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# Optimality Theory and Spanish Phonology

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Abstract

This article surveys research in Spanish phonology from the perspective of Optimality Theory, a formal linguistic framework based on ranked and violable constraints. Theoretical insights from OT enrich our understanding of Spanish phonology, and Spanish data also figure prominently in the latest theoretical developments within OT. The article concludes with areas for ongoing research and a bibliography of OT in Spanish phonology.

## *1. Introduction*

Among the languages of the world with at least 50 million first-language speakers, Spanish ranks second with 406 million spread across 31 different countries, just above English and far below Chinese (Lewis 2009). Linguistic theory and Hispanic dialectology have long enjoyed a healthy and symbiotic relationship. Within the context of contemporary research, "the study of Spanish language variation intersects naturally with a broad cross-section of theoretical and experimental linguistics" (Lipski 2008: 216). As a language with rich phonetic and phonological variation across multiple dialects, Spanish continues to be a fertile testing ground for the latest advances in phonological theory.

Since its inception in the early 1990s, Optimality Theory (OT; Prince and Smolensky 1993/2004) has emerged as one of the most influential frameworks in contemporary generative linguistics, especially in phonology. In an OT grammar, underlying forms go through a single mapping to surface forms in accordance with a hierarchy of ranked and violable constraints. These constraints are, by hypothesis, universal but can be ranked differently in different

languages. Faithfulness constraints compare input and output forms, or in some versions of OT, two related outputs, and are violated if the corresponding forms are not identical with respect to some specified property. Markedness constraints evaluate individual output forms and are violated if the output is ill-formed in a particular way. Alignment constraints require the left or right edges of morphological and prosodic domains to coincide. For more detailed introductions to OT, see Archangeli and Langendoen (1997), Gordon (2007), Kager (1999), McCarthy (2002, 2007b, 2008), Prince and Smolensky (1993/2004).

## *2. Contributions of OT to Spanish Phonology*

Since the first applications of OT to Spanish syllabification (Morales-Front 1994, Colina 1995), a considerable literature has developed on OT Spanish phonology, including research published in theoretical linguistics journals, in peer-reviewed proceedings from conferences such as the *Linguistic Symposium on Romance Languages,* the *Hispanic Linguistics Symposium,* and *Going Romance,* and in edited volumes (e.g. Martínez-Gil and Morales-Front 1997, Martínez-Gil and Colina 2006, Núñez Cedeño and Morales-Front 1999, Núñez Cedeño, Colina and Bradley 2014, in particular, Colina 2014, Bradley 2014). Colina (2009b) provides a comprehensive OT treatment of a wide range of phonological phenomena across different Spanish varieties (see Bradley 2011b for a review).

### 2.1. THE PLOSIVE-APPROXIMANT ALTERNATION

The realization of voiced obstruents /b̪d̪g/ in Spanish is a staple problem set in introductory phonology. Although there is some dialectal and stylistic variation, the basic pattern is one of

complementary distribution between two sets of allophones: plosive [b̪d̪g] appear after a pause, after nasals, and in the case of [d̪] after a lateral, while approximants [β̪ð̪ɣ̪] appear elsewhere. The examples in (1) illustrate the allophonic difference between [d̪] and [ð̪]:

(1) a. ||d̪a.me.lo *Dámelo!* 'Give it to me!'

b. ||me.lo.ð̪a *Me lo da.* 'S/he gives it to me.'

In the generative literature on Spanish voiced obstruents, much of the debate has centered on the nature of underlying representations and the directionality of the phonological change as one of lenition or fortition. Early generative accounts (e.g. Harris 1969) treat the plosives as underlying and derive the surface approximants by a spirantization rule that changes the feature [−continuant] to [+continuant] in the appropriate contexts. Lozano (1979) proposes that the underlying segments lack any specification for continuancy. Subsequent non-linear analyses (e.g. Harris 1984, Hualde 1989b) posit archiphonemic /BDG/, underspecified for the feature [continuant], and derive the surface distribution of continuancy by autosegmental spreading and default assignment rules. Barlow (2003b) argues in favor of a fortition account that assumes underlying approximants.

OT contributes to the analysis of Spanish voiced obstruents by ruling out feature underspecification as a source of explanation and by shifting the focus away from underlying representations and onto constraint interaction. A basic tenet of OT is **richness of the base,** which states that there are no language-specific constraints on the input representation

(McCarthy 2002: 71-6, Prince and Smolensky 1992/2004: 205, 225). Systematic differences across languages must be accounted for by interacting constraints in the grammar. As pointed out by Kirchner (1998/2001), underlying values of [continuant] become irrelevant in an OT analysis of lenition and fortition because the surface distribution of feature values is determined entirely by constraint interaction (see also Baković 1994). For example, the complementary distribution in (1) requires that faithfulness to the feature [continuant] rank below a context-free markedness constraint against voiced plosives, represented here as *VOIPLOS, which in turn must rank below a positional markedness constraint against voiced approximants in postpausal contexts, *VOIAPPROX/||_. A complete account would require additional *VOIAPPROX constraints, omitted here for reasons of space.

Tableau (2) gives two evaluations for the phrase *Dámelo,* the first with an input plosive /d̪/ and the second with an input approximant /ð̪/. High-ranking *VOIAPPROX/||_ rules out the input-output mappings in (2b,d), in which the output forms contain a voiced approximant in postpausal position. The outputs in (2a,c) contain voiced plosives, violating *VOIPLOS, but the plosive allophones are tolerated because it is more important to avoid approximants in this particular context. The constraint hierarchy ensures a plosive in the output, regardless of whether the input contains a plosive (2a) or an approximant (2c).

(2) Voiced plosive after a pause

| | *VOIAPPROX/||_ | *VOIPLOS | FAITH(cont) |
|---|---|---|---|
| ☞ a. /d̪a+me+lo/ → ||d̪a.me.lo | | * | |
| b. ||ð̪a.me.lo | *! | | * |
| ☞ c. /ð̪a+me+lo/ → ||d̪a.me.lo | | * | * |
| d. ||ð̪a.me.lo | *! | | |

In the evaluations of *Me lo da* in tableau (3), *VOIAPPROX/||_ is now irrelevant because [ð̪] does not appear in postpausal position. The decision is passed down to *VOIPLOS, which favors an approximant in the output, regardless of whether the input contains a plosive (3b) or an approximant (3d).

(3) Voiced approximant after a vowel

| | *VOIAPPROX/||_ | *VOIPLOS | FAITH(cont) |
|---|---|---|---|
| a. /me+lo+d̪a/ → me.lo.d̪a | | *! | |
| ☞ b. me.lo.ð̪a | | | * |
| c. /me+lo+ð̪a/ → me.lo.d̪a | | *! | * |
| ☞ d. me.lo.ð̪a | | | |

Since faithfulness is lowest ranked, surface contrasts between [bd̪g] and [β̪ð̪ɣ̪] are impossible. Assuming richness of the base, the question of which allophone to choose as underlying becomes a non-issue (Kirchner 2001: 74). The correct surface patterns are optimized by the constraint hierarchy regardless of whether the input contains plosives or approximants.

2.2. THE ONSET CONSPIRACY IN SYLLABIFICATION

A well-known generalization about Spanish syllable structure is that prevocalic glides syllabify as onsets when no preceding consonant is available (4a) but as part of the syllable nucleus after a consonantal onset (4b) (Harris 1983, Harris and Kaisse 1999, Hualde 1989a, 1991).

(4) a. $[G[V]_N]_\sigma$ b. $[C[GV]_N]_\sigma$

This difference is supported by patterns of glide fortition. In many dialects, glides are strengthened to obstruents in syllable-initial position (5a) but not after a preceding onset (5b).

| | | | |
|---|---|---|---|
| (5) a. | kɾe.jo > kɾe.ɟo, kɾe.ʝo, kɾe.ʒo, kɾe.ʤo | *creyó* | 'he/she/it believed' |
| | we.so > gʷe.so | *hueso* | 'bone' |
| b. | kɾe.sjo, *kɾe.sʝo | *creció* | 'he/she/it grew' |
| | pweɴ.t̪e, *pgʷeɴ.t̪e | *puente* | 'bridge' |

Colina (2006c, 2009b) shows that in OT, the behavior of prevocalic glides can be understood in terms of a Spanish-specific ranking of universal constraints on sonority and syllable structure. Languages are known to differ in the types of segments they allow in different positions within the syllable, in accordance with a scale of sonority, i.e. loudness in acoustic terms. One of the sonority scales proposed in the literature on Spanish is shown in (6), where segment classes to the left are less sonorous than those to the right.[1]

(6) Spanish sonority scale (Martínez-Gil 1996, 1997)

Stops < Fricatives < Nasals < Liquids < Glides < Vowels

Two important cross-linguistic generalizations are that less sonorous segments are preferred in the onset, while more sonorous segments are preferred in the nucleus. Drawing upon work by Prince and Smolensky (1993/2004), Colina (2006c: 180, 2009b: 20) formalizes these implicational generalizations as fixed rankings of markedness constraints, shown in (7), where stops and fricatives are grouped together as obstruents.

(7) a. *ONS/VOWEL » *ONS/GLIDE » *ONS/LIQUID » *ONS/NASAL » *ONS/OBSTRUENT

b. *NUC/OBSTRUENT » *NUC/NASAL » *NUC/LIQUID » *NUC/GLIDE » *NUC/VOWEL

These hierarchies encode the preference for less sonorous segments to syllabify as onsets and for more sonorous segments to syllabify as nuclei. *ONS/GLIDE and *NUC/GLIDE are relevant to the analysis of Spanish prevocalic glides, as well as a markedness constraint against onsetless syllables, ONSET (Itô 1989, Prince and Smolensky 1993/2004). The analysis also assumes a faithfulness constraint on the feature [consonantal], which distinguishes vowels and glides from consonants.

Tableau (8) gives the analysis of complex nucleus formation in the example *creció.* Given the input /kɾes+io/, the output candidates show three different syllabifications of the final /io/ sequence, where the relevant syllable nuclei are enclosed within brackets. The hiatus in (8b) leaves the final syllable without an onset consonant, violating ONSET, while (8c) syllabifies the

glide as part of a complex onset, violating *ONS/GLIDE. The optimal syllabification, as predicted by the low ranking of *NUC/GLIDE, parses the glide and the following vowel together in a complex nucleus in (8a).

(8) Prevocalic glide as part of a complex nucleus

| | /kres+io/ | ONSET | *ONS/GLIDE | *NUC/GLIDE |
|---|---|---|---|---|
| ☞ | a. kre.s[jo] | | | * |
| | b. kre.s[i].[o] | *! | | |
| | c. kre.sj[o] | | *! | |

Tableau (9) presents the analysis of syllable-initial glide strengthening in the example *creyó.* High-ranking ONSET rules out (9a,b) because they contain onsetless syllables, and *ONS/GLIDE rules out (9c) because a glide is syllabified in onset position. The optimal candidate is (9d), in which the input vowel /i/ is strengthened to [j̯], violating the low-ranking faithfulness constraint.[2]

(9) Strengthened glide as a syllable onset

| | /kre+io/ | ONSET | *ONS/GLIDE | *NUC/GLIDE | FAITH(cons) |
|---|---|---|---|---|---|
| | a. kre.[jo] | *! | | * | |
| | b. kre.[i].[o] | *!* | | | |
| | c. kre.j[o] | | *! | | |
| ☞ | d. kre.j̯[o] | | | | * |

Derivational accounts of word-level syllabification in Spanish (e.g. Hualde 1989a, 1991) typically include language-specific rules that stipulate vowels as the heads of syllables, as well as additional syllabification rules subject to constraints that make indirect reference to the sonority

scale. By contrast, OT is able to build sonority directly into the analysis using universal markedness constraints. Furthermore, in rule-based accounts of onset strengthening (e.g. Hualde 1991), it is unclear whether glides become obstruents after being resyllabified to the syllable onset or whether glides are resyllabified as onsets after becoming obstruents, which cannot occupy the syllable nucleus. This indeterminacy is avoided in an OT account. Since the optimal syllabification of glides is determined by comparing output candidates in parallel against a hierarchy of ranked and violable constraints, the question of which rule precedes the other in a serial derivation is no longer an issue.

The ONSET constraint also plays a key role in Spanish phonology at the phrase level. High vowels become glides when they are adjacent to another vowel across the word boundary (10a). A separate process resyllabifies a word-final consonant to the following onset before a vowel-initial word (10b). However, if the following word already begins with a consonant, then resyllabification does not occur (11a), even when the complex onset that would result from resyllabification is otherwise preferred word-internally (11b).

(10) a. mja.mi.ɣ̟o *mi amigo* ‘my friend’

b. t̪u.sa.mi.ɣ̟os *tus amigos* ‘your friends’

(11) a. kluβ̟.liɲ̪.d̪o *club lindo* ‘pretty club’

*klu.β̟liɲ̪.d̪o

b. a.β̟la.mos *hablamos* ‘we talk’

*aβ̟.la.mos

Although gliding and resyllabification seem to be independent and formally unrelated processes, both rules actually achieve the same result: the avoidance of an onsetless syllable. A main advantage of OT over rule-based phonology is its explanation of **rule conspiracies** (Kisseberth 1970), whereby some languages have multiple rules that seem to conspire together towards a common goal, i.e. avoiding a marked structure in the output. By distinguishing between the structural problem and the various strategies for repairing the problem, OT can reveal the functional unity of what appear to be separate rules of the language.

Colina (2006c: 191-195, 2009b: 45-53) shows that OT explains the conspiracy of gliding and resyllabification as an effect of ONSET. This constraint outranks a faithfulness constraint, represented here as FAITH(V→G), which is violated when an input vowel changes to a glide in the output. ONSET also outranks an alignment constraint, ALIGN-L(STEM,σ), which requires the left edge of a stem to coincide with the left edge of a syllable in the output. Alignment is violated whenever the initial segment of a stem is not also the initial segment of a syllable.

The tableaux in (12) show how a single constraint ranking captures the true motivation behind gliding and resyllabification while at the same time limiting the latter process to affect only prevocalic consonants. Candidates (12a,c) violate high-ranking ONSET because the initial syllable of *amigo(s)* lacks an onset. Candidates (12b,d,f) violate alignment because the left edge of the stem, denoted by a vertical line, does not coincide with the left edge of a syllable. Candidate (12b) also violates faithfulness for the change from input vowel to output glide. The violations incurred by (12b,d) are tolerated because Spanish places greater importance on avoiding onsetless syllables than on maintaining stem-syllable alignment or faithfulness to input vowels. In the case of *club lindo,* word-initial /l/ is already available to satisfy ONSET, so lower-

ranking ALIGN-L(STEM,σ) keeps word-final /b/ in the coda to maintain stem-syllable alignment in (12e).

(12) Conspiracy of gliding and resyllabification to avoid onsetless syllables[3]

| | ONSET | FAITH(V→G) | ALIGN-L(STEM,σ) |
|---|---|---|---|
| a. /mi amigo/ → mi.\|a.mi.ɣ̟o | *! | | |
| ☞ b. mj\|a.mi.ɣ̟o | | * | * |
| c. /t̪us amigos/ → t̪us.\|a.mi.ɣ̟os | *! | | |
| ☞ d. t̪u.s\|a.mi.ɣ̟os | | | * |
| ☞ e. /klub lind̪o/ → kluβ̪.\|lin̪.d̪o | | | |
| f. klu.β̪\|lin̪.d̪o | | | *! |

Working in a derivational framework, Hualde (1991) accounts for resyllabification by positing a CV rule that applies both lexically and postlexically. However, he must restrict the application of a complex onset rule to the lexical level only in order to avoid syllabifications such as *[klu.β̪lin̪.d̪o]. This stipulation is avoided in an OT analysis. Since the syllable onset can already be filled by the stem-initial lateral, moving word-final [β̪] into onset position amounts to an unnecessary violation of alignment.

### 2.3. STRESS

In Spanish non-verbs, primary stress can appear on one of the last three syllables of a word. Penultimate stress is the unmarked pattern for vowel-final words (13a), whereas words ending in a consonant prefer final stress (14a). For vowel-final words, antepenultimate stress is the marked

pattern (13b), and final stress is supermarked (13c). For consonant-final words, penultimate stress is marked (14b), and antepenultimate stress is supermarked (14c).

| | | | | |
|---|---|---|---|---|
| (13) | a. | pis.t̪ó.la | *pistola* | ‘pistol’ |
| | b. | e.pís.t̪o.la | *epístola* | ‘epistle’ |
| | c. | me.nú | *menú* | ‘menu’ |
| (14) | a. | a.ni.mál | *animal* | ‘animal’ |
| | b. | ka.ní.β̪al | *caníbal* | ‘cannibal’ |
| | c. | i.pér.β̪a.t̪on | *hipérbaton* | ‘hyperbaton’ |

As Roca (2006: 242-243) points out, these markedness differences are supported by empirical evidence including lexical frequency counts and the pronunciation of acronyms and nonce words. Roca argues that once a morphological distinction is recognized between the stem and **class marker,** or desinence in Roca’s terminology, the markedness relations become more transparent. Class markers are word-final inflectional suffixes and are always unstressed, with *-o, -a, -e* being the most common. In the reorganized presentation of examples in (15), both the position and markedness of stress are indicated relative to its position within the stem, whose right edge is denoted by a vertical line.

(15)

| | Stress within stem | Markedness | Examples | | |
|---|---|---|---|---|---|
| a. | Antepenultimate | supermarked | | i.pér.β̪a.t̪on\| | |
| b. | Penultimate | marked | e.pís.t̪o.l\|a | ka.ní.β̪al\| | |
| c. | Final | unmarked | pis.t̪ó.l\|a | a.ni.mál\| | me.nú\| |

Roca (2006: 245-248) develops an OT account of unmarked stem-final stress in (15c) using the following constraints on metrical structure: feet are left headed (TROCHEE), the right edge of any foot coincides with the right edge of the stem (ALIGN-R(FOOT,STEM)), and the stressed vowel is last in the stem (ALIGN-R(Ý,STEM)). In Spanish, these three constraints outrank the constraint requiring all syllables to be parsed into feet (PARSEσ). As tableau (16) shows, the result of this ranking is the creation of a degenerate (non-binary) foot whose right edge is aligned with the rightmost vowel of the stem in (16a,e,i).

(16) Unmarked stress on the final vowel of the stem

| | TROCHEE | ALIGN-R (FOOT,STEM) | ALIGN-R (Ý,STEM) | PARSEσ |
|---|---|---|---|---|
| ☞ a. pis.(ṭó).l\|a | | | | ** |
| b. (pís.ṭo).l\|a | | | *! | * |
| c. (pis.ṭó).l\|a | *! | | | * |
| d. pis.(ṭó.l\|a) | | *! | | * |
| ☞ e. a.ni.(mál)\| | | | | ** |
| f. a.(ní.mal)\| | | | *! | * |
| g. a.(ni.mál)\| | *! | | | * |
| h. a.(ní).mal\| | | *! | | ** |
| ☞ i. me.(nú)\| | | | | * |
| j. (mé.nu)\| | | | *! | |
| k. (me.nú)\| | *! | | | |

To account for the marked patterns involving penultimate stress within the stem, Roca (2006: 247) invokes a lexically indexed constraint requiring feet to contain minimally two syllables (FTBIN$^{\sigma}$MIN*). Crucially, this constraint is bound to the lexical class of words behaving like those in (15b), which cannot be predicted in a principled manner. In tableau (17), the asterisk in the input activates FTBIN$^{\sigma}$MIN* for these words, ruling out the degenerate foot in (17e) in favor of the binary foot in (17d). FTBIN$^{\sigma}$MIN* and ALIGN-R(FOOT,STEM) rule out the degenerate foot in (17b) and the binary foot in (17c), respectively, in favor of the binary foot in (17a). The effect of the ranking illustrated in tableau (17) is the creation of a binary foot whose right edge is aligned with the rightmost vowel of the stem.

(17) Marked stress on the penultimate vowel of the stem

| * | TROCHEE | FTBIN$^{\sigma}$MIN* | ALIGN-R (FOOT,STEM) | ALIGN-R (Ý,STEM) | PARSEσ |
|---|---|---|---|---|---|
| ☞ a. e.(pís.to).l\|a | | | | * | ** |
| b. e.pis.(tó).l\|a | | *! | | | *** |
| c. e.pis.(tó.l\|a) | | | *! | | ** |
| ☞ d. ka.(ní.bal)\| | | | | * | * |
| e. ka.ni.(bál)\| | | *! | | | ** |

Cases of supermarked stress as in (15a) require an additional lexically indexed constraint that gives preference to feet that are not word-final. This constraint rules out a candidate such as i.peɾ.(βá.ton)|, with a word-final binary foot, in favor of i.(péɾ.βa).ton|, in which the foot is both binary and non-final.

Although some of their constraints and representations differ from those assumed by Roca (2006), Lleó and Arias (2006) propose an OT analysis of stress patterns from Spanish first-language acquisition. They show how stages in the acquisition of stress are accounted for in terms of different rankings of the same set of universal constraints, which provides a simpler account of developmental stress patterns than do parametric rule-based frameworks. They also present evidence in favor of the syllabic trochee as the unmarked foot pattern in Spanish, which agrees with Roca's use of the TROCHEE constraint.

## 2.4. THE INTERFACE OF MORPHOLOGY AND PHONOLOGY IN /s/-ASPIRATION

Another staple topic in Spanish phonology is /s/-aspiration, whereby /s/ is realized as the glottal fricative [h] in coda position (18a). In some dialects, this rule shows evidence of opacity in prevocalic contexts, where the relevant segment is no longer in the syllable coda due to

resyllabification. Rule-based accounts (e.g. Hualde 1989a, 1991) view this opacity as evidence that morphological operations interact with rules of syllabification and /s/-aspiration at different levels within the derivation. For speakers who pronounce prefix-final /s/ as [h] before vowels (18b), aspiration applies at Level 1 in the lexical component after suffixation and syllabification, when /s/ is still in the coda. Prefixation and resyllabification at Level 2 then move [h] into the following onset. For speakers who maintain prefix-final /s/ as [s] before vowels (18c), aspiration applies at Level 2 after prefixation and resyllabification. Since /s/ is already in the onset, it is unaffected by the coda aspiration rule. Speakers of both varieties also aspirate word-final prevocalic /s/ (18d) because coda aspiration at either Level 1 or 2 in the lexical component necessarily targets word-final /s/, and resyllabification in the postlexical component then moves [h] into the following onset. Rule ordering makes it possible to account for the overapplication of coda /s/-aspiration and provides strong evidence in favor of rules, derivations, and ordered levels.

| | | | | | |
|---|---|---|---|---|---|
| (18) | a. | /d̪es+t̪apaɾ/ | [d̪eh.t̪a.paɾ] | *destapar* | ‘to uncover’ |
| | | /mes/ | [meh] | *mes* | ‘month’ |
| | b. | /d̪es+etʃo/ | [d̪e.he.tʃo] | *deshecho* | ‘undone’ |
| | c. | /d̪es+etʃo/ | [d̪e.se.tʃo] | | |
| | d. | /mes asul/ | [me.ha.sul] | *mes azul* | ‘blue month’ |

In OT, the opacity of /s/-aspiration can be explained in a parallel, constraint-based model without intermediate derivational steps or ordered levels (Baković 1998, Colina 2002, 2009b: 77-86, Kenstowicz 1997, Wiltshire 2006). In its original conception, faithfulness in OT involves a

comparison of corresponding input and output forms. One subtheory within OT is **output-output (OO) faithfulness,** which extends the notion of correspondence to include related output forms, e.g. a base and a reduplicant, a base and a morphologically-derived form, the isolation and phrasal forms of a word, etc. (Benua 1995, 1997/2000, McCarthy and Prince 1995, Kenstowicz 1997).

Crucial to Colina's analysis of opaque /s/-aspiration is an OO-faithfulness constraint, IDENTITY-PRWD, which requires that "prosodic words have only one output form in all contexts" (Colina 2009b: 78). A markedness constraint against coda [s] favors aspiration in syllable-final contexts (18a). For speakers who aspirate word-final prevocalic /s/ (18d), IDENTITY-PRWD is ranked high enough to favor aspiration in prevocalic contexts. Variation in the realization of prefix-final segments is accounted for by a difference in the prosodic representation of prefixes. Speakers who aspirate prefix-final /s/ before vowels (18b) adjoin prefixes to the prosodic word, which creates a recursive PrWd category and allows IDENTITY-PRWD to favor aspiration. Speakers who maintain prefix-final /s/ before vowels (18c) incorporate prefixes directly into the PrWd, where onset [s] is the optimal realization.[4]

A key advantage of the OO-faithfulness analysis is that it explains why variation is observed with respect to prefixation (and compounding) but never suffixation, e.g. *meses* [me.seh], *[me.heh] 'months'. A rule-based account must stipulate that the domain of syllabification is smaller than the word, excluding prefixes but including suffixes, to ensure that coda aspiration does not apply to stems. In Colina's analysis, the failure of aspiration in stem-final prevocalic contexts is explained by the fact that suffixes are never adjoined to the prosodic word and, therefore, fall outside the purview of IDENTITY-PRWD.

For an overview of other aspects of Spanish morphophonology, including many analyses couched within OT, see Colina (2011).

## *3. Contributions of Spanish Phonology to OT*

While insights from OT have shed light on the nature of Spanish phonology, crucial data from Spanish varieties have also contributed to the development of models and subtheories within OT. This section examines two examples from the literature on Spanish rhotics.

### 3.1. DISPERSION THEORY

Spanish has two rhotic segments, the tap /ɾ/ and trill /r/, which are phonologically contrastive only in word-medial intervocalic position (19a). Only the trill appears in other syllable-initial contexts, after coda consonants (19b) and word-initially (19c). The tap appears in complex onsets (19d), and there is stylistic and dialectal variation between the tap and trill in coda position (19e).

| | | | | |
|---|---|---|---|---|
| (19) | a. | ka.ɾo | *caro* | ‘expensive’ |
| | | ka.ro | *carro* | ‘car’ |
| | b. | on.ra | *honra* | ‘honor’ |
| | | al.re.ð̞e.ð̞oɾ | *alrededor* | ‘around’ |
| | | suβ.ra.ʝaɾ | *subrayar* | ‘to underscore’ |
| | c. | ro.sa | *rosa* | ‘rose’ |

d. pɾe.sjo *precio* ‘price’

e. paɾ.t̪e ~ par.t̪e *parte* ‘part’

The most widely accepted rule-based analysis (Harris 1983, 2001, 2002, Núñez Cedeño 1994) treats the intervocalic trill as an underlying geminate tap and derives all surface trills from underlying taps by a series of rules. The main argument for the geminate representation is that it explains why the rhotic contrast is limited to intervocalic position, since this is the only context where /ɾɾ/ can be properly syllabified. In the derivation of *carro,* underlying /kaɾɾo/ is first syllabified as kaɾ.ɾo, the second tap becomes a trill by a rule of postconsonantal strengthening, and the first tap is deleted, leaving [ka.ro] as the surface representation. One argument against the geminate representation is that Spanish otherwise lacks a phonological length distinction between singleton and geminate segments within the morpheme. Another drawback is that separate rules are needed to account for syllable-initial strengthening in postconsonantal (19b) and word-initial (19c) positions. Harris (2002) acknowledges that “the disjunction reflects the difficulty of stating formally the generalization that [r] is obligatory in syllable-initial position *except after a vowel”* (84-5) and accepts the disjunction as a mere “idiosyncratic wrinkle” (105) in the phonological grammar of Spanish. For an overview of arguments for and against the geminate representation, see Baković (2009) and Bradley (2006d).

Following similar work on Catalan by Padgett (2003b/2009), Bradley (2006d) proposes a constraint-based account of Spanish syllable-initial rhotics that avoids these drawbacks and provides further evidence for perceptual constraints in phonology. Both Padgett and Bradley

couch their analyses within **Dispersion Theory** (DT; Flemming 1995/2002, Padgett 2003a,c), a version of OT that uses perceptually-based constraints on contrast. In standard OT, single input-output mappings are evaluated to optimize single words as outputs. In DT, contrast is a systemic notion requiring evaluation not of isolated forms but of the larger system of contrasts in which those forms exist. An important type of DT constraint is **systemic markedness,** which seeks to maximize the perceptual distinctiveness of surface contrasts. In the DT analysis of rhotics, a systemic markedness constraint requires words that differ in tap versus trill to differ at least as much as the rhotics do when they appear between vowels. This constraint, represented here as SPACE(R/V_V), formalizes the hypothesis that duration-based contrasts are best perceived in intervocalic position. An additional constraint, σ[r, accounts for the preference of the trill, a perceptually salient segment, to appear in a phonologically strong position, the syllable onset. Both SPACE(R/V_V) and σ[r are perceptually-based constraints, but only the former is systemic, evaluating potentially contrasting output words.

In tableau (20), the input contains two words that form a minimal pair, *caro* versus *carro,* and subscripts are used to show whether the contrast is maintained or neutralized in the output. The intervocalic contrast in (20a) satisfies high-ranking SPACE(R/V_V), and faithfulness rules out neutralization in (20b,c).

(20) Maintenance of rhotic contrast in word-medial intervocalic position

| | /kaɾo$_1$ karo$_2$/ | SPACE(R/V_V) | FAITH(R) | σ[r |
|---|---|---|---|---|
| ☞ a. | ka.ɾo$_1$ ka.ro$_2$ | | | * |
| b. | ka.ɾo$_{1,2}$ | | *! | * |
| c. | ka.ro$_{1,2}$ | | *! | |

The tableaux in (21) give the analysis of syllable-initial trills in non-intervocalic contexts, as in *honra* and *rosa.* Candidates (21a,d) fatally violate SPACE(R/V_V) because they attempt a contrast outside of the perceptually optimal intervocalic position. The neutralization candidates are tied on faithfulness, so the decision is passed to lower-ranking σ[r, which favors neutralization to the syllable-initial trill in (21c,f).

(21) Neutralization to syllable-initial trill in non-intervocalic position

| | /onɾa$_1$ onra$_2$/ | SPACE(R/V_V) | FAITH(R) | σ[r |
|---|---|---|---|---|
| a. | on.ɾa$_1$ on.ra$_2$ | *! | | * |
| b. | on.ɾa$_{1,2}$ | | * | *! |
| ☞ c. | on.ra$_{1,2}$ | | * | |

| | /ɾosa$_1$ rosa$_2$/ | SPACE(R/V_V) | FAITH(R) | σ[r |
|---|---|---|---|---|
| d. | ɾo.sa$_1$ ro.sa$_2$ | *! | | * |
| e. | ɾo.sa$_{1,2}$ | | * | *! |
| ☞ f. | ro.sa$_{1,2}$ | | * | |

In the DT analysis, SPACE(R/V_V) explains why the rhotic contrast is limited to intervocalic position, without having to posit a geminate representation for a language that otherwise lacks morpheme-internal geminates. In any event, richness of the base requires an OT analysis to consider non-geminate /r/ as a possible input segment. Another advantage is that the DT analysis better explains the generalization that syllable-initial rhotics are trills except after a vowel, where trills contrast with taps. The unmarked preference for trills is expressed by a single constraint, σ[r, whereas a rule-based analysis must posit separate rules for postconsonantal and word-initial contexts. More recently, Colina (2009b:89-95, 2010) offers a two-phoneme account of Spanish

rhotics couched within standard OT, without perceptually-based constraints. She argues for a diachronic explanation of the intervocalic contrast, whereby the Latin geminate tap evolved into a singleton trill when Spanish lost geminates. Her analysis uses two separate constraints to get word-initial and postconsonantal trills, analogously to Harris (1983, 2001, 2002). The advantage of the DT analysis is that both contexts are unified under a single markedness constraint.

### 3.2. GESTURAL OT

In Spanish, a vocalic fragment, or **intrusive vowel,** of variable duration appears between the tap /ɾ/ and an adjacent consonant (22a) but is not found with other consonants, such as laterals (22b). The transcriptions in (22a) are more narrow than those in (19d,e), which omit the intrusive vowel.

| | | | | |
|---|---|---|---|---|
| (22) | a. | pᵉrésjo ~ perésjo | *precio* | 'price' |
| | | párᵃt̬e ~ párat̬e | *parte* | 'part' |
| | b. | plát̬a | *plata* | 'silver' |
| | | álma | *alma* | 'soul' |

While intrusive vowels in Spanish appear only with /ɾ/, languages vary with respect to the consonants that trigger vowel intrusion. A cross-linguistic survey by Hall (2003) reveals the implicational hierarchy shown in (23), whereby vowel intrusion is observed more often with liquids than with other sonorants, and more often with rhotics than laterals, except the alveolar

trill. In a given language, if a particular class of consonants triggers vowel intrusion in clusters, then so do all classes to the right.

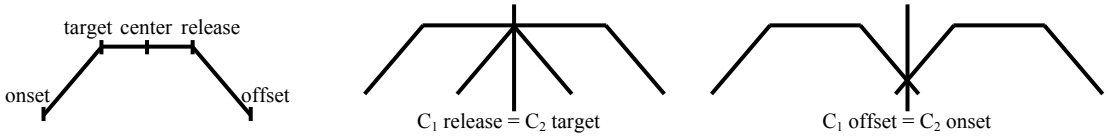
(23) Vowel intrusion triggers (Hall 2003: 28)

obstruents, if ever > other approximants, nasals > [r] > [l] > [ɾ], [ʁ] > gutturals

Among nasals: m > n

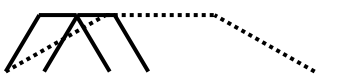
Research on vowel intrusion has contributed to the development of models that combine OT with the gestural representations of **Articulatory Phonology** (AP; Browman and Goldstein 1989, 1990). See Hall (2010) for an overview of AP. For early work on gestural OT in languages other than Spanish, see Bradley (2002, 2007b), Cho (1998), Davidson (2003), Gafos (2002), Hall (2003). In AP, the grammar is assumed to operate on abstract **articulatory gestures,** which are dynamically defined in both space and time to produce a constriction in the vocal tract. Gafos (2002) proposes that OT alignment constraints can make reference to gestural landmarks, shown in (24a), and that cross-linguistic differences in articulatory timing can be formalized as constraint interaction. For example, languages with close transition between adjacent consonants give priority to a constraint that aligns the release of the oral gesture of $C_1$ with the target of the oral gesture of $C_2$, as in (24b). Languages with open transition favor lesser degrees of gestural overlap, as in (24c), where the offset of $C_1$ is aligned with the onset of $C_2$.

(24) a. Gestural landmarks b. Close transition c. Open transition



AP provides an explanatory phonetic account of vowel intrusion, in which an overlapping vowel gesture is heard during the open transition between two consonants (Bradley 1999, Hall 2003, 2006, Steriade 1990). In Bradley's (2006c) analysis of Spanish complex onsets, the typology in (23) is formalized as a universal ranking of alignment constraints favoring open transition in [CC] clusters, with each constraint relativized to a different consonant class.[5] An alignment constraint favoring close transition ranks below the constraint that favors open transition in [Cr] but above the constraint that favors open transition in [Cl]. In tableau (25), output candidates pair different gestural alignments in /CCV/ demisyllables with the percepts they give rise to. The ranking ensures open transition with vowel intrusion in (25a) but close transition without vowel intrusion in (25d). The variability of intrusive vowel duration suggests that gestural alignment constraints might specify a range of landmarks, allowing for gradient coordination. See Bradley (2006c) for a more complete account of phonetic variation in /Cɾ/ clusters across Spanish dialects, including the assibilation and devoicing of /ɾ/ and the retraction of preceding dental stops.

(25) Open transition and vowel intrusion in /pɾ/ onsets versus close transition in /pl/[6]

| | ALIGN (C, OFFSET, /ɾ/, ONSET) | ALIGN ($C_1$, RELEASE, $C_2$, TARGET) | ALIGN (C, OFFSET, /l/, ONSET) |
|---|---|---|---|
| ☞ a.  [ p e ɾ e ] | | * | |
| b.  [ p ɹ̥ e ] | *! | | |
| c.  [ p a l a ] | | *! | |
| ☞ d.  [ p l a ] | | | * |

One argument for representing vowel intrusion as an effect of gestural alignment instead of phonological vowel epenthesis is that intrusive vowels are invisible to phonological processes that count segments (Hall 2003, 2006; cf. Colantoni and Steele 2007, who propose an OT analysis treating intrusive vowels as epenthetic segments). For example, if the intrusive vowel appearing in the /Cɾ/ clusters of Spanish proparoxytones such as *kilómetro* 'kilometer' and *demócrata* 'democrat' were to create a new syllable, then stress would fall outside the three-syllable window: *[ki.ló.me.t̪o.ɾo], *[de.mó.ka.ɾa.t̪a] (Bradley 2006c: 30). If the intrusive vowel is instead the result of non-overlapping consonant gestures, then it lacks segmental status and is predicted to be invisible to the constraints that govern stress placement. The Spanish data, therefore, support a unified model of phonology in which both gestures and segments coexist in the same representation but are governed by different alignment constraints (Hall 2003).

*4. Areas for Ongoing Research*

**Derivational versions of OT.** In the original formulation of OT, the **Generator** (GEN) is free to produce any number of modifications of the input form, including none at all, and the **Evaluator** (EVAL) determines which output form is optimal depending on the ranking of constraints. Conventional OT assumes a parallel model in which underlying forms are mapped to surface forms in a single pass through GEN and EVAL without intermediate derivational steps. Derivational versions of OT assume a series of input-output mappings, produced either by constraint hierarchies organized in different strata or by multiple passes through GEN and EVAL. In Stratal OT (Bermúdez-Otero 1999, 2003, 2006, Kiparsky 2000, 2003), morphosyntactic domains invoke separate constraint rankings, with the output of one ranking serving as input to the next. Other researchers combine DT constraints with a distinction between lexical and postlexical strata (Bradley 2005a, Bradley and Delforge 2006, Padgett 2003b/2009). OT with candidate chains (OT-CC; McCarthy 2007a) is a derivational model in which inputs and outputs are connected by a chain of intermediate forms, with chains competing against each other as candidates in EVAL. In Harmonic Serialism (HS; McCarthy 2010), input-output mappings involve multiple passes through the GEN-EVAL loop. The implications of OT-CC and HS for Spanish phonology remain largely unexplored, although see Cabrera-Callís, Pons-Moll, and Torres-Tamarit (2010) and Torres-Tamarit, Pons-Moll, and Cabrera-Callís (2012) for an HS analysis of rhotic metathesis in Catalan, a language closely related to Spanish.

**Variation and frequency effects in OT.** A basic OT analysis involves selecting the best output candidate from a set of competitors, yet natural human language typically shows variability as a function of sociolinguistic, stylistic, and/or usage-based factors such as frequency. Formal analyses and usage-based accounts are often seen as incompatible in the

literature, but there is a growing body of research that explores ways of incorporating variation and frequency effects into formal phonological analysis (Boersma and Hayes 2001, Coetzee 2009). In a viewpoint paper on the role of variation in mental grammars, Colina (2008) stresses the need for a greater alliance between variationist and OT approaches. Relatively few OT analyses of Spanish (Díaz-Campos and Colina 2006, Gabriel 2010, Holt 2004, Morris 1998) have attempted to formalize phonological variation, so further research is clearly called for.

**Laboratory phonology and OT.** It is not uncommon to find analyses in the generative literature based on impressionistic and/or introspective data or on phonetic or dictionary transcriptions. The contemporary research approach known as **laboratory phonology (LabPhon)** emphasizes the use of experimental methodologies to reevaluate phonological descriptions of impressionistic and introspective data and to question the psychological reality of generalizations made on the basis of such data (Bradley 2014, Cohn 2010, Kawahara 2011). Achieving descriptive adequacy is an important goal for any linguistic framework, including OT. Future experimental work should empirically investigate the data used and the claims made by many analysts of Spanish phonology working within OT. In turn, future OT studies ideally should be informed by rigorous, empirically-based investigations backed up by experimental data.

Recent LabPhon work has revealed the non-categorical nature of Spanish spirantization, in which allophones vary gradiently along a continuum of constriction degrees and as a function of vowel context and stress (Cole, Iskarous, and Hualde 1999, Hualde, Simonet, and Nadeu 2011, Ortega-Llebaria 2004). These findings challenge an OT analysis such as the one illustrated in Section 2.1, which assumes a complementary distribution between two basic allophones. One implication is that the analysis needs to allow for greater degrees of phonetic detail in the

representation of continuancy. See Kirchner (1998/2001) on the role of gradient phonetic representations and effort reduction constraints in an OT approach to lenition, and Piñeros (2002) for a phonetically-based OT account of Spanish voiced obstruents.

Other LabPhon work has reconsidered the psychological reality of generative accounts of Spanish stress assignment and quantity sensitivity (Alvord 2003, Bárkányi 2002, Eddington 2004, Face 2000, 2003). The emerging consensus is that stress is computed not by generative rules or constraints but by analogy with similar forms stored in the lexicon. One argument against a lexicalist approach comes from Lleó and Arias (2006), who point out that children acquiring Spanish as a first language make errors in stress placement whereby the trochaic foot pattern is overgeneralized to some iambic-shaped words. "A lexical approach fails to account for the occurrence of systematic stress errors or, in more general terms, deviations of the target adult pattern, since it renders it virtually impossible to learn a lexical entry without its correct stress specification" (Lleó and Arias 2006: 491). Instead, they interpret stress errors as overgeneralizations of an OT algorithm for stress assignment that favors the syllabic trochee as the unmarked prosodic pattern.

**The phonetic grounding of markedness constraints.** An important goal of research in OT phonology is to figure out what the constraints on human sound systems are and where they come from. Markedness constraints are commonly assumed to be part of our innate genetic endowment, but another possibility is that we learn them from experience on the basis of linguistic input. Whatever their source, the constraints employed in an OT analysis should ideally have wide cross-linguistic support and be grounded in phonetic facts of speech production, perception, or processing. In **phonetically-based OT** (Gordon 2007, Hayes 1999, Hayes and Steriade 2004), phonological analyses make use of ranked and violable constraints but

incorporate more phonetic detail than is usually included in conventional OT or traditional generative accounts. The analyses described in the preceding section are examples combining OT constraints with perceptual (Section 3.1) and articulatory (Section 3.2) aspects of phonetic detail. Another example of phonetically-based OT is Steriade's (1997) use of licensing by cue, in which constraint hierarchies on phonological features are based not on syllable structure but on the availability of perceptual cues across different phonetic contexts. Both phonetically-based OT and LabPhon share a greater emphasis on phonetic detail, but the use of LabPhon methodologies does not require an OT analysis to be phonetically-based. For example, Gerfen (2001) uses acoustic data on obstruent neutralization in East Andalusian Spanish to support an OT analysis that invokes syllable structure instead of direct reference to phonetic cues. On the other hand, the use of experimental data by OT practitioners is sometimes viewed with skepticism by laboratory phonologists (see Morrison's 2005 and Romero's 2006 reviews of Hayes, Kirchner, and Steriade 2004 and of Face 2004, respectively, in which several phonetically-based OT analyses are supported with data and insights from experimental investigation). However, the combination of OT formalism and experimental methodology is inevitable and, in any event, necessary to bridge the gap that has traditionally existed between theoretical and empirical approaches to phonology. As Cohn (2010: 11) points out, "the central goals of better dialog across boundaries, better integration of methodology, better collaboration have remained the hallmarks of LabPhon." Colina (2008: 444) argues that "experimental, quantitative and variationist studies need to formalize the results of their research ... and propose grammars that generate the variable patterns described, as well as their interaction with non-variable patterns."

*Notes*

[1] There is some evidence that in Spanish the fricative /f/ belongs to the same sonority level as stops, given their behavior with respect to complex onset formation (see Martínez-Gil 2001).

[2] In tableau (8), a candidate such as kɾe.s̪j̪[o] would be ruled out by a high-ranking constraint not shown here, requiring a maximal sonority distance between the members of an onset cluster (see Colina 2006c: 183, 2009b: 27-28).

[3] Since faithfulness and alignment are not crucially ranked with respect to each other, their constraint columns are separated by a broken line instead of a solid one.

[4] Baković (1998) and Kenstowicz (1997) also use OO-faithfulness in their analyses of Spanish /s/-aspiration. Wiltshire (2006) does not make use of OO-faithfulness, but she does assume a recursive PrWd structure in the representation of prefixes.

[5] This proposal differs from Hall (2003: 28-30), who posits a hierarchy of constraints penalizing the overlap of different types of consonant gestures by a tautosyllabic vowel gesture.

[6] The consonant gestures of the complex onset are shown as solid lines, while dotted lines represent the vowel gesture on which the consonant gestures are superimposed.

*Bibliography of OT in Spanish Phonology*

**Prosody and Syllable Structure**

Archangeli, Diana. 1997. Optimality Theory: an introduction to linguistics in the 1990s. *Optimality Theory: an overview,* ed. by Diana Archangeli and D. Terence Langendoen, 1-32. Malden, MA: Blackwell.

Bradley, Travis G. 2006a. Contrast and markedness in complex onset phonotactics. *Southwest Journal of Linguistics* 25.29-58. (Available on Rutgers Optimality Archive, ROA-808)

Bradley, Travis G. 2009. On the syllabification of prevocalic /w/ in Judeo-Spanish. *Romance linguistics 2007: selected papers from the 37th Linguistic Symposium on Romance Languages (LSRL),* ed. by Pascual J. Masullo, Erin O'Rourke, and Chia-Hui Huang, 51-67. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-962).

Colina, Sonia. 1995. A constraint-based approach to syllabification in Spanish, Galician, and Catalan. Urbana-Champaign, IL: University of Illinois thesis.

Colina, Sonia. 1997. Identity constraints and Spanish resyllabification. *Lingua* 103.1-23.

Colina, Sonia. 2006c. Optimality-theoretic advances in our understanding of Spanish syllable structure. *Optimality-theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 172-204. Amsterdam: John Benjamins.

Colina, Sonia. 2009b. *Spanish phonology: a syllabic perspective.* Washington, D.C.: Georgetown University Press.

Gabriel, Christoph. 2006. Focal pitch accents and subject positions in Spanish: comparing close-to-standard varieties and Argentinean Porteño. *Speech Prosody 2006 (Studientexte zur Sprachkommunikation 40),* ed. by Rüdiger Hoffman and Hansjörg Mixdorff. Dresden:

TUDpress Verlag der Wissenschaften. (Available on Rutgers Optimality Archive, ROA-826).

Gabriel, Christoph. 2010. On focus, prosody, and word order in Argentinean Spanish: a minimalist OT account. *Revista virtual de estudos a linguagem - ReVEL* 8.183-222. (Available at http://www.revel.inf.br/files/artigos/revel_special_4_on_focus_prosody_and_word_order.pdf ).

Gutiérrez-Bravo, Rodrigo. 2002. Focus, word order variation, and intonation in Spanish and English. *Romance phonology and variation,* ed. by Carolina R. Wiltshire and Joaquim Camps, 39-53. Amsterdam: John Benjamins.

Gutiérrez-Bravo, Rodrigo. 2005. Subject inversion in Spanish relative clauses: a case of prosody-induced word order variation without narrow focus. *Romance languages and linguistic theory 2003,* ed. by Twan Geerts and Haike Jacobs, 115-28. Amsterdam: John Benjamins. (Available at http://gutierrez-bravo.net/subj_inv.pdf).

Lleó, Conxita. 2003. Some interactions between word, foot, and syllable structure in the history of Spanish. *Optimality Theory and language change,* ed. by D. Eric Holt, 249-83. Dordrecht, the Netherlands: Kluwer Academic Publishers.

Morales-Front, Alfonso. 1994. A constraint-based approach to Spanish phonology. Urbana-Champaign, IL: University of Illinois thesis.

Morales-Front, Alfonso. 1999. El acento y la optimidad. *Fonología generativa contemporánea de la lengua española,* ed. by Rafael Núñez Cedeño and Alfonso Morales-Front, 251-76. Washington, D.C.: Georgetown University Press.

Piñeros, Carlos-Eduardo. 2000c. Vowel weightlessness and stress retraction in Spanish. Iowa City: University of Iowa, ms. (Available on Rutgers Optimality Archive, ROA-427).

Prieto, Pilar. 2006. Phonological phrasing in Spanish. *Optimality-theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 39-61. Amsterdam: John Benjamins.

Rao, Rajiv. 2007a. On the phonological phrasing in the Spanish of Lima, Perú. *Southwest Journal of Linguistics* 26.81-111.

Rao, Rajiv. 2007b. Phonological phrasing in Barcelona Spanish. *Proceedings of the 34th Western Conference on Linguistics,* ed. by Erin Bainbridge and Brian Agbayani, 345-60. Fresno, CA: Department of Linguistics, California State University, Fresno.

Roca, Iggy. 1997. There are no "glides", at least in Spanish: an optimality account. *Probus* 9.233-65.

Roca, Iggy. 2006. The Spanish stress window. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 239-77. Amsterdam: John Benjamins.

Shepherd, Michael. 2003. Constraint interactions in Spanish phonotactics: an Optimality Theory analysis of syllable-level phenomena in the Spanish language. Northridge, CA: California State University thesis. (Available on Rutgers Optimality Archive, ROA-639).

**Segmental Phonology**

Baker, Gary K., and Caroline R. Wiltshire. 2003. An OT treatment of palatal fortition in Argentinian Spanish. *Romance linguistics: theory and acquisition,* ed. by Ana Teresa Pérez-Leroux and Yves Roberge, 33-48. Amsterdam: John Benjamins.

Baković, Eric. 1994. Strong onsets and Spanish fortition. *Proceedings of the 6th student conference in linguistics (SCIL 6),* ed. by Chris Giordano and Daniel Ardron, 21-39. Cambridge, MA: MIT Working Papers in Linguistics. (Available on Rutgers Optimality Archive, ROA-96).

Baković, Eric. 1998. Spanish codas and overapplication. *Romance linguistics: theoretical perspectives,* ed. by Armin Schwegler, Bernard Tranel, and Miriam Uribe-Etxebarria, 13-23. Amsterdam: John Benjamins. (Available at http://works.bepress.com/ebakovic/6).

Baković, Eric. 2000. Nasal place neutralization in Spanish. *Proceedings of the 24th Annual Penn Linguistics Colloquium,* ed. by Michelle Minnick Fox, Alexander Williams, and Elsi Kaiser, 1-12. Philadelphia, PA: University of Pennsylvania. (Available on Rutgers Optimality Archive, ROA-386).

Baković, Eric. 2006. Hiatus resolution and incomplete identity. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 62-73. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-813).

Baković, Eric. 2007. A revised typology of opaque generalisations. *Phonology* 24.217-59. (Available at: http://works.bepress.com/ebakovic/20).

Bradley, Travis G. 2001a. A typology of rhotic duration contrast and neutralization. *Proceedings of the North East Linguistics Society (NELS) 31,* ed. by Minjoo Kim and Uri Strauss, 79-97. Amherst, MA: Graduate Linguistic Student Association. (Available on Rutgers Optimality Archive, ROA-436).

Bradley, Travis G. 2001b. The phonetics and phonology of rhotic duration contrast and neutralization. University Park, PA: Pennsylvania State University thesis. (Available on Rutgers Optimality Archive, ROA-473).

Bradley, Travis G. 2004. Gestural timing and rhotic variation in Spanish codas. *Laboratory approaches to Spanish phonology,* ed. by Timothy L. Face, 197-224. Berlin: Mouton de Gruyter. (Available at http://spanish.ucdavis.edu/tgbradley).

Bradley, Travis G. 2005a. Sibilant voicing in Highland Ecuadorian Spanish. *Lingua(gem)* 2:9-42. (Available on Rutgers Optimality Archive, ROA-783).

Bradley, Travis G. 2005b. Systemic markedness and phonetic detail in phonology. *Experimental and theoretical approaches to Romance linguistics,* ed. by Randall Gess and Ed Rubin,41-62. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-768).

Bradley, Travis G. 2006c. Spanish complex onsets and the phonetics-phonology interface. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 15-38. Amsterdam: John Benjamins. (Available at http://spanish.ucdavis.edu/tgbradley).

Bradley, Travis G. 2006d. Spanish rhotics and Dominican hypercorrect /s/. *Probus* 18.1-33. (Available on Rutgers Optimality Archive, ROA-640).

Bradley, Travis G. 2007c. Prosodically-conditioned sibilant voicing in Balkan Judeo-Spanish. *Proceedings of the 34th Western Conference on Linguistics,* ed. by Erin Bainbridge and Brian Agbayani, 48-60. Fresno, CA: Department of Linguistics, California State University, Fresno. (Available at http://spanish.ucdavis.edu/tgbradley).

Bradley, Travis G., and Benjamin S. Schmeiser. 2003. On the phonetic reality of /ɾ/ in Spanish complex onsets. *Theory, practice, and acquisition: papers from the 6th Hispanic Linguistics Symposium and the 5th Conference on the Acquisition of Spanish and Portuguese,* ed. by

Paula M. Kempchinsky and Carlos-Eduardo Piñeros, 1-20. Somerville, MA: Cascadilla Press. (Available at http://spanish.ucdavis.edu/tgbradley).

Cabré, Teresa, and Pilar Prieto. 2006. Exceptional hiatuses in Spanish. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 205-38. Amsterdam: John Benjamins. (Available at http://prosodia.upf.edu/home/arxiu/publicacions/cabre/cabre_exceptional_hiatuses_spanish.pdf).

Colantoni, Laura, and Jeffrey Steele. 2007. Voicing-dependent cluster simplification asymmetries in Spanish and French. *Segmental and prosodic issues in Romance phonology,* ed. by Pilar Prieto, Joan Mascaró, and Maria-Josep Solé, 109-29. Amsterdam: John Benjamins.

Colina, Sonia. 1999. Reexamining Spanish glides: analogically conditioned variation in vocoid sequences in Spanish dialects. *Advances in Hispanic linguistics: papers from the second Hispanic Linguistics Symposium,* ed. by Javier Gutiérrez-Rexach and Fernando Martínez-Gil, 72-98. Somerville, MA: Cascadilla Press.

Colina, Sonia. 2002. An account of inter and intradialectal variation in Spanish /s/ aspiration. *Structure meaning and acquisition in Spanish: papers from the 4th Hispanic Linguistics Symposium,* ed. by James Lee, Kimberly Geeslin, and J. Clancy Clements, 230-43. Somerville, MA: Cascadilla Press.

Colina, Sonia. 2009a. Sibilant voicing in Ecuadorian Spanish. *Studies in Hispanic and Lusophone Linguistics* 2.3-29.

Colina, Sonia. 2010. Rhotics in Spanish: a new look at an old problem. *Selected Proceedings of the 12th Hispanic Linguistics Symposium,* ed. by Claudia Borgonovo, Manuel Español-

Echevarría, and Philippe Prévost, 75-86. Somerville, MA: Cascadilla Proceedings Project. (Available at http://www.lingref.com/cpp/hls/12/abstract2407.html)

Delforge, Ann Marie. 2008. Gestural alignment constraints and unstressed vowel devoicing in Andean Spanish. *Proceedings of the 26th West Coast Conference on Formal Linguistics,* ed. by Charles B. Chang and Hannah J. Haynie, 147-55. Somerville, MA: Cascadilla Proceedings Project. (Available at http://www.lingref.com/cpp/wccfl/26/abstract1667.html).

Face, Timothy L. 2002. Re-examining Spanish "resyllabification." *Current issues in Romance languages: selected papers from the 29th Linguistic Symposium on Romance Languages (LSRL),* ed. by Teresa Satterfield, Christina Tortora, and Diana Cresti, 81-94. Amsterdam: John Benjamins.

González, Carolina. 2006. Constraint re-raking in three grammars: spirantization and coda devoicing in Peninsular Spanish. *New perspectives on Romance linguistics, vol. II: phonetics, phonology, and dialectology,* ed. by Jean-Pierre Montreuil, 97-111. Amsterdam: John Benjamins.

Kochetov, Alexei, and Laura Colantoni. 2011. Place vs. stricture in Spanish nasal assimilation. *West Coast Conference on Formal Linguistics 28 online proceedings*. (Available at https://sites.google.com/site/wccfl28pro/kochetov-colantoni).

Lipski, John. 1999. The many faces of Spanish /s/-weakening: (re)alignment and ambisyllabicity. *Advances in Hispanic linguistics,* ed. by Javier Gutiérrez-Rexach and Fernando Martínez-Gil, 198-213. Somerville, MA: Cascadilla Press. (Available at http://www.personal.psu.edu/jml34/sfaces.pdf).

Lloret, Maria-Rosa, and Joan Mascaró. 2006. Depalatalization in Spanish revisited. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 74-98. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-708).

Martínez-Gil, Fernando. 1997. Obstruent vocalization in Chilean Spanish: a series versus a constraint-based approach. *Probus* 9.165-200.

Martínez-Gil, Fernando. 2003b. Resolving ordering paradoxes of serial derivations: an Optimality-theoretical account of the interaction of spirantization and voicing assimilation in Peninsular Spanish. *Theory, practice, and acquisition: papers from the 6th Hispanic Linguistics Symposium and the 5th Conference on the Acquisition of Spanish and Portuguese,* ed. by Paula Kempchinsky and Carlos-Eduardo Piñeros, 40-67. Somerville, MA: Cascadilla Press.

Martínez-Gil, Fernando. 2006. Upstepping vowel height: a constraint-based account of metaphony in Proto-Spanish and Lena Asturian. *Optimality-theoretic studies in Spanish phonology*, ed. by Fernando Martínez-Gil and Sonia Colina, 99-145. Amsterdam: John Benjamins.

Morris, Richard. 2000. Constraint interaction in Spanish /s/-aspiration: three Peninsular varieties. *Hispanic linguistics at the turn of the millennium: papers from the third Hispanic Linguistics Symposium,* ed. by Héctor Campos, Elena Herburger, Alfonso Morales-Front, and Thomas J. Walsh, 14-30. Somerville, MA: Cascadilla Press. (Available on Rutgers Optimality Archive, ROA-391).

Morris, Richard. 2002. Coda obstruents and local constraint conjunction in north-central Peninsular Spanish. *Current issues in Romance languages: selected papers from the 29th Linguistic Symposium on Romance Languages (LSRL),* ed. by Diana Cresti, Teresa

Satterfield & Cristina Tortora, 207-223. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-383).

Padgett, Jaye. 2003b. Systemic contrast and Catalan rhotics. Santa Cruz: University of California, ms. (Available on Rutgers Optimality Archive, ROA-574).

Padgett, Jaye. 2009. Systemic contrast and Catalan rhotics. *The Linguistic Review* 26.431-63.

Piñeros, Carlos-Eduardo. 2001. Segment-to-syllable alignment and vocalization in Chilean Spanish. *Lingua* 111.163-88. (Available on Rutgers Optimality Archive, ROA-408).

Piñeros, Carlos-Eduardo. 2002. Markedness and laziness in Spanish obstruents. *Lingua* 112.379-413. (Available on Rutgers Optimality Archive, ROA-399).

Piñeros, Carlos-Eduardo. 2005. Syllabic-consonant formation in Traditional New Mexico Spanish. *Probus* 17.253-301. (Available on Rutgers Optimality Archive, ROA-635).

Piñeros, Carlos-Eduardo. 2006. The phonology of nasal consonants in five Spanish dialects. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 146-71. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-670).

Roca, Iggy. 2005. Strata, yes; structure preservation, no: evidence from Spanish. *Romance languages and linguistic theory 2003,* ed. by Twan Geerts and Haike Jacobs, 197-218. Amsterdam: John Benjamins.

Wiltshire, Caroline. 2002. Variation in Spanish aspiration and prosodic boundary constraints. *Current issues in Romance languages: selected papers from the 29th Linguistic Symposium on Romance Languages (LSRL),* ed. by Teresa Satterfield, Christina Tortora, and Diana Cresti, 375-89. Amsterdam: John Benjamins.

Wiltshire, Caroline. 2006. Prefix boundaries in Spanish varieties: a non-derivational OT account. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 358-77. Amsterdam: John Benjamins.

**Morphology-phonology Interface**

Bermúdez-Otero, Ricardo. 2006. Morphological structure and phonological domains in Spanish denominal derivation. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 278-311. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-766).

Bonet, Eulàlia. 2006. Gender allomorphy and epenthesis in Spanish. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 312-38. Amsterdam: John Benjamins.

Bradley, Travis G., and Jason Smith. 2011. The phonology-morphology interface in Judeo-Spanish diminutive formation: a lexical ordering and subcategorization approach. *Studies in Hispanic and Lusophone Linguistics* 4.2, 247-300.

Colina, Sonia. 1996. Spanish noun truncation: the emergence of the unmarked. *Linguistics* 43.1199-218.

Colina, Sonia. 2003. Diminutives in Spanish: a morphophonological account. *The Southwest Journal of Linguistics* 22.45-88.

Colina, Sonia. 2006a. No “double plurals” in Dominican Spanish: an optimality-theoretic account. *Linguistics* 44.541-68.

Colina, Sonia. 2006b. Output-to-output correspondence and the emergence of the unmarked in Spanish plural formation. *New perspectives on Romance linguistics, vol. II: phonetics,*

*phonology, and dialectology,* ed. by Jean-Pierre Montreuil, 49-63. Amsterdam: John Benjamins.

Elordieta, Gorka, and Maria M. Carreira. 1996. An optimality theoretic analysis of Spanish diminutives. *Proceedings from the main session of the Chicago Linguistic Society's 32nd Meeting,* ed. by Lise M. Dobrin, Kora Singer, and Lisa McNair, 49-60. Chicago: Chicago Linguistic Society.

Elsman, Minta, and D. Eric Holt. 2009. When small words collide: morphological reduction and phonological compensation in Old Leonese contractions. *Little words: their history, phonology, syntax, semantics, pragmatics, and acquisition,* ed. by Ronald Leow, Héctor Campos, and Donna Lardiere, 21-33. Washington, D.C.: Georgetown University Press. (Available online at http://people.cas.sc.edu/deholt01/papers/Elsman_and_Holt_GURT_2007.pdf).

Felíu, Elena. 2001. Output constraints on two Spanish word creation processes. *Linguistics* 39.871-91.

Holt, D. Eric. 2000. Comparative Optimality-Theoretic dialectology: singular/plural nasal alternations in Galician, Mirandese (Leonese) and Spanish. *Hispanic linguistics at the turn of the millennium: papers from the third Hispanic Linguistics Symposium,* ed. by Héctor Campos, Elena Herburger, Alfonso Morales-Front, and Thomas J. Walsh, 125-43. Somerville, MA: Cascadilla Press. (Available at http://people.cas.sc.edu/deholt01/papers/Holt_HLS3_GU_2000.pdf).

Miranda Miranda, Inés. 1999. An optimality theoretic analysis of Nicaraguan Spanish diminutivization: results of a field survey. Seattle, WA: University of Washington thesis.

Morris, Richard. 2005. Attraction to the unmarked in Old Spanish leveling. *Selected proceedings of the 7th Hispanic Linguistics Symposium,* ed. by David Eddington, 180-91. Somerville, MA: Cascadilla Proceedings Project. (Available at http://www.lingref.com/cpp/hls/7/abstract1097.html).

Moyna, Irene, and Caroline Wiltshire. 2000. Spanish plurals: why [s] isn't always optimal. *Hispanic linguistics at the turn of the millennium: papers from the third Hispanic Linguistics Symposium,* ed. by Héctor Campos, Elena Herburger, Alfonso Morales-Front, and Thomas J. Walsh, 31-48. Somerville, MA: Cascadilla Press.

Piñeros, Carlos-Eduardo. 1999a. Head dependence in Jerigonza, a Spanish-language game. *Advances in Hispanic linguistics: papers from the second Hispanic Linguistics Symposium,* ed. by Javier Gutiérrez-Rexach and Fernando Martínez-Gil, 265-77. Somerville, MA: Cascadilla Press. (Available on Rutgers Optimality Archive, ROA-305).

Piñeros, Carlos-Eduardo. 1999b. Prosodic morphology in Spanish: constraint interaction in word-formation. Columbus, OH: Ohio State University thesis. (Available on Rutgers Optimality Archive, ROA-272).

Piñeros, Carlos-Eduardo. 2000a. Foot-sensitive word minimization in Spanish. *Probus* 12.291-324. (Available on Rutgers Optimality Archive, ROA-308).

Piñeros, Carlos-Eduardo. 2000b. Prosodic and segmental unmarkedness in Spanish truncation. *Linguistics* 38.63-98. (Available on Rutgers Optimality Archive, ROA-332).

Piñeros, Carlos-Eduardo. 2004. The creation of portmanteaus in the extragrammatical morphology of Spanish. *Probus* 16.203-40. (Available on Rutgers Optimality Archive, ROA-526).

Roca, Iggy. 1996. Phonology-morphology interface in Spanish plural formation: an optimality analysis. *Interfaces in phonology,* ed. by Ursula Kleinhenz, 210-30. Berlin: Akademie Verlag.

Roca, Iggy. 2010. Theme vowel allomorphy in Spanish verb inflection: an autosegmental optimality account. *Lingua* 120.408-34.

Roca, Iggy, and Elena Felíu. 2003. Morphology in truncation: the role of the Spanish desinence. *Yearbook of morphology 2002,* ed. by Geert Booij and Jaap van Marle, 187-243. Dordrecht: Kluwer.

Saltarelli, Mario. 2006. A paradigm account of Spanish number. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 339-57. Amsterdam: John Benjamins.

Stephenson, Tamina. 2004. Declensional-type classes in derivational morphology: Spanish diminutives revisited. MIT, ms. (Available at http://dl.dropbox.com/u/4484634/2004/Phon-Genls/paper.pdf).

**Phonological Variation and Sound Change**

Baker, Gary K. 2006. Duration, voice, and dispersion in stop contrasts from Latin to Spanish. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 399-423. Amsterdam: John Benjamins.

Bradley, Travis G. 2006b. Metathesis in Judeo-Spanish consonant clusters. *Selected Proceedings of the 9th Hispanic Linguistics Symposium,* ed. by Nuria Sagarra and Almeida Jacqueline Toribio, 79-90. Somerville, MA: Cascadilla Proceedings Project. (Available at http://www.lingref.com/cpp/hls/9/abstract1368.html).

Bradley, Travis G. 2007a. Constraints on the metathesis of sonorant consonants in Judeo-Spanish. *Probus* 19.171-207. (Available at http://spanish.ucdavis.edu/tgbradley).

Bradley, Travis G. 2011a. Mid front vowel lowering before rhotics in Ibero-Romance. *Romance Linguistics 2010: Selected Papers from the 40th Linguistic Symposium on Romance Languages (LSRL),* ed. By Julia Herschensohn, 63-78. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-1136).

Bradley, Travis G., and Ann Marie Delforge. 2006. Systemic contrast and the diachrony of Spanish sibilant voicing. *Historical Romance linguistics: retrospective and perspectives,* ed. by Randall Gess and Deborah Arteaga, 19-52. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-634).

Díaz-Campos, Manuel, and Sonia Colina. 2006. The interaction between faithfulness constraints and sociolinguistic variation: the acquisition of phonological variation in first language speakers. *Optimality-theoretic studies in Spanish phonology,* ed. by Sonia Colina and Fernando Martínez-Gil, 424-46. Amsterdam: John Benjamins.

Gutiérrez-Rexach, Javier. 2006. Sonority scales and syllable structure: toward a formal account of phonological change. *Optimality-Theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 447-69. Amsterdam: John Benjamins.

Holt, D. Eric. 1998. The role of comprehension, reinterpretation and the Uniformity Condition in historical change: the case of the development of *Cl* clusters from Latin to Hispano-Romance. *Proceedings of the 26th Western Conference on Linguistics (WECOL) 1996,* ed. by Vida Samiian, 133-48. Fresno, CA: Department of Linguistics, California State University, Fresno. (Available at http://people.cas.sc.edu/deholt01/papers/Holt_WECOL_1996.pdf).

Holt, D. Eric. 1999. The moraic status of consonants from Latin to Hispano-Romance: the case of obstruents. *Advances in Hispanic linguistics: papers from the second Hispanic Linguistics Symposium,* ed. by Javier Gutiérrez-Rexach and Fernando Martínez-Gil, 166-81. Somerville, MA: Cascadilla Press. (Available at http://people.cas.sc.edu/deholt01/papers/Holt_HLS2_OSU_1999.pdf).

Holt, D. Eric. 2003. The emergence of palatal sonorants and alternating diphthongs in Hispano-Romance. *Optimality Theory and language change,* ed. by D. Eric Holt, 285-305. Dordrecht, the Netherlands: Kluwer Academic Publishers. (Available at http://people.cas.sc.edu/deholt01/papers/Holt OTLC 2003 chapter.pdf).

Holt, D. Eric. 2004. Optimization of syllable contact in Old Spanish via the sporadic sound change metathesis. *Probus* 16.43-61. (Available at http://people.cas.sc.edu/deholt01/papers/Holt_Probus_16_2004.pdf).

Holt, D. Eric. 2006. Optimality Theory and language change in Spanish. *Optimality-Theoretic studies in Spanish phonology*, ed. by Fernando Martínez-Gil and Sonia Colina, 378-96. Amsterdam: John Benjamins. (Available at http://people.cas.sc.edu/deholt01/papers/Holt_2007.pdf).

Lief, Eric Adler. 2006. Syncope in Spanish and Portuguese: the diachrony of Hispano-Romance phonotactics. Ithaca, NY: Cornell University thesis. (Available on Rutgers Optimality Archive, ROA-935).

Martínez-Gil, Fernando. 2003a. Consonant intrusion in heterosyllabic consonant-liquid clusters in Old Spanish and Old French: an optimality theoretical account. *A Romance perspective on language knowledge and use: selected papers from the 31st Linguistic Symposium on*

*Romance Languages (LSRL),* ed. by Richard Cameron, Luis López, and Rafael Núñez-Cedeño, 39-58. Amsterdam: John Benjamins.

Russell Webb, Eric, and Travis G. Bradley. 2009. Rhotic metathesis asymmetries in Romance: formalizing the effects of articulation and perception on sound change. *Romance linguistics 2007: selected papers from the 37th Linguistic Symposium on Romance Languages (LSRL),* ed. by Pascual J. Masullo, Erin O'Rourke, and Chia-Hui Huang, 321-37. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-963).

**Acquisition of First-language Phonology**

Barlow, Jessica. 2003a. Asymmetries in the acquisition of consonant clusters in Spanish. *Canadian Journal of Linguistics* 48.179-210.

Barlow, Jessica. 2005. Sonority effects in the production of consonant clusters by Spanish-speaking children. *Selected proceedings from the 6th Conference on the Acquisition of Spanish and Portuguese as First and Second Languages,* ed. by David Eddington, 1-14. Somerville, MA: Cascadilla Proceedings Project.

Barlow, Jessica. 2006. Constraint conflict in the acquisition of clusters in Spanish. *Optimality-theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 523-48. Amsterdam: John Benjamins.

Lleó, Conxita. 2006. The acquisition of prosodic word structures in Spanish by monolingual and Spanish-German bilingual children. *Language and Speech* 49.205-29.

Lleó, Conxita, and Javier Arias. 2006. Foot, word and phrase constraints in first language acquisition of Spanish stress. *Optimality-theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 472-96. Amsterdam: John Benjamins.

Lleó, Conxita, and Javier Arias. 2009. The role of weight-by-position in the prosodic development of Spanish and German. *Phonological domains: universals and deviations,* ed. by Janet Grijzenhout and Bariş Kabak, 221-48. Amsterdam: John Benjamins.

Morales-Front, Alfonso. 2006. Acquisition of syllable structure in Spanish. *Optimality-theoretic studies in Spanish phonology,* ed. by Fernando Martínez-Gil and Sonia Colina, 497-524. Amsterdam: John Benjamins.

*Additional Works Cited*

Alvord, Scott. 2003. The psychological unreality of quantity sensitivity in Spanish. *Southwest Journal of Linguistics* 22.2-12.

Archangeli, Diana, and D. Terence Langendoen. (eds.) 1997. *Optimality Theory: an overview.* Malden, MA: Blackwell.

Baković, Eric. 2009. Abstractness and motivation in phonological theory. *Studies in Hispanic and Lusophone Linguistics* 2.183-98. (Available at: http://works.bepress.com/ebakovic/21).

Bárkányi, Zsuzsanna. 2002. A fresh look at quantity sensitivity in Spanish. *Linguistics* 40.375-94.

Barlow, Jessica. 2003b. The stop-spirant alternation in Spanish: converging evidence for a fortition account. *Southwest Journal of Linguistics* 22.51-86.

Benua, Laura. 1995. Identity effects in morphological truncation. *University of Massachusetts occasional papers in linguistics 18: papers in Optimality Theory,* ed. by Jill Beckman, Laura Walsh, and Suzanne Urbanczyk, 77-136. Amherst, MA: Graduate Linguistic Student Association. (Available on Rutgers Optimality Archive, ROA-74).

Benua, Laura. 1997. Transderivational identity: phonological relations between words. Amherst, MA: University of Massachusetts thesis. (Available on Rutgers Optimality Archive, ROA-259).

Benua, Laura. 2000. *Phonological relations between words.* New York: Garland.

Bermúdez-Otero, Ricardo. 1999. Constraint interaction in language change: quantity in English and Germanic. Manchester and Santiago de Compostela: University of Manchester and Universidad de Santiago de Compostela thesis. (Available at http://www.bermudez-otero.com/PhD.pdf).

Bermúdez-Otero, Ricardo. 2003. The acquisition of phonological opacity. *Variation within Optimality Theory: proceedings of the Stockholm workshop on 'Variation within Optimality Theory',* ed. by Jennifer Spenader, Anders Eriksson and Östen Dahl, 25-36. Stockholm: Department of Linguistics, Stockholm University. (Available on Rutgers Optimality Archive, ROA-593).

Boersma, Paul, and Bruce Hayes. 2001. Empirical tests of the gradual learning algorithm. *Linguistic Inquiry* 32.45-86.

Bradley, Travis G. 1999. Assibilation in Ecuadorian Spanish: a phonology-phonetics account. *Formal perspectives on Romance Linguistics,* ed. by J.-M. Authier, B.E. Bullock and L.A. Reed, 57-71. Amsterdam: John Benjamins.

Bradley, Travis G. 2002. Gestural timing and derived environment effects in Norwegian clusters. *West Coast Conference on Formal Linguistics 21 Proceedings,* ed. by Line Mikkelsen and Christopher Potts, 43-56. Somerville, MA: Cascadilla Press. (Available at http://spanish.ucdavis.edu/tgbradley).

Bradley, Travis G. 2007b. Morphological derived-environment effects in gestural coordination: a case study of Norwegian clusters. Lingua 117.950-85. (Available at http://www.escholarship.org/uc/item/5mn3w7gz).

Bradley, Travis G. 2011b. Review of Spanish Phonology: A Syllabic Perspective. *Studies in Hispanic and Lusophone Linguistics* 4.1, 117-23.

Bradley, Travis G. 2014. Fonología de laboratorio. *Fonología generativa contemporánea de la lengua española (2ª edición),* ed. by Rafael Núñez Cedeño, Sonia Colina, and Travis G. Bradley, ch. 10. Washington, D.C.: Georgetown University Press.

Browman, Catherine P., and Louis Goldstein. 1989. Articulatory gestures as phonological units. *Phonology* 6.201-51.

Browman, Catherine P., and Louis Goldstein. 1990. Tiers in Articulatory Phonology, with some implications for casual speech. *Papers in laboratory phonology I: between the grammar and physics of speech,* ed. by John Kingston and Mary Beckman, 341-97. Cambridge: Cambridge University Press.

Cabrera-Callís, Maria, Clàudia Pons-Moll, and Francesc-Josep Torres-Tamarit. 2010. *Left is more: rhotic metathesis in Algherese Catalan.* Paper presented at the 20th Colloquium on Generative Grammar, Universitat Pompeu Fabra, Barcelona, 2010. (Available on Rutgers Optimality Archive, ROA-1100).

Cho, Taehong. 1998. Intergestural timing and overlap in Korean palatalization. Los Angeles, CA: UCLA thesis.

Coetzee, Andries W. 2009. Phonological variation and lexical frequency. *Proceedings of the North East Linguistics Society (NELS) 38,* ed. by Anisa Schardl, Martin Walkow, and

Muhammad Abdurrahman, 189-202. Amherst: Graduate Linguistic Student Association. (Available on Rutgers Optimality Archive, ROA-952).

Cohn, Abigail C. 2010. Laboratory phonology: past successes and current questions, challenges, and goals. *Laboratory phonology X,* ed. by Cécile Fougeron, Barbara Kühnert, Mariapaola D'Imperio, and Nathalie Vallée, 3-30. Berlin/New York: Mouton de Gruyter.

Cole, Jennifer, José Ignacio Hualde, and Khalil Iskarous. 1999. Effects of prosodic and segmental context on /g/-lenition in Spanish. *Proceedings of the 4th International Linguistics and Phonetics Conferences,* ed. by Osamu Fujimura, Brian Joseph, and Bohumil Palek, 575-89. Prague: The Karolinum Press, Charles University in Prague.

Colina, Sonia. 2008. The role of language variation in mental grammars: an optimality-theoretic perspective. *Studies in Hispanic and Lusophone Linguistics* 1.435-46.

Colina, Sonia. 2011. Spanish morphophonology. *Studies in Hispanic and Lusophone Linguistics* 4.1, 173-91.

Colina, Sonia. 2014. La teoría de la optimidad en la fonología del español. *Fonología generativa contemporánea de la lengua española (2ª edición),* ed. by Rafael Núñez Cedeño, Sonia Colina, and Travis G. Bradley, ch. 9. Washington, D.C.: Georgetown University Press.

Davidson, Lisa. 2003. The atoms of phonological representation: gestures, coordination and perceptual features in consonant cluster phonotactics. Baltimore, MD: Johns Hopkins University thesis.

Eddington, David. 2004. A computational approach to resolving certain issues in Spanish stress placement. *Laboratory approaches to Spanish phonology,* ed. by Timothy L. Face, 95-115. Berlin: Mouton de Gruyter.

Face, Timothy L. 2000. The role of syllable weight in the perception of Spanish stress. *Hispanic linguistics at the turn of the millennium,* ed. by Héctor Campos, Elena Herburger, Alfonso Morales-Front, and Thomas J. Walsh, 1-13. Somerville, MA: Cascadilla.

Face, Timothy L. 2003. Where is stress? Synchronic and diachronic Spanish evidence. *Theory, Practice, and Acquisition,* ed. by Paula Kempchinsky and Carlos-Eduardo Piñeros, 21-39. Somerville, MA: Cascadilla Press.

Face, Timothy L. (ed.) 2004. *Laboratory approaches to Spanish phonology.* Berlin: Mouton de Gruyter. (Available on Rutgers Optimality Archive, ROA-291).

Flemming, Edward. 1995. Auditory representations in phonology. Los Angeles, CA: UCLA thesis.

Flemming, Edward. 2002. Auditory representations in phonology. New York: Garland.

Gafos, Adamantios. 2002. A grammar of gestural coordination. *Natural Language and Linguistic Theory* 20.269-337. (Available on Rutgers Optimality Archive, ROA-462).

Gerfen, Chip. 2001. A critical view of licensing by cue: codas and obstruents in Eastern Andalusian Spanish. *Segmental phonology in Optimality Theory: constraints and representations,* ed. by Linda Lombardi, 183-205. Cambridge: Cambridge University Press.

Gordon, Matthew. 2007. Typology in Optimality Theory. *Language and Linguistics Compass* 1.750-69.

Hall, Nancy. 2003. Gestures and segments: vowel intrusion as overlap. Amherst, MA: University of Massachusetts thesis. (Available on Rutgers Optimality Archive, ROA-637).

Hall, Nancy, 2006. Cross-linguistic patterns of vowel intrusion. *Phonology* 23.387-429.

Hall, Nancy. 2010. Articulatory Phonology. *Language and Linguistics Compass* 4.818-30.

Harris, James. 1969. *Spanish phonology.* Cambridge, MA: MIT Press.

Harris, James. 1983. *Syllable structure and stress in Spanish.* Cambridge, MA: MIT Press.

Harris, James. 1984. Theories of phonological representation and nasal consonants in Spanish. *Papers from the XII Linguistic Symposium on Romance Languages,* ed. by Phillip Baldi, 153-68. Amsterdam: John Benjamins.

Harris, James, and Ellen Kaisse. 1999. Palatal vowels, glides and obstruents in Argentinian Spanish. *Phonology* 16.117-90.

Harris, James. 2001. Reflections on A Phonological Grammar of Spanish. *Features and interfaces in Romance,* ed. By Julia Herschensohn, Enrique Mallén, and Karen Zagona, 133-45. Amsterdam: John Benjamins.

Harris, James. 2002. Flaps, trills, and syllable structure in Spanish. *MIT Working Papers in Linguistics* 42.81-108.

Hayes, Bruce. 1999. Phonetically-driven phonology: the role of Optimality Theory and inductive grounding. *Functionalism and formalism in linguistics, vol. 1: general papers,* ed. by Michael Darnell, Edith Moravscik, Michael Noonan, Frederick Newmeyer, and Kathleen Wheatly, 243-85. Amsterdam: John Benjamins. (Available on Rutgers Optimality Archive, ROA-158).

Hayes, Bruce, Robert Kirchner, and Donca Steriade. (eds.) 2004. *Phonetically-based phonology.* Cambridge: Cambridge University Press.

Hayes, Bruce, and Donca Steriade. 2004. Introduction: the phonetic bases of phonological markedness. *Phonetically-based phonology,* ed. by Bruce Hayes, Robert Kirchner, and Donca Steriade, 1-33. Cambridge: Cambridge University Press. (Available at http://www.linguistics.ucla.edu/people/hayes/PBP/IntroToPBP.pdf).

Hualde, José Ignacio. 1989a. Silabeo y estructura morfémica en español. *Hispania* 72.821-32.

Hualde, José Ignacio. 1989b. Procesos consonánticos y estructuras geométricas en español. *Lingüística (Revista de la Asociación de Lingüística y Filología de la América Latina)* 1.7-44. (Reprinted, 2000, in *Panorama de la fonología española actual,* ed. by Juana Gil, 395-431. Madrid: Arco Libros.)

Hualde, José Ignacio. 1991. On Spanish syllabification. *Current studies in Spanish linguistics,* ed. by Hector Campos and Fernando Martínez-Gil, 475-93. Washington, D.C.: Georgetown University Press.

Hualde, José Ignacio, Miquel Simonet, and Marianna Nadeu. 2011. Consonant lenition and phonological recategorization. *Laboratory Phonology* 2.301-29.

Itô, Junko. 1989. A prosodic theory of epenthesis. *Natural Language and Linguistic Theory* 7.217-59.

Kager, René. 1999. *Optimality Theory.* Cambridge: Cambridge University Press.

Kawahara, Shigeto. 2011. Experimental approaches in theoretical phonology. *The Blackwell Companion to Phonology,* ed by Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume, and Keren Rice, 2283-303. Malden, MA: Wiley-Blackwell. (Available at www.rci.rutgers.edu/~kawahara/papers/companion-preproof.pdf).

Kenstowicz, Michael. 1997. Base identity and uniform exponence: alternatives to cyclicity. *Current trends in phonology: models and methods,* ed. by Jacques Durand and Bernard Laks, 363-94. Salford, UK: University of Salford Publications. (Available on Rutgers Optimality Archive, ROA-103).

Kiparsky, Paul. 2000. Opacity and cyclicity. *The Linguistic Review* 17.351-67. (Available online at http://www.stanford.edu/~kiparsky/Papers/vdhulst-ritter.pdf).

Kiparsky, Paul. 2003. Syllables and moras in Arabic. *The syllable in Optimality Theory,* ed. by Caroline Féry and Ruben van de Vijver. Cambridge: Cambridge University Press. (Available at http://www.stanford.edu/~kiparsky/Papers/syll.pdf).

Kirchner, Robert. 1998. An effort-based approach to consonant lenition. Los Angeles, CA: UCLA thesis. (Available on Rutgers Optimality Archive, ROA-276).

Kirchner, Robert. 2001. *An effort-based approach to consonant lenition.* New York, NY: Routledge.

Kisseberth, Charles. 1970. On the functional unity of phonological rules. *Linguistic Inquiry* 1.291-306.

Lewis, M. Paul. (ed.) 2009. *Ethnologue: languages of the world, sixteenth edition.* Dallas, TX: SIL International. (Available at http://www.ethnologue.com).

Lipski, John. 2008. Homeless in post-modern linguistics? (Re/Dis)placing Hispanic dialectology. *Studies in Hispanic and Lusophone Linguistics* 1.211-21.

Lozano, María del Carmen. 1979. *Stop and spirant alternations: fortition and spirantization processes in Spanish phonology.* Bloomington, IN: Indiana University Linguistics Club.

Martínez-Gil, Fernando. 1996. El principio de la distancia mínima de sonoridad y el problema de la vocalización consonántica en el español dialectal de Chile. *Hispanic Linguistics* 8.201-46.

Martínez-Gil, Fernando. 2001. Sonority as a primitive phonological feature. *Features and interfaces in Romance,* ed. By Julia Herschensohn, Enrique Mallén, and Karen Zagona, 203-22. Amsterdam: John Benjamins.

Martínez-Gil, Fernando, and Sonia Colina. (eds.) 2006. *Optimality-theoretic studies in Spanish phonology.* Amsterdam: John Benjamins.

Martínez-Gil, Fernando, and Alfonso Morales-Front. (eds.) 1997. *Issues in the phonology and morphology of the major Iberian languages.* Washington, D.C.: Georgetown University Press.

McCarthy, John. 2002. *A thematic guide to Optimality Theory.* Cambridge: Cambridge University Press.

McCarthy, John. 2007a. *Hidden generalizations.* London: Equinox.

McCarthy, John. 2007b. What is Optimality Theory? *Language and Linguistics Compass* 1.260-91.

McCarthy, John. 2008. *Doing Optimality Theory.* Malden, MA: Wiley-Blackwell.

McCarthy, John. 2010. An introduction to Harmonic Serialism. *Language and Linguistics Compass* 4.1001-18.

McCarthy, John, and Alan Prince. 1995. Faithfulness and reduplicative identity. *University of Massachusetts Occasional Papers in Linguistics 18*, ed. by Jill Beckman, Laura Walsh Dickey and Suzanne Urbanczyk, 249-384. Amherst, MA: Graduate Linguistic Student Association. (Available on Rutgers Optimality Archive, ROA-60).

Morris, Richard. 1998. Stylistic variation in Spanish phonology. Columbus, OH: Ohio State University thesis. (Available on Rutgers Optimality Archive, ROA-292).

Morrison, Geoff. 2005. Review of *Phonetically-based phonology,* ed. by . Bruce Hayes, Robert Kirchner, and Donca Steriade. Cambridge: Cambridge University Press. (Available at http://linguistlist.org/issues/16/16-1400.html).

Núñez Cedeño, Rafael. 1994. The alterability of Spanish geminates and its effects on the Uniform Applicability Condition. *Probus* 6.23-41.

Núñez Cedeño, Rafael, and Alfonso Morales-Front. (eds.) 1999. *Fonología generativa contemporánea de la lengua española.* Washington, D.C.: Georgetown University Press.

Núñez Cedeño, Rafael, Sonia Colina, and Travis G. Bradley. (eds.) 2014. *Fonología generativa contemporánea de la lengua española (2ª edición).* Washington, D.C.: Georgetown University Press.

Ortega-Llebaria, Marta. 2004. Interplay between phonetic and inventory constraints in the degree of spirantization of voiced stops: comparing intervocalic /b/ and intervocalic /g/ in Spanish and English. *Laboratory approaches to Spanish phonology,* ed. by Timothy L. Face, 237-55. Berlin: Mouton de Gruyter.

Padgett, Jaye. 2003a. Contrast and post-velar fronting in Russian. *Natural Language and Linguistic Theory* 21.39-87. (Available on Rutgers Optimality Archive, ROA-494).

Padgett, Jaye. 2003c. The emergence of contrastive palatalization in Russian. *Optimality Theory and language change,* ed. by D. Eric Holt, 307-35. Dordrecht, the Netherlands: Kluwer Academic Publishers. (Available at http://people.ucsc.edu/~padgett/locker/histpal.pdf).

Prince, Alan, and Paul Smolensky. 1993. Optimality Theory: constraint interaction in generative grammar. New Brunswick and Boulder: Rutgers University and University of Colorado, ms.

Prince, Alan, and Paul Smolensky. 2004. *Optimality Theory: constraint interaction in generative grammar.* Malden, MA: Blackwell.

Romero, Joaquín. 2006. Review of *Laboratory approaches to Spanish phonology,* ed. by Timothy L. Face. Berlin: Mouton de Gruyter. (Available at http://linguistlist.org/issues/17/17-359.html).

Steriade, Donca. 1990. Gestures and autosegments: comments on Browman and Goldstein's paper. *Papers in laboratory phonology I: between the grammar and physics of speech,* ed. by Mary Beckman and John Kingston, 382-97. Cambridge: Cambridge University Press.

Steriade, Donca. 1997. Phonetics in phonology: the case of laryngeal neutralization. Los Angeles: University of California, ms. (Available at: http://www.linguistics.ucla.edu/people/steriade/papers/phoneticsinphonology.pdf)

Torres-Tamarit, Francesc-Josep, Clàudia Pons-Moll, and Maria Cabrera-Callís. 2012. Rhotic metathesis in Algherese Catalan: a Harmonic Serialism account. *Selected Proceedings of the fourteenth Hispanic Linguistics Symposium,* ed. by Kimberly Geeslin and Manuel Díaz-Campos, 354-64. Somerville, MA: Cascadilla Proceedings Project. (Available at http://www.lingref.com/cpp/hls/14/abstract2677.html).