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Lateral Survival: An OT Account

MOIRA YIP*
University College London

ABSTRACT

When laterals are the targets of phonological processes, laterality may or may not survive. In a fixed feature geometry, [lateral] should be lost if its superordinate node is eliminated by either the spreading of a neighbouring node, or by coda neutralization. So if [lateral] is under Coronal (Blevins 1994), it should be lost under Place assimilation, and if [lateral] is under Sonorant Voicing (Rice & Avery 1991) it should be lost by rules that spread voicing. Yet in some languages lateral survives such spreading intact. Facts like these argue against a universal attachment of [lateral] under either Coronal or Sonorant Voicing, and in favour of an account in terms of markedness constraints on feature-co-occurrence (Padgett 2000). The core of an OT account is that if IDENTLAT is ranked above whatever causes neutralization, such as SHARE-F or *CODAF, laterality will survive. If these rankings are reversed, we derive languages in which laterality is lost. The other significant factor is markedness. High-ranked feature co-occurrence constraints like *LATDORSAL can block spreading from affecting laterals at all.

KEYWORDS: Lateral, Feature Geometry, Variation, Inventories, Feature Co-Occurrence

* ***Address for correspondence***: Moira Yip, Department of Phonetics and Linguistics, University College London, Gower Street, London WC1E 6BT, United Kingdom. Tel: +44-20-7679-3158. Fax: +44-20-7383-4108. E-mail: moira@ling.ucl.ac.uk.

I. INTRODUCTION

The proper treatment of laterals has been a matter of dispute for years. Among the unresolved questions are the following. Is there any justification for a feature [lateral]? Are laterals featurally always Coronal and if so is the feature [lateral] a dependent of the coronal node? Are they featurally always Sonorant, and if so is the feature [lateral] a dependent of the Sonorant Voicing node? The answers to these questions bear on larger theoretical issues. Is feature geometry invariant, or cross-linguistically variable within certain limits? In Optimality Theory, is feature geometry the only way to handle feature relationships, or are feature geometry effects instead the result of constraint interactions? If so, does the resulting typology match the observed facts?

This paper is one of a pair of papers that argues based on data from laterals that feature geometry is both inadequate and unnecessary in OT. Together with Yip (to appear), it shows that the behaviour of laterals is best captured not with feature geometry, but with constraints on the co-occurrence of [lateral] with certain other features, and that re-ranking these constraints produces the attested range of cross-linguistic variation. It thus supports recent work by Padgett (2000) and Flemming (2003a, c).

The focus of this paper is on the behaviour of the feature [lateral], so it is important to discuss the evidence for the existence of the feature in the first place. If a language has [l] but no [r], one might define [l] by the features [+cons, +son, -nas], and [lateral] would be redundant. However, if [l] contrasts with [r] as it does in many languages this will not suffice. Positive evidence for the feature [lateral] comes from its active role in the phonology of many languages. In Eastern Catalan (and Sanskrit), for example, [lateral] spreads onto nasals to create a lateral nasal: /nl/ → [n̺l] in /son les tres/ → [soṉles tres] (Mascaró 1976). Furthermore, there are phonological processes that involve only [l] and [r], and in which they either dissimilate, as in Latin, where the suffix /-alis/ surfaces as [-aris] after a lateral root: *nav-alis* vs. *sol-aris* (Steriade 1987), or assimilate, as in Sundanese, where the infix /-ar-/ surfaces as [-al] after a preceding /l/: *k-ar-usut* vs. *l-al-əga* (see Cohn 1992 for details). I conclude that the feature [lateral] cannot be dispensed with (but see Spencer 1984, Brown 1995 Walsh 1997 for a dissenting view). I should note that for the purposes of this paper I shall treat it as a privative feature, but the results would not be materially affected if it were to turn out to be binary, as Steriade argues.

This paper examines how laterals behave as the targets of phonological processes, and in particular whether laterality survives or is lost. In a fixed feature geometry, if its superordinate node is eliminated by the spreading of a neighbouring node, [lateral] should be lost. So if [lateral] is under Coronal, it should be lost under Place assimilation, and if [lateral] is under Sonorant Voicing it should be lost by rules that spread voicing. However, this is not always what happens. For example, in English where /l/ assimilates in Place to a following dental, it does not cease to be lateral: hea[l] *vs*. hea[l̪θ] *'health'*. Similarly, if a superordinate node is lost by some process like debuccalization in coda position, [lateral] should be lost. However, when place or voicing

contrasts are neutralized for such reasons, laterality may or may not survive. Caribbean Spanish allows only velars in coda position, and Coronals lose their Coronal node, so that /tren/ → [treŋ] *'train',* but coronal laterals survive: /tonel/ = [tonel] *'barrel'.*

The core of an OT account is that if IDENTLAT is ranked above whatever causes neutralization, laterality will survive. In the case of spreading, we have IDENTLAT » SHARE-F, and in the case of neutralization due to place markedness, we have IDENTLAT » *CODAF. If these rankings are reversed, we derive languages in which laterality is lost, and such languages also exist. The other factor that comes into play is markedness. Lateral does not commonly co-occur with certain other features, particularly Dorsal and Obstruent. High-ranked *LATDORS (and *LATOBS) can block spreading from affecting laterals at all, so that for example /lg/ stays [lg], not [ʟg]. Markedness may also have the inverse effect, of causing loss of laterality. *NASLAT in conjunction with SPREAD-NASAL can turn /n/ into [l] rather than a nasalized lateral.

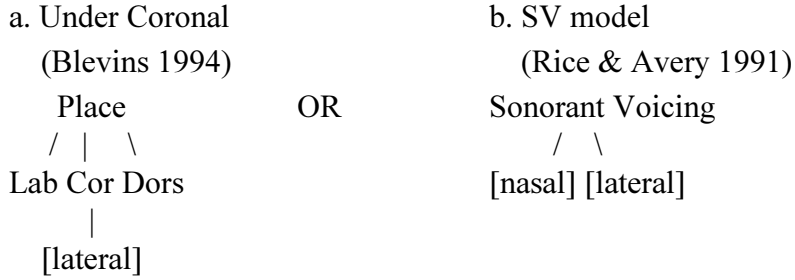
Although this paper primarily concerns the behaviour of laterals as the target of some process, the complete picture requires us to understand their distribution in inventories, and their behaviour as triggers. For reasons of space the full set of cases cannot be covered here, so I will just sketch the problem and proposal. The full details are worked out in Yip (to appear).

I begin with a summary of the previous feature-geometric approaches, showing the contradictory nature of the evidence for the placement of [lateral]. I then give an overview of my proposal in section II. Sections III.1 and III.2 are essentially the same as the early part of Yip (to appear), and can be skipped by anyone familiar with that paper. The body of the paper is sections IV and V, which offer case studies of the behaviour of laterals as targets of assimilation and neutralization respectively. Section VI sums up.

II. THE PROBLEM WITH FIXED GEOMETRY: CONFLICTING EVIDENCE

In the late 1980's and early 1990's it was argued that feature geometry was universally invariant (Sagey 1986, Clements & Hume 1995, and many others), but certain features were rarely discussed because they posed a problem for this view. Among them were [lateral] and [strident]. The two main contenders for the placement of lateral are shown below, where SV stands for Sonorant Voicing, and is responsible for voicing in sonorants but not (most) obstruents.

(1)



These proposals were motivated by two observations about laterals: they are normally Coronal (hence the Coronal proposal), and they are normally voiced sonorants (hence the SV proposal)

The predictions were clear: [lateral] required the presence of its superordinate node, and anything which affected that node (such as spreading it, delinking it, deleting it) would also affect [lateral]. Sister features should spread together with [lateral]. The trouble was, the evidence was contradictory, as the following table shows. The first two columns list evidence for and against placing [lateral] under the Coronal node, and the last two columns list evidence for and against placing Coronal under Sonorant Voicing.

Table I: Contradictory evidence for the placement of [lateral]
(Shaded cells are cases where no language with supporting data has yet been found.)

	Under Coronal?		**Under [Sonorant Voicing]?**	
	FOR	**AGAINST**	**FOR**	**AGAINST**
1	Laterals are usually Coronal: *many languages*	Placeless laterals: *Javanese* Velar laterals: *Yagaria*	Laterals are usually voiced sonorants: *many languages*	Voiceless laterals: *Tahltan* Obstruent laterals: *Min, Bantu* Affricate laterals *Tahltan, Zulu*
2		In affricates, [lateral] is clearly a release feature, i.e. manner: *Tahltan*		Need to state natural class of voiced obs. and voiced son.: *Polish, Min*
3	Place spreading spreads [lat] from trigger: *Selayarese*	Place spreading doesn't spread [lat]: *Chukchi*	Voice/nasal spreading spreads [lat] from trigger: *Sanskrit*	Voice spreading doesn't spread [lat]: *Polish*
4	Coronal node as target of [lateral] spreading: *Teralfene Flemish, Yanggu Chinese*	Laterals skipped by harmony that targets Coronals: *Tahltan*	[SonVoice] node as target of [lateral] spreading: *Toba Batak*	Laterals skipped by harmony that targets sonorants: ?
5	Place spreading removes [lat] from target: *Moroccan Arabic, Cuban Spanish*	Place spreading doesn't remove [lat]: *English, Basque*	Voice/nasal spreading removes [lat] from target: *Itsekiri*	Voice spreading doesn't remove [lat]: *English*
6	Place loss removes [lat]: ?	Place loss doesn't remove [lat]: *Caribbean Spanish*	Devoicing removes [lat]: *Yagaria*	Devoicing doesn't remove [lat]: *Koyukon, Angas*

It is the data in rows 5-6 on laterals as targets that are the focus of this paper. The data in rows 1-4 on inventories and laterals as triggers are discussed in detail in Yip (to appear), and I begin with a brief sketch of the account offered in that paper.

III.THE PROPOSAL

The perplexing behaviour of laterals, while a problem for a fixed feature geometry, can be handled quite simply within OT by means of rankable feature co-occurrence constraints (Padgett 1995, 2000, Pater 1999, Pulleyblank 1997, Flemming 2003 a, c). The preference for a coronal place of articulation means that *LATERALCORONAL is low-ranked in most languages, while the preference for lateral approximants means that *LATERALSONORANT is low-ranked in most languages. Conversely, the absence in a language of velar laterals and lateral affricates or clicks means that *LATERALDORSAL and *LATERALOBSTRUENT are high-ranked and thus surface-true. However, languages may vary as to how they rank these constraints. For example, if *LATERALDORSAL is low-ranked velar laterals may be found. This thus avoids one of the immediate problems with a fixed feature geometry: its excessive rigidity.

As in other aspects of phonology where the constraints are grounded in the articulatory phonetics, there are limits on the ranking permutations for the constraint families that derive from these physiological imperatives. Just as sonority-based constraints are usually agreed to have a fixed ranking with respect to each other, so too do the constraints relating to laterality. I shall posit the following fixed rankings, into which other constraints may intervene:[1]

(2) *LATERALOBSTRUENT » *LATERALSONORANT
*LATERALLABIAL » *LATERALDORSAL >> *LATERALCORONAL

These rankings, in conjunction with faithfulness constraints and other familiar parts of the OT grammar, have the following effects:

(1) restrict the types of lateral inventories
(2) explain the targets of spreading
(3) explain the outcomes of processes
(4) give the effects of dependency, without feature geometric representations

In so far as this account denies the need to place [lateral] under any particular node, it is in line with the claims of Hegarty (1989), Bao (1992), who argue that it is simply a dependent of the Root node. I would go further, and agree with Padgett (1995b, 2000) that features can be treated as an unstructured set of which [lateral] is a member, and that feature geometry as such is redundant. The next section expands on this proposal.

III.1. Lateral inventories

III.1.1. Preference for sonorants

The following typology arises from placing the faithfulness constraints at different points in the fixed ranking of *LATOBS » *LATSON:

(3)	*LAT OBS » *LATSON » FAITH	Languages with no laterals (18.6%, Maddieson 1984)
	*LATOBS » FAITH » *LATSON	Common language type, with sonorant laterals
	FAITH » *LATOBS »*LATSON	Languages with both obstruent and sonorant laterals

Examples of obstruent laterals include not only the obvious affricates and clicks, but also languages in which [l] patterns as a voiced obstruent, such as Min, which has [l] instead of [d]. For example, /p,t,k/ voice to [b,l,g] foot-internally (Hsu 1996) and /b,l,g/ nasalize to [m,n,ŋ] before nasal vowels. In some Bantu languages, like Ikalanga, historical *d has become /l/, but under velarization /l/ becomes the stop [gw], suggesting that it may still be an obstruent.

The prediction of the fixed ranking given here is that no language can have *only* obstruent laterals and no sonorant laterals. While this is certainly the usual case, there are some possible counter-examples, including Min if its [l] is an obstruent. However, Min has no other oral sonorant consonants —no /r/ - so high ranked SON=NAS could be invoked. An alternative might be to say that this [l] is not phonologically [lateral] at all, but is just an oral stop. Another possible counter-example is Tlingit, which has fricative and affricate laterals, but no voiced approximant. This needs further investigation. Finally, the existence of truly voiceless lateral approximants such as Toda [l̥] simply implies that SON=VOICE can be low-ranked.

II.1.2. Preference for coronals

I now turn to the preference for laterals to have Coronal place. There seems to be little doubt that this is real. Evidence includes common alternations between [l] and [n], or [l] and [d]. For example, in Cantonese, younger speakers are replacing [n] in onsets with [l] (Matthews & Yip 1994:6). In Min Chinese, in contexts where the nasals /m, ŋ/ alternate with the voiced stops /b, g/, /n/ alternates not with /d/ but with /l/. In Palenquero Spanish, (Piñeros 2003) /d/ becomes [l] in certain contexts. In Arabic roots, the coronal sonorants /l,r,n/ form a natural identity class that resist co-occurrence. The class of epenthetic consonants cross-linguistically, at least in onsets, includes glottal stop, [t], and [l]. Languages that use [l] include Chaoyang Chinese in reduplication: /kuaʔ/ > [kuaʔ luaʔ] 'cut off' (Yip 2001), SiSwati in its noun class prefixes (Class 5 and in loans, Doke (1954), and Gloria Malambe, p.c.), and Bristol English (Wells 1982, Lombardi 2002), to fill out a word-final syllable: 'Eva' [ivəl]. Nonetheless, laterals may also be placeless or velar, and the OT typology that produces this is given below:

(4)	*LATLAB » *LATDORS » *LATCOR » FAITH	Either no laterals, or placeless ones.
	*LATLAB » *LATDORS » FAITH » *LATCOR	Common type, with Coronal laterals[2]
	*LATLAB » FAITH » *LATDORS » *LATCOR	New Guinea type, with velar and coronal laterals, or perhaps Palatal laterals
	FAITH » *LATLAB » *LATDORS » *LATCOR	Unattested

An example of phonologically placeless laterals comes from Cambodian: (Nacaskul 1978). The co-occurrence restrictions on identical Place features do not treat /l,r/ as Coronal, even though Place restrictions cross-cut obstruents and sonorants, stops and fricatives, nasals and glides. Instead, they behave like [h,ʔ] in co-occurring freely with all other sounds.[3]

Languages with Dorsal laterals will include those like the Papuan New Guinea language Mid-Waghi (Blevins 1994), and also perhaps languages with palatal laterals, which have been argued to be both Coronal and Dorsal by Sagey (1986) and others. The last grammar in (4), which predicts the existence of the unattested labial laterals, is an unexplained gap. One possibility is that the perceptual effects of lateral release would be too subtle to make such a contrast functionally effective. I shall have nothing further to say about labial laterals.

The main prediction of this typology is that no language should have only Dorsal laterals. Either it must have complex corono-dorsal laterals, or Dorsal and Coronal ones in contrast. Blevins argues that many of the cases of apparent velar laterals, such as Yagaria and Kunite, are in fact phonologically complex, being both Coronal and Dorsal. The fact that they have /ʟ/ but no /l/ is then not a problem. In contrast Mid-Wahgi has a Dorsal /ʟ/ that (contra Blevins) does not seem to be in any way Coronal (although it does assimilate to a following Coronal /aʟ-to/ > [alto] 'eastwards'), but it also has contrasting /l̪/ and /l/, as shown by [aʟaʟe] 'dizzy', [al̪a al̪a] 'again and again' [alala] 'speak incorrectly' . For Blevins, committed to [lateral] under the Coronal node, this is a problem, since all laterals must be Coronal, but for the approach outlined here plain Dorsal laterals are fine, so long as they contrast with plain Coronal ones.[4]

Putting together the results of this section, a language with only coronal sonorant laterals will have the grammar in (5).Many of the languages discussed in this paper are of this type.

(5) *LATOBS, *LATDORS » IDENTLAT » *LATSON, *LATCOR

The relevant faithfulness constraint here is IDENTLAT, which requires that segments that are lateral in the input must be lateral in the output.[5]

III.2. Laterals as triggers of assimilation

Let us assume that assimilation involves a violation of the IDENT family of faithfulness constraints, such as IDENT-PLACE, or IDENT-SON, under pressure from higher ranked constraints

such as SHARE-F (or AGREE) and SYLLABLE CONTACT. Any assimilation process that creates the ordinary sonorant Coronal lateral [l] from an underlying non-coronal or non-sonorant will thus violate at least one of IDENT-PLACE and IDENT-SON. The ranking of these constraints with respect to the constraints causing assimilation, here abbreviated as ASSIM, will determine which segments may undergo the process. If IDENTSON » ASSIM, targets must be sonorant. If IDENTPLACE » ASSIM, targets must be Coronal. If the output is always Coronal and sonorant, *LATOBS and *LATDORS are always high ranked, and *LATCOR and *LATSON are always low-ranked. The following typology results:

(6) a. Target must be sonorant:
*LATOBS, **IDENT-SON » ASSIM** »*LATSON
a'. Target need not be sonorant, but output will be:
*LATOBS » **ASSIM » IDENT-SON**, *LATSON
b. Target must be Coronal:
*LATDORS, **IDENT-PLACE » ASSIM** » *LATCOR
b'. Target need not be Coronal, but output will be:
*LATDORS » **ASSIM » IDENT-PLACE**, *LATCOR

By combining one of the sonorancy rankings with one of the Place rankings, we get the following mini-grammars (with low-ranked *LATCOR and *LATSON omitted for space reasons).

(7) a & b.: Target must be sonorant and Coronal: Flemish, Toba Batak
*LATOBS, *LATDORS, **IDENT-PLACE, IDENT-SON » ASSIM**
a & b': Target must be sonorant, but need not be Coronal: Selayarese
*LATOBS, *LATDORS, **IDENT-SON » ASSIM » IDENT-PLACE**
a' & b: Target must be Coronal, but need not be sonorant: Sanskrit, Yanggu
*LATOBS, *LATDORS, **IDENT-PLACE » ASSIM » IDENT-SON**
a' & b': Target need not be Coronal or sonorant, but output will be both: ?
*LATOBS, *LATDORS, **ASSIM » IDENT-SON**, IDENT-PLACE

Finally, rankings with *LATSON, *LATCOR ranked above ASSIM, (and thus *LATOBS, *LATDORS even higher) would not allow laterality to surface at all on the target, so we would observe either failure of assimilation before laterals (Javanese), or possibly assimilation of other lateral properties, such as voicing (Polish), or coronality (Chukchi), but not laterality. Yip (to appear) discusses these cases in detail.

What about the possible outcomes? If *LATDORS, *LATOBS » ASSIM, the outputs must be coronal sonorants, and this is the most common case. If ASSIM» *LATDORS, assimilation could create velar laterals. Rather surprisingly, this seems to be unknown, but palatal laterals, which may be thought of as both Coronal and Dorsal (but see note 4), can certainly be created, as in English *welch* [ʎtʃ]. Lastly, if ASSIM » *LATOBS, assimilation could create lateral

obstruents. I am not aware of such cases, but some reports of failure of assimilation in /t-l/ inputs could perhaps actually be reinterpreted as [t͡l l] outputs, which would be hard to distinguish from simple [tl] clusters.[6]

III.3. Laterals as targets of assimilation

The final issue is how laterals behave as the targets of processes. Does the feature [lateral] survive under assimilation or neutralization? The remainder of this paper addresses this issue, which is of particular interest in the context of this volume because many languages of the Iberian peninsula, and also English, provide examples of just about the full range of lateral behaviour. A summary of lateral target behaviour is given below, re-organized by the effect of spreading type on laterality. SV stands for Sonorant Voicing.

(8)

Effect on [lateral]	**Place spread**	**SV spread**
stay lateral, but assimilate	Basque, English, Tamil, Central Catalan	English
lose lateral	Moroccan Arabic, Cuban Spanish	Ponapean, Itsekiri, Min, Yoruba
Effect on [lateral]	**Place loss**	**SV loss**
stay lateral	Caribbean Spanish	Koyukon, Angas
lose lateral	–	Yagaria, Kihungan, Swahili

In a feature-geometric approach, this erratic behaviour is obviously problematic. However, it is exactly what we expect given the existence of markedness restrictions on the co-occurrence of laterality with other features, and general constraints that enforce feature-sharing, and enforce restrictions on what may appear in non-prominent positions such as codas. Consider the typology below:

(9) Spreading with retention of laterality: IDENTLAT » SHARE-F
Spreading with loss of laterality: SHARE-F » IDENTLAT
Coda neutralization with retention of laterality: IDENTLAT » *CODA-F
Coda neutralization with loss of laterality: *CODA-F » IDENTLAT

Markedness restrictions also play a key role. If codas must be Dorsal, as in Caribbean Spanish, but laterals stay Coronal, we may attribute this to high-ranked *LATDORS, in combination with IDENTLAT » *CODA-COR. If nasality spreads, and converts a lateral to a plain non-lateral nasal as it does in Itsekiri and Min, instead of simply nasalizing the lateral itself, we may attribute this to top-ranked *NASLAT, in combination with SHARE-NAS » IDENT-NAS, IDENT-LAT. In what

follows I work out representative cases of the four grammars given above. Note that in some cases the key faithfulness constraint may be IDENT-SON, rather than IDENTLAT, if /r/ is also involved.

It is also important to compare the behaviour of laterals as targets to the behaviour of nasals and of coronal obstruents: do they differ in their vulnerability to assimilation, and in the type of outcome, or not? Only if they differ can it be attributed to constraints involving laterality. The following chart looks at Place assimilation in five representative languages, all discussed in more detail below. I have categorized assimilations as total, partial, or no change (shown by a dash). Total assimilation, shown by darker shading, creates a (near) geminate. Partial assimilation, shown by lighter shading, creates a homorganic cluster, but the target retains its original sonorancy, continuancy, laterality or nasality. Both types may or may not include assimilation of voice. I have tried to consult sources that are detailed enough to note small changes in place of articulation, so that, for example, [l̪θ] is not transcribed loosely as [lθ].

(10) Coronals as targets of Place assimilation:

	Basque	English	Central Catalan	Moroccan Arabic	Educated Havana Spanish
/l/ + non-Cor: e.g. /lb/	-	-	-	-	Total: /lb/ → [bb] /lp/ → [bp]
/l/ + Cor e.g. /l̪d̪/	Partial: l̪d̪	Partial: l̪θ	Partial: l̪d̪	Total: /ld/ → [dd]	Total: /ld/ → [dd]
/t/ + non-Cor e.g. /tp/	/t/ deletes before stops	-	Partial/Total /tf/ → [pf] /tk/ → [kk] /tm/ →[mm]	Unchanged, not even voicing assimilation	Unchanged, or obstruents velarize in casual speech
/t/ + Cor e.g. /tʃ/	ʔ	Partial: t̪θ t̪r	Partial/Total /tʃ/ → [t,ʃ] /tl/ → [ll]	Voicing assimilation: /tʒ/ →[dʒ]	As above
/n/ + non-Cor: e.g. /nb/	Partial: mb	Partial: mb	Partial: mb	-	Velarization; some secondary labialization before labials
/n/ + Cor: e.g. /n d̪/	Partial: n̪d̪	Partial: n̪θ	Partial: n̪d̪	/nr/ → [rr]	Velarization

The most common type seems to be the pattern shown by Basque and English, and many other languages including Tamil (Beckman 1998). Obstruents rarely assimilate, and then more often to other coronals, whereas nasals usually assimilate to everything. Obstruents may delete, or epenthesis may separate the cluster (as in Tamil). Laterals occupy a middle ground, assimilating

to coronals but not to non-coronals. Total assimilation is rare in all language types, and never found with nasals before obstruents, presumably because a nasal-obstruent intervocalic cluster is usually preferred to a geminate obstruent.

I have suggested earlier that the apparent non-existence of languages with partial assimilation of laterals to labials or velars, in which for example /lg/ → [Lg], results from the high-ranking of *LATDORS in most languages.

IV. CASE STUDIES OF LATERALS AS TARGETS OF ASSIMILATION

In this section I look at common assimilation rules in which a coda assimilates in Place to the following onset. If [lateral] were a feature under the Coronal node, such assimilation would remove [lateral] from the target. Only two language-types are thus expected. Either laterals should lose their laterality, or they should resist all assimilation. We shall see that there is a third type, in which laterals assimilate only in those features compatible with their laterality, always remaining coronal. Indeed, this is probably the most common type, and I have not found any languages in which the lateral resists all assimilation even before other coronals.

IV.1. Place spreading does not remove lateral

In Central Catalan, Place spreading from labials and velars affects coronal stops (optionally) as in (11a) and coronal nasals as in (11b), but does not touch laterals, (11c). It also fails to affect fricatives, (11d). Data from Mascaró (1976:68), Grijzenhout (1994:171):

(11)	a.	set xinesos	→	se[t,ʃ]insesos	‘seven Chinese men’
		set focs	→	se[pf]ocs	‘seven fires’
		set cases	→	se[kk]ases	‘seven houses’
		set linies	→	se[ll]inies	‘seven lines’
		set mans	→	se[mm]ans	‘seven hands’
	b.	só[n] pocs	→	só[m] pocs	‘they are few’
		só[n] grans	→	só[ŋ] grans	‘they are big’
	c.	e[l] pa	→	e[l] pa	‘the bread’
		e[l] foc	→	e[l] foc	‘the fire’
	d.	me[s] pa	→	me[s] pa	‘more bread’
		me[s] flors	→	me[s] flors	‘more flowers’

Before coronals, however, laterals do assimilate in Place:

(12)	el [d̪]ia	→	e[l̪d̪]ia	‘the day’
	el ric	→	e[[r]ic	‘the rich’
	el [ʒ]erma	→	e[l,ʒ]erma	‘the brother’

Before velars, /l/ becomes velarized, but retains its primary coronal articulation: el gos→e[ɬg]os, 'the dog'.

Similar facts hold in Basque, except that coronal stops delete before another consonant. There is general Place spreading onto sonorants, as can been seen in the left-hand column below. Laterals also assimilate before coronals, but are unchanged before other places. (Hualde 1991). Similar facts hold in Tamil (Beckman 1998), and in English: we[l̪θ] *'wealth',* we[ʎtš] *'welch'* but whe[lk]. The interesting fact is that in all these languages laterals do not lose their laterality under assimilation. If [lateral] were a dependent of the Place node via the Coronal node, we would expect that Place spreading would delink the original Place node, taking [lateral] with it.

(13)				
	egu[n]a	'the day'	ata[l]a	'the section'
	egu[m] berri	'new day'	ata[l] berri	'new section'
	egu[ŋ] fresku	'cool day'	ata[l] fresku	'cool section'
	egu[n̪ d̪] enak	'every day'	ata[l̪ d̪]enal	'every section'
	egu[ɲ] tiki	'small day'	ata[ʎ] tiki	'small section'
	egu[ŋ] gorri	'red day'	ata[l] gorri	'red section'

In the theory proposed here, this is straightforward. High ranked ***LATDORS, IDENTLAT** stop the creation of non-coronal laterals, and also the loss of laterality, leaving only the features compatible with Coronal and [lateral] free to spread.

(14) ***LATDORS, IDENTLAT » SHARE-F » IDENT-PLACE**

SHARE-F is a cover term for the entire family of constraints that enforce feature sharing, and I shall only use its component constraints, such as SHARELAT or SHAREPLACE, when it is clear that they are differentially ranked. The use of SHARE-F thus implies that they either are, or could be, ranked at the same level, thus encouraging total assimilation. Note that in the tableaux SHARE-F is violated once for each unshared feature, so that [ld] and [ʟg] get one asterisk for unshared [lateral], and [l̪d̪] and [lg] get two for unshared [lateral] and the place feature. I consider only outputs in which the second consonant is unchanged, presumably as a result of high-ranked positional faithfulness to onsets.

(15) /l/ before coronals

/l̪d̪/	*LATDORS	IDENTLAT	SHARE-F	IDENT-PLACE
☞ a. l̪d̪			*	*
b. l̪d̪			**!	
c. d̪d̪		*!		

IDENTLAT blocks total assimilation, but all other features are shared under the influence of SHARE-F, so that candidate (a) wins.

(16) /l/ before non-coronals

/lg/	*LATDORS	IDENTLAT	SHARE-F	IDENT-PLACE
☞ a. lg			**	
b. gg		*!		*
c. Lg	*!		*	*

Before non-coronals, the picture is different. The markedness constraint *LATDORS rules out candidate (c) with a lateral whose primary articulation is velar, and IDENTLAT rules out candidate (b). The result is no assimilation of the primary place of articulation. The secondary velarization found in Catalan is probably phonetic.

Finally, note that Basque, Catalan and English differ in how /t/ is treated as a target. Basque deletes /t/, presumably to avoid a poor sonority profile across the syllable-boundary. Catalan assimilates almost completely, as the grammar above would predict. English assimilates /t/ only before Coronals, probably because obstruent clusters never contain more than one non-coronal (Yip 1991).

IV.2. Place spreading does remove lateral

My first example of total assimilation comes from Educated Havana Spanish (Padgett 1991:228, Harris 1985, Guitart 1976). Liquids assimilate in Place, Manner and nasality to the following consonant. Before stops, they always remain voiced, but before voiceless fricatives they devoice. In all cases they lose their laterality:

(17)	albañil	a[bb]añil	'mason'
	tal droga	ta[dd]droga	'such a drug'
	pulga	pu[gg]a	'flea
	el pobre	e[bp]obre	'the poor man'
	el tres	e[dt]res	'the three]
	tal mata	ta[mm]ata	'such a shrub'
	el fino	e[ff]ino	'the refined one'

The core grammar here is SHARE-F » IDENTLAT, which will produce the loss of laterality. In general, voicing is unchanged, so IDENT-VOICE must dominate SHARE-F.

(18)

/lp/	IDENT-VOICE	SHARE-F	IDENTLAT
☞ a. bp		*	*
b. pp	*!		*
c. lp		**!	

To allow for the fricative facts, IDENT-VOICE must be over-ridden by a prohibition on (new) voiced fricatives, *[CONT, VOI]$_{NM}$, following McCarthy (2002).[7] For completeness, let me mention the unusual behaviour of the other coronals. These pervasively velarize in coda position, at least in fast speech, as Guitart shows. For example:

(19) u[ŋ] domingo /etniko/ → e[g]niko /afta/ → a[h]ta
u[ŋ] señor /absoluto/ → a[k]soluto /esta/ → e[h]ta

[h] is described as a voiceless pharyngeal fricative. The nasals also add some secondary labialization before labials. Neutralization to velars in coda position is controversial. De Lacy (2003) denies its existence, and argues that cases like these actually involve glottalization, but Guitart's descriptions are very careful. Putting aside this issue, I shall use a constraint CODA=DORSAL, which must outrank SHARE-F. However, liquids escape this coda condition because of the undominated *LATDORS, and instead assimilate. The option of nasalization of /lm/ to [ŋm] is, I assume, prohibited by high-ranked DEP-NAS (not shown), which prohibits insertion of a second separate [nasal] feature. [mm] on the other hand just shares the nasality of the original [m].[8]

(20)

/lm/	*LATDORS	CODA=DORS	SHARE-F
☞ a. mm		*	
b. lm		*	**!
c. Lm	*!		**
/ dm/	*LATDORS	CODA=DORS	SHARE-F
☞ a. gm			**
b. mm		* !	
e. dm		* !	**
/nm/	*LATDORS	CODA=DORS	SHARE-F
☞ a. ŋm			*
b. mm		* !	
c. nm		* !	*

A more complex case is found in Moroccan Arabic, where the definite article /l/ totally assimilates before Coronals, but is unaffected elsewhere.(Guerssel 1978, Heath 1987: 223)).

(21)	l kamyu	'the truck'	*vs.*	ššəmš	'the sun'
	l bṛa	'the letter'		ddfal	'the saliva'
				ttuma	'the garlic'
				n-nlm-a	'the ant' (Heath:37)

The voicing aspect of this assimilation is more general: The prefix /t-/ also assimilates in voice and in pharyngealization before Coronals, according to Heath. However, /t/ does not assimilate in manner, so for example /tẓ̣/ becomes /ḍẓ̣/, where /ẓ̣/ is a pharyneaglized coronal fricative. /n/, surprisingly, does not assimilate across morpheme boundaries: ta-n-gul '*I say*' (Heath: 210)

As a first pass, a plausible grammar might look like this: IDENT-COR » SHARE-F » IDENTLAT. SHARE-F » IDENTLAT is necessary to allow the loss of laterality. IDENT-COR stops /l/ becoming [p] or [k] before labials or velars. However, this grammar wrongly predicts that the lateral would assimilate to non-coronals in the other features such as manner or voicing, as the following tableau shows (22):

(22) Failed tableau for /l/ before a non-coronal:

/lp/	IDENT-COR	SHARE-F	IDENTLAT
☹ a. tp		*	*
b. lp		***!	
c. pp	*!		*

Candidate (a) will wrongly win, whereas candidate (b), [lp] is the actual output. Following Yip (1988), suppose that the driving force behind the assimilation to coronals is the OCP, which dislikes sequences of two Coronals, and requires that one be lost.[9] The features of the surviving coronal spread to fill the slot vacated by the /l/. In all other circumstances no assimilation of oral features takes place, suggesting that in general IDENT-F » SHARE-F. Since we have already established, however, that SHARE-F » IDENTLAT, what we need is a grammar in which IDENT for all *other* oral features dominates SHARE-F. Rather than listing each feature separately, I will use IDENT-F* to denote the set of constraints for each oral feature other than lateral. Tableau (23) shows how this works for two inputs: /lp/ and /lt/. Note by the way that the role of the OCP here provides evidence for laterals being specified as Coronal.

(23) Successful grammar for /l/ before (i) non-coronal and (ii) coronal:

(i) /lp/	OCP-COR	IDENT-F*	SHARE-F	IDENTLAT
☞ a. lp			son, voi, Cor	
b. tp		son, voi!	Cor	*
c. pp		son, voi, Cor!		*
(ii) /lt/	OCP-COR	IDENT-F*	SHARE-F	IDENTLAT
☞ a. tt		son, voi		*
b. lt	*!		son, voi	

I now move on to cases of SV spreading.

IV.3. SV spreading doesn't remove [lateral]

The only case of this sort that I have been able to find so far is not terribly convincing, since the facts are open to a quite different interpretation outlined at the end of this section. I include it here because it illustrates the form of the argument.

In English, liquids after voiceless aspirated stops become voiceless:

(24)

[bl]eak	[pl̥]ease	[gl]eam	[kl̥]ean
[br]eam	[pr̥]een	[gr]een	[kr̥]eam

If [lateral] were under an SV node, the devoicing would presumably mean that the SV node had been delinked, and one would then expect loss of [lateral] as well, but no such thing happens. In our account, there is no such expectation. The voicing assimilation means that SHARE-VOICE » IDENT-VOICE, and the creation of marked voiceless liquids means that IDENT-SON » SON=VOICE. Laterality is uninvolved, and thus unchanged.

(25) IDENT-SON, SHARE-VOICE » SON=VOICE, IDENT-VOICE

/pl/	IDENT-SON	SHARE-VOICE	SON=VOICE	IDENT-VOICE
☞ a. pl̥			*	*
b. pl		*!		
c. ps	*!			*

This example is not as problematic for an SV feature-geometric account as it might seem, for another reason. The devoicing only happens after aspirated stops: s[pl]een, not *s[pl̥]een. This suggests that the spreading feature is not voicing at all, but aspiration, in which case no consequences would be expected for laterality. In either case, an OT account is straightforward.

IV.4. SV spreading removes lateral

Languages where laterals nasalize, and then lose their laterality, have been taken as evidence for an SV node: the SV node of the nasal spreads, forcing delinking of the SV node of the lateral, which therefore loses its laterality.The following facts from Itsekiri (Nigeria, Piggott 1991 cited in Brown 1995:64) are often cited, and very similar facts hold in Southern Min Chinese, and in Yoruba.

(26) lã → nã 'ask the price of'
lɔ̃ → nɔ̃ 'be lost'

In the approach taken here, nasal harmony implies a grammar in which SHARE-NAS » IDENT-NAS. The loss of laterality is the result of high-ranked *LATNAS » IDENTLAT. Such segments are certainly marked, perhaps because they are not sufficiently perceptually distinct from plain nasals (Flemming 2003b). Note that [ɬ] is here used in a non-standard way, to show a nasalized lateral.

(27) Loss of laterality under nasal spreading

/lã/	*LATNAS	SHARE-NAS	IDENT-NAS	IDENTLAT
☞ a. nã			*	*
b. ɬã	*!		*	
c. lã		*!		

A fourth candidate [la] is presumably ruled out by a high-ranked constraint preserving the underlying contrast between oral and nasal vowels, as opposed to consonants. I conclude that the analysis does not depend in any way on an SV constituent.

A somewhat different situation is found in Ponapean reduplication (Itô:137), where /l/ becomes [n] before a Coronal:

(28) dil → din-dil 'penetrate'
sel → sen-sel 'tied'

This is only minimally different from Moroccan Arabic, and looks like an OCP-triggered process that spreads [-cont] from the stop onto the sonorant. I will adopt an idea from Padgett (1991: 238) for Educated Havana Spanish. He suggests that [+son, -cont] sounds must be nasals, and that this causes the loss of laterality. Translated into feature co-occurrence constraints, we can add *[+son, -cont, -nasal] to the grammar, ruling out [ld], with shared [-cont]. [ɬd] will be ruled out by *LATNAS as before, leaving [nd] as the winner. I assume that [dd] is ruled out by IDENTBR-SON, since geminates are permissible in the language, at least in loans. (cf. kiassi 'catcher').[10]

This concludes the case studies of assimilation, and I now move on to neutralisation.

V. CASE STUDIES OF LATERALS IN POSITIONS OF NEUTRALIZATION

V.1. Loss of place does not remove lateral

In Caribbean Spanish (Trigo 1988 : 71) place features are neutralized in codas. /d/ deletes, /s/ becomes [h], and all nasals become velar. /r/ and /l/ are unchanged.

(29)	a.	βerdad	→	βerða	'truth'
	b.	ines	→	ineh	'Ines'
	c.	album	→	albuŋ	'album' (optional)
		tren	→	treŋ	'train'
		desdeɲ	→	desdeŋ	'disdain'
	d.	tonel	→	tonel	'barrel'
		par	→	par	'pair'

Trigo analyses this as loss of Place features.[11] If this is correct, then it poses a problem for placing [lateral] under Coronal, since laterality survives even when Coronality does not. The account offered here is rather different. I shall assume that the codas are in fact Dorsal, not placeless. High-ranked *LATDORS bans velar laterals, and IDENTLAT blocks the loss of laterality. As a result laterals survive, and stay coronal. In the tableau below I assume a positional markedness constraint *CODACOR, but a positional faithfulness account would be equally viable.

(30)

/n/	IDENTLAT	*LATDORS	*CODACOR	MAX-PLACE
a. n			*!	
☞ b. ŋ				*
/l/	**IDENTLAT**	***LATDORS**	***CODACOR**	**MAX-PLACE**
a. ŋ	*!			*
b. ʟ		*!		
☞ c. l			*	

V.2 Loss of Place removes lateral.

I do not know of any cases where Place loss removes laterality.

V.3 Loss of SV leaves lateral unchanged:

The Athapaskan language Koyukon (Rice 1994) devoices syllable-final sonorants and continuants, including /l/. For the lateral, the result is a voiceless fricative [ɬ]. Similar facts hold in Angas (Halle & Clements: 45): siɻ 'to forgive', taɱ 'bench', k^{w}aḷ 'joint'.

(31)

	nəɣæ[l]ə	'your (SG) trap'	xæ[ɬ]	'trap'
	səʔɔ[x̊]ə'	'my snowshoes'	ʔɔ[x]	'snowshoes'
	nizu[n]i	'that which is good'	nizu[n̥]	'it is good'

Final stops are plain voiceless unaspirated. Under the SV hypothesis, where [lateral] is under SV and devoicing of sonorants means removal of the SV node, laterality should also disappear, but it does not. For different reasons Rice in her 1994 paper (p.115) takes voicing to be under the root node, in which case the survival of [lateral] is expected. This is entirely compatible with the approach taken here. The grammar we need has IDENTLAT, *CODAVOICE » IDENT-VOICE, SON=VOI, so that laterality is retained but voicing is lost.

(32)

/xæl/	IDENTLAT	*CODA-VOICE	IDENT-VOICE	SON=VOI
☞ a. xæɬ			*	*
b. xæl		*!		
c. xæt	*!		*	

V.4 Loss of SV removes [lateral]

The Papuan New Guinea language Yagaria shows a coalescence of a lateral and a glottal stop. The result is a voiceless coronal stop, in which the devoicing causes loss of sonorancy and laterality. The lateral in question is a phonetically velar lateral which Blevins argues to be phonologically Coronal (Blevins 1994), because the output of the coalescence is [t]. The process changes /ʋ/ to [p] and the velar lateral /ʟ/ to [t] after /ʔ/:

(33)

	/igopa-ʋiʔ/	igopaʋiʔ	*'into the land'*	/joʔ-ʋiʔ/	jopiʔ	*'into the house'*
	/igopa-ʟoʔ/	igopaʟoʔ	*'on the ground'*	/gipaʔ-ʟoʔ/	gipatoʔ	*'at the door'*

In Blevins' feature-geometric analysis, /ʟ/ is Coronal. After ʔ, it becomes [-son, -cont], and this causes loss of [lateral]. Elsewhere, a default rule adds secondary Dorsality. While this process certainly suggests that /ʟ/ is Coronal, it does not demonstrate that [lateral] is under Coronal, and it is still necessary to allow these velar laterals to also be Dorsal.

Under the approach taken here, the coalescence of the velar lateral and the glottal stop produces a segment that is a stop, and thus an obstruent, as a result of high-ranked MAX[-CONT]. Since sonorancy is lost altogether, I will use MAX-SON rather than IDENT-SON to avoid the issue of whether the output segment is the correspondent of glottal stop or /l/ or both. In our terms, the loss of laterality is then the result of high-ranked *LATOBS. In the tableau below I assume that coalescence is required by some independently high-ranked constraint not given here, which rules out the fully-faithful candidate.

(34) *LATOBS, MAX[- CONT], MAX-COR » MAX-SON

/ʔL/	*LATOBS	MAX[- CONT]	MAX-COR	MAX-SON
a. L		*!		
b. l		*!		
c. t͡l	*!			*
☞ d. t				*
e. ʔ			*!	

A slightly different but related case is found in Kihungan and Swahili (Padgett 1991), where liquids harden to [d] after nasals, so that /Nr/ and /Nl/ > [nd]. This is presumably driven by the Syllable Contact Law, which requires a falling sonority profile across a coda-onset sequence. As such, in an SV approach it must involve the loss of the SV node, which would thus remove laterality. In our approach, it follows from the grammar SYLLCONTACT, *LATOBS » IDENT-SON.

VI. CONCLUSIONS AND DISCUSSION

We have seen that when laterals are placed in positions where they are vulnerable to feature loss by assimilation or neutralization they often retain their laterality even when a feature-geometric approach would predict its loss. This is the case even when they clearly undergo the assimilation in question, since some features do indeed assimilate. The analysis presented here sees this as resulting from a combination of faithfulness to the feature [lateral], and restrictions on feature co-occurrence such as *LATDORS. Feature geometry plays no role.

It is clear that traditional universal feature geometry is too rigid to handle variation like that seen with laterals. It is a desirable property of OT that it allows for cross-linguistic variation in affinities between features, while also expressing universal preferences as fixed rankings of constraints governing feature-combinations. These fixed rankings are grounded in phonetic dictates. The preference for Coronal laterals is the phonologization of the articulatory fact that lateral release is most readily produced with the blade of the tongue not the dorsum or the lips. The preference for voiced sonorant laterals is the phonologization of the fact that in a laterally released sound the airflow is never obstructed enough to hinder spontaneous voicing.

The need for admitting flexibility in the relationship between features, despite strong preferences for certain pairings, makes any attempt to incorporate a fixed feature geometry into OT a retrograde step. It is also unnecessary: the advantages of feature geometrical theories can be achieved by constraints on feature co-occurrence, along the lines of Padgett (1995, 2000). The arguments for representational approaches to feature combinatorics are rendered moot.

A different criticism of the feature-geometric approach, suggested by a reviewer, is that feature geometry cannot capture the observation that laterals must be *both* coronal *and* sonorant. This is true in any version of feature geometry in which terminal features must have a unique

superordinate node, but one can imagine a version of feature geometry in which this requirement is relaxed to allow double domination, as suggested in Yip (1990). [lateral] can then be dominated by both Coronal and SV. Such a move, however, does not solve the issues raised by the variable behaviour of [lateral] documented in this paper.

The arguments here have been based entirely on the feature [lateral], but what of other features. Variable behaviour might be seen whenever the features are most readily produced on a certain type of segment, but not necessarily so. For example, [strident] sounds, in which the turbulence produced at the point of constriction is sufficiently strong, and/or where the ensuing airstream then hits a sharp obstacle like the teeth, is easy to produce with the tip or blade of the tongue, but hard to produce elsewhere. We derive from this a constraint hierarchy *[Labial, strident] » *[Coronal, strident]. Languages which contrast [f] and [ϕ], like Ewe, arguably violate the former as well as the latter. Turbulent airflow also requires a period of incomplete closure, or continuancy, so we also derive *[-cont, strident] » *[+cont, strident]. Languages that violate the former have strident affricates, which have often been argued to be strident stops. In principle, then, the interactions of these constraints might also produce comparable variation to that we have seen with laterals.

For other features, no such variation is to be expected. [anterior] and [distributed] refine the type of contact the tip or blade of the tongue makes with the roof of the mouth. As such they can only be present in Coronals, and a sound that is [Dorsal, +ant] is phonetically uninterpretable.

Finally, I should note that a related but somewhat different approach to these issues is taken in recent work by Mielke (2004), who takes the variability in behavior of 'ambivalent segments' like laterals to be an argument against universal distinctive features. Instead, he argues for 'emergent distinctive features' based on phonetic similarity. Laterals, for example, may pattern with either continuants (16 languages) or non-continuants (61 languages) because like continuants they do not have totally blocked airflow, but like non-continuants they do have 'a blockage of airflow past the primary structure'. It remains to be seen how this differs empirically from the approach taken here.

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NOTES:

1. On the issue of whether we need constraints that penalize the least-marked entities, such as *LATCOR, *LATSON, see Gouskova (2003)

2. Walsh (1997) argues that all laterals have both Coronal and Dorsal Place. This is certainly true phonetically in some languages, and perhaps phonologically too (in English, for example, /l/ vocalizes to the Dorsal [u] in many dialects, and children often turn coronals into velars before [l]), but in other languages there is no evidence of a phonologically active Dorsal component.Palatal laterals may also be Coronal and Dorsal, and contrast with plain Coronal laterals. This analysis of palatals is problematic for the details of the view taken here, as a reviewer points out, since it seems to require a positive constraint LAT=COR, but I have no room to explore this further here.

3. Of course, these laterals are phonetically implemented with the tip or blade of the tongue, but I am assuming that this is the articulatory realization of a segment specified for laterality, but not for place of articulation.

4. For reasons of space, I shall have to leave unresolved here issues surrounding the features of dark velarized [ɬ], and also of palatal [ʎ]. If either or both is specified as both Coronal and Dorsal, Faithfulness must dominate both *LatDors and *LatCor, and one would thus expect a language that has [ɬ] or [ʎ] to also have not only plain light [l], but also velar [ʟ], and this is clearly wrong. In the approach taken here, we thus seem to be forced to the conclusion that [ɬ] and [ʎ] do not have a Dorsal specification.

5. A reviewer points out that the grammar in (5) has two different outcomes depending on the ranking of IDENTPLACE. If IDENTPLACE »*LATCOR, coronal inputs will remain coronal, but dorsal inputs will become placeless, resulting in a surface contrast. If *LATCOR » IDENTPLACE, then all laterals will become placeless. Thus the only way to ensure that all laterals are coronal on the surface is to assume that placeless segments violate some constraint like SPECIFY PLACE.

6. Since the approach outlined here clearly predicts the possibility of assimilation creating new velar laterals and new lateral obstruents, their non-existence is a real problem. I can only assume that the tendency for *LATDORS and *LATOBS to be very high-ranked in most languages makes them very rare, but that they should be found if we look hard enough.

7. A reviewer points out that if high ranked this would appear to block spirantization, a process found in many dialects of Spanish. Unfortunately as we go to press I am away from my desk, and have no access to the data sources on this dialect, so I am unable to confirm whether there is spirantization or not.

8. A further option might be to velarize the /l/ (or the /d/), and spread nasality rather than inserting it, also giving [ŋm]. Technically, this can be achieved by ranking a conjoined constraint IDENTNAS & IDENTDORS above CODA=DORSAL, but this does not shed much light on *why* nasal spreading is blocked in this one instance.

9. It is not clear how widespread this prohibition of two coronals is, but it is unsurprising given the well-known avoidance of homorganic consonants in Semitic.

10. A reviewer points out that under this account we must assume that all Ponapean laterals are [+cont]. This is not unprecedented, but certainly marked, see Mielke (2004).

11. It is not clear why /d/ deletes instead of simply debuccalizing to a glottal stop. Its failure to velarize to [g], as a reviewer points out, can be explained as a constraint against obstruent codas.

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