Vowel Weightlessness and Stress Retraction in Spanish

Carlos-Eduardo Piñeros
University of Iowa

0. Introduction

It is well known that Spanish primary stress is constrained to appear within a window that consists of the last three syllables of the word. Depending on its meaning, a form such as *estimulo* may be assigned ultimate (1a), penultimate, (1b), or antepenultimate stress, (1c). Stress on the pre-antepenultimate syllable, and beyond, is never possible, (1d).[1]

(1) a. es.ti.mu.**ló**
's/he stimulated'

b. es.ti.**mú**.**lo**
'I stimulate'

c. es.**tí**.**mu**.**lo**
'stimulus'

d. ***és**.**ti**.**mu**.**lo**

Despite the possibility of retracting stress as far as the antepenultimate syllable, the majority of Spanish words have ultimate or penultimate stress. This follows from the projection of a trochaic foot, which is required to appear in absolute word-final position (e.g. [es.ti.(mú.lo)] 'I stimulate'). To abide by the universal principle that metrical feet must be binary, this trochee must be disyllabic when the word ends in a light syllable, (2a), but may be monosyllabic when the final syllable is heavy, (2b),

(2) Unmarked stress

a. [… Ĺ L]	b. [... Ĥ]
[pe.(pí.no)]	[a.de.(más)]
‘cucumber’	‘besides’
[e.(nór.me)]	[ful.(gór)]
‘enormous’	‘glow’

Although this is the most productive metrical pattern of the language, alternative footings do arise because primary stress may be morphologically conditioned. Certain morphemes cause the foot to shrink to a single light syllable, (1a), whereas others force it to expand to three syllables, (1c). For instance, the fact that the word [es.ti.mu.(ló)] ‘s/he stimulated’ has final stress is due to the presence of the morpheme *-o* ‘3rd sg. preterite’, as evinced by the fact that all Spanish words that contain this morpheme have final stress. Similarly, the antepenultimate stress of the word [es.(tí.mu.lo)] ‘stimulus’ is a property of the root *stimul-* when it is nominal. It is because this root does not carry a mark when it is verbal, that the unmarked word-final trochee is able to emerge in verbal forms such as [es.ti.(mú.lo)] ‘I stimulate’, unless, of course, a stress-shifting morpheme is attached (e.g. [es.ti.mu.la.(ré)] ‘I will stimulate’).

This paper focuses on the prosodic structure of Spanish words that exhibit stress retraction, antepenultimately stressed words, in particular. It presents evidence in support of the claim that the main-stressed foot of Spanish proparoxytones contains not two, but three syllables: [… (σ́σσ)]. Such foot type is possible because the vowel of the penultimate syllable is metrically deficient for being deprived of a mora. This is identified as the reason why stress is forced to retract in marked words.

1. Stress retraction as constraint re-ranking

After unmarked stress, (2), the second most common pattern consists of retracting stress by one syllable. The words in (3) are stressed on the syllable immediately before the one that would be the stress bearer if a regular trochee were projected in absolute word-final position.

(3) Retracted stress

a. […σ́ L L]	b. [...σ́ H]
ka.nó.ni.ko	i.nú.til
‘canonical’	‘useless’
pi.rá.mi.de	ár.bol
‘pyramid’	‘tree’

To account for stress retraction, previous analyses couched within Optimality Theory have resorted to the mechanism of constraint re-ranking (Rosenthall 1994). Such analyses rely on the following constraints.

(4) ALIGN-R: The main-stressed foot must be final.

(5) NONFINALITY: The main-stressed foot must not be final

When ALIGN-R dominates NONFINALITY, the unmarked stress pattern arises. In tableau (6), candidate (6a) is optimal because the foot it projects is in absolute word-final position.

(6) ALIGN-R >> NONFINALITY

	Input: /pepino/		ALIGN-R	NONFINALITY
☞	a.	[pe.(pí.no)]		*
	b.	[(pé.pi).no]	*!	

In order to account for stress retraction, this approach assumes that the order of these constraints is reversed for certain words. In that case, the candidate that has the foot in absolute word-final position is at a disadvantage, (7a). In the evaluation in (7), candidate (7b) is the winner because the foot it projects is neither rightmost nor exceedingly misaligned. Given that shifting the foot back one syllable is enough to comply with NONFINALITY, there is no need for stress to retract beyond the antepenultimate syllable, (7c).

(7) NONFINALITY >> ALIGN-R

	Input: /kanoniko/		NONFINALITY	ALIGN-R
	a.	[ka.no.(ní.ko)]	*!	
☞	b.	[ka.(nó.ni).ko]		*
	c.	[(ká.no).ni.ko]		*!*

When the final syllable is heavy, stress retracts to the penultimate syllable allegedly because leaving the word-final consonant unparsed is enough to keep the foot from being final, (8b). Candidate (8b) is superior to (8c) because a foot misaligned by a single mora is less costly than one misaligned by a bimoraic syllable.

(8) NONFINALITY >> ALIGN-R

	Input: /inutil/		NONFINALITY	ALIGN-R
	a.	[i.nu.(tíl)]	*!	
☞	b.	[i.(nú.ti)l]		*
	c.	[(í.nu).til]		**!

Although constraint re-ranking succeeds in deriving the two most common stress patterns of Spanish, this method is stipulative rather than explanatory. As Roca (1997:240) points out, this type of analysis is undesirable not only for its appeal to brute force but also because "the large number of logical ranking possibilities for *n* constraints potentially leads to the endowment of each lexical item with its own grammar (=item-specific ranking), an untenable result both empirically and from the perspective of learnability".

2. An alternative to constraint re-ranking

A misaligned foot, (9), is certainly not the only parsing that may be attributed to antepenultimately stressed words. This pattern could also arise from projecting a foot that encompasses the last three syllables of the word, (10). In this section, I discuss several prosodic phenomena that are incompatible with (9) but follow naturally from the parsing in (10).

(9) Analysis A: [… (σ́σ)σ] The foot is misaligned

(10) Analysis B: [… (σ́σσ)] The foot is trisyllabic

Navarro Tomás (1967:196) observes that proparoxytone words have their highest peak of prominence on the antepenultimate syllable. This syllable is followed by a much weaker one, but prominence rises again on the final syllable, although not to the same level as the antepenultima. Using three levels of prominence, he represents the rhythmic sequence of Spanish proparoxytones as 3-1-2.

(11) Antepenultimate stress rhythm: … 3-1-2

re.**tó**.ri.**ka**	‘rhetoric’
e.**pís**.to.**la**	‘epistle’
ka.**tó**.li.**ko**	‘catholic’
es.**tí**.mu.**lo**	‘stimulus’

The fact that the penultimate syllable is weaker than the ultima is contrary to what one would expect under Analysis A. Given that feet are domains of prosodic prominence, no unfooted syllable should be more prominent than a footed one. If proparoxytones were indeed footed as [… (σ́σ)σ], then the prominent syllables should be the antepenultima and penultima. This incongruence between Analysis A and the actual facts about Spanish metrics is manifested in other prosodic phenomena that suggest that the penultimate syllable of Spanish proparoxytones is metrically deficient.

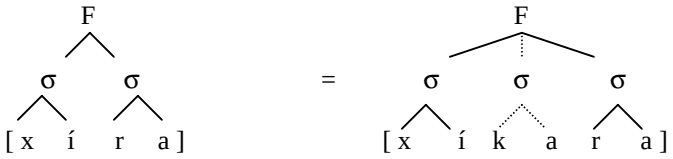
Harris (1983) remarks that in Spanish versification, the penultimate syllable of proparoxytone words is metrically irrelevant for the purpose of syllable count. An antepenultimately stressed word such as *fábula*, for example, counts as disyllabic. Harris also underscores that it is precisely the penult that is treated as though it were absent. This is illustrated by the following examples, which he quotes from the Real Academia Española (1973, 62-62).

(12)	*á-e*	ángel	rhymes (assonates) with	árboles, hábiles
		‘angel’		‘trees’, ‘agile’
	á-a	sálva		fábula, cerámica
		‘save’		‘fable’, ‘ceramics’
	á-o	prádo		ángulo, elástico
		‘lawn’		‘angle’, ‘elastic’
	é-a	trénza		cédula, intrépida
		‘braid’		‘document’, ‘intrepid’

é-e	véces	célibe, acércale
	‘times’	‘celibate’, ‘bring it close’
í-a	míra	vísperas, retícula
	‘look’	‘eve’, ‘reticle’

The examples in (12) show that all that is required for these two types of words to rhyme is that the vowels of the antepenultimate and ultimate syllable of the proparoxytone be identical to the vowels in the last two syllables of the paroxytone. Interestingly, the vowel of the penultimate syllable of the proparoxytone does not keep the words from rhyming. It is treated as though it were non-existent. Because the penultimate syllable of a proparoxytone is metrically ignored, the last three syllables of a proparoxytone correspond to the last two syllables of a paroxytone. As a consequence of this, the main-stressed foot of a proparoxytone is equivalent to the main-stressed foot of a paroxytone: [... (σ́σσ)] = [... (σ́σ)].

(13) Metrical equivalence between paroxytones and proparoxytones



There are several independent processes that support the claim that the foot projected by proparoxytone words is trisyllabic, and that its middle syllable is

metrically deficient. Let us consider first the evidence that favors the trisyllabic parsing.

In Tudanca Montañes, a dialect spoken in northwestern Spain, there is a vowel harmony process involving the feature [-ATR] (Penny 1978, Hualde 1989). This process is triggered by the masculine singular morpheme *–U*. When present, the vowel of this morpheme spreads its [-ATR] specification leftwards causing other vowels to become lax, (14a-c). Note that when the word does not include this morpheme, all vowels remain tense, (14d-f).

(14) Vowel harmony in Tudanca Montañes (Penny 1978, Hualde 1989)

a.	čÍkU	'boy'
b.	sekÁlU	'to dry him'
c.	ahambrÁU	'hungry' (masc)
d.	číka	'girl'
e.	sekálo	'to dry it' (mass)
f.	ahambráa	'hungry' (fem)

As Hualde (1989) points out, this process is metrically conditioned. Given that spreading may not reach beyond the syllable that bears primary stress, the domain of vowel harmony must be the main-stressed foot. This explains why in

(14a-c) the only vowels that are lax are those parsed by the ultimate and penultimate syllables. As revealed by the parsing in (15), the vowels that are unaffected are those outside the main-stressed foot, which confirms that this process is constrained to this prosodic domain.

(15) Vowel harmony is constrained to the main-stressed foot

a. [(čÍ.kU)]

b. [se.(kÁ.lU)]

c. [a.ham.(brÁU)]

Of particular interest is the behavior of proparoxytones. The examples in (16) show that when the word bears antepenultimate stress, the vowels of the last three syllables surface as lax.

(16) Vowel harmony in proparoxytones

orÉgAnU	'oregano'
rakÍtIkU	'rachitic'
antigwÍsImU	'very old'

Since the domain of vowel harmony is the main-stressed foot, the data in (16) are solid confirmation that proparoxytone words contain a trisyllabic foot.

The fact that the vowels of the last three syllables of a proparoxytone word harmonize in laxing follows from the parsing in (16). This is crucial because unless we recognize that the main-stressed foot of proparoxytone words is trisyllabic, it is impossible to maintain the evident generalization that this harmony process operates within a well-defined prosodic domain.

(17) [o.(rÉ.gA.nU)]
[ra.(kÍ.tI.kU)]
[an.ti.(gwÍ.sI.mU)]

Further evidence that proparoxytone words contain a trisyllabic foot is provided by one of the two main truncation processes that take place in Spanish. The following examples are representative of the most common type of hypocoristic among Latin-American dialects.

(18) Latin-American Hypocoristics (Boyd-Bowman 1955, Piñeros 1998, 2000a,b)

a. Oxytones

Isabél	→	Bela
Beatríz	→	Ticha
Inés	→	Necha

b. Paroxytones

Dorotea	→	Tea
Cristina	→	Tina
Gonzálo	→	Chalo

Piñeros (1998, 2000a,b) analyzes this process as a case of output-to-output correspondence. This means that the input for this process is a derived output form. An abstract form may not be the input because the formation of the hypocoristic crucially depends on the prosodic structure of the base. This is evinced by the fact that the segments of the base that are preserved in the truncated form are those within the main-stressed foot, (19). Since foot structure is not present underlyingly, the input for this process must be a derived form.

(19) Preservation of the main-stressed foot

a. Oxytones

[i.sa.(bél)]	→	[(bé.la)]
[be.a.(trís)]	→	[(tí.ča)]
[i.(nés)]	→	[(né.ča)]

b. Paroxytones

[do.ro.(té.a)]	→	[(té.a)]
[kris.(tí.na)]	→	[(tí.na)]
[gon.(sá.lo)]	→	[(čá.lo)]

It is worth noting that although this process enforces the preservation of a prosodic head, the truncated form is not always identical to the main-stressed foot of the base because there are additional constraints working against marked structures such as syllable codas, complex onsets and diphthongs, which are avoided through epenthesis or deletion (e.g. [(tí.ča] < [be.a.(trís)]). The point of interest to us is how antepenultimately stressed bases are truncated. The examples in (20) are representative.

(20) Truncation of proparoxytone bases

Hipólito	→	Polo
Aristóbulo	→	Tobo
Mélida	→	Mela

Since this process prioritizes the preservation of footed segments over unfooted ones, the prediction made by Analysis A is that the segments from the antepenultimate and penultimate syllables should be preserved in the truncated

form to the exclusion of the segments parsed by the final syllable. However, as the examples in (20) show, this prediction is not borne out. Consider, for example, the case of [i.pó.li.to], which is truncated to [(pó.lo)]. If the foot structure of the base were [i.(pó.li).to], then the hypocoristic could only be *[(pó.li)]. This form, however, is impossible in all dialects.

By contrast, Analysis B predicts that all segments from the last three syllables of the word qualify to be preserved in the truncated form unless, of course, their preservation gives rise to marked syllable structure. Because the prosodic structure of proparoxytone bases is [… (σ́σσ)], this analysis does not make the wrong prediction that the vowel of the final syllable should not be preserved. More importantly, by acknowledging that the right parsing for proparoxytone bases is as in (21), we are able to maintain the insight that this truncation process is about preserving the head of the prosodic word, which is the generalization common to all the data in (19) and (21).

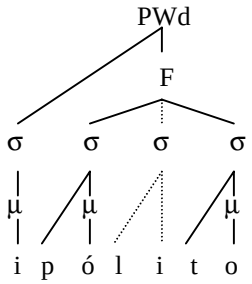
(21) Truncation of proparoxytone bases

[i.(pó.li.to)]	→	[(pó.lo)]
[kri.(sós.to.mo)]	→	[(čó.to)]
[(mé.li.da)]	→	[(mé.la)]

It is clear from (21) that even segments within the main-stressed foot that would not give rise to marked syllable structure are not preserved in the truncated form. main-stressed foot of the base may not be preserved even though their preservation. This is because the Prosodic-Word Restrictor constraints (e.g. FT-BIN, PARSE-SYLL and ALL-FTR), which force the minimization of the base, require that the truncated form be maximally disyllabic.[2] Without going into exhaustive detail, truncated forms must be maximally disyllabic because the very reason why words are truncated is to obtain a Minimal Word, which may not exceed a binary foot. As a consequence of this, one of the three vowels in the main-stressed foot of the base must be sacrificed. The data above show that it is the vowel of the penult that is lost. Here we find again that the antepenultimate and ultimate syllables of a proparoxytone word are favored over its penult.

Rather than a striking coincidence, I propose that the consistent weakness of the penultimate syllable of proparoxytone words originates from a metrical deficiency. The vowel parsed by this syllable is weightless. Consequently, since this vowel does not bear a mora, the syllable that parses it may not make a weight contribution to the foot and this causes it to be metrically irrelevant, (22). According to this, the precise prosodic structure of *Hipólito* is [i^{μ}.($pó^{\mu}$.li.to^{μ})], consisting of a trisyllabic foot with a moraless vowel in the penult. This is illustrated by the representation in (22).

(22)



Word tier
Foot tier
Syllabic tier
Moraic tier
Segmental tier

The reason why [(pó$^{\mu}$.lo$^{\mu}$)] is selected as the optimal truncated form for [i$^{\mu}$.(pó$^{\mu}$.li.to$^{\mu}$)] is now clear. If total faithfulness to the head foot is not possible, then at least the degree of unfaithfulness should be minimal. By preserving the correspondents of the two weight-bearing vowels in the base, a greater degree of faithfulness between the truncated form and its base is secured. Tableau (23) below shows that whereas [(pó$^{\mu}$.lo$^{\mu}$)] projects a binary foot without violating the faithfulness constraint IDENT-MORA, [(pó$^{\mu}$.li$^{\mu}$)] incurs one violation of this constraint because it is forced to assign a mora to the correspondent of the moraless vowel so that the truncated form may consist of a binary foot, a condition that no truncated form may violate. In brief, the optimal truncated form chooses to preserve the vowels that allow it to remain as faithful to the main-stressed foot of the base as possible, (23a).

(23) Optimal truncated form

	Input: [i$^{\mu}$.(pó$^{\mu}$.li.to$^{\mu}$)]	FT-BIN	IDENT-MORA
☞	a. [(pó$^{\mu}$.lo$^{\mu}$)]		
	b. [(pó$^{\mu}$.li$^{\mu}$)]		*!
	c. [(pó$^{\mu}$.li)]	*!	

A dialect spoken in the province of La Mancha, Spain, provides an additional piece of evidence supporting the claim that the penultimate syllable of proparoxytone words is weightless. In this dialect, proparoxytone words containing the superlative morpheme *–isim* are turned into paroxytones by dropping the vowel of the penultimate syllable.

(24)	mučísimo	→	mučísmo	'very much'
	grandísimo	→	grandísmo	'very big'
	malísimo	→	malísmo	'very bad'

This pattern also follows from Analysis B. The suffix *-isim* is a marked morpheme because it contains a weightless vowel, which being metrically deficient, tends to delete. From this standpoint, the aim of this process is to regularize a marked morpheme by getting rid of its marked property, (25). Under Analysis A, however, it is not evident why this vowel should disappear since it is viewed as a regular vowel and it is protected by the prominence of the main-stressed foot.

(25) Lost of the weightless vowel

[mu.(čí$^{\mu}$.si.mo$^{\mu}$)]	→	[mu.(čí$^{\mu}$s.mo$^{\mu}$)]
[gran.(dí$^{\mu}$.si.mo$^{\mu}$)]	→	[gran.(dí$^{\mu}$s.mo$^{\mu}$)]
[ma.(lí$^{\mu}$.si.mo$^{\mu}$)]	→	[ma.(lí$^{\mu}$s.mo$^{\mu}$)]

3. Formalizing the proposal

The emergence of a word-final trochee as the unmarked Spanish stress pattern may be explained through three universal constraints that govern the projection of metrical feet (Prince and Smolensky 1993).

(26) FT-BIN: *Foot Binarity*

Feet are binary at some level of analysis (μ, σ).

(27) TROCH: *Trochaic Rhythm*

Feet are left-headed: Align(H, L, Ft, L).

(28) ALIGN(H)R: *Align prosodic heads right*

Prosodic heads (e.g. main-stressed foot and main-stressed syllable) must be final in PWd. Align(H,R,PWd, R).

For the main-stressed foot to be both binary and left headed, ALIGN(H)R may need be violated. Specifically, if the last syllable of the word is light, then stressing this syllable would require violating either FT-BIN (e.g. [pe.pi.(nó)]) or TROCH (e.g. [pe.(pi.nó)]. Because most Spanish words that end in a light syllable have penultimate stress, the constraints FT-BIN and TROCH must dominate ALIGN(H)R.

(29) FT-BIN, TROCH >> ALIGN(H)R

	Input: /pepino/	FT-BIN	TROCH	ALIGN(H)R
	a. [pe.pi.(nó)]	*!		
	b. [pe.(pi.nó)]		*!	
☞	c. [pe.(pí.no)]			*
	d. [(pé.pi).no]			**!*
	e. [(pé.pi.no)]	*!		**

The candidates that exhibit final stress are discarded because this would require the foot to be either unary, (29a), or iambic, (29b). Antepenultimate stress is also avoided because it would cause the foot to exceed two syllables/moras, (29f), or be misaligned, (29e). Note that antepenultimate stress would additionally cause the main-stressed syllable to be misaligned by two syllables. By contrast, penultimate stress allows the foot to be binary, left-headed and final, although the main-stressed syllable is minimally misaligned.

These prosodic constraints are also responsible for the fact that when the last syllable of the word is closed by a consonant, ultimate stress is preferred. By forcing the word-final consonant to become moraic, both the main-stressed foot and the main-stressed syllable may appear in absolute final position (e.g. [a.de.(más)] 'besides'). There is, however, a cost in associating segments with moras. I adopt the markedness constraints *MORA[C] and *MORA[V] proposed by Morén (1998) to capture this structural cost.

(30) *MORA[C]: Do not associate a mora with a consonant.

(31) *MORA[V]: Do not associate a mora with a vowel.

Although there are languages in which any segment may be moraic, vowels always make better weight-bearing units than consonants because moraicity is a prosodic property that depends on sonority (Zec 1988, 1995). The greater cost of making consonants moraic may be captured through the universal ranking *MORA[C] >> *MORA[V] (Morén 1998). When ALIGN(H)R outranks these markedness constraints, segments are forced to become moraic for the sake of improving the alignment of prosodic heads, (32b). Note, however, that being in the coda does not automatically make a consonant moraic. When the consonant does not contribute to improve the alignment of the main-stressed foot or the main-stressed syllable, endowing it with a mora is an unnecessary expense, (32e,f). In passing, it is worth noting that this finding dovetails with the fact that Spanish primary stress is weight-sensitive, but secondary stress is not.

(32) FT-BIN, TROCH >> ALIGN(H)R >> *MORA[C] >> *MORA[V]

	Input: /ademas/	FT-BIN	TROCH	ALIGN (H)R	*MORA [C]	*MORA [V]
	a. [a$^{\mu}$.de$^{\mu}$.(má$^{\mu}$s)]	*!				***
☞	b. [a$^{\mu}$.de$^{\mu}$.(má$^{\mu}$s$^{\mu}$)]				*	***
	c. [a$^{\mu}$.(dé$^{\mu}$.ma$^{\mu}$s)]			*!		***
	Input: /asfalto/					
☞	d. [a$^{\mu}$s.(fá$^{\mu}$l.to$^{\mu}$)]			*		***
	e. [a$^{\mu}$s.(fá$^{\mu}$l$^{\mu}$.to$^{\mu}$)]			*	*!	***
	f. [a$^{\mu}$s$^{\mu}$.(fá$^{\mu}$l$^{\mu}$.to$^{\mu}$)]			*	*!*	***

I demonstrate below that this constraint ranking also determines what syllable is to bear primary stress in words that exhibit stress retraction, and that there is no need to resort to the arbitrary mechanism of constraint re-ranking. For that purpose, one must take into account that Spanish learners are exposed not only to unmarked words but also to words in which one of the vowels is metrically ignored. Consider, for example, words that contain the adjectival morpheme *–ik*, which always causes stress to retract.

(33)	[ka$^{\mu}$.(nó$^{\mu}$.ni.ko$^{\mu}$)]	‘canonical’
	[i$^{\mu}$.(ró$^{\mu}$.ni.ko$^{\mu}$)]	‘ironical’
	[te$^{\mu}$.(ó$^{\mu}$.ri.ko$^{\mu}$)]	‘theoretical’
	[i$^{\mu}$.(ló$^{\mu}$.xi.ko$^{\mu}$)]	‘illogical’

On this type of evidence, Spanish learners gather that the vowel of this morpheme is metrically anomalous since it is always treated as non-existent for all metrical purposes. Guided by the principle of Lexicon Optimization (Prince and Smolensky 1993), the underlying representation Spanish learners posit for this morpheme is one in which its vowel is deprived of a mora, as opposed to regular vowels which, must be moraic given that they always make a weight contribution. This information is reverted to the output because there are faithfulness constraints that require input and output forms to be identical. In particular, I assume the following positional faithfulness constraint.

(34) IDENT(H)MORA: A segment that bears a head mora must be associated with the same number of moras as its input correspondent.

This faithfulness constraint prohibits that an epenthetic mora act as the nucleus of a prosodic head. This type of constraint is grounded on the fact that the greater prominence of prosodic heads demands greater faithfulness (Alderete 1995, Beckman 1999). It is precisely because Spanish strongly objects to epenthetic moras in the role of prosodic heads that stress is forced to retract when the input contains a morpheme with a weightless vowel, (35c).

(35) IDENT(H)MORA >> FT-BIN, TROCH >> ALIGN(H)R

	Input: /ka$^{\mu}$no$^{\mu}$niko$^{\mu}$/	IDENT (H)MORA	FT-BIN	TROCH	ALIGN (H)R
	a. [ka$^{\mu}$.no$^{\mu}$.ni.(kó$^{\mu}$)]		*!		
	b. [ka$^{\mu}$.no$^{\mu}$.(ní$^{\mu}$.ko$^{\mu}$)]	*!			*
☞	c. [ka$^{\mu}$.(nó$^{\mu}$.ni.ko$^{\mu}$)]				**

Candidate (35a) is discarded by FT-BIN because a light syllable cannot support a binary foot by itself. Stress would then normally be assigned to the penultimate syllable; however, candidate (35b) is also discarded because if stress were assigned to the penultimate syllable, the vowel of that syllable would become unfaithful to its input correspondent in the number of moras it is associated with. Candidate (35c) is optimal because it prefers to skip the metrically anomalous vowel so that the nucleus of the main-stressed syllable is

not a vowel associated with an epenthetic mora. Doing this does not result in an illformed foot because despite parsing three syllables, this foot contains exactly two moras. It is true that the main-stressed syllable is misaligned by two syllables but this is tolerated because ALIGN(H)R is the lowest ranking of the prosodic constraints.

Without constraint re-ranking, this analysis answers the challenge posed by contrasts such as *sabána* 'savanna' vs. *sábana* 'bed sheet'. What is puzzling about such pairs is that there is no phonological property that could be used to explain why stress should retract in one word but not in the other. Since stress retraction is unpredictable on merely phonological grounds, we are forced to conclude that this is a specific property of certain morphemes. Given that Spanish learners are exposed to these words pronounced as [sa.(bá.na)] and [(sá.ba.na)], they have grounds to assume that each one of the vowels of the root *saban-*, 'savanna', is associated with a mora, but the rightmost vowel of the root *saban-* 'bed sheet' is not. After the learner has acquired these underlying forms, the grammar takes care of generating their corresponding output forms, (36b,f).

(36) IDENT(H)MORA >> FT-BIN, TROCH >> ALIGN(H)R

	Input: /sa$^{\mu}$ba$^{\mu}$na$^{\mu}$/ 'savanna'	IDENT (H)MORA	FT-BIN	TROCH	ALIGN (H)R
	a. [sa$^{\mu}$.ba$^{\mu}$.(ná$^{\mu}$)]		*!		
☞	b. [sa$^{\mu}$.(bá$^{\mu}$.na$^{\mu}$)]				*
	c. [(sá$^{\mu}$.ba$^{\mu}$.na$^{\mu}$)]		*!		**
	Input: /sa$^{\mu}$bana$^{\mu}$/ 'bed sheet'				
	d. [sa$^{\mu}$.ba.(ná$^{\mu}$)]		*!		
	e. [sa$^{\mu}$.(bá$^{\mu}$.na$^{\mu}$)]	*!			*

☞	f.	[(sá$^{\mu}$.ba.na$^{\mu}$)]				**

When the word that contains a marked morpheme ends in a consonant, stress does not need to retract beyond the penultimate syllable because this segment may be used to achieve binarity and keep the right edge of the main-stressed foot aligned with the right edge of the PWd, (37b). As an example, consider stress assignment to the word *inútil* 'useless', which contains the marked adjectival morpheme *–(t)il*. Because the vowel of this morpheme is weightless, stress must retract (e.g. [por.tá.til] 'portable', [bo.lá.til] 'volatile', etc.). Final stress, (37a), would require allowing an epenthetic mora to be the nucleus of the main-stressed syllable, a fatal violation of IDENT(H)MORA. To comply with the top-ranking constraint, stress must move back, but not beyond the point that would give rise to unnecessary violations of lower-ranking constraints. Retracting stress to the penultimate syllable not only avoids having an epenthetic mora in a prominent position but also allows the main-stressed foot to be aligned with the right edge of the prosodic word, (37b). By contrast, if stress were retracted to the antepenultimate syllable, the foot would have to be either misaligned, (37c), or ternary, (37d).

(37) IDENT(H)MORA >> FT-BIN, TROCH >> ALIGN(H)R

	Input: /i$^{\mu}$nu$^{\mu}$til/		IDENT (H)MORA	FT-BIN	TROCH	ALIGN (H)R
	a.	[i$^{\mu}$.nu$^{\mu}$.(tí$^{\mu}$l$^{\mu}$)]	*!			
☞	b.	[i$^{\mu}$.(nú$^{\mu}$.tíl$^{\mu}$)]				*
	c.	[(í$^{\mu}$.nu$^{\mu}$).til]				**!*
	d.	[(í$^{\mu}$.nu$^{\mu}$.til$^{\mu}$)]		*!		**

Finally, when the word ends in a consonant but does not contain a marked morpheme, final stress is optimal because both the main-stressed foot and the main-stressed syllable may end up in absolute word-final position. This is partly because the word-final consonant is coerced to be moraic, and partly because IDENT(H)MORA is irrelevant in this case. Put in a different way, only when the final syllable is heavy and the word does not contain a marked morpheme is it possible to achieve perfect satisfaction of the three constraints that regulate the projection of the main-stressed foot, (37a).

(38) IDENT(H)MORA >> FT-BIN, TROCH >> ALIGN(H)R

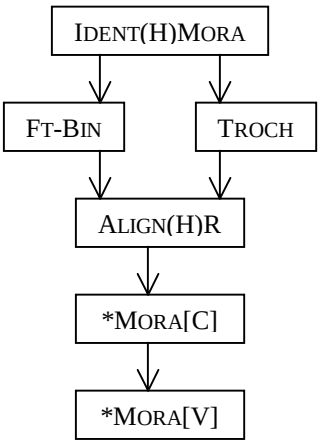
	Input: /fu$^{\mu}$lgo$^{\mu}$r/		IDENT (H)MORA	FT-BIN	TROCH	ALIGN (H)R
☞	a.	[fu$^{\mu}$l.(gó$^{\mu}$r$^{\mu}$)]				
	b.	[(fú$^{\mu}$l.go$^{\mu}$r)]				*!

4. Conclusion

In this paper I have presented a new constraint-based analysis of the two most common stress patterns of Spanish. This proposal has the advantage that it accounts for stress retraction without having to resort to arbitrary re-ranking of the constraints. Focusing on proparoxytone words, I have gathered evidence to support the claim that they contain a trisyllabic foot. Such foot is not in violation of the binarity condition imposed on metrical feet because it contains only two moras. What makes this possible is that the nucleus of the middle syllable of the trisyllabic foot is a weightless vowel, which is a marked feature

that characterizes certain Spanish morphemes. Because Spanish learners are exposed to evidence that certain morphemes contain a metrically irrelevant vowel, they posit underlying forms that carry this information, which is then preserved in output forms to comply with faithfulness constraints. I have shown that the assignment of primary stress in Spanish is governed by three universal prosodic principles requiring prosodic heads to be final and feet to be left-headed and binary. Perfect satisfaction of these principles is only possible when the final syllable is heavy and the word does not contain a marked morpheme. By contrast, if the final syllable is light or if it contains a morpheme with a metrically anomalous vowel, stress needs to retract so that the prosodic constraints may be optimally satisfied and prosodic heads are free of epenthetic elements. This always happens at the cost of misaligning the main-stressed syllable but never the main-stressed foot, which explains why stress must fall on one of the last three syllables of the word. The constraint ranking responsible for Spanish primary stress is summarized below.

(39) Spanish primary stress constraint hierarchy



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Notes

[1] All cases where stress seems to fall beyond the antepenultimate syllable of the word (e.g. *dígamelo* ‘say it to me’) are not actual exceptions to the three-syllable window because they always involve enclitics, which lie outside the word.

[2] For a detailed account of Spanish truncation processes, the reader is referred to Piñeros (1998, 2000a,b), where these constraints and their rankings are motivated.