

Foot alignment in Spanish secondary stress

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Recent theories of metrical structure in Optimality Theory differ starkly in whether feet can be aligned gradiently (McCarthy and Prince 1993, Gordon 2002, Hyde 2002) or only categorically (Kager 2001, 2005, McCarthy 2003, Buckley 2009). Particularly challenging for categorical theories are certain apparent cases of the initial-dactyl effect, where all feet align rightward except for the leftmost, and in particular where the main stress is on the final foot. Hyde and McCord (2012) argue that Spanish, which has such a pattern, requires gradient directional alignment; I show that a more complete account of Spanish stress makes such gradient unnecessary.

A crucial point is that Spanish secondary stress actually has two patterns (Harris 1983, Roca 1986, Hualde 2012): a more colloquial and common pronunciation that can include an initial dactyl, and a more “rhetorical” one with right alignment; so we must first account for variation. In addition, the initial dactyl is found across words in a phrase (Navarro Tomás 1977, Roca 1986); so we must also account for phrasal interactions.

I argue that the right-aligned pattern is created lexically, but phrasally a new trochaic foot is potentially left-aligned with a prosodic phrase. In colloquial style, the left-aligned foot overrides faithfulness to lexical foot structure; but in rhetorical style, faithfulness wins. Any theory of phonology requires some account of the difference between lexical and phrasal patterns; under the analysis proposed here, which takes advantage of the two components, each stage of metrification remains more restricted, without resorting to the computational and formal complexity of gradient alignment.¹

1. Gradient alignment

Traditional metrical phonology uses ordered rules to create iterative feet (Hayes 1995) or similar metrical structure (Halle and Idsardi 1995) by building one constituent at a time in a particular direction. For example, in Pintupi (Hansen and Hansen 1969) stress occurs on the first syllable and on every subsequent odd-numbered syllable, excluding the final.

¹ This paper is a significantly expanded version of Buckley (2014). I am grateful for comments by participants at the University of Delaware Conference on Stress and Accent, as well as for suggestions by the anonymous reviewers.

- (1) a. (pú liŋ) (kà la) tju ‘we (sat) on the hill’
 b. (tjá mu) (lim pa) (tjùŋ ku) ‘our relation’
 c. (tí li) (ři ŋu) (làm pa) tju ‘the fire for our benefit flared up’

This pattern can be generated by building a disyllabic foot on the first two syllables, then on the next two, and so forth, until there are no longer at least two syllables remaining. The fact that the unfooted syllable in a word of odd parity is the one in final position follows from the left-to-right direction of the parse.

- (2) tí li ři ŋu lam pa tju
 → (tí li) ři ŋu lam pa tju
 → (tí li) (ři ŋu) lam pa tju
 → (tí li) (ři ŋu) (làm pa) tju

Theories of metrical structure in classic Optimality Theory (Prince and Smolensky 1993) face the fundamental task of positioning multiple feet correctly without iterative operations. A close analogy to iterative foot construction involves gradient alignment of all feet toward one end of the domain (McCarthy and Prince 1993, Gordon 2002, Hyde 2002); in this case, ALL-FT-LEFT penalizes every foot that is not at the left edge of the word, and does so gradiently by counting the number of syllables that intervene. PARSE-SYL and FT-BIN are ranked high to favor the maximum number of binary feet.

(3)

	FT-BIN	PARSE-SYL	ALL-FT-LEFT
a. (tí li) (ři ŋu) (làm pa) (tjù)	*!		0+2+4+6 = 12
☞ b. (tí li) (ři ŋu) (làm pa) tju		*	0+2+4 = 6
c. (tí li) (ři ŋu) lam (pà tju)		*	0+2+5 = 7!
d. (tí li) ři (ñù lam) (pà tju)		*	0+3+5 = 8!
e. tí (lí ři) (ñù lam) (pà tju)		*	1+3+5 = 9!
f. (tí li) ři ŋu lam pa tju		***!***	0

In Harmonic Serialism (McCarthy 2000b), such feet can be constructed one by one just as in traditional approaches, while maintaining gradient alignment (Pruitt 2010). Other authors argue, however, that gradient alignment of feet, like all gradient constraint evaluation, should be rejected on formal and typological grounds in favor of constraints that are strictly categorical (Kager 2001, 2005, McCarthy 2003, Buckley 2009). General arguments against gradient alignment include the fact that the notion of alignment has been used inconsistently, but primarily in a categorical manner, so that a more consistent approach would have only categorical interpretations (Zoll 1996, McCarthy 2003); that gradient evaluation is massively nonlocal in its formal properties and cannot be modeled by a finite state machine (Eisner 2000, Bíró 2003, Riggle 2004, Heinz 2009); and that for these reasons, not only alignment but all constraints in OT should be categorical in their interpretation (Eisner 1997, McCarthy 2003). I focus here on a rhythmic approach to foot placement as an alternative to gradient alignment.

1.1 Rhythmic constraints

In a categorical approach that evaluates fully footed candidates, methods other than gradient alignment are necessary to control the positioning of medial feet, which are not adjacent to any edge and therefore cannot be categorically aligned with an edge. Kager (2001, 2005) argues that most feet should in fact be positioned not by alignment at all, but by reference to rhythmic structure – especially the positions of lapses, or adjacent unstressed syllables. Here ALIGN-L is categorical, violated if no foot occurs at the left edge of the word. *LAPSE penalizes any sequence of two unstressed syllables, whereas LAPSE-AT-END penalizes only a lapse that occurs in any position other than the end (right edge) of the word. The final constraint is discussed below.

- (4) ALIGN-L Align (PrWd, Left, Foot, Left)
 *LAPSE No two adjacent unstressed syllables.
 LAPSE-AT-END Lapse must be adjacent to the right edge.
 LAPSE-AT-PEAK Lapse must be adjacent to the peak.

(5)

	ALIGN-L	*LAPSE	LAPSE-AT-END
☞ a. (tí lǐ) (řǐ ŋu) (lám pa) tju		*	
b. (tí lǐ) (řǐ ŋu) lam (pà tju)		*	*!
c. (tí lǐ) řǐ (ŋù lam) (pà tju)		*	*!
d. tǐ (lǐ řǐ) (ŋù lam) (pà tju)	*!		

Kager argues that rhythmic constraints provide a better typological account of the world’s stress patterns, avoiding predictions of gradient alignment that he considers to be empirically unmotivated.² McCarthy (2003) advocates the same constraints because they are categorical in nature, and thus are both formally and empirically superior to gradient evaluation. Buckley (2009) argues for a more rigorously local formulation of the constraints that evaluate different rhythmic configurations, and therefore makes distinct typological predictions, but does this within a strictly categorical framework.

A central aspect of the rhythmic theory is that the evaluation of lapses depends on the location of main stress. This effect derives from the additional constraint LAPSE-AT-PEAK, where the “peak” is the main stress. This constraint accounts for languages such as Garawa (Furby 1974), which is similar to Pintupi except that the lapse occurs immediately after the initial foot, rather than at the right edge. (The medial stresses are of lower, tertiary prominence, but this is independent of how the feet are positioned.)

- (6) a. (ká ma) la (řǐ ŋji) ‘wrist’
 b. (yá ka) (là ka) (lám pa) ‘loose’
 c. (ŋán ki) řǐ (kǐ rim) (pà yi) ‘fought with boomerangs’
 d. (ná řǐ) ŋin (mù ku) (ŋji na) (mì ra) ‘at your own many’

² Kager (2012) introduces a new approach in which ternary feet are sometimes created by adjoining one syllable to a binary foot, as in the pseudo-dactyl ([óσ]σ). See Section 4 for more discussion.

In Pintupi, LAPSE-AT-END generates the apparent effect of left-to-right iterative parsing, by ensuring that the leftover syllable is at the right edge. In Garawa, on the other hand, LAPSE-AT-PEAK ensures that the unparsed syllable occurs immediately after the initial, main stress foot.³ Thus the effect of apparent right-alignment is actually generated by a constraint on the location of the lapse created by this distribution of feet.

(7)		ALIGN-L	*LAPSE	LAPSE-AT-PEAK
	a. (ɲán ki) ři (kì rim) (pà yi)		*	
	b. (ɲán ki) (ři ki) rim (pà yi)		*	*!
	c. (ɲán ki) (ři ki) (rìm pa) yi		*	*!
	d. ɲan (kí ři) (kì rim) (pà yi)	*!		

This constraint set predicts that there will be no “anti-Garawa” language (Kager 2005) in which the lapse occurs after an initial secondary stress foot, because neither LAPSE-AT-END nor LAPSE-AT-PEAK favors that outcome. Yet precisely this “initial dactyl” pattern – named for the long-short-short sequence (ōōō) of a dactylic foot in classical meter – has been cited for certain languages with main stress at the right edge, such as Indonesian (Cohn 1989, 1993). Only loanwords reveal this pattern, since native vocabulary shows cyclic effects.

- | | | | |
|-----|----|------------------------------------|--------------------|
| (8) | a. | (kòn ti) nu (á si) | ‘continuation’ |
| | b. | (ò to) (bì o) (grá fi) | ‘autobiography’ |
| | c. | (à me) ri (kà ni) (sá si) | ‘Americanization’ |
| | d. | (dè mi) li (tè ri) (sá si) | ‘demilitarization’ |
| | e. | (èk sis) ten (si a) (lís me) | ‘existentialism’ |

Words with just two feet, such as *(kònti)nu(ási)*, do not present a formal problem in the rhythmic theory, since one need only align a foot categorically at both the left and right edges; and with full footing, as in *(òto)(bìo)(gráfi)*, there is no issue of where a lapse occurs. The challenge comes in long words with five syllables preceding the main stress, since the medial foot then has to be placed without appeal to gradient alignment.⁴

Using numerals to indicate the level of stress, we can summarize that a gradient theory easily generates initial dactyl (20)0(20)(10) as well as right-aligned 0(20)(20)(10). (Here “right-aligned” is intended to be descriptive, and not to imply the use of ALL-FT-R.) For Kager’s rhythmic theory, due to the role of main stress in determining the positions of lapses, an initial dactyl is possible in left-headed (10)0(20)(20) for Garawa but not in (20)0(20)(10) for Indonesian. Similarly, this theory generates the pattern attested in Piro, (20)(20)0(10), and rules out “anti-Piro”, (10)(20)0(20), with primary stress at the left but a lapse before a final secondary stress foot.

For Indonesian, LAPSE-AT-PEAK incorrectly favors **(àme)(rìka)ni(sási)*, with the lapse before the final foot, equivalent to Piro (Kager 2001). Kager attributes the medial

³ Kager (2005) replaces LAPSE-AT-PEAK with *LAPSE-IN-TROUGH, i.e. no lapse between secondary stresses, which makes different overall typological predictions but does not differ for the current data; form (7c) does not violate *LAPSE-IN-TROUGH but would be ruled out by undominated ALIGN-WORD-RIGHT.

⁴ Similarly, although English also has an initial-dactyl effect, words such as *(Winne)pe(sáukee)* are too short to have a medial foot, and categorical left-alignment of a foot will account for the secondary stress.

sec-ondary stress not to the native phonology, but rather to Dutch, the source language for the relevant loanwords. Kager notes that all Indonesian words cited with this pattern are borrowed from Dutch, where the medial stress arises cyclically from the primary stress on the contained adjective (*Amerikáan, militáir, existentieel*), but claims that in Indonesian it is an arbitrary fact about these words. Thus, although Indonesian could be analyzed by gradient alignment, the evidence comes from loanwords in which the right solution is not unambiguously a matter of productive metrical phonology.

Another potential challenge is Hawaiian as presented by Prince (1983), with patterns such as (*pùle*)*le(húa)* ‘butterfly’. But not all words show the apparent initial dactyl, for example *ma(kúa)(híne)* ‘mother, aunt’ (Schütz 1978). Kager states that this pattern (and perhaps a similar pattern in Fijian) cannot be generated solely by the basic metrical constraints and requires lexicalized secondary stresses. There may also be a role for morphological or special word-internal prosodic structure (Schütz 1981). So, again, these data are not clear counterexamples to the rhythmic predictions.

The third potentially problematic language that Kager (2001) mentions is Spanish. He says that in this language the “initial dactyl pattern is not basic, but derived”; the facts that he describes, however, are not the complete pattern. Nevertheless, I argue in this paper that his essential response is correct: the Spanish facts can be accommodated by the rhythmic theory and do not require gradient alignment constraints.

2. Spanish stress

Primary stress in Spanish falls within a three-syllable window at the right edge of the word, depending partly on syllable structure but also subject to lexical irregularities as well as verb suffixes that impose specific stress requirements. This fact can be illustrated by some minimal contrasts, presented in standard orthography with the addition of accent marks for stress in words that normally lack them (as also throughout this paper) and periods to show syllable breaks.

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|------|----|-------------|--------------------|
| (9) | a. | sa.bá.na | ‘savannah’ |
| | b. | sá.ba.na | ‘sheet’ |
| (10) | a. | per.dí.da | ‘lost, stray (f.)’ |
| | b. | pér.di.da | ‘loss, waste’ |
| (11) | a. | so.li.ci.tó | ‘he/she solicited’ |
| | b. | so.li.cí.to | ‘I solicit’ |
| | c. | so.lí.ci.to | ‘solicitous’ |

These and other differences can be generated by a combination of lexical stresses, extra-metricity, and syllable weight (see, for example, Harris 1983 and Roca 2006), but I will not pursue a specific analysis of the primary stress facts here.

Secondary stress, on the other hand, does not show any effects of syllable weight or lexical or morphological properties. In the most commonly attested pattern, when a word is sufficiently long, Spanish secondary stress occurs on alternating syllables preceding the main stress. Important for the present discussion is that we find the initial dactyl effect when an odd number of syllables precedes the main stress (Harris 1983, Roca 1986, Hyde

and McCord 2012); here I indicate the inferred trochaic foot structure as well as the levels of stress.

- | | | |
|------|------------------------------|------------------------|
| (12) | (gène)ra(tívo) | ‘generative’ |
| | (gràma)ti(cál) | ‘grammatical’ |
| | (Còstan)ti(nópla) | ‘Constantinople’ |
| (13) | (gràma)ti(càli)(dád) | ‘grammaticality’ |
| | (màte)ma(tìci)(dád) | ‘mathematicity’ |
| | (nàtu)ra(liza)(ción) | ‘naturalization’ |
| | (ràcio)na(liza)(ción) | ‘rationalization’ |
| | (bùro)cra(tiza)(ción) | ‘bureaucratization’ |
| (14) | (còstan)ti(nòpo)(liza)(ción) | ‘Constantinoplization’ |

As shown by Hyde and McCord (2012), only a subset of these words can be accounted for by means of a cyclic derivation, or by some equivalent in Optimality Theory such as multiple lexical strata (Kiparsky 2000, Bermúdez-Otero 2011). For example, the medial stress in *(gràma)ti(càli)(dád)* could be attributed to a relationship with the contained adjective *(gràma)ti(cál)*, since the medial secondary stress in the noun corresponds to the primary stress in the adjective. Such words do not, therefore, present a problem for Kager’s rhythmic theory if supplemented by morphological relationships.

In forms such as *(màte)ma(tìci)(dád)*, however, reference to the stress in related *(màte)(màti)co* ‘mathematical’ makes exactly the wrong prediction for the medial foot, i.e. **(màte)(màti)ci(dád)*. The same problem exists for *(nàtu)ra(liza)(ción)*, where the medial stress fails to match either *(nàtu)(rál)* ‘natural’ or *(nàtu)(ràli)(zár)* ‘to naturalize’.⁵ Hyde and McCord claim on this basis that gradient alignment is necessary for an empirically adequate account of the data. I argue, however, that a fuller picture of Spanish secondary stress placement requires two steps in the derivation, and that these two steps – each one evaluated rhythmically – make gradient alignment unnecessary.

2.1 Variation in Spanish secondary stress

Detailed descriptions of Spanish secondary stress (Harris 1983, Roca 1986, Hualde 2012) report at least two variants: one, more common and colloquial, that follows the initial-dactyl pattern illustrated in the previous section; and another, more formal or emphatic, in which feet are fully aligned to the right. Harris reports this as one of several “firmly established” generalizations regarding Spanish stress. (Hyde and McCord mention the second pattern, but do not analyze it.) Harris (1983) says that the right-aligned pattern “has a rhetorical tinge” and is “often heard in newscasting, in lecturing, and in high-lighted chunks of otherwise informal speech.” Hualde (2007) reports that this style is “very frequent in news broadcasts”, is “also found in other types of public discourse, such as lectures and speeches”, and “conveys a certain ‘didactic’ tone.” Hualde and Nadeu

⁵ Hyde and McCord include the example of *Tlàtlauquitepéc*, a municipality in Mexico, but this word patterns like *(màte)ma(tìci)(dád)* only if /au/ is treated as two syllables. A reviewer suggests this is unexpected for Spanish, and indeed the stress on words like *náufrago* ‘shipwrecked, castaway’ shows that /nau/ is a single complex syllable: otherwise *náufrago* (and other examples) would violate the three-syllable window that is well established for the language (Roca 2006).

(2014) label the patterns “rhythmic” and “emphatic”, and say that a third “list” pattern evinces no secondary stress at all.

Since the impetus for this paper is to consider whether, as claimed by Hyde and McCord, Spanish provides evidence that gradient alignment is a necessary part of phonological theory, I accept the footing representations that they present for the colloquial or rhythmic style, but also the competing rhetorical or emphatic pattern that is supported by multiple scholars of Spanish stress.

Hualde (2007) reports a number of pronunciations that he observed in news broadcasts and lectures; below are some that reflect the right-aligned rhetorical footing.

(15)	de(tèrmi)(nádo)	‘determined’
	en(càmi)(náda)	‘directed, aimed’
	pre(pòsi)(ciónes)	‘prepositions’
	me(tàlin)(güísti)ca	‘metalinguistic’
	ca(pàci)(dád)	‘capacity, ability’
	e(vòlu)(ción)	‘evolution’
	tra(dicio)(nál)	‘traditional’
	in(tròdu)(cír)	‘to introduce’

Remember that these are not the only possible pronunciations of these words; rather, these are the stress patterns found on these words in a rhetorical context.

Roca (1986) gives a set of morphologically related words to illustrate this style of footing in domains of various lengths.

(16)	(Còstan)(tíno)	‘Constantine’
	Cons(tànti)(nópla)	‘Constantinople’
	(còstan)(tino)(pléño)	‘Constantinople guy’
	cons(tànti)(nòple)(ár)	‘to hang out in Constantinople’
	(còstan)(tino)(pòli)(táno)	‘Constantinopolitan’
	cons(tànti)(nòpo)(liza)(ción)	‘Constantinoplization’

Because this stress pattern reflects a different style or register of speech, rather than a different dialect of the language, there is intraspeaker variation in the realization of secondary stresses.

(17)	(gène)ra(tívo)	~	ge(nèra)(tívo)
	(gràma)ti(càli)(dád)		gra(màti)(càli)(dád)
	(Còstan)ti(nópla)		Cons(tànti)(nópla)
	(còstan)ti(nòpo)(liza)(ción)		cons(tànti)(nòpo)(liza)(ción)

The very existence of these two pronunciations calls into question an account that focuses on generating just the colloquial style. Plainly, the grammar of any speaker who controls both these styles must include a way of generating either stress pattern.

2.2 Secondary stress and phrasal context

In addition, secondary stress interacts with phrasal context in a way that requires a further dimension to the analysis. If a word exits the lexicon with right-aligned feet, and happens to have an unparsed syllable at the beginning, then it can be footed with a preceding preposition or article (examples from Roca 1986).

- | | | |
|------|---|--|
| (18) | Cons(tànti)(nópla)
(èn Cons)(tànti)(nópla) | ‘Constantinople’
‘in Constantinople’ |
| (19) | cons(tànti)(nòpo)(liza)(ción)
(là cons)(tànti)(nòpo)(liza)(ción) | ‘Constantinoplization’
‘the Constantinoplization’ |

But just as we find variation within words, two patterns are possible in at least some phrasal configurations (although the full extent of variation that might occur is not thoroughly described in the literature).

- | | | |
|------|--|------------------------------------|
| (20) | (Còstan)(tíno)
por (Còstan)(tíno) ~ (pòr Cons)tan(tíno) | ‘Constantine’
‘for Constantine’ |
|------|--|------------------------------------|

The position of the secondary stress on *(Còstan)(tíno)* in isolation is not variable, but this position may or may not be what is found in the larger phrase; it can be preserved, in which case *por* is unfooted and we have the effect of full right-alignment (the rhetorical pattern); or a new foot can be constructed that begins with *por*, resulting in an initial dactyl effect (the colloquial pattern). This is precisely the kind of variation attested within a single word of the same length, such as *generativo*.

The initial dactyl pattern is commonly found across word boundaries in phrases of various composition (Navarro Tomás 1977); compare these examples to *(gène)ra(tívo)* and *(pòr Cons)tan(tíno)*.⁶

- | | | |
|------|---|--|
| (21) | (sòbre) la (frénte)
(pòr la) ma(ñána)
(èn la) cor(riénte) | ‘on the front’
‘in the morning’
‘in the current’ |
|------|---|--|

But rhetorical right-alignment is also attested in phrases of similar composition (Hualde 2007), parallel to *ge(nèra)(tívo)* and seen already in *por (Còstan)(tíno)*.

- | | | |
|------|--------------------------------------|--------------------------------|
| (22) | la (pòbla)(ción)
en (èl e)(xílio) | ‘the population’
‘in exile’ |
|------|--------------------------------------|--------------------------------|

An example such as *la (pòbla)(ción)* can be generated simply by maintaining the lexical stress – something that is also true of all the other nouns here. But stress on the article *el* in *en (èl e)(xílio)* cannot be a hold-over from the lexical derivation. This issue is addressed below in Section 3.1.

⁶ The sources focus almost exclusively on secondary stress in nouns and noun phrases, but verbs and their proclitics may be expected to behave in a similar manner, setting aside the frequent morphological basis of primary stress in verbs.

3. A two-stage analysis

The formal analysis must include some account of the stylistic variation – for example, two possible constraint rankings depending on the speech style. The obvious constraints that have to change their ranking are ALIGN-L and *LAPSE, since the two styles differ in their satisfaction of them. In addition, we also need to take into account new footing at the phrasal level, when a function word is potentially grouped with the following lexical word. The analysis I propose is that the right-aligned pattern is basic, and assigned lexically; the initial dactyl is (sometimes) later derived from it at the phrasal level. In a Stratal OT model (Kiparsky 2000, Bermúdez-Otero 2011), the output of the lexicon serves also as the input to the phrasal component. Since the stress pattern might change between these components, violable constraints must enforce faithfulness to stress.

For the sake of concreteness, I adopt HEAD-MATCH from McCarthy (2000a), which requires faithfulness to an input main stress, i.e. the head of the prosodic word; this constraint is high-ranked to prevent changes to the primary stress assigned in the lexicon.⁷ A more general version of this constraint, FOOT-MATCH, is proposed here to govern all stresses in the input; it is lower-ranked so that secondary stresses are subject to change.

- (23) HD-MATCH A segment that bears main stress in the input corresponds to a segment that bears main stress in the output.
 FT-MATCH A segment that bears stress in the input corresponds to a segment that bears stress in the output.

Since the primary stress in *sa(bána)* does not become *(sába)na* in colloquial speech, but *ge(nèra)(tívo)* does change its secondary stress to *(gène)ra(tívo)*, it must be that HD-MATCH >> ALIGN-L >> FT-MATCH in the colloquial style. I do not entertain changes to the location of primary stress – satisfaction of HD-MATCH is simply assumed⁸ – but FT-MATCH becomes relevant in words of sufficient length to have five syllables before the main stress; crucially, ALIGN-L can force replacement of a secondary-stress foot near the beginning of the word, but does not affect any following feet.

Lexically, rightward alignment follows from the ranking *LAPSE >> ALIGN-L; this gives us the rhetorical style, and is the basic pattern generated in the lexicon.⁹

(24)

LEXICAL	FT-BIN	*LAPSE	ALIGN-L
☞ a. gra(màti)(càli)(dád)			*
b. (gràma)ti(càli)(dád)		*!	

⁷ See McCarthy (2000a) for a more technical definition. Various other approaches to accentual faithfulness are possible: for example, Pater (1995) and Alderete (1995, 1999). HD-MATCH resembles the MAX-PEAK of Roca (2006), and FT-MATCH is roughly equivalent to MAX-FT but follows McCarthy in explicitly mediating the faithfulness via the segment.

⁸ To generate a final stress on *grammaticalidad* as well as words such as *café* ‘coffee’, the lexical grammar aligns a stress with the right edge of the stem, excluding a final theme vowel or similar desinence; see Roca (2006) for a recent discussion of primary stress placement (although he has a different approach to binarity). FT-BIN must be ranked below the relevant constraints to permit a final non-branching foot.

⁹ I tacitly assume here the effects of END-RULE-R, so that the rightmost foot is the main stress, and TROCHEE, so that all feet are left-headed. The effect of FT-BIN is largely the same as *CLASH.

c. (gràma)(tica)li(dád)		*!	
d. (grà)(màti)(càli)(dád)	*!		

This lexical footing is independent of style, but what happens phrasally depends on the style of speech. Suppose this word passes to the phrasal component as a full utterance, or without forming a larger phrase with adjacent material. It will surface unchanged if the same ranking $*LAPSE \gg ALIGN-L$ holds, which is the rhetorical style (*R*). But the colloquial style (*C*), potentially with an initial dactyl, reflects the ranking $ALIGN-L \gg *LAPSE$ (and FT-MATCH). In these tableaux, the component and style are indicated in the upper left cell, along with the lexical output that serves as the phrasal input.

(25) $PHRASAL_R < gra(màti)(càli)(dád)$ FT-BIN *LAPSE ALIGN-L FT-MATCH

☞ a. gra(màti)(càli)(dád)			*	
b. (gràma)ti(càli)(dád)		*!		*
c. (gràma)(tica)li(dád)		*!		**
d. (grà)(màti)(càli)(dád)	*!			

(26) $PHRASAL_C < gra(màti)(càli)(dád)$ FT-BIN ALIGN-L *LAPSE FT-MATCH

a. gra(màti)(càli)(dád)		*!		
☞ b. (gràma)ti(càli)(dád)			*	*
c. (gràma)(tica)li(dád)			*	**!
d. (grà)(màti)(càli)(dád)	*!			

Note that the position of the medial secondary stress was determined in the lexicon, when all feet were right-aligned; at the phrasal level, this stress is the result of preservation of that stress, and is not directly determined by phrasal rhythmic properties. Because ALIGN-L does not interact with the medial foot, faithfulness is observed for (*càli*) even when it is not for (*màti*). The unattested candidate $*(gràma)(tica)li(dád)$ would require a gratuitous violation of faithfulness and is correctly excluded. In this manner, the apparent effect of ALL-FT-R can be generated without resorting to gradient alignment.

As discussed above, the initial left-aligned trochee is created relative to prosodic constituents that potentially include prepositions and articles (see also Section 3.1). The exact outcome depends on style and the interaction of lexical footing with new syllabic material; but in the rhetorical style, faithfulness wins and no initial dactyl arises.

- (27) a. (Còstan)(tíno) *lexical footing*
 b. por (Còstan)(tíno) *phrasal footing: faithful to lexical feet*
 (pòr Cons)tan(tíno) *phrasal footing: unfaithful left-alignment*

The following tableaux illustrate how the lexical output (*Còstan*)(*tíno*) is either kept the same or modified in the presence of a preceding *por*, depending on the ranking.

(28) $PHRASAL_R < por (Còstan)(tíno)$ FT-BIN *LAPSE ALIGN-L FT-MATCH

☞ a. por (Còstan)(tíno)			*	
-------------------------	--	--	---	--

b. (pòr Cons)tan(tíno)		*!		*
c. (pòr) (Còstan)(tíno)	*!			
d. (pòr Cons)(tàn)(tíno)	*!			*

(29)	<i>PHRASAL_C</i> < por (Còstan)(tíno)	FT-BIN	ALIGN-L	*LAPSE	FT-MATCH
	a. por (Còstan)(tíno)		*!		
	☞ b. (pòr Cons)tan(tíno)			*	*
	c. (pòr) (Còstan)(tíno)	*!			
	d. (pòr Cons)(tàn)(tíno)	*!			*

When sufficient material is added before the noun, a new foot can be created faithfully without affecting the structure that is already present – a single syllable before a word that does not have an initial stress, or two or more syllables added before any word. In such cases, both constraints are satisfied in the same output.

- (30) a. Cons(tànti)(nópla) *lexical footing*
 b. (èn Cons)(tànti)(nópla) *phrasal footing: faithful and left-aligned*

(31)	<i>PHRASAL_{R-C}</i> < en Cons(tànti)(nópla)	FT-BIN	ALIGN-L	*LAPSE	FT-MATCH
	a. en Cons(tànti)(nópla)		*!	*!	
	☞ b. (èn Cons)(tànti)(nópla)				

It might seem surprising that the most common secondary stress pattern often requires an adjustment at the phrasal level, whereas the more limited “rhetorical” pattern reflects the footing initially produced in the lexicon. But complex derivations are well known in phonology; consider the classic example of Yawelmani vowels, which are underlyingly long and short /a i o u/, but surface as /a e i o u/ where only the nonhigh vowels can occur long (Archangeli 1988). And from a different point of view this pattern is exactly what we might expect: natural, colloquial speech tends to involve larger phrasal groupings, whereas more formal speech tends to resist changes that take the pronunciation further from the underlying representation.

3.1 Phrasal prosodic structure

In broad strokes, this analysis predicts that a form such as *(pòr Cons)tan(tíno)* is more characteristic of colloquial style, with which it shares the phrasal ranking *LAPSE >> ALIGN-L, whereas *por (Còstan)(tíno)* is predicted to be rhetorical. The complication, however, is that there might be variation in the prosodic phrasing to which ALIGN-L refers.

As noted above, a phrase such as a PP may show left-alignment of a foot or the equivalent of full right-alignment. This variation can be fully independent of any possible differences from lexical stress, as in the following words repeated from Section 2.2.

- (32) e(xílio) *lexical footing*
 en (èl e)(xílio) *phrasal footing, all feet right-aligned*

- (33) cor(riénte) *lexical footing*
 (èn la) cor(riénte) *phrasal footing, one foot left-aligned*

The pattern *en (èl e)(xílio)* is ambiguous between right-alignment of feet in the entire domain, or left-alignment of a foot in some domain smaller than the full PP, namely that defined by the DP *el exilio*. The right-aligned pattern is easy for the rhythmic theory to generate by high ranking of *LAPSE. Nonetheless, an alternative is to locate the variation in the relation of feet to the XP structure rather than the position of feet relative to the entire domain.

- (34) [PP (èn [DP la] [N cor(riénte)]]] *aligned with PP ?*
 [PP en [DP (èl [N e](xílio)]]] *aligned with DP ?*

I make no claim, of course, that these are the only possible footings for the given phrases; rather, these are two attested alignments for parallel structures, and both must be possible in the grammar.

Given the long line of work that aligns larger constituents such as prosodic phrases with XP boundaries (see Selkirk 2011), the point of variation in locating the additional secondary stress at the left might also be in the prosodic phrasing rather than the feet directly, since ALIGN-L refers to this structure (a phonological phrase, or a recursive prosodic word, or perhaps a clitic group). In other words, *en (èl e)(xílio)* may reflect a prosodic boundary at the left edge of the DP, where *(èn la) cor(riénte)* lacks a boundary in that position.¹⁰

The choice of phrasal prosodification might be affected by pragmatic or other conditions that are not identical to the colloquial versus rhetorical style that determines whether a foot is left-aligned within the phrase. For example, different prosodic structures predict the variation *(èn Cons)(tànti)(nópla) ~ en (Còstan)ti(nópla)*, although Roca does not discuss this possibility. On the other hand, full right-alignment at the phrasal level, attributable to *LAPSE, would yield *so(brè la) (frénte)* as a possible pronunciation, metrically parallel to *en (èl e)(xílio)*; since there is no morphosyntactic boundary in the middle of *sobre*, distinct prosodic phrasing is not available as an analysis. This prediction is confirmed by Hualde (2009), who cites phrases such as *pa(rà la) (cása)* ‘for the house’. (Thanks to an anonymous reviewer for pointing out this example.)

Unfortunately, there is not enough clear data available on all the possible configurations and points of variation to say whether left-alignment is the entire story at the phrasal level; as a result, I leave open the possibility of variation in both the ranking of ALIGN-L (based on style) and the construction of prosodic phrases (based perhaps on pragmatics). Section 4 considers some additional possible effects of pragmatic context such as focus and emphasis.

¹⁰ Bill Idsardi pointed out to me a very interesting comparison to Polish. Word-internally, we find a pattern that follows the predictions of Kager (2001), with the lapse before the main stress, such as (20)(20)0(10). When a three-syllable proclitic string occurs before a word like this, there are clearly two points of alignment: in (20)0=(20)(20)0(10), the lexical secondary-stress feet align with the word, and the additional foot on the postlexical material aligns with the larger phrasal constituent. This type of pattern is predicted by the two-component analysis I propose for Spanish; see Idsardi (1994) for further details, including complications in the role of enclitics and exceptional stresses.

3.2 Against a purely phrasal analysis

Roca (1986), one of the most detailed previous discussions of Spanish secondary stress, posits a similar relationship between what I have called right-aligned feet and the initial dactyl, couched in ordered rules. The basic secondary stresses are generated by right-to-left binary feet starting from the primary stress, which yields the rhetorical pattern; but a rule of Initial Shift (p. 358, following Harris 1983: 86) moves a secondary stress from the second to the first syllable. I certainly agree with him that this is a postlexical process. Contrary to my analysis, however, Roca argues that secondary stress feet cannot be present at all in the lexicon, and are necessarily just postlexical, to avoid problems with the outcome of stress clashes. His arguments, though accepted also by Harris (1991), do not apply here, because I make several distinct assumptions; these can be summarized in a few points.¹¹

First, Roca assumes that lexical assignment of secondary stresses would apply to function words, yielding clashes such as *ò còn lòs* ‘or with the’. But in my view the same special prosodic status as clitics that exempts such elements from primary stress (consistent with Roca) will equally prevent any lexical foot structure at all, and these will be assigned stress only in the phrasal component.

Second, for some speakers a final stress occurs in phrases with antepenultimate primary stress (often including clitics), such as *dáselò* ‘give it to him’. Roca argues that this final stress creates problematic clashes with a following word if it is assigned lexically. But this final secondary stress is quite independent of those preceding the primary stress, and need not be created until the phrasal component, where it will be blocked by stress on the first syllable of the following word. In fact, since the final stress often falls on a clitic (here *lo* ‘it’), it is necessarily phrasal. Further, Harris (1991) argues that only a single new stress occurs in such phrases, no matter how long, as in *cantándosemelò* ‘it being sung for me’: the lack of iterative feet distinguishes this process from that which occurs lexically to the left of the main stress, supporting its status as a later, phrase-final phenomenon.¹²

A third argument by Roca involves the Syllable Merger of adjacent vowels into a diphthong; clashes in this context are also claimed to be difficult to resolve properly. But in OT, a merged syllable is evaluated simultaneously with phrasal foot structure, so a candidate that lacks clash will be chosen. Where a secondary stress has been lexically assigned to a vowel susceptible to Syllable Merger, as in *lè.al.tád* ‘loyalty’ → *leal.tád*, we need posit only that the phrasal constraint against vowel hiatus (simply ONSET in Roca 2006) outranks faithfulness to secondary stresses (FT-MATCH): we already know that secondary stresses can be disrupted in the phrasal component, since that is how the initial dactyl effect is generated. The same is true for sequences that arise across words, as in *cáro ènemígo* ‘dear enemy’ → *cá.roe.ne.mí.go*. Primary stresses remain intact and

¹¹ Another possible lexical and phrasal difference is that much of the literature on Spanish primary stress makes reference to syllable weight, whereas secondary stress is clearly not quantity sensitive. Roca (2006), however, casts significant doubt on the role of weight in primary stress, and notes a trend away from this view in the more recent literature. For the general question of differences between primary and secondary stress, see Hulst (1996).

¹² In some dialects this undergoes “enhancement” that shifts the main prominence to the following stress, *cantándosemeló*, but this does not change the location of the stresses.

resist Syllable Merger, as in *le.ál* ‘loyal’, which is consistent with high ranking of HD-MATCH mentioned above.

In summary, the essential difference between Roca (1986) and the present approach is that the clashes he discusses can be blocked by *CLASH in an OT analysis, rather than having to be specifically targeted by processual ordered rules. This means that it is possible to assign secondary stresses in the lexicon; but is it necessary? The first problem with a delay in iterative footing, central to the point of this paper, is that OT would then require gradient alignment at the phrasal level; this is, however, a theory-internal reason. More generally, alternating stress systems seem to assign feet iteratively as a default option – in some theories (e.g. Halle and Idsardi 1995), iterative footing is obligatory for binary constituents, and in OT the constraint PARSE-SYL ensures that multiple feet will be created unless there is a specific reason (encoded by a higher-ranked constraint) not to do so. It is therefore actually the unmarked choice in many approaches to have iterative lexical footing.

Since a foot can cross a word boundary, we also clearly need phrasal footing of some sort. But that level normally determines no more than the leftmost foot in the relevant domain. Thus the simplest (and most unmarked) approach is two steps: iterative footing within the word, and just one extra foot in the (potentially) larger phrase, which can disrupt the leftmost lexical foot but does not disturb any others.

According to the analysis I have presented, Hyde and McCord are correct that word-internal faithfulness or cyclicity will not generate all the Spanish data in a categorical alignment approach. But the alternative to gradient alignment nonetheless lies in a different variety of faithfulness, between the lexical and phrasal components, as assumed here. Any complete theory requires some account of the difference between lexical and phrasal patterns (see Kaisse and McMahan 2011); the analysis proposed here simply makes use of that architecture.

4. Empirical questions

Phonetic work on the location of Spanish secondary stress (Prieto and van Santen 1993, Díaz-Campos 2000) has not confirmed the representations found in much of the phonological literature. Harris (1991: 457, fn. 14) notes that Spanish secondary stresses “are often not perceptually salient, and native judgments about them are typically not robust. The latter do converge, however, with much greater than chance frequency.” And as Hualde and Nadeu (2014: 229) state, “Data from intuition are worthy of attention to the extent that they are consistent among speakers of the language.” In other words, although the empirical evidence for the locations of secondary stresses is not consistent, those speakers who do have intuitions tend to agree with the metrical structures cited above.

Based on the patterning of foot structure in a wide range of languages, I take the position that feet may be present that are not always (or not saliently) realized phonetically; that is, I accept the potential presence of metrical heads that might not always map to an easily detectable phonetic prominence (Buckley 2009). In problematic individual cases, it is sensible to be guided by cross-linguistic typology and the theoretical models that have been developed to account for other languages.

Hualde (2007) discusses cases where no secondary stress is realized, or clearly noticeable, on a sequence of two syllables. I mark foot structure but omit an accent mark on the underlined vowel (following Hualde).

- | | | |
|------|---|---------------------------------------|
| (35) | (pro <u>ce</u>)(d <u>e</u> ntes) | ‘arriving (from); proper (pl.)’ |
| | (<u>i</u> nves)(ti <u>ga</u>)(d <u>o</u> res) | ‘investigators’ |
| | (<u>i</u> nsti)(tu <u>ci</u> o)(n <u>al</u>) | ‘institutional’ |
| | (<u>e</u> spec)(ta <u>cu</u>)(l <u>ar</u>) | ‘spectacular’ |
| | (<u>u</u> ni)(v <u>e</u> rsi)(d <u>ad</u>) | ‘university’ (the “rhythmic” pattern) |
| | (<u>u</u> ni)(v <u>e</u> rsi)(d <u>ad</u>) | ‘university’ (the “emphatic” pattern) |

The last pair illustrates a role for pragmatics in the choice of accent pattern. For Hualde, a rhythmic HLH* contour, with the second H aligned to the main stress and the first H two syllables before it, conveys the meaning “keep listening because this is all important information”. This pattern corresponds to the right-aligned footing in words like *ge(nèra)(tívo)*, but makes no commitment to the realization of a third foot in longer words. By contrast, if the speaker wishes to emphasize a specific lexical item, Hualde indicates that an initial accent is used; although (*ùni*)(*versi*)(*dád*) is already predicted to have an initial stress because it has an even number of syllables preceding the main stress, there would appear to be a connection between the left-aligned foot in colloquial (*gène*)*ra(tívo)* and the pragmatically conditioned emphatic H on the first syllable.

Catalan has been described as having similar secondary stress to Spanish, but its pattern of unstressed vowel reduction provides an additional useful diagnostic. Nadeu and Hualde (2012) find acoustic evidence that the typical case is a single “emphatic” (secondary) stress, as in *de l’administració* ‘of the administration’; but that multiple stresses in a binary pattern can also occur, as in (*còmu*)(*nica*)(*cións*) ‘communications’. I would posit, as in Spanish, that iterative feet are present in the abstract representation, i.e. *de (l’àdmi)(nìstra)(ció)*, but that the foot heads are variably realized depending on pragmatic factors.

On another potentially pragmatic issue, Hualde (2009) presents Spanish data in which function words such as prepositions are normally unstressed, and can form minimal pairs with segmentally identical words that do take a stress in the same position.

- | | | |
|------|--------------|----------------------|
| (36) | menos amigos | ‘except for friends’ |
| | mènos amigos | ‘fewer friends’ |
| | como pán | ‘like bread’ |
| | còmo pán | ‘I eat bread’ |

He writes that the phrases with a stress, or perhaps more precisely a pitch accent, on the initial syllable of a preposition or conjunction do so as a result of narrow focus.

- | | | |
|------|----------------|---------------------------------------|
| (37) | para la ciudad | ‘for the city’ (broad focus) |
| | pàra la ciudad | ‘ for the city’ (narrow focus) |

Once again, it is plausible that both phrases have a foot on *para*, but only in the case of narrow focus is a pitch accent assigned to that word. Without that strong pitch cue, the metrical prominence on the preposition is much less distinctive, but based on reports by Roca and others, it does appear that a more subtle stress can appear on the word without narrow focus.

Hualde (2010) states that secondary stresses are realized by pitch accent, whereas primary stresses include increased duration; similar results are reported by Hualde and Nadeu (2014). In particular, he gives examples of emphatic accentual prominence on word-initial syllables even when immediately followed by a stress, as in *rùmáno* ‘Romanian’. According to most authors (Navarro Tomás, Harris, Roca, and others), such words do not have a metrical clash. It might be that certain intonational contours require a H accent preceding the main pitch accent, and in forms such as *(rù)(máno)* the clashing stress prominence is introduced to bear the additional accent. In longer words such as *do(mìni)(cános)* ‘Dominicans’, the H aligns with the secondary stress in its expected “rhetorical” position, not on the initial syllable, indicating an alignment of the accent with a metrical prominence.

These data suggest that the realization of a secondary stress is dependent on the presence of pitch accents, which in turn depend on emphasis, focus, and other pragmatic factors. A fuller understanding of the variation in Spanish secondary stress must await further study that explores these dimensions in considerable detail.

4.1 Typological predictions

I have analyzed data here that motivate a grammar of Spanish in which two stress patterns are possible; the lexical derivation produces the rhetorical pattern, which is most often modified in the phrasal component. Could there be grammars of Spanish in which the “rhetorical” stress pattern is completely absent? Harris (1991) cites the existence of such dialects based on personal communication. This would mean that for these speakers, phrasal left-alignment is obligatory, i.e., ALIGN-L >> *LAPSE, FT-MATCH without variation. But do they still create the rhetorical pattern in the lexicon, even if it is not realized on the surface? The theory advocated here requires that assumption, and the same abstraction would be true (as steps in the postlexical derivation) of Harris (1983) and Roca (1986) with their rule of Initial Shift.

In any model that includes both lexical and phrasal effects, a derivation with right-alignment in the lexicon and one left-aligned foot in the phrase will be available to the learner. If the theory also permits gradient directionality, then *(gràma)ti(càli)(dád)* has two possible derivations: different categorical alignments in the two components as proposed here, and single-representation generation of the initial-dactyl effect. From this perspective, gradient alignment is redundant and gives unneeded power. In essence, the learner notices that all the feet align to the right except for the leftmost foot, which is also influenced by the larger phrasal context. If gradient alignment is unavailable in the formal apparatus of the theory, then the learner has no choice but to posit two stages of footing subject to slightly different principles.

As mentioned above, Kager (2012) proposes a theory of foot structure that makes significantly different predictions from his earlier lapse-based rhythmic theory. I became aware of this new approach only after the conference at which this work was initially presented, but here I briefly address its relevance to my argument. Kager’s central claim is that feet can be recursive by adjoining a single syllable to a standard foot, yielding a layered ternary foot, e.g. $((\sigma)\sigma)$. In this approach, a Spanish initial-dactyl form would be footed *((gràma)ti)(càli)(dád)* and would not in fact have an unfooted medial syllable. Martínez-Paricio and Kager (2013) present a further development of this approach that controls the location of these “maximal” feet by means of categorical alignment

constraints, which in Spanish would prefer the ternary foot at the left edge, allowing $((gr\grave{a}ma)ti)(c\grave{a}li)(d\acute{a}d)$ and $(gr\grave{a}(m\grave{a}ti))(c\grave{a}li)(d\acute{a}d)$ but not $*(gr\grave{a}ma)((t\grave{ì}ca)li)(d\acute{a}d)$ or $*(gr\grave{a}ma)(t\grave{ì}ca)(li)(d\acute{a}d)$.

More to the point, this newer work abandons the typological prediction of Kager (2001, 2005) that a form such as $(gr\grave{a}ma)ti(c\grave{a}li)(d\acute{a}d)$ will never be chosen. As a result, the recursive-foot approach no longer makes that claim that Hyde and McCord (2012) considered to make false predictions for Spanish, and provides a different means of answering their objections than the one that I have outlined here. Nonetheless, although I consider the recursive foot theory to be promising, my analysis does not rely upon it. In addition, the new approach to foot structure does not replace a theory of lexical and phrasal interactions, so that the analysis I propose here remains available as a means of accounting for such interactions in Spanish. Finally, like Kager (2001, 2005), the recursive theory does not make use of gradient alignment and is consistent with the core theoretical claim of this paper that all alignment is categorical.

5. Conclusion

Accepting the possibility of distinct lexical and phrasal foot alignment changes Kager's (2001, 2005) typological predictions, which were a central part of the original motivation for the rhythmic theory. He relies on a single step of metrical evaluation for his claims, which is very common in the typological literature. But there is already evidence that these predictions are too restrictive and cannot be sustained; for example, they exclude the rare but attested languages that exhibit left-edge extrametricality (Buckley 2009).¹³

I propose that we acknowledge, and exploit, the already necessary power of the lexical–phrasal distinction and in so doing avoid the computational and formal complexity of gradient alignment. This distinction, in some form, is independently motivated by decades of research on phonological patterns. This step keeps the metrical system itself more restricted, and we continue to make specific typological predictions. For example, in a two-level model of the lexicon, we predict that no pattern like colloquial Spanish could occur strictly at the Stem level (Bermúdez-Otero 2011), but could between the Stem and Word. By contrast, gradient alignment combined with lexical strata does predict the initial-dactyl effect within the Stem domain, which could then interact with new footing at the Word or Phrase. This difference can, however, only be tested in a language with quite long stem constituents.

The essential insight of this analysis is that the rhetorical pattern in Spanish secondary stress, with right-alignment of all feet, characterizes the lexical derivation. At the phrasal level, a new trochaic foot can be left-aligned with a prosodic phrase that has been constructed over an XP, depending on whether the speaker chooses the colloquial or rhetorical style. The potentially complex role of pragmatics remains an open question.

Any serious theory of phonology requires some account of the difference between lexical and phrasal patterns. While Hyde and McCord are correct that faithfulness to morphologically defined bases such as $(m\grave{à}te)(m\grave{à}ti)co$ will not generate the Spanish data with categorical alignment, the answer nonetheless lies in a different type of faithfulness, that between the lexical and phrasal components.

¹³ Kager (2012) does account for left-edge extrametricality by permitting a recursive foot ($\sigma(\sigma\acute{\sigma})$) at the beginning of a word.

References

- Alderete, John. 1995. Faithfulness to prosodic heads. Available on Rutgers Optimality Archive, ROA 94, <http://roa.rutgers.edu/>.
- Alderete, John. 1999. Head dependence in stress-epenthesis interactions. In Ben Hermans and Marc van Oostendorp (eds.), *The derivational residue in phonological Optimality Theory*, 29-50. Amsterdam: John Benjamins.
- Archangeli, Diana. 1988. *Underspecification in Yawelmani phonology and morphology*. New York: Garland.
- Bermúdez-Otero, Ricardo. 2011. Cyclicity. In Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume, and Keren Rice (eds.), *The Blackwell companion to phonology*, 2019-2048. Hoboken, NJ: Wiley-Blackwell.
- Bíró, Tamás. 2003. Quadratic alignment constraints and finite state Optimality Theory. *Proceedings of the Workshop on Finite-State Methods in Natural Language Processing (FSMNLP)*, 10th Conference of the European Chapter of the ACL, Budapest, 119-126.
- Buckley, Eugene. 2009. Locality in metrical typology. *Phonology* 26. 389-435.
- Buckley, Eugene. 2014. Spanish secondary stress without gradient alignment. *NELS* 43. 37-50.
- Cohn, Abigail. 1989. Stress in Indonesian and bracketing paradoxes. *Natural Language and Linguistic Theory* 7. 167-216.
- Cohn, Abigail. 1993. The initial dactyl effect in Indonesian. *Linguistic Inquiry* 24. 372-381.
- Díaz-Campos, M. 2000. The phonetic manifestation of secondary stress in Spanish. In Hector Campos, Elena Herburger, Alfonso Morales-Front, and Thomas J. Walsh (eds.), *Hispanic linguistics at the turn of the millennium: Papers from the 3rd Hispanic Linguistic Symposium*, 49-65. Somerville, MA: Cascadilla Press.
- Eisner, Jason. 1997. What constraints should OT allow? Paper presented at the 71st Annual Meeting of the Linguistic Society of America, Chicago. Available on Rutgers Optimality Archive, ROA 204, <http://roa.rutgers.edu/>.
- Eisner, Jason. 2000. Directional constraint evaluation in Optimality Theory. *COLING 2000: Proceedings of the 18th Conference on Computational Linguistics, Saarbrücken*, vol. 1, 257-263. San Francisco: Morgan Kaufmann.
- Furby, Christine. 1974. *Garawa phonology*. Canberra: Australian National University.
- Gordon, Matthew. 2002. A factorial typology of quantity-insensitive stress. *Natural Language and Linguistic Theory* 20. 491-552.
- Halle, Morris, and William Idsardi. 1995. General properties of stress and metrical structure. In John Goldsmith (ed.), *The handbook of phonological theory*, 403-443. Oxford: Blackwell.
- Hansen, Kenneth C., and Lesley E. Hansen. 1969. Pintupi phonology. *Oceanic Linguistics* 8. 153-170.
- Harris, James. 1983. *Syllable structure and stress in Spanish: A nonlinear analysis*. Cambridge, MA: MIT Press.

- Harris, James. 1991. With respect to accentual constituents in Spanish. In Héctor Campos and Fernando Martínez-Gil (eds.), *Current studies in Spanish linguistics*, 447-471. Washington, DC: Georgetown University Press.
- Heinz, Jeffrey. 2009. On the role of locality in learning stress patterns. *Phonology* 26. 303-351.
- Hualde, José I. 2005. *The sounds of Spanish*. Cambridge: Cambridge University Press.
- Hualde, José I. 2007. Stress removal and stress addition in Spanish. *Journal of Portuguese Linguistics* 5(2)/6(1). 59-89.
- Hualde, José I. 2009. Unstressed words in Spanish. *Language Sciences* 31. 199-212.
- Hualde, José I. 2010. Secondary stress and stress clash in Spanish. In Marta Ortega-Llebaria (ed.), *Selected proceedings of the 4th Conference on Laboratory Approaches to Spanish Phonology*, 11-19. Somerville, MA: Cascadilla Proceedings Project.
- Hualde, José I. 2012. Stress and rhythm. In José Ignacio Hualde, Antxon Olarrea, and Erin O'Rourke (eds.), *The handbook of Hispanic linguistics*, 153-171. Hoboken, NJ: Wiley-Blackwell.
- Hualde, José I., and Marianna Nadeu. 2014. Rhetorical stress in Spanish. In Harry van der Hulst (ed.), *Word stress: Theoretical and typological issues*, 228-252. Cambridge: Cambridge University Press.
- Hulst, Harry van der. 1996. Separating primary accent and secondary accent. In Rob Goedemans, Harry van der Hulst, and Ellis Visch (eds.), *Stress patterns of the world*, 1-26. The Hague: Holland Academic Graphics.
- Hyde, Brett. 2002. A restrictive theory of metrical stress. *Phonology* 19. 313-339.
- Hyde, Brett, and Bethany McCord. 2012. The inadequacy of a faithfulness-based approach to Spanish secondary stress. Ms., Washington University. Available on Rutgers Optimality Archive, ROA 1151, <http://roa.rutgers.edu/>.
- Idsardi, William. 1994. Optimality, alignment and Polish stress. Paper presented at the Linguistic Society of America annual meeting, Boston.
- Kager, René. 2001. Rhythmic directionality by positional licensing. Handout from the Fifth Holland Institute of Linguistics Phonology Conference, University of Potsdam. Available on Rutgers Optimality Archive, ROA 514, <http://roa.rutgers.edu/>.
- Kager, René. 2005. Rhythmic licensing theory: An extended typology. *Proceedings of the 3rd Seoul International Conference on Phonology*, 5-31. Seoul: Phonology-Morphology Circle of Korea.
- Kager, René. 2012. Stress in windows: Language typology and factorial typology. *Lingua* 122. 1454-1493.
- Kaisse, Ellen, and April McMahon. 2011. Lexical phonology and the lexical syndrome. In Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume, and Keren Rice (eds.), *The Blackwell companion to phonology*, 2236-2257. Hoboken, NJ: Wiley-Blackwell.
- Kiparsky, Paul. 2000. Opacity and cyclicity. *The Linguistic Review* 17. 351-367.
- Kimura, Takuya. 2006. Mismatch of stress and accent in spoken Spanish. In Yuji Kawaguchi, Ivan Fonagy, and Tsunekazu Moriguchi (eds.), *Prosody and syntax: Cross-linguistic perspectives*, 141-155. Amsterdam: John Benjamins.
- Martínez-Paricio, Violeta, and René Kager. 2013. Non-intervention constraints and the binary-to-ternary rhythmic continuum. Paper presented at the The 21st Manchester Phonology Meeting. Manchester, England.
- McCarthy, John J. 2000a. The prosody of phase in Rotuman. *Natural Language and Linguistic Theory* 18. 147-197.

- McCarthy, John J. 2000b. Harmonic serialism and parallelism. *Proceedings of NELS* 30. 501-524.
- McCarthy, John J. 2003. OT constraints are categorical. *Phonology* 20. 75-138.
- McCarthy, John J., and Alan S. Prince. 1993. Generalized alignment. In Geert Booij and Jaap van Marle (eds.), *Yearbook of Morphology 1993*, 79-153. Dordrecht: Kluwer.
- Navarro Tomás, Tomás. 1977. *Manual de pronunciación española*. 19th edn. Madrid: Consejo Superior de Investigaciones Científicas.
- Pater, Joe. 1995. On the nonuniformity of weight-to-stress and stress preservation effects in English. Ms., McGill University. Available on Rutgers Optimality Archive, ROA 107, <http://roa.rutgers.edu/>.
- Prieto, Pilar, and Jan van Santen. 1996. Secondary stress in Spanish: Some experimental evidence. In Claudia Parodi, Carlos Quicoli, Mario Saltarelli, and Maria Luisa Zubizarreta (eds.), *Aspects of Romance Linguistics*, 337-356. Washington, DC: Georgetown University Press.
- Prince, Alan S. 1983. Relating to the grid. *Linguistic Inquiry* 14. 19-100.
- Pruitt, Kathryn. 2010. Serialism and locality in constraint-based metrical parsing. *Phonology* 27. 481-526.
- Riggle, Jason. 2004. *Generation, recognition, and learning in finite state Optimality Theory*. Los Angeles: University of California dissertation.
- Roca, Iggy. 1986. Secondary stress and metrical rhythm. *Phonology Yearbook* 3. 341-370.
- Roca, Iggy. 2006. The Spanish stress window. In Fernando Martínez-Gil and Sonia Colina (eds.), *Optimality-Theoretic studies on Spanish phonology*, 239-277. Amsterdam: John Benjamins.
- Schütz, Albert J. 1978. Accent in two Oceanic languages. *Anthropological Linguistics* 20. 141-149.
- Schütz, Albert J. 1981. A reanalysis of the Hawaiian vowel system. *Oceanic Linguistics* 20. 1-43.
- Selkirk, Elisabeth. 1995. The prosodic structure of function words. In Jill Beckman, Linda Walsh Dickey, and Suzanne Urbanczyk (eds.), *Papers in Optimality Theory*, 439-470. Amherst, MA: GLSA Publications.
- Selkirk, Elisabeth. 2011. The syntax-phonology interface. In John A. Goldsmith, Jason Riggle, and Alan C. L. Yu (eds.), *The handbook of phonological theory*, 2nd edn., 435-484. Hoboken, NJ: Wiley-Blackwell.
- Zoll, Cheryl. 1996. *Parsing below the segment in a constraint-based framework*. Berkeley: University of California dissertation. Published 1998, Stanford: CSLI.

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