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Contrast and Markedness in Complex Onset Phonotactics

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Abstract

In many languages that permit coronal laterals to follow labial and velar stops in complex onsets, sequences of a coronal stop followed by a coronal lateral are prohibited. Standard accounts rule out coronal-lateral clusters as an effect of the Obligatory Contour Principle, but this approach cannot explain languages such as Mong Njua and Katu, which neutralize the coronal-velar place contrast but still allow the coronal-lateral clusters to appear. Recent work in Dispersion Theory (Flemming 1995, 2002, Padgett 2003a,b,c) has argued that Optimality Theory (Prince and Smolensky 1993/2004) must also include systemic constraints that evaluate phonological forms in the context of the larger system of contrasting forms in a language. This paper offers a new Dispersion-theoretic analysis of restrictions on onset clusters involving laterals. Systemic markedness constraints penalize indistinct coronal-velar contrasts in different pre-lateral contexts. Directionality of neutralization is determined by faithfulness constraints on input place, whose ranking can vary across languages and dialects (Hume 2003, Hume and Tserdandelis 2002). The proposed analysis solves problems with earlier accounts and also encompasses typological patterns from over forty languages, including velarization in early Romance sound change and Mexican Spanish loanword adaptations from Nahuatl.[*]

1. Introduction. In many languages that permit coronal laterals to follow labial and velar stops in complex onsets, sequences of a coronal stop followed by a coronal lateral are prohibited. For example, English allows the clusters in 1a,c but prohibits the coronal stop-lateral clusters in 1b.

(1) a. /pl/, /bl/ plead, bleed, plank, blank

b. */tl/, */dl/

c. /kl/, /gl/ clue, glue, class, glass

Standard generative analyses invoke similarity avoidance and formalize the restriction as an effect of the Obligatory Contour Principle (henceforth, OCP; Leben 1973, McCarthy 1986), which prohibits adjacent identical segmental specifications. The OCP bans the coronal-coronal clusters in 1b but allows clusters in which the initial stop is labial 1a or velar 1c. However, the OCP cannot account for languages in which coronal stop-lateral clusters occur either in free variation with or to the exclusion of velar stop-lateral clusters. In Mong Njua (Northern Thailand; Lyman 1974) and Katu (South Vietnam, Laos; Wallace 1969), the OCP-violating clusters themselves are not problematic. Rather, these languages prohibit a contrast between coronal and velar stops before laterals.

Flemming (1995, 2002) considers these restrictions as evidence for Dispersion Theory. In addition to the standard faithfulness and markedness constraints of Optimality Theory (Prince and Smolensky 1993/2004), Dispersion Theory also includes constraints that govern the well-formedness of phonological contrasts. These constraints are SYSTEMIC inasmuch as they evaluate phonological forms in the context of the larger system of contrasting forms in a language. In this paper, I develop an analysis of stop-lateral clusters within the version of Dispersion Theory elaborated by Padgett (2003a,b,c), which admits input representations and input-output faithfulness constraints. Furthermore, I adopt the proposal by Hume (2003) and Hume and

Tserdandelis (2002) that place markedness is not universal but can vary cross-linguistically. I argue that different patterns of place neutralization in stop-lateral clusters are determined by the interaction between systemic markedness (SPACE) constraints, which penalize indistinct coronal-velar contrasts in different segmental contexts, and MAX(PLACE) constraints, whose language-specific ranking determines the directionality of neutralization (i.e., to coronal, velar, or variably to both). I show how the proposed analysis avoids the problems faced by an alternative Dispersion-theoretic account, suggested by Flemming (1995, 2002), that appeals to perceptual distinctiveness of affricates. In addition, the analysis put forth here predicts that stop-lateral onset cluster phonotactics should follow independently attested place assimilation asymmetries in the language, which is substantiated on the basis of available data from English, Catalan, and Mong Njua.

The place neutralization account is further extended to cover data from Romance and other languages. First, no variety of Spanish allows /dl/ clusters, while only some varieties allow /tl/. Harris (1983) proposes dialect-specific filters against adjacent coronal noncontinuants, while Martínez-Gil (2001) and Gerlach (2004) suggest a possible analysis in terms of the OCP. These analyses fall short when the [+continuant] allophone [ð] of Spanish /d/ is taken into account, but such allophony is unproblematic for the Dispersion-theoretic analysis developed here. Since (i) the release burst of a stop provides significant cues to place of articulation, (ii) voiced stops have quieter bursts than voiceless stops, and (iii) voiced continuants have no audible burst, it follows that a [dl-gl] or [ðl-ɣl] contrast is less perceptible than a [tl-kl] contrast. This difference in perceptibility is captured by a universal ranking of SPACE constraints penalizing coronal-velar contrasts in different contexts, with permissible clusters determined by dialect-specific rankings of MAX(PLACE) constraints along the hierarchy. Because this approach does not require reference to continuancy specifications, it does not face the same problems as an OCP-based account of Spanish /dl/. Second, the proposed hierarchy makes typological predictions that extend beyond Spanish, which are confirmed on the basis of data from Tobin's (2002) survey of initial clusters in forty different language varieties. The significant generalization is that in a given language, the existence of a [dl-gl] contrast entails the existence of a [tl-kl] contrast, but not vice-versa. Finally, /tl/ often neutralizes to /kl/, as evidenced in early Romance sound change and in Mexican Spanish loanword adaptations from Nahuatl, although in some cases /tl/ is maintained or varies with /kl/. These patterns are accounted for by different rankings between faithfulness and systemic markedness constraints, lending further support to an analysis in terms of coronal-velar place neutralization.

This paper is organized as follows. Section 2 examines onset cluster data that are problematic for an OCP account and develops an analysis in terms of systemic markedness and MAX(PLACE) constraints. Section 3 further explores the inadequacies of an OCP account, with additional data from Spanish dialects. Section 4 examines the typological predictions of the novel Dispersion-theoretic analysis, while Section 5 extends the analysis to early Romance sound change and to Mexican Spanish loanword phonology. Section 6 summarizes the analysis and provides some concluding remarks on the issue of universal place markedness.

2. Perceptual distinctiveness and coronal-velar neutralization before laterals. There are at least two languages in which an OCP analysis cannot explain the distribution of coronal and velar stops before laterals in complex onset clusters. First, consider the Mong Njua data in 2, taken from Lyman (1974:30-32, 38). Coronal and velar stops vary non-contrastively before laterals in

2a, but no such variation is found involving the labials in 2b. Coronal and velar stops are contrastive before vowels, as shown in 2c.

(2) a. [klĕ ~ tlĕ] 'dog'

[k^{h}la ~ t^{h}la] 'to run; jump'

[ŋglua ~ ndlua] 'flash (as of lightning)'

[ŋk^{h}l ~ nt^{h}l] (no examples)

b. [pláŋ] 'stomach'

[p^{h}lu] 'cheek; face'

[mblôŋ] 'leaf'

[mp^{h}lái] '(finger-)ring'

c. [tău] 'to dam up water'

[kău] 'barking-deer'

Second, the Katu data in 3 show that coronal- and velar-lateral clusters do not coexist in the same dialect (Wallace 1969:72). Velar-lateral clusters in the An^{ʔ}di^{ʔ}êm dialect correspond to coronal-lateral clusters in the Phúhòa dialect. The former dialect lacks /tl,dl/, while the latter does not have /kl,gl/.

(3) a. [klâm] 'urinate' [gluh] 'go out' (An^{ʔ}di^{ʔ}êm)

b. [tlâm] [dluh] (Phúhòa)

The OCP cannot account for the data from Mong Njua in 2a because coronal stop-lateral clusters actually do occur, in free variation with velar stop-lateral clusters. Like English 1b, the An^{ʔ}di^{ʔ}êm dialect of Katu 3a has velar stop-lateral clusters but excludes clusters with an initial coronal stop. However, the OCP cannot explain the Phúhòa data in 3b, in which coronal stop-lateral clusters appear to the exclusion of velar stop-lateral clusters.

As Flemming (1995, 2002) argues, the data from Mong Njua and Katu suggest that indistinct coronal-velar place contrasts are problematic rather than the coronal-lateral sequences themselves. The formant transitions and release burst of an oral stop provide significant cues to place of articulation (Lieberman and Blumstein 1988, Olive et al. 1993, Stevens 1998). In oral stops that are released into a following lateral, coronal and velar constrictions are produced at or behind the lateral constriction. As a result, these stops are not well differentiated by their release bursts when coarticulated with a following lateral (Kawasaki 1982). The release bursts of labial stops are not affected by coarticulation in the same way because the labial constriction is formed in front of the lateral constriction. Flemming (2002:134) captures the similarity of coronal-lateral and velar-lateral clusters in terms of the auditory specifications shown in 4:

(4)

	[pl]	[tl]	[kl]
transitions:			
F2	1	3	3
burst:			
diffuse	+	–	–
noise frequency	2	4	4

In Flemming's system, auditory dimensions such as formant transitions and noise frequency are assumed to be multi-valued features, represented on a numerical scale. Diffuseness of stop bursts, however, is treated as a binary feature since quantifying degrees of 'peakedness' versus flatness of fricative spectra appears to be unmotivated (Flemming 2002:20). According to the auditory representations in 4, coronal and velar stops that are released into a following lateral have identical specifications for F2 transitions and for diffuseness and noise frequency of the burst. In the same context, labial stops remain distinct from both coronal and velar stops.

The increased similarity of coronal and velar stop release is visible in the acoustic analysis of American English data, shown in Figure 1 (Olive et al. 1993:284). F2 rapidly descends in the transition from [d] and [g] into the lateral, whereas the transition after [b] shows no discernible formant motion. In contrast to [dl], however, [gl] presents a lowered F3 in the transition from the stop into the lateral due to the velar pinch, or the convergence of the second and third formants that is typical of velars. Thus, while coronal and velar stops are not completely identical before laterals, due to the difference in F3 transition, the key observation here is that [bl] is more distinct from [dl] and [gl] than the latter two are from each other.

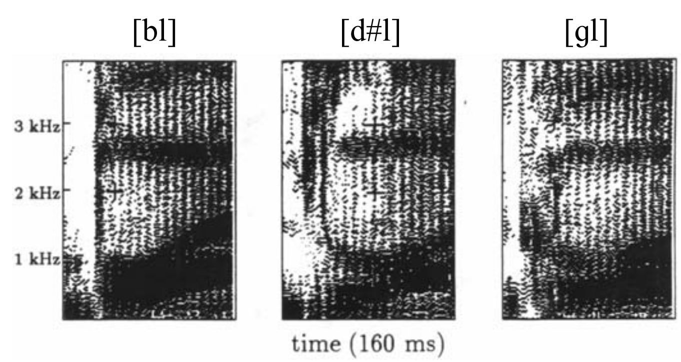

Figure 1: Spectrograms of American English voiced stop-lateral clusters (adapted from Olive, Greenwood, and Coleman 1993:284)

Flemming (1995, 2002) views these facts as evidence for Dispersion Theory (henceforth, DT), which incorporates the functionalist principles of Adaptive Dispersion Theory (Lindblom

1986, 1990) into Optimality Theory (henceforth, OT; Prince and Smolensky 1993/2004). DT has been subsequently developed in different directions by Itô and Mester (in press), Ní Chiosáin and Padgett (2001), Padgett (2003a,b,c), Padgett and Zygis (2003), and Sanders (2002, 2003). 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. Flemming's original formulation of DT is entirely surface-oriented, dispensing with URs and input-output faithfulness constraints altogether. However, for reasons to be made clear below, I adopt the version of DT elaborated by Padgett (2003a,b,c), which admits input-output mappings and faithfulness constraints.[1]

The relationship between standard OT constraints and systemic DT constraints is shown in Table 1. Standard markedness constraints penalize marked structures contained in an output form, while standard faithfulness constraints require corresponding input and output forms to be identical in certain respects. SPACE constraints are systemic markedness constraints that require contrasting output forms to be perceptually distinct along a given phonetic dimension. *MERGE is a systemic faithfulness constraint that requires distinct input forms to remain distinct in the output. Systemic markedness and standard faithfulness constraints will play a key role in the analysis to come. (See the references cited above for discussion and analyses involving other constraints, such as systemic faithfulness.)

	Markedness	Faithfulness
Standard	ONSET, WEIGHT-TO-SRESS, OBLIGATORY CONTOUR PRINCIPLE, etc.	MAX, DEP, IDENT, UNIFORMITY, INTEGRITY, LINEARITY, etc.
Systemic	SPACE	*MERGE

Table 1: Standard Optimality-theoretic constraints and systemic Dispersion-theoretic constraints (adapted from Itô and Mester, in press, and Padgett and Zygis 2003)

Consider the perceptibility scales in 5, which encode the perceptual distance between coronal and velar stops in two different contexts. Henceforth, ‘T’ and ‘K’ denote coronal and velar stops, respectively, whether voiced or voiceless. For reasons discussed above, the place contrast is more perceptually distinct when the stops appear before vowels in 5a than when the stops are released into a following lateral in 5b.

(5) a. [TV]..............................[KV] >

b. [TlV]...................[KlV]

Following Ní Chiosáin and Padgett (2001), Padgett (2003a,b,c), and Padgett and Zygis (2003), I assume that the forms under comparison here are highly idealized, abstracting away from vowel differences or other segments in the word. Since voiced and voiceless stops pattern together in the data from English, Mong Njua, and Katu, it is also feasible for the moment to abstract away from voicing distinctions in the stops (although see Section 4 for more on the role of stop voicing). For example, the idealized forms [TV] and [KV] in 5a correspond to actual words such as Mong Njua [tǎu] ‘to dam up water’ and [kǎu] ‘barking-deer’ in 2c. Idealized [TlV] and [KlV] in 5b correspond to the any of the pairs of non-contrastive variants in 2a, such as [ndlua ~ ŋglua] ‘flash’.

In the version of DT adopted here, SPACE constraints serve to maximize the perceptual distinctiveness of contrasts (Ní Chiosáin and Padgett 2001, Padgett 2003a,b,c, Padgett and Zygis 2003). The constraint in 6 requires coronal and velar stops to be at least as perceptually distinct as they are before vowels.

(6) SPACE(TV-KV)

Potential minimal pairs differing in coronal-velar place differ at least as much as coronal and velar stops do before vowels.

'Potential minimal pairs' are defined as any two idealized forms, all but one of whose corresponding segments are identical. 'Coronal-velar place' is a cover term denoting the auditory properties that distinguish coronal and velar stops, i.e., formant transitions and release burst. The constraint is satisfied by the perceptual spacing of the idealized minimal pair in 5a but is violated by the pair in 5b because the coronal-velar place contrast is less perceptible before laterals, as discussed above.

In order to satisfy the demands of perceptual distinctiveness, languages may choose to avoid the marked [Tl-Kl] contrast by neutralizing it to either member of the pair or by allowing both to surface in non-contrastive free variation. As an anonymous reviewer points out, the phonetic explanation surrounding 4 above adequately accounts for languages, such as Mong Njua, that allow free variation between coronal and velar stops before laterals. But if, in fact, in the pre-lateral context these stops are not well differentiated by their release bursts, then how do members of a given speech community come to agree on an invariable place of articulation in languages without variation in this context? Recall that coronals and velars are not completely identical when coarticulated with a following lateral, just less perceptually distinct (see the discussion surrounding Figure 1). I propose that the degree to which speakers attend to such differences is grammatically controlled. Specifically, the possible outcomes of coronal-velar neutralization are determined by different rankings of input-output faithfulness constraints on place of articulation, interacting with the systemic markedness (SPACE) constraint in 6. Following Padgett (1995), Lombardi (1998), and others, I assume the general constraint in 7, which can be decomposed into specific constraints relativized to each place feature.

(7) MAX(PLACE)

Every input PLACE feature has an output correspondent.

PLACE ∈ {LAB, COR, PAL, DOR}

Rather than assume a universal harmonic ranking of place markedness (Prince and Smolensky 1993/2004, Ch. 9; Lombardi 2002), I follow Hume (2003) and Hume and Tserdandelis (2002), who argue that place constraints are freely rankable in different languages and dialects. The outcomes of place neutralization in stop-lateral clusters can now be accounted for by different rankings of MAX(COR) and MAX(DOR), with the directionality of neutralization determined by the dominant constraint.

The most common pattern is that observed in English and in the Anˀdiˀêm dialect of Katu, in which velar stops are allowed before laterals but coronal stops are not. This pattern is captured by the ranking of MAX(DOR) » MAX(COR), illustrated in Tableau 1. In this and subsequent tableaux, idealized words are tagged with subscripts to indicate whether the contrast between input forms is maintained or neutralized in the output. For example, in output candidate a, input words TlV and KlV are maintained as separate contrasting forms. In candidates b and c, however, the input contrast is neutralized to TlV and to KlV, respectively. Since the systemic markedness constraint SPACE(TV-KV) is highly ranked in this grammar, the perceptually marked contrast in candidate a is ruled out. Dominant MAX(DOR) keeps the input velar stop from mapping to a coronal stop in the output in candidate b, thereby favoring neutralization to the velar in candidate c.

TlV$_1$ KlV$_2$	SPACE(TV-KV)	MAX(DOR)	MAX(COR)
a. TlV$_1$ KlV$_2$	*!		
b. TlV$_{1,2}$		*!	
☞ c. KlV$_{1,2}$			*

Tableau 1: Neutralization to velar stop before laterals

The opposite ranking of MAX(PLACE) constraints derives the pattern attested in the Phúhòa dialect of Katu, as shown in Tableau 2. Here, the input contrast is neutralized in favor of the coronal stop because high-ranking MAX(COR) rules out the coronal-to-velar mapping in candidate c. As seen in 3, coronal- and velar-lateral clusters do not coexist in the same dialect of Katu. This can be accounted for by dialect-specific rankings of faithfulness constraints. Before laterals, the Anˀdiˀêm dialect neutralizes the place contrast to velar, as illustrated in Tableau 1, while the Phúhòa dialect shows the opposite pattern in Tableau 2.

TlV$_1$ KlV$_2$	SPACE(TV-KV)	MAX(COR)	MAX(DOR)
a. TlV$_1$ KlV$_2$	*!		
☞ b. TlV$_{1,2}$			*
c. KlV$_{1,2}$		*!	

Tableau 2: Neutralization to coronal stop before laterals

Finally, Mong Njua chooses to avoid surface contrasts between coronal and velar stops before laterals but allows either input place to surface in the output, as in 2a. Tableau 3 shows that this pattern can be analyzed in terms of a variable ranking of MAX(PLACE) constraints

(Reynolds 1994, Kang 1997). The indistinct contrast in candidate a is avoided, and both candidates b and c are co-optimal. Since the input contrast is neutralized in both cases, the outputs are in non-contrastive free variation.

	TlV_1 KlV_2	SPACE(TV-KV)	MAX(COR)	MAX(DOR)
	a. TlV_1 KlV_2	*!		
☞	b. $TlV_{1,2}$			*
☞	c. $KlV_{1,2}$		*	

Tableau 3: Neutralization of coronal-velar stop contrast with free variation before laterals

Another way to avoid violation of SPACE(TV-KV) would be to map either the input velar or coronal stop to a labial stop in the output. However, the data in 2a,b show that in Mong Njua, surface [Pl] clusters do not participate in the free variation that [Tl] and [Kl] exhibit. Furthermore, only [Tl] and [Kl] clusters are in cross-dialectal correspondence in Katu, as shown in 3. I claim that input /Tl/ and /Kl/ readily undergo neutralization because they are perceptually more similar to each other than to labial-lateral clusters, as explained in 4 and the surrounding discussion. Mapping either input cluster to output [Pl] constitutes a greater deviation of identity and would entail an additional violation of the input-output faithfulness constraint in 8:

(8) IDENT(DIFFUSE)

Corresponding input and output stops are identical in the feature [diffuse].

Elaborating upon the analysis of Mong Njua free variation in Tableau 3 above, Tableau 4 gives a solution to the problem of unattested labialization. As seen in candidates b and c, MAX(DOR) alone cannot distinguish between the /Kl/ → [Pl] and the /Kl/ → [Tl] mappings. In both cases, the dorsal place feature of the input stop is not realized faithfully in the output, which violates MAX(DOR) once. The same holds true for input /Tl/ with respect to violations of

MAX(COR) in candidates d and e. Given the faithfulness constraint IDENT(DIFFUSE), which requires output stops to have identical specifications for the auditory feature [diffuse] as their input correspondents, labialization is ruled out. Because of their additional faithfulness violation, candidates b and d are harmonically bounded by (i.e., will always be less optimal than) candidates c and e, respectively—regardless of the ranking of IDENT(DIFFUSE) with respect to the MAX(PLACE) constraints.

	TlV$_1$ KlV$_2$	SPACE(TV-KV)	MAX(COR)	MAX(DOR)	IDENT(DIFFUSE)
	a. TlV$_1$ KlV$_2$	*!			
	b. TlV$_1$ PlV$_2$			*	*!
☞	c. TlV$_{1,2}$			*	
	d. PlV$_1$ KlV$_2$		*		*!
☞	e. KlV$_{1,2}$		*		

Tableau 4: Unattested labialization is ruled out by additional faithfulness violations

Let us consider an alternative systemic account of the patterns analyzed above. Flemming's original formulation of DT eschews input-output faithfulness constraints and does away with underlying representation altogether (see Flemming 2002:33-35). Without MAX(PLACE) constraints or some faithfulness equivalent, the outcome of place neutralization in stop-lateral clusters must be explained in some other fashion. Flemming suggests the possibility of different rankings of constraints requiring the neutralized stop to be perceptually distinct from other segments in the language. Since homorganic [Tl] is prone to affrication, this would enhance contrastiveness with [Pl] but might reduce distinctiveness from other affricates. However, this proposal seems counterintuitive given that Mong Njua has a relatively crowded space of no fewer than twelve affricates yet still permits [Tl] (Lyman 1974:34; Mortensen 2004:2). Conversely, English has only two affricates but still prefers [Kl].

Another problem with the systemic alternative has to do with the formal comparison of bisegmental [Tl] with monosegmental affricates. The evaluation of phonological contrast presupposes a definition of potential minimal pair that requires two idealized forms to have the same number of segments (see Ní Chiosáin and Padgett 2001, Padgett 2003a,b,c). This means that [tV], denoting a prevocalic voiceless coronal stop, forms a minimal pair with [t͡ʃV] in 9a, while [tlV] forms a separate minimal pair with [t͡ʃlV] in 9b. (Here, subscripts denote individual segments in correspondence.)

(9)	a.	t$_1$ V$_2$	b.	t$_1$ l$_2$ V$_3$	c.	t$_1$ l$_2$ V$_3$
		| |		| | |		
		t͡ʃ$_1$ V$_2$		t͡ʃ$_1$ l$_2$ V$_3$		t͡ʃ$_1$ V$_2$

A SPACE constraint evaluating the perceptual distinctiveness between an affricated [tl] cluster and a monosegmental affricate entails the comparison in 9b, in which each form has the same number of corresponding segments. However, such a comparison is problematic for languages that do not permit affricate-lateral clusters. SPACE would be vacuously satisfied by the comparison in 9c because [tlV] and [t͡ʃV] differ in the number segments and, therefore, do not constitute a potential minimal pair.

An account that incorporates freely rankable MAX(PLACE) constraints does not face the same problems because the directionality of coronal-velar neutralization is determined independently of the status of affricate segments. Moreover, such an account makes a novel prediction: the outcome of place neutralization in pre-lateral contexts will correspond to the unmarked pole of the coronal-velar opposition, as established by independently motivated place assimilation asymmetries in the language. That is, if there is independent evidence for a particular ranking of MAX(COR) and MAX(DOR) in a given language, then the same ranking should have consequences for the patterning of onset clusters involving laterals. Corroborating evidence comes from English and Catalan, in which coronal stops and nasals optionally assimilate to the place of articulation of a following consonant, while labials and velars fail to undergo assimilation (Avery and Rice 1989, Jun 1995, Mascaró 1976, Kiparsky 1985). In an analysis of Catalan, Herrick (2002) assumes the ranking of MAX(NONCORONAL) » MAX(CORONAL), with an intervening markedness constraint that drives place assimilation. The low ranking of MAX(CORONAL) explains why coronals pattern as unmarked targets in regressive place assimilation while noncoronals are resistant. Not surprisingly, Catalan chooses to avoid surface contrasts between [Tl] and [Kl] by sacrificing the input coronal. On the assumption that English has the same ranking, the restriction against coronal-lateral onset clusters is directly related to the fact that coronals, but not velars, are targeted in place assimilation elsewhere in the language. The alternative systemic account discussed above cannot make this connection, and the fact that coronal unmarkedness is observed in both phenomena would be simply accidental.

In Mong Njua, on the other hand, the only true consonant clusters are stop-lateral sequences (see Mortensen 2004:3 and references cited therein). Presumably, no independent basis exists on which to establish a fixed ranking between MAX(COR) and MAX(DOR), and as a result, Mong Njua allows either input place to surface in non-contrastive free variation. Finally, the ranking of MAX(COR) » MAX(DOR) proposed for the Phúhòa dialect of Katu in Tableau 2 predicts that velar stops should pattern as unmarked relative to coronals in place assimilation. As in Mong Njua, however, such evidence is hard to come by because consonant clusters are phonotactically rare (Wallace 1969:69-71). What this suggests is that in the absence of independent evidence favoring coronal or dorsal place markedness, languages may either treat both as equally unmarked, as in Mong Njua, or arbitrarily choose one over the other, as in the Katu dialects.

3. Against similarity avoidance. Replacing systemic markedness with an OCP-type constraint shows why similarity avoidance cannot account for Mong Njua and Katu: the analysis is incapable of generating neutralized [Tl] as an optimal output. Leben (1973) first proposed the OCP in order to explain distributional regularities in lexical tone systems. Subsequently, McCarthy (1986) modified the OCP to apply to nonlinear segmental phonology:

(10) Obligatory Contour Principle

At the melodic level, adjacent identical elements are prohibited.

OT approaches to the segmental OCP have incorporated some version of 10 as a violable constraint (see Bonet and Lloret 2002, Gerlach 2004, Myers 1997, and Yip 1998, among others). Others have analyzed OCP effects in terms of local constraint conjunction, whereby a markedness constraint against a feature or combination of features is conjoined with itself to prohibit multiple violations of the constraint in some local context (e.g., Alderete 1997, MacEachern 1999).[2] Since the formal implementation of 10 in OT terms is not at issue here, I simply adopt the constraint in 11:

(11) OCP(COR, −cont)

In an onset cluster, adjacent coronal noncontinuant segments are prohibited.

On the assumption that coronal laterals are noncontinuant, this constraint is violated by any output candidate that contains an onset cluster consisting of a coronal stop followed by a coronal lateral.

Consider Tableau 5, in which the OCP constraint is substituted for SPACE(TV-KV) without any particular ranking of MAX(PLACE) constraints. Candidate b is harmonically bounded by the other two candidates, as no ranking of the constraints can select neutralized [Tl] as the winner. Such an account predicts either a [Tl-Kl] contrast or neutralization to [Kl] but cannot generate the Mong Njua pattern of non-contrastive variation [Tl ~ Kl] or the Anˀdiˀêm Katu pattern of neutralization to [Tl]. The similarity avoidance approach fails because the OCP cannot distinguish between candidates a and b, both of which contain the problematic coronal-lateral sequence.

	TlV$_1$ KlV$_2$	MAX(COR)	MAX(DOR)	OCP(COR, −cont)
☞	a. TlV$_1$ KlV$_2$			*
	b. TlV$_{1,2}$		*	*!
☞	c. KlV$_{1,2}$	*		

Tableau 5: Similarity avoidance cannot select the neutralized coronal-lateral cluster

In contrast, the DT account proposed in Section 2 is capable of generating the Mong Njua and Katu patterns. Because SPACE(TV-KV) penalizes only the problematic place contrast in [Tl-Kl], the candidate with neutralized [Tl] is no longer harmonically bounded and can emerge as optimal under some ranking of the constraints. As shown in Tableau 2 and Tableau 3 above, neutralized [Tl] is chosen when SPACE(TV-KV) and MAX(COR) dominate MAX(DOR).

Another problem for an account based on 11 comes from Spanish and involves reference to the feature [continuant]. In Spanish, complex onsets consist of an obstruent /p, t, k, b, d, g, f/ followed by a liquid /l/ or /ɾ/, but there are exceptions involving clusters of a coronal stop followed by the lateral (Harris 1983:13-14, 20-22, 31-35, Harris and Kaisse 1999:125, Hualde 1991:481-483, 1999:171-172, Martínez-Gil 2001:208-209). Specifically, /dl/ is not a permissible onset cluster in any dialect. /tl/ does not occur word-initially in the patrimonial Spanish lexicon (i.e., lexical items inherited primarily from Vulgar Latin). Word-medially the cluster is found only in a few nonpatrimonial items such as *atlas* ‘atlas’, *atleta* ‘athlete’, *Atlántico* ‘Atlantic’, *Atlanta*, etc. With respect to the syllabification of /tl/, Hualde (1999:171-172) observes the following:

> ‘Una palabra como *atlas* se pronuncia [á.tlas] en casi toda Latinoamérica y áreas del oeste peninsular, mientras que en el centro y este de la península se pronuncia [át.las] ~ [áð.las]. ... En español mexicano el grupo /tl/ ocurre incluso en principio de palabra, en topónimos y préstamos del nahuatl como *Tlaxcala*, *tlapalería*, etc.
> [A word such as *atlas* ‘atlas’ is pronounced [á.tlas] in almost all of Latin America and in areas of the western Peninsula, while in the central and eastern areas it is pronounced [át.las] ~ [áð.las]. ... In Mexican Spanish the /tl/ cluster appears even in word-initial position, in toponyms and borrowings from Nahuatl such as *Tlaxcala* (place name), *tlapalería* ‘hardware store’, etc.].’

Most authors agree that while sonority sequencing accounts for the general shape of Spanish complex onsets, additional filters or constraints are required to rule out coronal-lateral sequences. For instance, Harris (1983:32-33) assumes the featural specifications in 12 and proposes the filters shown in 13.

(12)

	[t]	[d]	[ɾ]	[l]
[coronal]	+	+	+	+
[continuant]	−	−	+	−
[voice]	−	+	+	+

(13) a. $$*\left[\begin{bmatrix} +\text{cor} \\ -\text{cont} \\ +\text{voice} \end{bmatrix}\begin{bmatrix} +\text{cor} \\ -\text{cont} \\ +\text{voice} \end{bmatrix}\right]_{\text{ONSET}}$$

b. $$*\left[\begin{bmatrix} +\text{cor} \\ -\text{cont} \end{bmatrix}\begin{bmatrix} +\text{cor} \\ -\text{cont} \end{bmatrix}\right]_{\text{ONSET}}$$

Dialects that have /tl/ but exclude /dl/ employ 13a, whereas dialects that exclude both clusters have the more general 13b. More recently, Martínez-Gil (2001:209, 219) suggests that such filters are probably not parochial restrictions of Spanish but can be analyzed as an OCP effect. Gerlach (2004:159, 165 Fn. 13) also proposes to account for the exclusion of coronal-lateral clusters with an OCP constraint disallowing adjacent segments identical in place and manner. Following the OT implementation adopted above, we may assume that filter 13b corresponds to the OCP constraint shown in 11. The more specific 13a can be formalized as follows:

(14) OCP(COR, −cont, +voi)

In an onset cluster, adjacent coronal noncontinuant voiced segments are prohibited.

In Spanish dialects that prohibit both voiceless and voiced coronal stops before laterals, the more general OCP constraint 11 must dominate MAX(COR) in order to select neutralized [klV] and [glV] as optimal. More permissive dialects that exclude only /dl/ can be accounted for by ranking 14 above MAX(COR), which, in turn, dominates 11. In Tableau 6, this ranking allows voiceless coronal and velar stops to contrast before laterals in candidate a. In Tableau 7, the contrast is neutralized in voiced stops, and only velars appear before laterals in candidate c.

tlV$_1$ klV$_2$	OCP(COR, −cont, +voi)	MAX (DOR)	MAX (COR)	OCP(COR, −cont)
☞ a. tlV$_1$ klV$_2$				*
b. tlV$_{1,2}$		*!		*
c. klV$_{1,2}$			*!	

Tableau 6: Voiceless coronal and velar stops contrast before laterals

		OCP(COR, −cont, +voi)	MAX (DOR)	MAX (COR)	OCP(COR, −cont)
	dlV_1 glV_2				
	a. dlV_1 glV_2	*!			*
	b. $dlV_{1,2}$	*!	*		*
☞	c. $glV_{1,2}$			*	

Tableau 7: Neutralization to voiced velar stop before laterals

As Harris (1983:141, Fn. 9) originally pointed out, however, the generalization expressed by the filters in 13 fails to obtain at the surface level when the realization of voiced obstruents is taken into account. In Spanish, voiced obstruents are realized as noncontinuants [b,d,g] postpausally and after a homorganic nasal or lateral, while elsewhere they surface as continuants [β,ð,ɣ]. As shown in 15, in word-initial voiced obstruent-liquid clusters surfacing in the elsewhere environment, the voiced obstruent is realized as continuant (Martínez-Gil 2001:210).

(15) *casa* [β]*lanca* 'white house'

una [β]*roma* 'a joke'

toma [ð]*rogas* 's/he takes drugs'

la [ɣ]*loria* 'the glory'

muy [ɣ]*rato* 'very pleasant'

If the initial voiced obstruent of a coronal-lateral cluster were to appear in the elsewhere environment, then its surface realization would be [+continuant], and the filters in 13 would no longer apply. The implications are that stops underlie the continuancy alternation in voiced obstruents and that filters must refer either to underlying representations or to some other abstract level where voiced obstruents are represented as noncontinuants. However, the prevailing view is that voiced obstruents are underspecified for [continuant] (see Harris 1984, Lozano 1979, Martínez-Gil 2001, among many others). Even if underlying [−continuant] values are posited, a problem remains for an OT implementation of similarity avoidance. Since markedness constraints in OT refer only to information present in output forms, the OCP constraints in 11 and 14 are incapable of ruling out surface [ðl] clusters as onsets.

In the next section, I show that the restrictions against /dl/ and /tl/ clusters observed in Spanish dialects are actually part of a broader cross-linguistic typology encompassing many other languages. I extend the DT analysis to account for the typological patterns in a way that avoids the problematic appeal to continuancy specifications in Spanish.

4. A typology of coronal-velar contrast and neutralization in complex onsets. Based on lexical frequency counts of initial consonant clusters appearing in monosyllabic words and stems taken from standard dictionaries, results from Tobin's (2002) survey of forty different language varieties suggest an implicational relationship between voiced and voiceless coronal stop-lateral sequences.[3] Specifically, if a language permits initial /dl/, then it also permits initial /tl/, but not vice-versa. As shown in Table 2, the surveyed languages fall into three groups, which I henceforth refer to as Types A, B, and C. Type A languages prohibit both /dl/ and /tl/, Type B languages allow initial /tl/ but prohibit /dl/, and Type C languages allow both clusters. No language systematically allows /dl/ to the exclusion of /tl/, and all languages permit voiced and voiceless velar-lateral clusters.[4]

	/dl/	/tl/	/gl/	/kl/
Type A Germanic: German (Middle High & Modern), Dutch, English, Afrikaans, Swedish, Norwegian, Danish Romance: Latin (Vulgar & Classical), French, Castilian Spanish, Portuguese, Italian, Catalan, Romansch, Sardinian, Romanian Baltic: Lithuanian, Latvian Albanian Indo-Iranian: Bukharian Finno-Ugric: Finnish, Estonian, Hungarian	no	no	yes	yes
Type B Romance: Mexican Spanish Hellenic: Greek (Classical & Modern) Celtic: Irish, Welsh	no	yes	yes	yes
Type C Slavic: Russian, Ukranian, Polish, Czech, Slovak, Serbo-Croatian, Bulgarian Semitic: Hebrew, Arabic (Classical & Moroccan), Aramaic Caucasian: Georgian	yes	yes	yes	yes

Table 2: Implicational relationship between initial /dl/ and /tl/ clusters (based on Tobin 2002)

In terms of similarity avoidance, the greater markedness of /dl/ can be attributed to the higher degree of similarity between the two segments, as reflected by the ranking of OCP constraints in Tableau 6 and Tableau 7. However, we have seen that this approach has difficulty ruling out surface [ðl] clusters in Spanish. How can we capture the markedness implication between /dl/ and /tl/ but avoid the problematic appeal to continuancy? I propose to extend the DT analysis by taking into account the effect of stop voicing on the perceptibility of coronal-velar place contrasts before laterals. As discussed in Section 2, the formant transitions and release burst contain important cues to place of articulation of oral stops. Properties of the release burst include diffuseness and noise frequency, as listed in 4, but also noise loudness, or intensity (Flemming 2002:23-24). Since voiced stops have quieter bursts than voiceless stops (Zue 1976), [d] and [g] have less intensity than their voiceless counterparts. Therefore, it follows that a [dl-gl] contrast is less perceptually distinctive than a [tl-kl] contrast. This motivates further elaboration of the perceptibility scales in 5, as shown in 16.

(16) a. [TV]..............................[KV] >

b. [tlV]....................[klV] >

c. [dlV]........[glV]

Specifically, the coronal-velar place contrast in [TlV-KlV] is distinguished according to the voicing of the initial stop. The smaller distance in 16c reflects the diminished perceptibility of coronal-velar contrast in voiced stops appearing before laterals.

A formal account of these perceptual differences requires an additional SPACE constraint enforcing the distance in 16b:

(17) a. SPACE(tl-kl)

Potential minimal pairs differing in coronal-velar place differ at least as much as voiceless coronal and velar stops do before laterals.

b. SPACE(tl-kl) » SPACE(TV-KV)

The universal ranking of SPACE(tl-kl) above SPACE(TV-KV) is motivated by the smaller perceptual distance in 16b relative to 16a, i.e., the less distinct the coronal-velar contrast, the greater the violation. Languages will enforce the greatest perceptual distance possible, subject to conflicting faithfulness constraints. Permutation of MAX(DOR) and MAX(COR) with respect to the ranking in 17b yields a factorial typology of coronal-velar place contrasts, as illustrated in 18.

(18) a. SPACE(tl-kl) » SPACE(TV-KV) » MAX(DOR) » MAX(COR)

b. SPACE(tl-kl) » SPACE(TV-KV) » MAX(COR) » MAX(DOR)

c. SPACE(tl-kl) » MAX(DOR) » MAX(COR) » SPACE(TV-KV)

d. SPACE(tl-kl) » MAX(COR) » MAX(DOR) » SPACE(TV-KV)

e. MAX(DOR), MAX(COR) » SPACE(tl-kl) » SPACE(TV-KV)

Constraint rankings 18a,b derive the patterns observed in Type A languages, Katu dialects, and Mong Njua, as illustrated in Section 2. These varieties all share the common property of neutralizing coronal-velar place contrasts before laterals, but they differ in the directionality of neutralization. As was shown in Tableau 1 through Tableau 3, high-ranking SPACE(TV-KV) rules out both [tl-kl] and [dl-gl] contrasts, while opposite rankings of MAX(DOR) and MAX(COR) determine whether coronals or velars appear before laterals in the output. A variable ranking of the two faithfulness constraints accounts for the non-contrastive variation observed in Mong Njua.

The ranking in 18c generates the Type B pattern observed in Mexican Spanish, Greek, Irish, and Welsh. Since MAX(PLACE) constraints dominate SPACE(TV-KV), the maximum perceptual distance in 16a is no longer enforced, and the less perceptible [tl-kl] contrast now becomes possible. As shown in Tableau 8, high-ranking SPACE(tl-kl) still disallows the less perceptible [dl-gl] contrast. The ranking of MAX(COR) below MAX(DOR) ensures that the input coronal stop will merge with the velar stop in the output cluster in candidate c.

	dlV_1 glV_2	SPACE(tl-kl)	MAX(DOR)	MAX(COR)	SPACE(TV-KV)
	a. dlV_1 glV_2	*!			*
	b. $dlV_{1,2}$		*!		
☞	c. $glV_{1,2}$			*	

Tableau 8: Neutralization to voiced velar stop before laterals

Given the assumption that MAX(PLACE) constraints may be ranked differently across language varieties, factorial typology predicts 18d as a possible language, in which the [dl-gl] contrast is neutralized to [dl] instead of [gl], as illustrated in Tableau 9. This pattern partially resembles that of Type B languages for its tolerance of the [tl-kl] contrast as well as that of Phúhòa Katu for its neutralization to voiced coronal-lateral clusters. I am unaware of any descriptive work documenting the predicted pattern. However, such a 'mixed' system is exactly what we would expect in an analysis that formalizes the perceptual difference in 16b,c independently of general place markedness. Clearly, further empirical research is called for.

	dlV_1 glV_2	SPACE(tl-kl)	MAX(COR)	MAX(DOR)	SPACE(TV-KV)
	a. dlV_1 glV_2	*!			*
☞	b. $dlV_{1,2}$			*	
	c. $glV_{1,2}$		*!		

Tableau 9: Neutralization to voiced coronal stop before laterals

Finally, the most permissive languages of Type C allow both [dl-gl] and [tl-kl] contrasts. This pattern corresponds to the ranking in 18e, in which both SPACE constraints are dominated by MAX(COR) and MAX(DOR).

As the factorial typology in 18 shows, the DT account encompasses all of the attested patterns of coronal-velar place neutralization in stop-lateral clusters. The DT account can also explain Spanish [ðl], which was shown to be problematic in an OCP approach that appeals to the feature [continuant]. While Spanish [β,ð,ɣ] have traditionally been labelled fricative allophones of corresponding voiced stops, these sounds are better categorized as approximants because they lack turbulent airflow and involve less articulatory precision than stops (Martínez-Celdrán 2004). As the spectrograms presented by Martínez-Celdrán (2004) indicate, Spanish voiced approximants do not have release bursts or noise during their constriction period. Given the importance of release in conveying information about place contrasts, it follows that a [ðl-ɣl] contrast is less perceptible than a [tl-kl] contrast. In terms of perceptual spacing, this means that the distance between [ðl] and [ɣl] is smaller than the distance between [tl] and [kl] shown in 16b. (I leave open the question of how [ðl-ɣl] is ordered with respect to [dl-gl] in 16c.) Therefore, the SPACE constraint in 17a is violated by both [ðl-ɣl] and [dl-gl] because neither pair is as perceptually distinctive as [tl-kl]. In sum, an analysis in terms of place neutralization unifies [ðl] and [dl] clusters in a way that the OCP account cannot, and this is accomplished by systemic markedness constraints on the well-formedness of coronal-velar place contrasts in output forms.

5. Coronal-velar neutralization in sound change and loanword phonology. Further evidence for coronal-velar neutralization in stop-lateral clusters comes from sound change in early Romance.

First, when the loss of intertonic vowels in spoken Latin resulted in coronal stop-lateral clusters, the coronal changed to velar. Two examples from the *Appendix Probi* are given in 19:

(19)	*vetulus non veclus*	‘old (diminuative)’
	vitulus non viclus	‘calf’

In the development of the Old Spanish consonant system, medial *-t’l-* clusters derived by vowel deletion underwent the same changes as medial *-c’l-* clusters. The following examples from Penny (2002:70) show that both *-c’l-* 20a and *-t’l-* 20b became the voiced prepalatal fricative /ʒ/ in Old Spanish, which corresponds to the grapheme <j>:

(20)	a.	*lenticula*	> *lenteja*	‘lentil’
		novacula	> *navaja*	‘razor’
		oculu	> *ojo*	‘eye’
		vermiculu	> *bermejo*	‘red’
	b.	*rotulare*	> *arrojar*	‘to throw’
		vetulu	> *viejo*	‘old’

Contemporary Western Romansch exhibits both velarization and maintenance of derived *-t’l-* clusters from spoken Latin (Montreuil 1999:530-532).[5] Velarization, shown in 21a, is a common outcome, although in some cases [tl] is maintained, as in 21b:

(21)	a.	*martellare*	> [mərkláː]	‘to hammer’
		bartholomaeu	> [bərkləmíw]	‘Bartholomew’
		rotulare	> [rukláː]	‘to fall’
		setula	> [sájklə]	‘pigskin’

b.	*titulare*	> [tətláː ~ təkláː]	'to listen'
	patellana	> [pətláwnə]	'a kind of cake'
	patellarui	> [pətlɛ́ː]	'three-legged stool'
	scatula	> [ʃkátlə]	'box'

Similar patterns of velarization are found in loanword phonology in Mexican Spanish. As discussed in Section 3, most Spanish varieties lack word-initial /tl/ clusters, and speakers from the central and eastern Peninsula treat such clusters as heterosyllabic word-medially. In contrast, Mexican Spanish contains many nonpatrimonial words with initial /tl/, and these speakers treat word-medial /tl/ as a tautosyllabic onset. Lope Blanch (1972:97-98) ascribes this characteristic to the influence of Nahuatl, which has a voiceless dentoalveolar lateral affricate /t͡ɬ/. Presumably, when Spanish speakers were confronted with this phoneme in Nahuatl loanwords and Aztec toponyms, they interpreted it as a bisegmental sequence of coronal /t/ followed by the lateral liquid /l/, both of which exist independently in Spanish.[6] The following examples show intact /tl/ in loanwords 22a and place names 22b:

(22)	a.	*tlapalería*	'hardware store'
		tlaco	'type of coin'
		cenzontle	'mockingbird'
		ixtle	'type of plant'
		zontle	'unit of measurement for grain'
		huitlacoche	'maize mushroom'

b. *Tlanepantla*

Acatitla

Atlixco

Ocotlán

Popocatepetl

While /tl/ clusters are predominant in contemporary Mexican Spanish, they were avoided in earlier stages of loanword adaptation (see Henríquez Ureña 1976:100-101, Hernández 1996:200, Lope Blanch 1972:98). The examples in 23a show velarization to /kl/, similar to Western Romansch 21a, while those in 23b show variability between /kl/ and /tl/.

(23)	a.	*awáutli*	> *aguacle*	‘water fly egg’
		kakawuátl-sentli	> *cacahuacincle*	‘variety of corn’
		káktli	> *cacle*	‘sandal, shoe’
		ŝíktli	> *chicle*	‘juice of a type of fruit’
		iŝkwíntli	> *escuincle*	‘native Mexican dog’
		šináčtli	> *chinascle*	‘vermin’
	b.	*metlapili-li*	> *meclapil* ~ *metlapil*	‘stone roller’
		tlacomiztli	> *cacomiscle* ~ *cacomistle*	‘weasel-like animal’

An anonymous reviewer raises the possibility that Mexican Spanish *tl* in 22 might be a monosegmental affricate, as in the original Nahuatl, instead of a bisegmental sequence, as proposed by Lope Blanch (1972). Presumably, distributional evidence could be brought to bear on this issue.[7] If, in a given language, affricates are found word-finally but genuine clusters are not, then this is evidence that the affricates are monosegmental. In Spanish, the voiceless alveopalatal /t͡ʃ/—uncontroversially an affricate—does not occur in coda position, and word-final clusters are virtually inexistent in the native lexicon (cf. loanwords such as *fax* 'fax' and *vals* 'waltz'). Therefore, distributional facts do not seem to provide evidence for either the monosegmental or bisegmental status of Spanish /t͡ʃ/. Interestingly, in some cases Nahuatl word-final /t͡ɬ/ has lost either its lateral component (with concomitant /e/-epenthesis), as in 24a, or its stop component, as in 24b (Lope Blanch 1972:97-98):

(24)	a.	*čáyotl*	> *chayote*	'type of vegetable'
		élotl	> *elote*	'variety of corn'
		tomatl	> *tomate*	'tomato'
		ókotl	> *ocote*	'variety of pine tree'
		mekatl	> *mecate*	'type of rope'
	b.	*cempoalxochitl*	> *cempasúchil*	'marigold flower'
		oyametl	> *oyamel*	'fir tree'
		Popocatepetl	> *Popocatepel*	

These examples show that velarization was not the only strategy for adaptation of Nahuatl /t͡ɬ/ into Spanish (see Hernández 1996:200-203 for more detailed discussion). If borrowed final /tl/ is treated as a cluster, then an analysis of the changes in 24 would plausibly require some ranking of faithfulness constraints on consonant deletion and vowel insertion, syllabic markedness constraints banning complex codas, and sonority constraints favoring the less sonorous coronal stop as an onset and the more sonorous lateral as a coda. But again, since affricates are not otherwise allowed in coda position in Spanish, it is difficult to know what the relevant markedness constraints are in this case (i.e., those banning complex codas or those banning complex segments, such as affricates, from coda position).

If we accept the bisegmental analysis of Mexican Spanish /tl/, then the patterns of velarization both from spoken Latin into Old Spanish and Western Romansch and from early Nahuatl borrowings into Mexican Spanish can be seen as evidence for the constraint ranking proposed for Type A languages in 18a. In this grammar, high-ranking SPACE(TV-KV) prohibits the [tl-kl] contrast, and [kl] is chosen by MAX(DOR) as the outcome of neutralization. The eventual maintenance of coronal stop-lateral clusters in Western Romansch 21b and in loanwords of contemporary Mexican Spanish 22 suggests that over time, the pressure to maximize coronal-velar place contrasts was relaxed. The demotion of SPACE(TV-KV) below MAX(PLACE) constraints yielded the grammar in 18c, which would have permitted a contrast between emergent [tl] and extant [kl] clusters, while still prohibiting surface [dl]. The existence of [tl] and [kl] in variant forms of the same lexical item in Western Romansch [tətláː ~ təkláː] 'to listen' 21b and in Mexican Spanish 23b suggests an intermediate diachronic stage of variable ranking between SPACE(TK-KV) and MAX(COR).

6. Summary and concluding remarks. Building upon work by Flemming (1995, 2002), I have argued that phonotactic restrictions on onset clusters involving laterals are best analyzed in terms of perceptual distinctiveness of coronal-velar place contrasts. Formalizing the markedness of coronal-lateral sequences as an OCP effect cannot explain languages that neutralize coronal-velar contrasts before laterals but still allow the coronal-lateral clusters to appear. In this paper, I have proposed a new analysis in DT in which systemic markedness constraints interact crucially with standard faithfulness constraints on place features. The analysis captures the typological implication between /dl/ and /tl/ clusters, accommodates the exceptional patterns observed in

Mong Njua and Katu, and avoids the complications associated with an OCP account when Spanish [ðl] is taken into consideration.

With respect to the relative markedness of major place of articulation, it has been claimed that coronal is universally unmarked (Paradis and Prunet 1991, Prince and Smolensky 1993/2004, among others).[8] Coronal unmarkedness seems to be the most common case cross-linguistically. Indeed, the majority of languages that neutralize coronal-velar contrasts in stop-lateral onsets do so by sacrificing the unmarked coronal place (recall Table 2). The opposite pattern of neutralization to coronal-lateral clusters is typologically rare and, to my knowledge, attested only in Mong Njua and in dialects of Katu. Instead of assuming that MAX(PLACE) constraints are freely rankable across languages, as do Hume (2003) and Hume and Tserdandelis (2002), an alternative approach would be to maintain a universal ranking of MAX(NONCORONAL) » MAX(CORONAL), as projected from the harmonic place ranking scale PL/NONCORONAL ➢ PL/CORONAL (see Prince and Smolensky 1993/2004, Ch. 9). The typological exceptions observed in Mong Njua and Katu could then be accounted for by an additional high-ranking markedness constraint favoring coronal-lateral clusters.[9] However, Hume and Tserdanelis (2002) discuss cross-linguistic evidence showing that any major place of articulation can pattern as the unmarked in place assimilation asymmetries. As they point out, 'a theory with freely rankable place constraints is empirically equivalent to one using fixed rankings supplemented by more highly ranked constraints: both allow all place features to pattern as unmarked' (455). By Occam's Razor, a theory that assumes freely rankable place constraints is simpler. This is precisely the type of analysis that I have proposed here to account for phonotactic restrictions on onset clusters involving laterals.

References

Avery, Peter, and Keren Rice. 1989. Segment structure and coronal underspecification. Phonology 6.179-200.

Alderete, John. 1997. Dissimilation as local conjunction. Proceedings of North East Linguistic Society 27, ed. by Kiyomi Kusumoto, 17-31. Amherst: Graduate Linguistic Student Association. [ROA-175-0297]

Bonet, Eulàlia, and Maria-Rosa Lloret. 2002. OCP effects in Catalan cliticization. Catalan Journal of Linguistics 1.19-39.

Bradley, Travis G. In press-a. Sibilant voicing in highland Ecuadorian Spanish. To appear in Lingua(gem) 2.2.

----------. In press-b. Spanish rhotics and Dominican hypercorrect /s/. To appear in Probus 18.1.

----------. 2005. 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.

----------, and Ann Marie Delforge. 2006. Systemic contrast and the diachrony of Spanish sibilants. Historical Romance linguistics: retrospective and perspectives, ed. by Randall Gess and Deborah Arteaga, 19-52. Amsterdam: John Benjamins.

Caduff, Leonard. 1952. Essai sur la phonétique du parler roman de la vallée de Tavetsch. Bern: A. Francke Verlag.

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

----------. 2002. Auditory representations in phonology. New York: Routledge.

Gerlach, Sharon. 2004. Another look at effects of environment on L2 epenthesis: evidence for transfer of ranked constraints. Laboratory approaches to Spanish phonology, ed. by Timothy L. Face, 143-169. Berlin: Mouton de Gruyter.

Harris, James. 1983. Syllable structure and stress in Spanish: a nonlinear analysis. Cambridge: MIT Press.

----------. 1984. La espirantización en castellano y la representación fonológica autosegmental. Working Papers in Linguistics 1.149-167, Universitat Autònoma de Barcelona.

----------, and Ellen Kaisse. 1999. Palatal vowels, glides and obstruents in Argentinean Spanish. Phonology 16.117-190.

Henríquez Ureña, Pedro. 1976. Observaciones sobre el español en América y otros estudios fiológicos. Buenos Aires: Academia Argentina de Letras.

Hernández, Esther. 1996. Vocabulario en lengua castellana y mexicana de Fray Alonso de Molina: estudio de los indigenismos léxicos y registro de las voces españolas internas. Madrid: Consejo Superior de Investigaciones Científicas.

Herrick, Dylan. 2002. Catalan phonology: cluster simplification and nasal place assimilation. Romance phonology and variation, ed. by Caroline R. Wiltshire and Joaquim Camps, 69-83. Amsterdam: John Benjamins.

Hualde, José Ignacio. 1991. On Spanish syllabification. Current studies in Spanish linguistics, ed. by Héctor Campos and Fernando Martínez-Gil, 475-493. Washington: Georgetown University Press.

----------. 1999. La silabificación en español. Fonología generativa contemporánea de la lengua española, ed. by R. Núñez Cedeño and A. Morales-Front, 177-188. Washington: Georgetown University Press.

Hume, Elizabeth. 2003. Language specific markedness: the case of place of articulation. Studies in phonetics, phonology and morphology 9.295-310.

---------- and Georgios Tserdanelis. 2002. Labial unmarkedness in Sri Lankan Portuguese Creole. Phonology 19.441-458.

Itô, Junko, and Armin Mester. In press. Systemic markedness and faithfulness. To appear in Proceedings of Chicago Linguistics Society 39. [ROA-710-0105]

Jun, Jongho. 1995. Perceptual and articulatory factors in place assimilation: an Optimality Theoretic approach. Los Angeles: UCLA dissertation.

Kang, Hyeon-Seok. 1997. Phonological variation in glides and diphthongs of Seoul Korean: its synchrony and diachrony. Columbus: Ohio State University dissertation.

Kawasaki, Haruko. 1982. An acoustical basis for universal constraints on sound sequences. Berkeley: UC Berkeley dissertation.

Kiparsky, Paul. 1985. Some consequences of Lexical Phonology. Phonology Yearbook 2.85-138.

Leben, William. 1973. Suprasegmental phonology. Cambridge: MIT dissertation (published 1980, New York/London: Garland).

Lieberman, Philip, and Sheila Blumstein. 1988. Speech physiology, speech perception, and acoustic phonetics. Cambridge: Cambridge University Press.

Lindblom, Björn. 1986. Phonetic universals in vowel systems. Experimental phonology, ed. by J. J. Ohala and J. J. Jaeger, 13-44. Orlando: Academic Press.

----------. 1990. Explaining phonetic variation: A sketch of the H&H theory. Speech production and speech modelling, ed. by W. J. Hardcastle and A. Marchal, 403-439. Dordrecht: Kluwer.

Lombardi, Linda. 1998. Evidence for MaxFeature constraints from Japanese. College Park: University of Maryland, ms. [ROA-247-0298]

----------. 2002. Coronal epenthesis and unmarkedness. Phonology 19.219-251.

Lope Blanch, Juan M. 1972. Estudios sobre el español de México. Mexico City: Universidad Nacional Autónoma de México.

Lozano, María del Carmen. 1979. Stop and spirant alternations: fortition and spirantization processes in Spanish phonology. Columbus: Ohio State University dissertation.

Lyman, Thomas. 1974. Dictionary of Mong Njua, a Miao (Meo) language of Southeast Asia. The Hague: Mouton.

MacEachern, Margaret. 1999. Laryngeal cooccurrence restrictions. New York: Garland.

Mascaró, Joan. 1976. Catalan phonology and the phonological cycle. Cambridge: MIT dissertation.

Martínez-Celdrán, Eugenio. 2004. Problems in the classification of approximants. Journal of the International Phonetic Association 34.201-210.

Martínez-Gil, Fernando. 2001. Sonority as a primitive phonological feature: evidence from Spanish complex onset phonotactics. Features and interfaces in Romance: essays in honor of Heles Contreras, ed. by Julia Herschensohn, Enrique Mallén and Karen Zagona, 203-222. Amsterdam: John Benjamins.

Mateus, Maria Helena, and Ernesto d'Andrade. 2000. The phonology of Portuguese. Oxford: Oxford University Press.

McCarthy, John. 1986. OCP effects: gemination and anti-gemination. Linguistic Inquiry 17.207-263.

Montreuil, Jean-Pierre. 1999. The Romansch syllable. The syllable: views and facts, ed. by H. van der Hulst and N.A. Ritter, 527-550. Berlin: Mouton de Gruyter.

Mortensen, David. 2004. Preliminaries to Mong Leng (Hmong Njua) phonology. Berkeley: UC Berkeley, ms.

Myers, Scott. 1997. OCP effects in Optimality Theory. Natural Language and Linguistic Theory 15.847-892.

Ní Chiosáin, Maire, and Jaye Padgett. 2001. Markedness, segment realization, and locality in spreading. Segmental phonology in Optimality Theory: constraints and representations, ed. by Linda Lombardi, 118-156. Cambridge: Cambridge University Press.

Olive, Joseph P., Alice Greenwood, and John Coleman. 1993. Acoustics of American English speech: a dynamic approach. New York: Springer-Verlag.

Padgett, Jaye. 1995. Partial class behavior and nasal place assimilation. Arizona phonology conference: proceedings of the South Western Optimality Theory Workshop, volume 5 coyote papers, ed. by K. Suzuki and D. Elzinga, 145-183. Tucson: University of Arizona.

----------. 2003a. Contrast and post-velar fronting in Russian. Natural Language and Linguistic Theory 21.39-87.

----------. 2003b. The emergence of contrastive palatalization in Russian. Optimality Theory and language change, ed. by D.E. Holt, 307-335. Dordrecht: Kluwer Academic Publishers.

----------. 2003c. Systemic contrast and Catalan rhotics. Santa Cruz: UC Santa Cruz, ms. [ROA-574-0203]

Padgett, Jaye and Marzena Zygis. 2003. The evolution of sibilants in Polish and Russian. ZAS papers in linguistics, ed. by T.A. Hall and Silke Hamann, 155-174. Berlin: Zentrum für Allgemeine Sprachwissenschaft.

Paradis, Carole and Jean François Prunet (eds.) 1991. Phonetics and phonology 2: the special status of coronals. San Diego, CA: Academic Press.

Penny, Ralph. 2002. A history of the Spanish language. Cambridge: Cambridge University Press.

Prince, Alan and Paul Smolensky. 1993. Optimality Theory: constraint interaction in generative grammar. New Brunswick and Boulder: Rutgers University and University of Colorado, ms. [ROA-537-0802]

----------. 2004. Optimality Theory: constraint interaction in generative grammar. Malden, MA: Blackwell.

Reynolds, William. 1994. Variation and Optimality Theory. Philadelphia: University of Pennsylvania dissertation.

Sanders, Nathan. 2002. Dispersion in OT: middle Polish nasal vowels. WCCFL 21 proceedings, ed by. Line Mikkelsen and Christopher Potts, 415-428. Somerville, MA.: Cascadilla Press.

----------. 2003. Opacity and sound change in the Polish lexicon. Santa Cruz: UC Santa Cruz dissertation. [ROA-603-0503]

Stevens, Kenneth. 1998. Acoustic phonetics. Cambridge: MIT Press.

Tobin, Yishai. 2002. Phonology as human behavior: initial consonant clusters across languages. Signal, meaning, and message, ed. by W. Reid, R. Otheguy, and N. Stern, 191-255. Amsterdam: John Benjamins.

Wallace, Judith. 1969. Katu phonemes. Mon Khmer Studies 3.64-73.

Yip, Moira. 1998. Identity avoidance in phonology and morphology. Morphology and its relation to phonology and syntax, ed. by Steven Lapointe, Diane Brentari, and Patrick Farrell, 216-246. Stanford, CA: CSLI Publications.

Zue, Victor. 1976. Acoustic characteristics of stop consonants: a controlled study. Cambridge: MIT dissertation.

Notes

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1 Other recent works have applied Padgett's version of DT to consonantal phenomena in Spanish. See Bradley (in press-b) on the interaction between hypercorrective /s/-insertion and syllable-initial rhotics in Dominican Spanish, Bradley (2005) on infinitival rhotic deletion in northern Peninsular dialects, Bradley and Delforge (2006) on the diachrony of Spanish sibilant voicing, and Bradley (in press-a) on prefix- and word-final sibilant voicing in highland Ecuadorian subdialects.

2 For example, OCP effects on stop-lateral clusters could be formalized as a self-conjoined markedness constraint *[coronal, −continuant]^2, relativized to the syllabic domain of complex onsets. This constraint would be violated by a surface [Tl] onset cluster, which contains a double violation of the simplex constraint *[coronal, −continuant]. (See Alderete 1997 for more discussion of dissimilation as Local Conjunction.)

[3] Tobin (2002:197-198) presents several arguments motivating a lexical analysis of initial clusters: (i) Dictionaries permit a more representative data sample by avoiding memory limitations of native speakers in recall tasks. (ii) Dictionaries provide both a diachronic and synchronic view of the lexicon. (iii) Lexical analysis includes relevant tokens regardless of their frequency in actual language use. (iv) Dictionaries include multiple styles and registers for spoken and written discourse. (v) The collection of monosyllabic words or stems limits the potential influence of prosodic factors which may affect the phonotactic distribution of initial clusters.

[4] Tobin's (2002) lexical frequency counts for Spanish indicate no word-initial /dl/ and /tl/ clusters, in line with most other Romance languages. Since Mexican Spanish permits initial /tl/ as a result of contact with Nahuatl, I have categorized Castilian and Mexican varieties as Type A and B, respectively, in Table 2. Furthermore, Tobin counts only one token of word-initial /tl/ in Portuguese, which suggests that Type A is a more appropriate typological classification. The only word with initial /tl/ in Portuguese is onomatopoeic *tlim* 'tinkle' (Mateus and Andrade 2001:40, Fn. 6).

[5] Recall from Table 2 that Romansch is a Type A language according to Tobin's (2002) lexical frequency counts. The data discussed by Montreuil (1999) are from the Tujetsch subdialect of Western Romansch, as described in phonetic detail by Caduff (1952).

[6] According to Lope Blanch (1972:98), 'nos hallamos de nuevo ante una peculiaridad fonética del habla mexicana, explicable por la influencia indígena, que consiste no en una reestructuración del sistema fonológico castellano como consecuencia de la aparición en él de un fonema nuevo, sino sólo en la particular *manera de articular* un grupo consonántico constituido

por dos fonemas existentes en castellano [again we encounter a phonetic peculiarity of Mexican speech, explainable in terms of indigenous influence, which involves not a restructuring of the Spanish phonological system due to the appearance of a new phoneme, but rather the particular *manner of articulating* a consonant cluster made up of two existing phonemes in Spanish—emphasis in original]'.

[7] Thanks to Eric Bakovic (personal communication) for discussion of conventionally accepted arguments bearing on the status of affricate consonants.

[8] Lombardi (2002) argues that laryngeal place is even less marked than coronal.

[9] Thanks to Adam Werle (personal communication) for suggesting the possibility of an analysis that maintains a universal ranking of place constraints.