos ordenar DEP a una posición jerárquica superior para que se prohíba la inserción de segmentos. Esto elimina la oportunidad de que surja una vocal epentética entre la raíz y el morfema plural. La restricción que alinea el morfema plural debe ocupar una posición inferior de la jerarquía ya que no tenemos prueba alguna de que la /s/ que aparece en posición final de palabra de las formas plurales sea otro segmento aparte del que aparece en la forma singular.

Consideremos la siguiente jerarquía:

(20)
PARSE » DEP » CONTIGUOUS » MAX-I/O» ALIGN{s}-R

Podemos observar su interacción en las siguientes tablas:

(21)
Aducto: /tesis/ [± plural]

/tesis/ [+plural]	PARSE	DEP	MAX	ALIGN{s}-L
a. [te.sis][s]	*!			
☞ b. [te.sis]				*
c. [te.si]			*!	*
d. [te.si.se]		*!		*
e. [te.si.ses]		*!		

(22)[17]
Aducto: /toraks[18]/ [± plural]

/toraks/ [+plural]	PARSE	DEP	MAX	ALIGN{s}-L
a. [tó.raks][s]	*!			
☞ b. [tó.raks]				*
c. [tó.rak]			*!	*
d. [to.rák.se]		*!		*
e. [to.rák.ses]		*!		

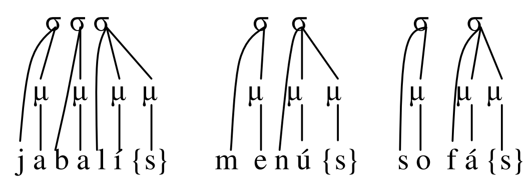
En estas tablas, los candidatos (b) resultan óptimos al retener una máxima cantidad de rasgos subyacentes en la representación patente, aunque esto infringe la restricción inferior de la jerarquía, ALIGN{s}-R. Los candidatos (a) afijan el morfema al margen derecho de la raíz, pero, debido a que quedan prohibidos los segmentos epentéticos, establecido por DEP, el morfema se tiene que quedar sin silabificar, incurriendo en una infracción inviable de PARSE. Los candidatos (c) eliminan el último segmento de la raíz, infringiendo MAX, que prohíbe la eliminación de segmentos fonológicos. Los candidatos (d) y (e) presentan eductos con segmentos post-léxicos, y resultan así no óptimos por su infracción de DEP.

4.2.4 Palabras acabadas en una vocal tónica

Los plurales de palabras acabadas en vocal tónica pueden aparecer con un segmento epentético [e] más el morfema plural, o simplemente con el morfema {s}, que se afija directamente al lado de la vocal final.

Justificamos el surgimiento del segmento epentético como una estrategia para prevenir la formación de una sílaba pesada en posición final de palabra. Es decir, para evitar la formación de una sílaba bimoraica al final de la palabra:

(23)



Expresamos la tendencia en contra de la formación de sílabas bimoraicas en posición final con la siguiente restricción:

(24)
DEP-I/Oμ
Todas las moras en el educto tienen que tener una mora correspondiente en el aducto (*inserción de moras).

Consideremos la posición de esta restricción en la siguiente jerarquía que ofrecemos para justificar el surgimiento de [e] en estas formas:

(25)
PARSE » PLUR-MORPH » MAX » DEP-I/Oμ» DEP » ALIGN{s}-R

Contemplemos su interacción en la siguiente tabla:

(26)
Aducto: menú {s}

	PARSE	PLUR-MORPH	MAX	DEP-I/Oμ	DEP	ALIGN{s}-R
a. menús				*!		
☞b. menúes					*	*
c. mes			**!	*		*
d. menutes					**!	*
e. menú		*!				*

En esta tabla, el candidato que inserta [e] entre la vocal final de la raíz y el morfema plural es el que resulta óptimo, el candidato (b). El candidato (a) alinea el morfema al margen derecho de la vocal final, satisfaciendo ALIGN a cambio de infringir una restricción superior, DEP-I/Oμ, por lo cual este candidato resulta no óptimo. El candidato (c) elimina varios segmentos para evitar la infracción de DEP-I/Oμ, incurriendo en una infracción grave de MAX, una restricción superior. Aparte de insertar el segmento epentético [e], el candidato (d) también inserta una consonante epentética para evitar una infracción de DEP-I/Oμ. Esta es una estrategia interesante, pero a la vez no óptima, ya que significa una infracción doble de DEP, una más que recibe el candidato óptimo. El candidato (e) no infringe DEP-I/Oμ porque no alinea el sufijo plural. Esta estrategia evita una infracción importante de DEP-I/Oμ, pero obliga a infringir PLUR-MORPH, por lo cual queda eliminado.

4.3 CONCLUSIONES

En este capítulo hemos expuesto un modelo integral de inserción de segmentos fundado en el conflicto y la conciliación de dos restricciones universales principales que determinan la buena formación fonológica y la alineación morfológica. En nuestro primer análisis hemos visto que una estructura impermisible en el aducto puede motivar la inserción de un segmento que reestructura los componentes de una sílaba, de modo que el primer segmento de la secuencia ilícita se convierte en la coda de una nueva sílaba, y el segundo segmento se convierte en el onset de la segunda sílaba. En este caso, la dominancia de marcadez obligó un cambio estructural tanto de la sílaba como la palabra, ya que el mantenimiento de máxima fidelidad entre las dos niveles de representación hubiera infringido de manera inadmisible una restricción que prohíbe la secuencia /s/+[consonante] en posición inicial de sílaba, sea en posición inicial de palabra o dentro de la palabra. En este caso, los principios que dominaban la buena formación de onset servían como el *estímulo* que motivó el proceso.

En nuestro segundo análisis, la reparación era la inserción de un onset para interrumpir el hiato vocálico que se creaba cuando se modificaba la morfología de una palabra. En este caso, se infringía la fidelidad entre el aducto y el educto por la necesidad de reparar la estructura defectuosa antes de que tuviera la oportunidad de surgir en el nivel fonético. Aquí, la inserción del onset constituía la *rectificación*.

En el último apartado examinamos la formación de los plurales. Aprovechando las restricciones que expusimos en las secciones anteriores, hemos ofrecido una justificación basada en restricciones universales de los plurales en español que es capaz de predecir la forma correcta y, al mismo tiempo, explicar de modo exhaustivo las razones por las que se descartaban los eductos no óptimos. El beneficio de esta base universal es que, al contrario de las justificaciones generativas, nuestra explicación es independiente del contexto. Esto es, nuestro modelo explica las tendencias, y sus posiciones jerárquicas, que pueden producir una forma óptima y rechazar las demás. Pero las tendencias, o restricciones, no son exclusivas del proceso de la formación de los plurales, sino que explican una variedad de procesos. Por tanto, los tres análisis que hemos examinado en este capítulo quedan teóricamente unidos por las restricciones que componen sus jerarquías. Los análisis generativos nunca llegaron a este nivel de profundidad.

CAPÍTULO V

LA APLICACIÓN DEL ACENTO DESDE LA TEORÍA DE OPTIMIDAD

5.0 INTRODUCCIÓN

En el capítulo 5 estudiamos una serie de restricciones universales que determinan la aplicación del acento tónico en sustantivos y adjetivos en español. Nuestro trabajo trata de ordenar estas restricciones y aportar una tipología del acento prosódico en español. Probamos una hipótesis de Hammond (1999) que expone que todos los paradigmas de acentuación en todas las lenguas del mundo se pueden explicar con la ordenación jerárquica de seis restricciones básicas. Determinamos que las predicciones expuestas en Hammond son correctas para los datos que aportamos del español.

Por un lado, presentamos un juego de restricciones que define la forma del pie métrico, esto es, explica el pie desde el punto de vista de su configuración silábica. En segundo lugar, ofrecemos una serie de restricciones que determina su imposición sobre la estructura prosódica.

Desarrollamos este apartado de la siguiente manera: primero, presentamos las restricciones en las que basamos nuestra tipología. Más adelante, exponemos las ordenaciones de estas restricciones y configuramos una tipología del acento tónico en español. A continuación, examinamos los datos del español y los probamos en las jerarquías expuestas en la sección anterior. Concluimos que la organización jerárquica de estas pocas restricciones aporta un análisis más simple y transparente del proceso de acentuación en español que los modelos que se basaban en la aplicación de reglas.

5.1 LAS RESTRICCIONES

Hammond (1999) afirma que la conciliación de seis restricciones básicas puede justificar el surgimiento del acento tónico en todas las lenguas del mundo. Estas restricciones están divididas en dos tipos. Básicamente, un juego de restricciones trata la forma del pie, mientras que otro juego se encarga de imponer esta estructura sobre la organización silábica de una palabra dada. En esta sección definimos estas restricciones para, a continuación, ofrecer una tipología que justifica el surgimiento del golpe de voz en español.

Primero, para tratar la formación de un pie métrico, una restricción, PARSE-σ, requiere que se organicen todas las sílabas en un pie. Se sabe, sin embargo, que esto no es siempre posible. A veces, una sílaba puede quedar fuera de esta estructura. Esto puede justificarse con la ordenación superior de una restricción FAITH-v̊[19], que requiere la retención del acento léxico en la representación patente. El posicionamiento superior de esta restricción en relación con una restricción FTBIN, que estipula que todos los pies sean bisilábicos, puede producir un pie monosilábico. Formalizamos todas estas restricciones en el siguiente ejemplo (1):

(1)
PARSE-σ
Se organizan todas las sílabas en pies.

FAITH-v̊
El acento léxico debe mantenerse en la representación patente.

FTBIN
Los pies métricos deben ser bisilábicos.

[19] Hammond también propone una restricción, WSP, que cumple el mismo fin. Básicamente, esta restricción requiere que una sílaba bimoraica atraiga el acento tónico. Nosotros proponemos, mostrando los datos empíricos, que tal restricción en español no es viable.

Luego, para tratar la alineación del pie a la organización silábica, Hammond propone las siguientes restricciones:

(2)
RL
El margen derecho de un pie debe alinearse con el margen derecho de la palabra.

NONFINALITY
$* \ \Sigma \ ]_{palabra}$
Un pie no puede alinearse al margen final de una palabra.

PARSE-σ
Se organizan todas las sílabas en pies.

La primera restricción en (2), RL, requiere que se alinee el pie al margen derecho de una palabra. En cambio, NONFINALITY expresa que no puede alinearse un pie al margen final de la palabra. Por supuesto, estas dos restricciones están inherentemente en conflicto. Si RL es dominante en la jerarquía, el educto óptimo debe situar el pie al margen derecho de la palabra. En caso contrario, es decir, que NONFINALITY sea dominante, el pie no se situará al margen derecho de la palabra.

5.2 TIPOLOGÍA DEL ACENTO EN ESPAÑOL

En esta sección ofrecemos nuestra tipología y probamos los datos del español. Observemos la siguiente tabla que muestra la organización de estas restricciones para justificar la aplicación del acento tónico en español:

(3)

Tipología del estrés en sustantivos y adjetivos

Tipo de sílaba	Ordenaciones jerárquicas: Forma	Alineación
a. σσ´	FAITH-v̂ » FTBIN , PARSE-σ	RL » PARSE-σ » NONFINALITY
b. σ´σ	FTBIN » PARSE-σ	RL » PARSE-σ » NONFINALITY
c. σσσ´	FAITH-v̂ » FTBIN , PARSE-σ	RL » PARSE-σ » NONFINALITY
d. σσ´σ	FTBIN » PARSE-σ	RL » PARSE-σ » NONFINALITY
e. σ´σσ	FAITH-v̂ » FTBIN , PARSE-σ	NONFINALITY » PARSE-σ » RL
f. σσσ´σ	FTBIN » PARSE-σ	RL » PARSE-σ » NONFINALITY
g. σσ´σσ	FAITH-v̂ » FTBIN , PARSE-σ	NONFINALITY » PARSE-σ » RL

5.2.1 Palabras disilábicas

A continuación examinamos los datos del español y demostramos que la tipología que ofrecimos en el apartado anterior es capaz de justificar la aplicación del acento. Consideremos la aplicación del acento en palabras disilábicas:

(4)
Palabras disilábicas [σσ]

Sustantivos		Adjetivos	
a. σσ´			
Silabas tónicas cerradas			
-balcón*	[bal.kón]	-truhán[20]	[tru.án]
-pared	[pa.ɾéð]	-ardid*	[aɾ.ðið]
-vigor	[bi.ɣóɾ]	-astur*	[as.túɾ]
-hotel	[o.tél]	-atroz	[a.tróθ]
-revés	[re.βés]	-sutil	[su.tíl]
-perdiz*	[peɾ.ðíθ]		
-bazar	[ba.θáɾ]		
Sílabas tónicas abiertas			
-sofá	[so.fá]	-hindú[21]	
-café	[ka.fé]		
-carné	[kaɾ.né]		
-tabú	[ta.bú]		
-rondó	[ron.dó]		

[20] Del francés -*truand*

[21] Del francés -*hindou*

b. σ́σ

Sílabas tónicas cerradas

-cisne	[θís.ne]	-gordo	[góɾ.ðo]
-horno	[óɾ.no]	-triste	[tɾís.te]
-compra	[kóm.pɾa]	-lento	[lén.to]
-susto	[sús.to]	-zurdo	[θúɾ.ðo]
-pasta	[fál.ta]	-calmo	[kál.mo]
-cárcel	[káɾ.θel]		
-cóndor	[kón.doɾ]		

Sílabas tónicas abiertas

-nata	[ná.ta]	-cojo	[kó.xo]
-globo	[gló.βo]	-majo	[má.xo]
-clase	[clá.se]	-fino	[fí.no]
-taxi	[ták.si]	-mudo	[mú.ðo]
-tribu	[tɾí.bu]	-peno	[pé.no]
-lunes	[lú.nes]	-útil	[ú.til]
-cutis	[kú.tis]		
-iris	[í.ɾis]		
-crimen	[kɾí.men]		
-cráter	[kɾá.teɾ]		
-túnel	[tú.nel]		
-líder	[lí.ðeɾ]		

La distinción entre sílabas cerradas y abiertas está hecha para demostrar que no existe ninguna correlación funcional entre la aplicación del acento y las sílabas bimoraicas en el español contemporáneo.

La aplicación del acento en los ejemplos de (4a) puede justificarse según la siguiente jerarquía:

(5)
FAITH-v̊ » FTBIN , PARSE-σ

Consideremos un ejemplo en la siguiente tabla:

(6)
Aducto: /parе̊d/

	FAITH-v̊	FTBIN	PARSE-σ
a. [pá.ɾeð]	*!		
b. [pá].ɾeð	*!	*	
☞c. pa[ɾéð]		*	*

En esta tabla, el candidato que mantiene el acento léxico en la representación patente es el que resulta óptimo, el candidato (c). Los candidatos (a) y (b) infringen la restricción superior al presentar eductos que no respetan la retención del acento léxico y, por tanto, resultan no óptimos.

Esta misma jerarquía se puede aprovechar para justificar el mantenimiento del acento léxico en los préstamos del inglés que divergen de las normas de la aplicación del acento tónico establecidas para el español.

Fijémonos en la siguiente tabla:

(7)
Aducto: /pv̊ster/

	FAITH-v̊	FTBIN	PARSE-σ
☞a. [pós.teɾ]			
b. [pós]teɾ		*!	*
c. pv̊s[téɾ]	*!	*	*

De nuevo, esta jerarquía requiere que el acento léxico se retenga en la representación patente. Como se puede observar, esta jerarquía no expresa ninguna estipulación respecto a la sílaba sobre la que el acento tiene que recaer. Por tanto, podemos utilizar la misma jerarquía para justificar el mantenimiento del acento léxico en todas las palabras que tienen un acento léxico. Esto representa una gran ventaja de nuestro modelo.

En esta tabla, el candidato (a) resulta óptimo ya que satisface todas las restricciones de la jerarquía. El candidato (b), propone un pie monosilábico, lo cual infringe FTBIN de modo irremediable. El candidato (c) presenta un educto que no mantiene el acento léxico y, por tanto, resulta no óptimo.

Se pueden justificar las palabras trocaicas disilábicas con la siguiente jerarquía:

(8)
FTBIN » PARSE-σ

Observemos su interacción en la siguiente jerarquía:

(9)
Aducto: /gordo/

	FTBIN	PARSE-σ
☞a. [góɾ.ðo]		
b. [góɾ].ðo	*!	*
c. goɾ.[ðó]	*!	*

Como se puede apreciar, el candidato (a) resulta óptimo al presentar un educto que tiene un pie bisilábico. Además, el carácter bisilábico del aducto significa que PARSE-σ también se puede satisfacer por el educto óptimo. Los demás candidatos, (b) y (c), presentan pies monosilábicos, infringiendo de manera grave ambas restricciones de la jerarquía.

5.2.2 Palabras trisilábicas

Consideremos los ejemplos de palabras trisilábicas y la posición del acento prosódico:

(10)
Palabras trisilábicas [σσσ]

Sustantivos		Adjetivos
a. σσσ´		
Sílabas tónicas cerradas		
-capitán	[ka.pi.tán]	-
-neceser	[ne.θe.séɾ]	-
-estrangul	[es.tran.gúl]	-
-patatús	[pa.ta.tús]	-
-aguarrás	[a.gwa.rás]	-
-avestruz	[a.βes.trúθ]	-
-animal	[a.ni.mál]	

Sílabas tónicas abiertas

-alajú	[a.la.xú]	-carmesí	[kaɾ.me.sí]
-alamí	[a.la.mí]		

b. σσ́σ

Sílabas tónicas cerradas

-recuerdo	[re.kwéɾ.ðo]	difunto	[di.fún.to]
-demanda	[de.mán.da]	presunto	[pre.sún.to]
-suspenso	[sus.pén.so]		
-asfalto	[as.fál.to]		
-lagarto	[la.ɣáɾ.to]		

Sílabas tónicas abiertas

-zapato	[θa.pá.to]	-acates	[a.ká.tes]
-patata	[pa.tá.ta.]	-sensato	[sen.sá.to]
-resumen	[re.sú.men]	-hermoso	[eɾ.mó.so]
-enchufe	[en.ʧú.fe]	-caníbal	[ka.ní.βal]
-artritis	[aɾ.tɾí.tis]		
-hipnosis	[ip.nó.sis]		

c. σ́σσ

Sílabas tónicas cerradas

-péndulo	[pén.du.lo]	-plástico	[plás.ti.ko]
-lástima	[lás.ti.ma]	-póstumo	[pós.tu.mo]
-máscara	[más.ka.ɾa]		
-víspera	[bís.pe.ɾa]		
-ómnibus	[óm.ni.βus]		
-ángulo	[áŋ.gu.lo]		
-ínterin	[ín.te.ɾin]		
-Mánchester	[mán.ʧes.teɾ]		

Sílabas tónicas abiertas

-régimen	[ré.xi.men]	-lúcido	[lú.θi.ðo]
-ático	[á.ti.ko]	-clásico	[klá.si.ko]
-ácido	[á.θi.ðo]	-plácido	[plá.θi.ðo]
-médula	[mé.ðu.la]	-trágico	[tɾá.xi.ko]
-pétalo	[pé.ta.lo]	-módico	[mó.ði.ko]
-módulo	[mó.ðu.lo]	-cómodo	[kó.mo.ðo]
-época	[é.po.ka]		
-ómicron	[ó.mi.kɾon]		
-Wáshington	[wá.šin.ton]		
-Remington	[ré.min.ton]		

La aplicación, o mejor dicho la retención, del acento en los ejemplos de (10a) y (10c) se puede justificar con la siguiente jerarquía, la misma que presentamos para justificar la asignación del acento en los ejemplos que aparecían en (4a):

(11)
FAITH-v̊ » PARSE-σ » FTBIN

Se puede obervar su interacción en las siguientes jerarquías. Para mantener cierta brevedad, no haremos comentarios sobre cada tabla ya que los resultados son idénticos a los que presentamos para las palabras disilábicas:

(12)
Aducto: /abestruθ/

	FAITH-v̊	PARSE-σ	FTBIN
a. [á.βes] truθ	*!	*	
b. a[βés.truθ]	*!	*	
☞c. [a.βes][trúθ]			*
d. [a][βés.truθ]	*!		*
e. a.βes.truθ	*!	***	
f. [a][βes][trúθ]			**!*

(13)
Aducto: /pe̊ndulo/

	FAITH-v̊	FTBIN	PARSE-σ
a. [péndu][lo]		*!	
b. [pén][dulo]		*!	
c. pen[dúlo]	*!		*
☞d. [péndu]lo			*
e. [péndulo]		*!	
f. pendulo	*!		*!**

Para justificar la alineación del pie, exponemos la siguiente jerarquía. Omitimos esta jerarquía en nuestra justificación de las palabras disilábicas ya que el carácter disilábico del aducto dejó una única opción. Sin embargo, en los ejemplos trisilábicos es necesario programar un esquema de alineación para poder predecir el surgimiento del acento:

(14)
RL » PARSE-σ » NONFINALITY

Observemos su interacción en la siguiente tabla:

(15)
Aducto: /abestruθ/

	RL	PARSE-σ	NONFINALITY
a. aβestruθ		**!*	
b. (á) βestruθ	*!*	**	
c. (a.βés)truθ	*!	*	
d. (á).βès.truθ	*!*	**	
☞e. à.βes.(trúθ)		**	*

Esta tabla expresa que la alineación del pie a la sílaba final es primordial. PARSE-σ requiere que todas las sílabas aparezcan dentro de un pie métrico, mientras que NONFINALITY prohíbe la alineación del pie a la sílaba final de palabra.

El candidato (e) satisface RL al alinear el pie a la sílaba final, resultando así óptimo aunque incurra en dos infracciones de las restricciones inferiores. Los candidatos (b), (c) y (d) infringen la restricción superior al no alinear el pie a la sílaba final de palabra, resultando todos no óptimos. El candidato (a) no presenta ningún pie, con lo cual no puede infringir RL. Sin embargo, este candidato está eliminado por las tres infracciones de PARSE-σ, al no dividir las sílabas en pies.

Para justificar la posición del pie en los ejemplos de (10c), hay que ordenar NONFINALITY a una posición superior de la jerarquía, ya que el pie no se alinea a la sílaba final. Al mismo tiempo, RL debe ocupar una posición inferior, ya que está infringida habitualmente por los eductos óptimos. Contemplemos la siguiente jerarquía:

(16)
NONFINALITY » PARSE-σ » RL

Su interacción está expuesta en la siguiente tabla:

(17)
Aducto: /reximen/

	NONFINALITY	PARSE-σ	RL
a. reximen		**!*	
b.(ré)ximen		**!	**!
c. re(xí.men)	*!	*	*
☞d. (ré.xi)men		*	*
e. (ré)(xì.men)	*!		*

El candidato (d) resulta óptimo por su satisfacción de la restricción superior, NONFINALITY. Los candidatos (c) y (e) están eliminados al alinear el pie a la sílaba final de la palabra, infringiendo la restricción superior de la jerarquía. Todos los demás candidatos todos cometen infracciones graves de PARSE-σ al presentar sílabas que no aparecen dentro de un pie métrico.

Exponemos la siguiente jerarquía para justificar el surgimiento del acento trocaico en los ejemplos de (10b). Se puede observar que es la misma jerarquía que expusimos para nuestra justificación del acento trocaico en las palabras disilábicas:

(18)
FTBIN » PARSE-σ

Contemplemos de nuevo su interacción en la siguiente tabla:

(19)
Aducto: /asfalto/

	FTBIN	PARSE-σ
☞a. as[fál.to]		*
☞b. [ás.fal]to		*
c. [as.fal][tó]	*!	
d. [as][fál.to]	*!	
e. [as.fál.to]	*!	
f. asfalto		*!*

El que esta jerarquía no pueda determinar la sílaba que no se incorporará en un pie no representa ningún defecto del modelo, ya que a continuación se determinará con la jerarquía de alineación.

Como se puede observar, los candidatos (a) y (b) empatan con respecto a la optimidad. El candidato (a) prefiere no incorporar la primera sílaba, mientras que el candidato (b) deja sin incorporar en un pie la última sílaba. Los candidatos (c), (d) y (e) infringen FTBIN al no presentar un pie bisilábico y, por tanto, están eliminados. El candidato (f) no divide las sílabas en pies, por lo cual incurre en dos infracciones de PARSE-σ y resulta así no óptimo.

Ahora, para justificar la posición del pie sobre la estructura silábica, podemos aprovechar la jerarquía que presentamos para justificar la alineación del pie en los ejemplos de (10a). Exponemos de nuevo esta jerarquía en el siguiente ejemplo:

(20)
RL » PARSE-σ » NONFINALITY

Observemos la posición del pie que predice esta jerarquía para los ejemplos de (10b):

(21)
Aducto: /θapato/

	RL	PARSE-σ	NONFINALITY
a. (θá) pàto	*!*		*
b. (θápa)to	*!	*	
☞ c. θa(páto)		*	*
d. (θàpa)(tó)	*!		*
e. (θa)(pa)(to)	**!*		*

Los candidatos (a), (b), (d) y (e) están eliminados al no situar un pie bisilábico al margen derecho de la palabra, lo cual representa una infracción grave de RL. Es el candidato (c) el que resulta el único candidato viable según las restricciones expuestas en esta jerarquía.

5.2.3 Palabras polisilábas

Como cabría de esperar, podemos justificar el surgimiento del acento tónico en las palabras polisilábicas con las mismas jerarquías que hemos expuesto para justificar la aplicación del golpe de voz en las palabras bisilábicas y trisilábicas. Consideremos los siguientes datos del español:

(22)

Palabras polisilábicas [σσσσ]

Sustantivos		Adjetivos
a. σσσ´σ		
Silabas tónicas cerradas		
-vagabundo [bà.γa.βún.do]		-estupendo [es.tu.pén.do]
Sílabas tónicas abiertas		
-mariposa [mà.ɾi.pó.sa]		
-maravilla [mà.ɾa.βí.ja]		
b. σσ´σσ		
Sílabas tónicas cerradas		
-arándano [a.ɾán.da.no]		-romántico [ro.mán.ti.ko]
-albóndiga [al.bón.di.γa]		-fantástico [fan.tás.ti.ko]
		-espléndido [es.plén.di.ðo]
Sílabas tónicas abiertas		
-estímulo	[es.tí.mu.lo]	-intrépido [in.tɾé.pi.ðo]
-escrúpulo	[es.kɾú.pu.lo]	-insípido [in.sí.pi.ðo]
-obstáculo	[obs.tá.ku.lo]	-ridículo [ri.ðí.ku.lo]
-esdrújula	[es.ðɾú.xu.la]	-metículo[me.tí.ku.lo]
-vestíbulo	[bes.tí.bu.lo]	
-oxígeno	[ok.sí.xe.no]	

El acento trocaico que se aplica en los ejemplos de (22a) se puede justificar mediante la misma jerarquía que presentamos para predecir el surgimiento del acento tónico en los ejemplos que aparecían en (4b) y (10b). Consideremos de nuevo esta jerarquía:

(23)

FTBIN » PARSE-σ

(Recordemos esta jerarquía expresa que todas las sílabas se tienen que incorporar en pies bisilábicos).

Observemos las predicciones que hace esta jerarquía con un ejemplo de (22a):

(24)

Aducto: /bagabundo/

	FTBIN	PARSE-σ
☞a. [bà.ɣa][βún.do]		
b. [bá.ɣa]βun.do		*!*
c. ba[ɣá.βun]do		*!*
d. ba.ɣa[βún.do]		*!*
e. [ba][ɣa.βun][do]	*!*	

En esta tabla, es el candidato (a) el único que satisface todas las estipulaciones representadas por las restricciones. Como se puede apreciar, todas las sílabas aparecen en pies bisilábicos. Los candidatos (b), (c) y (d) no incorporan una o más sílabas en un pie, lo cual constituye unas infracciones importantes de PARSE-σ. El candidato (e) incorpora todas las sílabas en pies, pero sólo uno de estos representa un pie bisilábico, obligando así una inadmisible infracción de FTBIN.

Se determina la situación del pie mediante la misma jerarquía de alineación que hemos expuesto para justificar la posición del pie en los ejemplos de (4a), (4b) (10a). (10b) y (10c): RL » PARSE-σ » NONFINALITY.

Contemplemos la situación del pie que predice esta jerarquía con un ejemplo de (22a):

(25)
Aducto: /mariposa/

	RL	PARSE-σ	NONFINALITY
a. mariposa		**!**	
b. (má.ri)posa	*!*	**	
c. (ma.ri)(po)sa	*!**	*	
☞d. (màri)(pósa)			*
e. mari(pó.sa)		*!*	*

Los candidatos (b) y (c) resultan no óptimos al no alinear el margen derecho del pie con el margen derecho de la palabra, lo cual representa una infracción seria de RL. El candidato (a) no presenta ningún pie y, por tanto, queda eliminado por PARSE-σ. El candidato (e) presenta un solo pie, a pesar de que la estructura silábica de esta palabra permita dos pies binarios. Este hecho constituye una infracción grave de PARSE-σ, y por tanto este candidato está eliminado. Es el (d), el único candidato que satisface las restricciones superiores de esta jerarquía, por lo cual resulta óptimo.

La justificación del surgimiento del estrés sobre la antepenúltima sílaba en los ejemplos de (22b) se puede expresar con la siguiente jerarquía:

(26)
FAITH-v̊ » FTBIN » PARSE-σ

No debería resultar sorprendente que esta fuese la misma jerarquía que aprovechamos para justificar la aplicación del acento tónico en los ejemplos de (4a), (10a) y (10c).

Veamos un ejemplo de (22b) que aparece en la siguiente jerarquía:

(27)
Aducto: /aråndano/

	FAITH-v̊	FTBIN	PARSE-σ
a. [àɾ.an][dá.no]	*!		
☞b. a[ɾán.da]no			**
c. a[ɾán][da.no]		*!	*
d. [a][ɾán][da.no]		*!*	
e. arandano	*!		****

Los candidatos (a) y (e) presentan acentos tónicos que divergen del acento léxico, lo cual supone una infracción significativa de FAITH-v̊. Los candidatos (c) y (d) satisfacen esta restricción, pero no resultan óptimos al presentar pies monosilábicos, incurriendo así en una infracción de FTBIN. El candidato (b) mantiene el acento léxico en la representación patente, pero no incorpora dos de las sílabas en un pie métrico. Aunque esto representa una infracción doble de PARSE-σ, la posición inferior de esta restricción hace que no sea grave la infracción, permitiendo por tanto que este candidato resulte óptimo.

Lógicamente, para justificar la posición del pie, nuestra jerarquía tiene que expresar que el margen derecho del pie no puede alinearse al margen derecho de la palabra, lo cual queda expresado por la siguiente jerarquía:

(28)
NONFINALITY » PARSE-σ » RL

Demostramos con los ejemplos de (10c) que esta jerarquía es capaz de situar el pie sobre la sílaba correcta. Observemos su interacción con un ejemplo de (22b):

(29)
Aducto: /bestíbulo/

	NONFINALITY	PARSE-σ	RL
a. bestiβulo		*!***	
b. (bés.ti)βulo		*!*	**
c. (bés.ti)(βu)lo		*	*!*
d. (bès.ti)(βú.lo)	*!		
☞ e. (bès)(tí.βu)lo		*	*

De nuevo, vemos que esta jerarquía es capaz de justificar la posición del pie en palabras no trocaicas. El candidato (a) está eliminado por no incorporar las sílabas en pies. El candidato (b) está eliminado por la misma razón, pero con dos infracciones menos que el candidato (a). El candidato (d) sí que incorpora todas las sílabas en pies, pero, por el contrario, alinea erróneamente el margen derecho del pie al margen derecho de la palabra, infringiendo así la restricción superior de la jerarquía, NONFINALITY. El candidato óptimo en este caso está determinado por la restricción inferior de la jerarquía, RL. Ya que cada sílaba que aparece entre el pie bisilábico y el margen derecho de la palabra, contando desde el margen derecho de la palabra, constituye una infracción independiente, el candidato (c) recibe dos infracciones por situar el margen izquierdo del pie silábico al margen izquierdo de la palabra, y resulta así no óptimo. El candidato (e), en cambio, comete una infracción sencilla de esta restricción al alinear el margen derecho del pie con el margen derecho de la penúltima sílaba, y consigue así ser óptimo.

5.3 CONCLUSIONES

El modelo que propusimos en este capítulo manifiesta que el acento en español se aplica de dos maneras. Por un lado, hay un proceso *productivo* que se encarga de aplicar el acento trocaico en palabras de dos, tres y cuatro sílabas. Esto se lleva a cabo mediante una jerarquía encabezada por una restricción, FTBIN, que requiere que todos los pies sean bisilábicos. En cambio, los ejemplos divergentes, es decir no trocaicos, se producen mediante una jerarquía dominada por una restricción de fidelidad, FAITH-v̊́, que requiere la retención del acento léxico que aparece en el aducto.

Nuestro modelo representa una gran ventaja desde el punto de vista de la adquisición, porque un niño en su etapa de la adquisición fonológica sólo tiene que aprender dos jerarquías básicas para producir el acento tónico en español. Aunque nuestro modelo implica una carga mayor para el léxico, debido a que el niño tiene que almacenar el acento léxico de varias palabras en su memoria, la simplicidad esquemática del modelo significa una carga menor para la gramática productiva.

CAPÍTULO VI

LAS FORMACIÓN DE LOS DIMINUTIVOS EN ESPAÑOL

6.0 INTRODUCCIÓN A LAS FORMAS DIMINUTIVAS

En este capítulo final, ofrecemos un análisis exhaustivo de las formas diminutivas en español basado en la resolución del conflicto entre la buena formación fonológica y la alineación morfológica. Presentamos estas formas en el siguiente ejemplo:

(1)

Las distintas formas diminutivas en español				
-it				
	-gato	→	-gatito	[gá.to]→[ga.tí.to]
	-casa	→	-casita	[ká.sa]→[ka.sí.ta]
-/eθ/-*it*				
	-huevo	→	-huev-ec-ito	[wé.βo]→[we.βe.θí.to]
	-hueso	→	-hues-ec-ito	[wé.so]→[we.se.θí.to]
	-radio	→	-radi-ec-ito	[rá.djo] →[ra.dje. θí.to]
	-patio	→	-pati-ec-ito	[pá.tjo] →[pa.tje. θí.to]
	-solØ	→	-sol-ec-ito	[sól]→[so.le.θí.to]
	-panØ	→	-pan-ec-ito	[pán]→[pa.ne.θí.to]
	-mesØ	→	-mes-ec-ito	[més]→[me.se.θí.to]
	-reyØ	→	-rey-ec-ito	[rej]→[re.je.θí.to]
-[θ]-*it*				
	-pintorØ	→	-pintorcito	[pin.tóɾ]→[pin.toɾ.θí.to]
	-CarmenØ	→	-Carmencita	[káɾ.men]→[kaɾ.men.θí.ta]
	-padre	→	-padrecito	[pá.ðɾe]→[pa.ðɾe.θí.to]
	-jefe	→	-jefecito	[xé.fe]→[xe.fe.θí.to]
	-clase	→	-clasecita	[klá.se]→[kla.se.θí.ta]
-it/-[θ]-*it*				
	-sofá	→	-sofacito	[so.fá]→[so.fa.θí.to]
	-mamá	→	-mamita/mamacita	[ma.má]→[ma.mí.ta]~[ma.ma.θí.ta]
	-papá	→	-papito/papacito	[pa.pá]→[pa.pí.to]~[pa.pa.θí.to]
	-virus	→	-virusito	[bí.ɾus]→[bi.ɾu.sí.to]
	-brindis	→	-brindisito	[bɾín.dis]→[bɾin.di.sí.to]
	-azúcar	→	-azuquítar/azuquillar	[a.θú.kar] → [a.θu.kí.yar]

De acuerdo con lo expuesto, se pueden extraer las siguientes generalizaciones:

(2)
Generalizaciones sobre la formación de los diminutivos en español

1. La vocal inicial del morfema {-it}[22] se alinea siempre a un onset.
2. Respecto al sufijo diminutivo, sólo los segmentos [it] aparecen con regularidad.
3. Todas las formas diminutivas acaban en [o] u [a], de acuerdo con el género morfosintáctico de la raíz a la que se adjuntan, incluso en aquellos casos de infijación del morfema diminutivo en una raíz que acaba en [o] u [a], en la que estas vocales no representan el género morfosintáctico de la raíz: por ejemplo, [problema]→problem-it-a (sustantivo masculino del griego)
4. El morfema diminutivo aparece de modo sistemático en la penúltima sílaba.
5. Los únicos segmentos que pueden aparecer al margen derecho del sufijo diminutivo son /a,o,s/.

A lo largo de este capítulo, demostramos que se pueden justificar todas las formas que aparecen en (1) desde un modelo en el que se refleja jerárquicamente la proclividad de que los núcleos tengan un onset, expresada por ONSET, en relación con otra restricción, ALIGN, que requiere que se alinee el sufijo diminutivo al margen derecho de la base. Además de este esquema básico, las formas divergentes, es decir aquellas en las que aparecen los segmentos adjuntos [eθ], se pueden justificar mediante un esquema en el que una restricción fonológica superior impone un requerimiento sobre la cantidad de pies que debe tener un diminutivo cuya base es, o bien una palabra disilábica con un diptongo alternante en la penúltima sílaba, o bien una monosílaba acabada en consonante.

Se desarrolla la organización de este capítulo de la siguiente manera: la primera sección, §5.1, delimita nuestra orientación con respecto a los componentes individuales que aparecen en las distintas formas diminutivas. Mostramos los datos del español de acuerdo con los tipos de bases a las que se alinea el morfema, y definimos nuestra posición respecto a la vocal final que se adjunta a estas bases. A continuación, presentamos el morfema diminutivo y formalizamos esta unidad con una restricción desde la TO. Más adelante, presentamos una restricción que define los segmentos

[22] Existen unas pocas excepciones, pero estas no ponen en duda la veracidad de nuestro modelo.

adjuntos, /eθ/, y otra que explica su inserción en determinadas formas diminutivas en español. En el siguiente apartado, §5.2, presentamos las restricciones que emplearemos en nuestro modelo. Posteriormente, ordenamos estas restricciones en las jerarquías que justifican las distintas formas diminutivas.

6.1 LOS COMPONENTES

6.1.1 Las clases de base y las vocales finales de base

Basamos nuestro modelo en gran parte en la clasificación de bases nominales expuesta en Bermúdez-Otero (2006). Según este autor, todos los sustantivos en español pertenecen a una de las cuatro clases de base. Consideremos el siguiente sistema clasificatorio expuesto en Bermúdez-Otero (2006):

(3)

	Singular	Plural
Bases -o		
	-gato	gat-o-s
	-abuelo	abuel-o-s
	-lobo	lob-o-s
	-huevo	huev-o-s
	-hueso	hues-o-s
Bases -a		
	-casa	cas-a-s
	-mesa	mes-a-s
	-reina	rein-a-s
	-risa	ris-a-s
	-blusa	blus-a-s
Bases -e (/Ø)		
	-padre	padr-e-s
	-jefe	jef-e-s
	-clase	clas-e-s
	-reyØ	rey-e-s
	-pintorØ	pintor-e-s
	-solØ	sol-e-s
-Bases atemáticas		
	-menú	menú-s~menú-e-s
	-mamá	mama-s
	-café	café-s
	-virus	virus
	-dosis	dosis

-crisis	crisis

Además, cada clase de base tiene unos escasos ejemplos de pseudoplurales:

(4)
Pseudo plurales

Bases -o	Carlos	[kár.l-o-s]
Bases -a	mecenas	[me.θé.n-a-s]
Bases -e	Sócrates	[só.kra.t-e-s]
Bases atemáticas	análisis	[a.ná.li.si-s]

Estas unidades, aunque sintácticamente singulares, muestran un comportamiento morfofonológico más parecido al de los plurales. Esto es, terminan en /s/.

Consideramos que las vocales que aparecen al margen derecho de estas bases son fonológicas, y por tanto aparecen en la representación fonológica[23]. Esto es un punto importante de nuestro modelo que influye de modo fundamental en nuestra justificación de la alineación del sufijo diminutivo a la base.

Básicamente, si mantenemos que la vocal final de base es fonológica, el que se alinee el sufijo diminutivo al margen derecho de la consonante final de base incurre de modo obligatorio en una infracción de ALIGN-{it}-R, ya que no hay alineación directa al margen derecho de la palabra. En cambio, si la vocal es morfológica, hay una alineación perfecta con el margen derecho de la palabra, ya que la consonante final de la base constituye en efecto el margen derecho de la palabra, y no incurre en ninguna infracción de la restricción de alineación. No obstante, la infracción en sí de la restricción de alineación no descarta, a priori, ninguno de los dos argumentos anteriores, pues simplemente significa que, para justificar la infracción, tendría que haber una restricción dominante cuya satisfacción justificara la infracción. En nuestro modelo,

[23] Aunque no profundizamos en la justificación para esta afirmación, constituye un punto importante de nuestro modelo, sobre todo respecto a la alineación del sufijo diminutivo. La explicación teórica y las consecuencias de nuestra orientación para nuestro modelo aparecen en las páginas 307-316 de la tesis.

manifestamos que esta restricción dominante es ONSET. Observemos un esquema en el que ONSET domina ALIGN-{it}-R:

(5)
Aducto: /gato/ + {-it}

	ONSET	ALIGN-{-it}-R
☞a. gat-it-o		*!
b. gato-it	*!	

El candidato (a) resulta óptimo ya que satisface ONSET aunque esto significa una infracción de ALIGN-{-it}-R. El candidato (b) infringe ONSET, al alinear el morfema al margen derecho de la vocal final, resultando así no óptimo.

Como se puede observar, una de las ventajas de este modelo es que la alineación de la vocal al margen derecho del morfema diminutivo se entiende como una consecuencia de la resolución de conflicto entre ONSET y ALIGN, y así no tiene que estar programada una restricción específica que alinea este segmento al margen derecho del sufijo. Además, visto que ONSET representa una tendencia universal, su incorporación en nuestro modelo significa que podemos expresar una cantidad superior de información fonológica en nuestra jerarquía.

Si manifestáramos que la vocal final se proporcionara por una regla morfológica en un nivel post-léxico, la alineación del morfema sería directa. Consideremos la siguiente tabla:

(6)
Input: /gat/ + {-it}

	ALIGN-{-it}-R
☞a. gat-it-	
b. gato-it	*!

En esta tabla, se alinea el morfema diminutivo al margen derecho de la palabra. La desventaja de este esquema, sin embargo, es que se queda sin representarse la tendencia universal de que los núcleos tienen que alinearse a un onset. Y aunque este paradigma es más simple que el que presentamos en (5), no hay ningún mecanismo programado que especifique la alineación de la vocal final al margen derecho del sufijo diminutivo, lo cual quedó como una consecuencia secundaria de la resolución de conflicto entre ONSET y ALIGN-{-it}-R.

Para justificar el surgimiento de la vocal final en las formas diminutivas de las palabras de la clase de base –e/(Ø), tenemos que programar una restricción que proporciona un marcador de palabra de acuerdo con el género morfosintáctico de la base. Como los datos en (1) confirman, esta generalización es fiable en español. Proponemos una restricción GENDERMARKER que se encarga de proporcionar una vocal final a las formas diminutivas que proceden de la clase de base –e/(Ø) y las bases atemáticas:

(6)
GENDERMARKER
Las formas diminutivas de los nominales de la clase de base –e (Ø) y de la clase de base atemática deben afijar una vocal final al margen derecho del morfema diminutivo en función del género morfosintáctico de la base.

Si esta restricción ocupa una posición dominante de la jerarquía, el educto óptimo debe afijar una vocal al margen derecho del sufijo diminutivo. Consideremos la siguiente jerarquía:

(7)
GENDERMARKER » MAX-V[24] » ONSET » ALIGN-{-it}-R

Contemplemos la siguiente tabla. Para no complicar nuestra jerarquía, de momento sólo presentaremos los candidatos que se distinguen en su vocal final:

[24] Esta restricción prohíbe la preclusión de vocales subyacentes en el educto.

(8)
Aducto: /nube/ + -it (-*cloud*)

	GENDERMARKER	MAX-V	ONSET	ALIGN-{-it}-R
a. nubeθ-it-o	*!			*
☞b. nubeθ-it-a				*

En esta tabla, el candidato (b) resulta óptimo porque alinea una [a], vocal por defecto para sustantivos femeninos, al margen derecho del sufijo diminutivo. El candidato (a) resulta no óptimo porque no refleja el género morfosintáctico de la base en la vocal final.

Se puede justificar la alineación peculiar del morfema diminutivo al margen derecho de la consonante interior de palabra en diminutivos como –*Carlitos* y –*Merceditas*, en los que el sufijo se comporta como un infijo, al programar una restricción superior, ALIGN(PD), que prohíbe la resilabificación de la consonante final de palabra al estar modificada por el sufijo diminutivo. Si esta restricción domina otra restricción que pretende situar el sufijo diminutivo al margen derecho de la base, la sufijación al margen derecho de la base implica una infracción grave de la restricción superior para satisfacer una restricción inferior. Consideremos la siguiente jerarquía:

(9)
ALIGN(PD) » ALIGN-{-it}-R

Observemos su interacción en la siguiente jerarquía:

(10)
Aducto:/kar.los/ + -it

	ALIGN(PD)	ALIGN-{-it}-R
☞a karl-it-os		*
b karlos-it-o	*!	
c kar-it-los		*!*
d k-it-ar.los		**!*

En esta tabla, el candidato (a) resulta óptimo al no dejar que se resilabifique la consonante final al agregar el sufijo diminutivo a la base. La estrategia óptima en este caso es infringir la restricción inferior al alinear el morfema a una consonante en el interior de palabra. El candidato (b) resulta no óptimo al incurrir en una infracción de la restricción superior. Los candidatos (c) y (d) incurren en dos y tres infracciones caprichosas de la restricción inferior, una marca de infracción por cada sílaba que se desvía el morfema del margen derecho de la palabra.

6.1.2 El morfema diminutivo

En esta sección definimos el morfema diminutivo. Un repaso de los datos que presentamos en (1) indica que los únicos segmentos que son constantes en todas las formas diminutivas en español son /it/[25]. Por tanto, en nuestro análisis no reconocemos ningún alomorfo aparte del mismo morfema. En su lugar, proponemos que los demás segmentos que aparecen en conjunto con el morfema en ciertos diminutivos en español se proporcionan por la interacción de la fonología y la morfología mediante un esquema de resolución de conflicto. Formalizamos el morfema con la siguiente restricción:

(11)
DIM-MORPH
Hay un morfema diminutivo {it} que se afija a una base nominal, adjetival o adverbial en los diminutivos en español.

Sin ninguna ordenación jerárquica, esta restricción seleccionará el educto que manifiesta un morfema diminutivo:

[25] De esta clase de diminutivo. Otros morfemos existen en español: -et, -illo/a etc., pero no los tratamos en este apartado.

(12)

	DIM-MORPH
☞a. gat-it-o	
b. gato	*!

Como se puede apreciar, esta restricción elige el educto que aparece con el morfema diminutivo.

6.1.3 Los segmentos adjuntos /eθ/

Los segmentos adjuntos, o en conjunto o por separado, aparecen en las siguientes formas diminutivas:

(13)

Diminutivos con segmentos adjuntos

(a)				
/eθ/	-huevo	→	-huevecito	[wé.βo]→[we.βe.θí.to]
	-hueso	→	-huesecito	[wé.so]→[we.se.θí.to]
	-reina	→	-reinecita	[réj.na]→[rej.ne.θí.ta]
(b)				
/eθ/	-bestia	→	-bestiecita	[bés.tja] →[bes.tje. θí.ta]
	-radio	→	-radiecito	[rá.djo] →[ra.dje. θí.to]
	-patio	→	-patiecito	[pá.tjo] →[pa.tje. θí.to]
(c)				
/eθ/	-solØ	→	-solecito	[sól]→[so.le.θí.to]
	-panØ	→	-panecito	[pán]→[pa.ne.θí.to]
	-mesØ	→	-mesecito	[més]→[me.se.θí.to]
	-reyØ	→	-reyecito	[rej]→[re.je.θí.to]
(d)				
/θ/	-pintorØ	→	-pintorcito	[pin.tóɾ]→[pin.toɾ.θí.to]
	-CarmenØ	→	-Carmencita	[káɾ.men]→[kaɾ.men.θí.ta]
(e)				
	[e/Ø-θ] -padre	→	-padrecito	[pá.ðre]→[pa.ðre.θí.to]
	-jefe	→	-jefecito	[xé.fe]→[xe.fe.θí.to]
	-clase	→	-clasecita	[klá.se]→[kla.se.θí.ta]
(f)				
/θ/	-sofá	→	-sofacito	[so.fa.θí.to]
	-mamá	→	-mamita/mamacita	[ma.mí.ta]/[ma.ma.θí.ta]

(g)

/eθ/	-crisis	→	cris<u>ec</u>ita	[krí.si-s] →[kri.se. θí.ta]
	-dosis	→	dos<u>ec</u>ita	[dó.si-s] →[dó.se.θí.ta]

Entendemos la inserción de los segmentos adjuntos en las formas que aparecen en los ejemplos (13a), (13c), y (13g) como el resultado de la satisfacción de una restricción dominante que estipula que cumplan un requerimiento de tamaño de dos pies métricos los diminutivos de bases disilábicas que tienen un diptongo alternante en la penúltima sílaba y monosílabos acabados en consonante. Justificamos la inserción en los ejemplos de (13b) como una estrategia de prevenir que se alinee la vocal alta inicial de morfema a otra vocal alta, creando así un conjunto prohibido en español, [jí]. La inserción de /θ/ en los ejemplos de (13d) parece estar vinculada a una tendencia de mantener la estructura moraica de la base en la forma diminutiva, mientras que la inserción del segmento en (13f) parece representar una estrategia de alinear la vocal inicial de morfema a una consonante prenuclear.

Definimos los segmentos adjuntos y su inserción en las formas diminutivas con la siguiente restricción:

(14)

ADJ(UNCT)-SEG(MENTS)
Los segmentos [e] y [θ], exclusivamente, pueden insertarse entre la base y el morfema diminutivo (obligatorio), en ciertas formas diminutivas para satisfacer otra restricción superior.

Lógicamente, esta restricción sólo puede surtir efecto en conjunto con otra restricción de buena formación[26]. Un repaso de los datos pertinentes a la inserción de los segmentos adjuntos en palabras disílabicas con un diptongo en la penúltima sílaba y monosílabas acabadas en consonante sugiere la existencia de una restricción superior

[26] En esta redacción, sólo mostramos la relación entre ADJSEG y MIN-FT-REQ. La justificación para los demás casos de inserción aparece en las páginas (323-328) de la tesis.

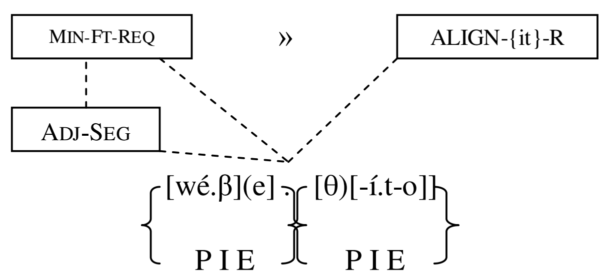
que impone un requerimiento de tamaño sobre las bases que cumplen las antemencionadas estipulaciones. Esta restricción se formaliza en el siguiente ejemplo:

(15)
MIN-FT-REQ (*Minimum Foot Requirement*)

Las formas diminutivas de palabras disilábicas con un diptongo en la penúltima sílaba y monosílabas acabadas en consonante deben constar de dos pies métricos.

A continuación, se esquematiza la relación entre MIN-FT-REQ, ADJSEG y ALIGN-{it}-R:

(16)



En este esquema, ADJSEG constituye un dependiente de MIN-FT-REQ. El requerimiento de que las formas diminutivas de ciertas palabras se compongan de dos pies métricos significa que algún proceso tendrá que surtir efecto para que se cumpla esta restricción. En nuestro análisis, el cumplimiento de MIN-FT-REQ está programado por la formalización de ADJSEG. La interacción de estas restricciones aparece en la siguiente tabla:

(17)
Aducto: /webo/ + -it

	MIN-FT-REQ	ADJ-SEG	ALIGN-{-it}-R
a. we.b-i.t-o	*!	*	*
☞b. we.b[e.θ]-i.t-o			***
c. we.b[e.t]-i.t-o		*!	***

Esta tabla requiere que tenga dos pies métricos el educto óptimo de una base disilábica con un diptongo en la penúltima sílaba. El candidato (a) presenta un educto que sólo tiene un pie métrico, [bí.to], más una sílaba métrica extra, [we]. El candidato

(b) sí tiene dos pies métricos y por tanto resulta óptimo, aunque incurre en una triple infracción de ALIGN-{it}-R. El candidato (c) satisface el requerimiento que estipula la cantidad de pies, pero resulta no óptimo al presentar un segmento que no está autorizado por ADJSEG.

6.2 NUESTRO ANÁLISIS

Esta sección ofrece una redacción de tres análisis expuestos en la tesis. Exponemos las restricciones y sus posiciones jerárquicas de tres tipos de diminutivos: las formas regulares, las formas disilábicas con un diptongo en la penúltima sílaba en las que surgen los segmentos adjuntos /eθ/, y un caso de infijación del morfema diminutivo.

6.2.1 Las formas regulares

Las formas diminutivas regulares son aquellas que terminan en una vocal que se corresponde con el género morfosintáctico de la base, y las que sólo manifiestan el morfema diminutivo, es decir sin ningún segmento adjunto. Es interesante notar que estas formas siempre provienen de la clase de base -o/-a expuesta en Bermúdez-Otero (2006). Observemos de nuevo los datos pertinentes a estas formas:

(18)
(a)

Formas regulares			
-gato	→	-gatito	[gá.to]→[ga.tí.to]
-casa	→	-casita	[ká.sa]→[ka.sí.ta]
-lobo	→	-lobito	[ló.βo]→[lo.βí.to]
-abuelo	→	-abuelito	[a.βwé.lo]→[a.βwe.lí.to]

Estos diminutivos no presentan dificultad alguna a la hora de justificar su formación mediante un esquema que se basa en la resolución de conflicto. En efecto, justificamos estas formas como el resultado de un paradigma de conflicto entre una restricción superior que requiere que se alineen los núcleos a un segmento post-nuclear, esto es a una consonante, y una restricción inferior que pretende alinear el morfema diminutivo al margen derecho de la base. Lógicamente, no se pueden satisfacer las dos restricciones a la vez.

Aparte de las dos restricciones protagonistas, debemos programar dos restricciones de correspondencia a posiciones mediales para expresar el hecho de que se prohíban tanto la eliminación como la inserción de segmentos para satisfacer la restricción superior. Básicamente, estas restricciones excluirán formas no óptimas como *[gato[t]-it-o] ó *[gato-[Ø]t-a].

Ponderemos la siguiente jerarquía:

(19)
DIM-MORPH » ONSET » MAX-V » DEP » ALIGN-{it}-R

Podemos observar su interacción en la siguiente tabla:

(20)
Aducto: /gato/

	DIM-MORH	ONSET	MAX-V	DEP	ALIGN-{it}-R
a. gato-it-o		*!		*	
☞b. gat-it-o					*
c. gato-it		*!			
d. gato	*!				
e. gat-it			*!		*
f. gato-t			*!		*
g. gato-[t]-it				*!	*

Esta jerarquía escoge como óptimo el candidato (b). La única infracción en la que incurre es la de la restricción inferior que comete al no alinear el morfema diminutivo al margen derecho de la base. Esta estrategia resulta a pesar de ello deseable, ya que implica la satisfacción de la restricción superior ONSET. Los candidatos (a) y (c), en cambio, prefieren la alineación directa del morfema diminutivo al margen derecho de la base, y por lo cual resultan no óptimos, ya que esta estrategia implica una infracción grave de ONSET. El candidato (d) está eliminado por proponer una forma diminutiva que no tiene morfema diminutivo, cometiendo una infracción fatal de la restricción más importante de la jerarquía. Los candidatos (e) y (f) resultan no válidos por la eliminación de vocales, lo cual satisface ONSET, pero infringe de una manera no permisible MAX-V, según la ordenación de esta jerarquía.

6.2.2 Los diminutivos de palabras disilábicas que tienen un diptongo penúltimo

Los diminutivos de palabras disilábicas que tienen un diptongo en la penúltima sílaba manifiestan dos segmentos adjuntos /eθ/ en el educto óptimo:

(21)
(b)

Diminutivos de palabras disilábicas con diptongo en la penúltima sílaba:			
-huevo	→	-huev<u>ec</u>ito	[wé.βo]→[we.βe.θí.to]
-hueso	→	-hues<u>ec</u>ito	[wé.so]→[we.se.θí.to]
-reina	→	-rein<u>ec</u>ita	[réj.na]→[rej.ne.θí.ta]

Hemos explicado el surgimiento de los segmentos adjuntos en estos ejemplos como el resultado del requerimiento de que las formas diminutivas de esta clase de palabras se compongan de dos pies métricos. Hemos podido representar este hecho en nuestro análisis al proponer una restricción que impone un tamaño mínimo de ciertos diminutivos. Ofrecemos de nuevo esta restricción para recordar:

(22)
MIN-FT-REQ (*Minimum Foot Requirement*)

Las formas diminutivas de palabras disilábicas con un diptongo en la penúltima sílaba y monosílabas acabadas en consonante deben constar de dos pies métricos.

En teoría, sin embargo, existen muchas maneras de satisfacer esta restricción. La epéntesis productiva por ejemplo insertaría los segmentos [et]. Sin embargo, vemos que en las formas óptimas, sólo hay una manera programada para llegar al educto óptimo, la inserción de los segmentos adjuntos [eθ], lo cual queda representado en la restricción ADJ-SEG:

(23)
ADJ(UNCT)-SEG(MENTS)
Los segmentos [e] y [θ], exclusivamente, pueden insertarse entre la base y el morfema diminutivo (obligatorio), en ciertas formas diminutivas para satisfacer otra restricción superior.

Si estas restricciones dominan ALIGN-{-it}-R, el educto óptimo debe constar de dos pies métricos e insertar los segmentos adjuntos para cumplir esta estipulación. A continuación, se ofrece la jerarquía entera:

(24)
DIM-MORPH»MIN-FT-REQ»ADJ-SEG»ONSET»MAX»DEP»ALIGN- {-it}-R

Observemos esta jerarquía en la siguiente tabla:

(25)
Aducto: /webo/

	DIM-MORPH	MIN-FT-REQ	ADJ-SEG	ONSET	MAX	DEP	ALIGN-{-it}-R
a. we.(β-ít-o)		*!	*				*
☞b. (wè.βe)(θí.to)						**	**
c. wè.βo.(θ-ít)		*!	*			**	*
d. (we.βe)(tí.to)			*!			**	
e. (βí.to)		*!	*		**		*
f. (wé.βo)	*!		*				

En esta tabla, el que resulta óptimo es el educto que consta de dos pies métricos al insertar los segmentos adjuntos que hemos programado, el candidato (b). El candidato (a), que también es una forma permitida, resulta no óptimo ya que incurre en una infracción grave de MIN-FT-REQ, que en esta jerarquía asume una posición importante. El candidato (c) también infringe esta restricción al no insertar el segmento /e/, junto con el otro segmento adjunto /θ/. El candidato (d) resulta casi óptimo, pero su infracción de ADJ-SEG que se comete al insertar una consonante epentética productiva, en vez del segmento estipulado por ADJ-SEG, hace que no pueda resultar óptimo este candidato. El candidato (e) está eliminado por MIN-FT-REQ ya que se eliminan los primeros dos segmentos de la base, lo cual no supone ninguna ventaja y constituye una infracción grave de MIN-FT-REQ»ADJ-SEG y dos infracciones de MAX. El candidato (f) presenta un educto que en sí está bien formado, pero no afija un morfema diminutivo a la base, resultando así no óptimo por su infracción de DIM-MORPH, que requiere que un morfema diminutivo se afije a una forma diminutiva.

6.2.3 Un caso de infijación del morfema diminutivo

En escasos casos, el morfema diminutivo puede funcionar como un infijo. Entendemos este proceso como el resultado de un conflicto entre ALIGN(PD), que requiere que el margen de un dominio fonológico se alinee con el margen de una sílaba, y ALIGN-{it}-R, que requiere una alineación directa del morfema diminutivo al margen derecho de la base. La primera restricción previene la resilabificación de los segmentos fonológicos en contextos en los que un morfema que empieza por vocal se alinea a una base que acaba en consonante, lo cual opone la alineación directa estipulada por ALIGN-{it}-R.

Consideremos el diminutivo de la palabra *azúcar*: *azuquillar*/*azuquítar* [a.θu.qu-i.t/ʝ.ar]. En este ejemplo, la alineación directa del morfema al margen derecho de la base motivaría un proceso de resilabificación tal que la consonante final de base /r/, se tendría que resilabificar como el onset de la nueva sílaba [a.θu.ka.<u>ri</u>.to]. Esto se previene por un esquema encabezado por ALIGN(PD), ya que esta restricción no permite que un margen de un dominio fonológico no se corresponda con el mismo margen de la sílaba. Al programar dos restricciones de correspondencia, MAX y DEP, que prohíben la eliminación e inserción de segmentos post-léxicos, la única opción que tiene el educto óptimo es alinear el morfema a una consonante en el interior de la base. Por supuesto, esto constituiría una infracción grave de CONTIGUOUS, que requiere que los segmentos adyacentes del aducto aparezcan contiguos en el educto. Pero si esta restricción ocupa una posición jerárquica inferior, su infracción no resultará significativa. Contemplemos la siguiente jerarquía:

(26)
DIM-MORPH » ONSET » ALIGN(PD) » MAX » DEP » ALIGN-{-it}-R
CONTIGUOUS

Podemos observar la interacción de estas restricciones en la siguiente tabla:

(27)
Aducto: /aθůkar/

	DIM-MORPH	ONSET	ALIGN(PD)	MAX	DEP	ALIGN-{-it}-R	CONTIGUOUS
a. a.θu.ka.ɾ-it-			*!				
b. a.θú.ka.ɾ-i.t-o			*!		*		
☞c. a.θu.k-í.t-aɾ						**	*
d. a.θ-i.t-u.kar						*!**	*
e. –i.ta.θu.kar		*!				**!**	*

Como hemos predicho, esta jerarquía es capaz de justificar la inserción del morfema diminutivo en el interior de la base. El candidato (c) resulta óptimo ya que satisface todas las restricciones superiores, mientras que infringe de manera mínima ALIGN-{it}-R al no alinear el morfema al margen derecho de la base. Aunque este candidato comete dos infracciones de esta restricción, son menos graves que las infracciones cometidas por los candidatos (d) y (e). Los candidatos (a) y (b) quedan eliminados por ALIGN(PD) al alinear el morfema directamente al margen derecho de la base, motivando el proceso de resilabificación que prohíbe ALIGN(PD).

6.3 CONCLUSIONES

En este capítulo, hemos visto surgir una tendencia central respecto a la tipología de los diminutivos en español: la buena formación fonológica domina la alineación de los constituyentes morfológicos. En todos nuestros casos, el deseo de producir un educto fonológicamente bien formado ha dominado cualquier estipulación respecto a la alineación del morfema diminutivo.

Hemos mostrado que las irregularidades que surgen en la formación de los diminutivos se pueden explicar por dos motivos principales: la clase de base a la que pertenece la raíz y las estipulaciones de buena formación a la que cada clase se tiene que adherir.

Las formas regulares se producen por un modelo dominado por ONSET, que requiere que las vocales se alineen a un segmento consonántico. Hemos demostrado que cuando ONSET domina la inclinación de que el morfema diminutivo se alineara directamente al margen derecho de la base representada por ALIGN-{it}-R, el resultado es un educto que sitúa el morfema diminutivo al lado derecho de la consonante final de base aunque esto implicara una infracción de ALIGN-{it}-R.

Más adelante, hemos expuesto una restricción que requería que las formas diminutivas de palabras disilábicas que tienen un diptongo en la penúltima sílaba constaran de dos pies métricos. Para cumplir este requerimiento, era necesario programar una restricción que estipulaba los segmentos concretos que podían ser insertados. Cuando estas dos restricciones dominan ALIGN-{-it}-R, el resultado es un educto que consta de dos pies métricos con los dos segmentos adjuntos /eθ/.

Por último, hemos visto un caso de infijación que hemos justificado mediante un modelo de conflicto entre ALIGN(PD), el cual requiere que el margen del dominio fonológico se corresponda con el margen de la sílaba. Hemos demostrado que cuando esta restricción domina ALIGN-{it}-R, la única opción posible es infijar el morfema diminutivo en el interior de la palabra.

Los beneficios de nuestro modelo son numerosos. Primero, hemos presentado un modelo que se basa primordialmente en tendencias universales para justificar la formación de los diminutivos en español. En segundo lugar, hemos incorporado una cantidad más amplia de generalizaciones fonológicas que eran capaces de explicar tanto la razón por la que un educto resultaba óptimo, como justificar con motivos concretos por qué se descartaban los eductos no deseados. El resultado inherente de la incorporación de esta información en nuestro modelo significa un mayor grado de transparencia de análisis, lo cual representa una gran ventaja para nuestro modelo.

CAPÍTULO VII

RESULTADOS Y CONCLUSIONES

A lo largo de esta redacción hemos examinado varios procesos recurrentes de la fonología del español desde el enfoque de la Teoría de Optimidad. Al observar el conjunto de los modelos que hemos expuesto, se destaca un punto global. En todos nuestros análisis hemos visto que el objetivo principal de la gramática productiva del español ha sido reducir la cantidad de marcadez de las representaciones patentes, o, mejor dicho, incrementar el nivel de buena formación, a costa de infringir los principios universales de fidelidad. Aunque es verdad que la fonología del español permite cierta cantidad de estructuras marcadas, la tendencia que hemos podido ver, en parte por la transparencia del modelo que se basa en la resolución de conflicto, era una reducción general de marcadez estructural al nivel fonémico, silábico y prosódico.

La ventaja más significativa que ha aportado la TO ha sido un grado mayor de transparencia paradigmática, por el hecho de que no sólo había que justificar el surgimiento de los eductos óptimos, sino también explicar los motivos por los cuales los eductos no óptimos no resultan elegidos. Por supuesto, el resultado de esto es la incorporación de una mayor cantidad de generalizaciones fonológicas universales en nuestros análisis.

Otra de los aportaciones más destacadas de la TO es su orientación en la representación patente, es decir en el nivel fonético. Esto significa que la base en la que se centra un análisis desde la TO está basada en datos observables y cuantificables, haciendo que la teoría sea más falseable. Esto representa una ruptura importante de los modelos generativos en el sentido de que estos últimos modelos, por el deseo de mantener un grado superior de abstracción, dependían de una manera exagerada de la especulación en lo referido a ciertos aspectos no falseables de la representación fonológica.

Aunque nuestro análisis de la fonología del español ofrecido aquí ha sido exhaustivo, hemos omitido varios puntos que esperamos recoger en estudios posteriores. Específicamente, no hemos tratado dos aspectos importantes que ponen en duda la validez y longevidad de la TO, que son la elección del educto óptimo en un paradigma de variación libre y el concepto de buena formación gradiente. Ambos temas sirven para desafiar la validez de la TO ya que ponen en duda la existencia del concepto de optimidad. En los análisis que hemos expuesto aquí, no hemos tenido que cuestionar estas nociones ya que siempre había *una* forma óptima. Sin embargo, en estudios posteriores habrá que tratar la eficaz de la TO a la hora de discernir entre *dos* formas que pueden resultar óptimas. Por supuesto, esto representa un gran desafío para cualquier modelo determinístico y, en nuestra opinión, debe ocupar una gran parte de los estudios futuros.

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