

A place for lateral in the feature geometry*

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Phonological models of feature geometry suggest that the internal structure of segments is highly articulated. Distinctive features are organized hierarchically within the segment, and this hierarchical organization is relatively stable across and within languages. Much recent work has been devoted to determining the precise location of place of articulation features within the hierarchy. In this study, the distinctive feature [lateral] is the focus of investigation. Though [lateral] is often considered a manner feature, it is usually associated with coronal articulations. By examining the behaviour of coronal and velar laterals in phonological rules and constraints, evidence emerges that [lateral] is a terminal feature of the coronal node within the feature tree.

1. INTRODUCTION

In this paper I argue that the distinctive feature [lateral] is a terminal feature of the coronal node within the segment-internal feature geometry. Following Campbell (1974), Clements (1985), Sagey (1986), and McCarthy (1988), dominance and precedence relations within the segment are recognized, and features are organized into a hierarchical tree whose terminal and non-terminal nodes are subject to autosegmental rules. Within such a tree, the position of [lateral] has been the subject of some controversy. Steriade (1986) assumes [lateral] to be a terminal feature of the coronal node; Sagey (1986) suggests [lateral] is at least as high up as the place node; and Shaw (1989, 1991) argues that [lateral] is immediately dominated by the root node.

The debate as to where [lateral] belongs centres on two distinct issues, one concerning phonological representations, and the other phonological rules. The first issue is simply stated: if non-coronal laterals exist, then lateral cannot be a feature exclusively associated with coronal segments. The existence of non-coronal laterals necessitates representations where [lateral]

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is present, but coronal is not. The second issue is whether or not there are rules which illustrate a dependency relationship between [lateral] and the coronal node. For instance, if rules spreading the coronal node always involve spreading of [lateral] as well, then this is evidence that [lateral] is properly represented as a terminal feature of the coronal node. In this paper, both representational and rule-based phonological arguments are presented in favour of [lateral] as a terminal feature immediately dominated by the coronal node.

Before turning to these arguments, section 2 provides a brief review of evidence for [lateral] as a distinctive feature, outlines aspects of feature definitions, feature geometry and phonological rules relevant to the discussion and presents the Coronal-Lateral Hypothesis. In section 3 representational evidence for velar and palatal laterals is considered. Section 4 examines available rule- and constraint-based evidence for the precise positioning of [lateral] within the feature hierarchy. Potential counter-examples to the Coronal-Lateral Hypothesis are dealt with in section 5, and results are summarized in section 6.

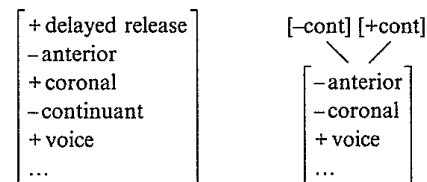
2. PRELIMINARIES

2.1 *Evolution of the segment*

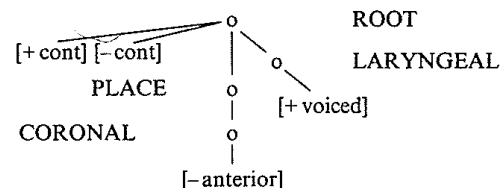
Autosegmental theory has led to radical restructuring of distinctive feature theory as put forth in Chomsky & Halle (1968). Three independent developments define the core of this restructuring. First, segmental features were shown to have autosegmental status (Thráinsson 1978; McCarthy 1979; Clements 1981). Second, such features were claimed to be ordered internal to the segment (Campbell 1974; Halle & Vergnaud 1980; Steriade 1982), with affricates and pre-nasalized segments represented as single feature matrices with differing sequential values of continuancy and nasality respectively. Third, rules of assimilation and dissimilation were viewed as autosegmental spreading and delinking respectively of a feature, or feature bundle: as a result, grouping of features in assimilatory and dissimilatory processes was claimed to provide evidence of hierarchical feature structure internal to the segment (Clements 1985; Sagey 1986; McCarthy 1988). This evolution of the segment is illustrated in (1), with partial representations of the alveo-palatal affricate [tʃ].

LATERAL IN THE FEATURE GEOMETRY

- (1) (a) *Feature matrix as unordered set* (b) *Features as autosegments: partial linear order*



- (c) *Feature geometry: linear order and hierarchical structure*



The restructured segment in (1c) is more complex than the original two-dimensional feature matrix in (1a). As a result of this added complexity, phonological theory must not only define the set of distinctive features which compose segments, but must also determine where these features belong within the segment, whether they have binary or privative status, and whether or not they are sequentially ordered within the segment. In this paper, I focus on the precise hierarchical placement of [lateral] within the realm of dominance relations which currently define all segments. These dominance relations and their precise implications for phonological rules are outlined in the following subsection.

2.2 *Feature geometry and the Coronal-Lateral Hypothesis*

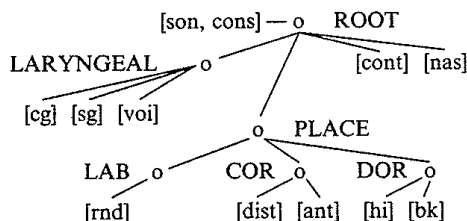
Emerging models of segment-internal feature hierarchy of the kind illustrated in (1c) (Clements 1985; Sagey 1986; McCarthy 1988) assume that the hierarchical representation of features is fixed and universal. Determination of features and their place within the segment tree are based for the most part on four postulates of autosegmental theory, summarized in (2).

- (2) *Autosegmental theory and feature geometry*
- (a) Assimilation rules involve autosegmental spread of a single (terminal) feature, or of a single non-terminal node. The set of assimilation rules therefore is co-extensive with the set of nodes defining the segment tree.

- (b) Dissimilation or segment reduction/neutralization involves auto-segmental delinking of a single (terminal) feature, or of a single non-terminal node. The set of dissimilation/reduction rules therefore is co-extensive with the set of nodes defining the segment tree.
- (c) The Obligatory Contour Principle (OCP) prohibits adjacent identical elements, where adjacency is defined on tiers, and tiers are defined by the set of nodes defining the segment tree. The set of OCP constraints is therefore co-extensive with the set of nodes defining the segment tree.
- (d) Association lines may not cross, where crossing association lines are defined on parallel tiers, and tiers are defined by the set of nodes defining the segment tree. The set of opacity constraints is therefore co-extensive with the set of nodes defining the segment tree.

Argumentation based on the postulates in (2) has resulted in a rather complex segment-internal hierarchical structure. In this paper, I adopt with minor modifications the model of segment-internal structure argued for in McCarthy (1988: 105), based on extensive review and investigation of the relationship between distinctive features. Relevant aspects of the model are illustrated in (3).¹

(3) *Segment-internal feature geometry*



Non-terminal node-labels are in capitals, and terminal features are in lower

[1] Aspects irrelevant to the discussion are the existence of a PHARYNGEAL node, and its terminals.

The model in (3) differs from that of McCarthy (1988) only in its definitive placement of [high] and [back] as daughters of the dorsal node, following proposals of Sagey (1986). I have also taken the liberty of replacing McCarthy's [stiff] and [slack] with the single binary feature [voiced]. Furthermore, I have left out McCarthy's designation of [lateral] as a terminal feature of CORONAL, since such designation is precisely what is under investigation, and since McCarthy's placement of [lateral] is based in large part on earlier versions of this paper. See Kenstowicz (1994, Chapter 5) for a summary of feature geometry models and points of controversy.

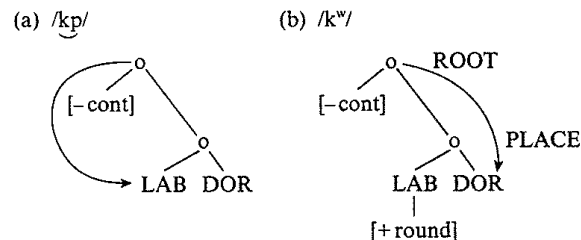
Abbreviations used throughout are: COR for CORONAL, LAB for LABIAL, and DOR for DORSAL. All other abbreviations are standard.

case. (Here and throughout I use expressions like 'PLACE' and 'COR' to refer to the place node and coronal node respectively.) Within this model, only terminal features have binary +/− values. Non-terminal nodes define distinct segments based on their presence or absence within the segment tree.

This model of segment-internal geometry solves three problems which were intractable within earlier two-dimensional unordered matrix representations. First, affricates, prenasalized stops and other 'contour' segments can be successfully represented as segments with branching terminal features. Such segments were problematic within linear frameworks as there was no way to express segment-internal timing relationships. As illustrated in (1c), an affricate like [tʃ] is represented as branching on the continuant tier: there it has ordered values [−cont][+cont].²

Second, segments involving two distinct places of articulation, such as labio-velar stops [kp], [gb] or labialized velar stops [kʷ], [gʷ] can be represented, following Sagey (1986), as segments with two distinct place features represented under the place node. Following Anderson (1976), Sagey (1986: 199 ff.) argues that for every multiply articulated segment, one and only one articulation is considered primary: primary status of an articulator is not predictable from its degree of closure, but must be phonologically specified. The articulation which is 'primary', or 'major' in Sagey's terms is that for which degree of closure features are defined. Secondary or minor articulations are claimed to have predictable degree of closure features within a given language. In (4), two complex segments are illustrated which differ only with respect to which of the two place features is designated as the major articulator. The designation of a major articulator is indicated by an arrow going from the root-node to the specified place feature.³

(4) *Complex segments (following Sagey 1986)*



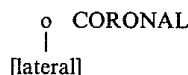
[2] Representing contour segments as ordered feature values within a single segment was suggested prior to the development of autosegmental theory in Campbell (1974).

[3] See Sagey (1986) for detailed arguments for this approach, along with arguments for treating clicks as complex segments of this sort.

Finally, feature geometry allows for the elimination of powerful variable-notation in phonological rules. Such variable-notation was formerly used in the statement of common assimilatory and dissimilatory processes: under place-assimilation a segment becomes [α coronal, β anterior,...] when adjacent to [α coronal, β anterior...]. Such assimilation is now expressed as simple spreading of the place-node. Variable notation can be eliminated, and as a consequence, the theory is more appropriately constrained. In summary, there is extensive motivation for a universal model of feature-geometry like that in (3).

Having established motivation for hierarchical feature relationships, the position of each feature must be assessed relative to available phonological evidence. Where then does the feature [lateral] belong in the multi-branching tree in (3)? I will argue that [lateral] is a terminal feature of the coronal node as shown in (5), and will refer to this as the Coronal-Lateral Hypothesis.

(5) *The Coronal-Lateral Hypothesis (CLH)*



A corollary of this hypothesis is that all laterals are coronals. This corollary has been assumed by many and rejected by others without serious phonological investigation on either side. Sagey (1986: 281) summarizes the primary objections to (5) as follows:

If it were true that only coronals could be lateral, then we could represent [lateral] under the coronal articulator in the hierarchy. However, non-coronal laterals have been attested in certain languages... Since [lateral] may apply to either coronals or dorsals, it cannot be represented under the coronal node. Rather, it should be represented under either the place node, the supralaryngeal node, or the root node.

The attestation of non-coronal laterals in the phonetics of various languages does not bear on the coronal hypothesis, unless it can be shown that such segments must be distinguished phonologically from coronal laterals, or that they must be treated as non-coronals by some phonological process. In section 3 evidence is presented for a coronal node in the representation of velar and palatal laterals.

Other objections to the CLH involve the failure of laterals to behave as coronals in relation to the autosegmental principles outlined in (2). In sections 5 and 6 phonological rules and constraints involving laterals are shown to either follow from or be consistent with the CLH.

2.3 *Feature definitions and the Coronal-Lateral Hypothesis*

The dependency relationship between laterality and coronality suggested in (5) above can be straightforwardly related to articulatory definitions of these features.

Lateral sounds have traditionally been defined as those which involve active lowering or raising of one or both sides of the tongue margins.⁴ Phonetic analysis of English laterals by Sproat & Fujimura (1993) reveals that the clear-dark allophonic distinction assumed by many is non-categorical, and that all English laterals actively involve the tongue body. They define lateralization in terms of necessary front-to-back lengthening of the tongue and suggest that a [+back] dorsum in conjunction with a specified position for the tongue blade results in a lengthened tongue when phonetically implemented.

Coronal sounds on the other hand are defined as those which involve the tongue blade as an active articulator. The tongue blade, as defined by Halle & Stevens (1979), includes the section of the tongue from the tip up to the dorsum, including the tongue margins.

The CLH then can be derived straightforwardly from the articulatory definitions in (6).

(6) *Articulatory definitions*

- (a) [lateral]. Lateral sounds involve lowering or raising of one or both sides of the tongue margins and may also involve lengthening of the tongue which is accomplished by movement of both the tongue blade and the tongue dorsum.
- (b) CORONAL. Coronal sounds involve the tongue blade as an active articulator.
- (c) Tongue blade. The tongue blade includes the section of the tongue from the tip up to the dorsum, including the tongue margins.

If, as defined in (6a) [+lateral] sounds involve the tongue margins and the tongue blade as active articulators, it follows from the definition of [coronal] that all lateral sounds are coronal.⁵ The mother-daughter relationship between coronal and lateral can be viewed as another instance of the general

[4] While pure dental, alveolar and alveopalatal laterals involve lowering of the tongue margins, velar laterals, because of the high position of the dorsum, may involve raising of the tongue margins off the lower back teeth. See section 3 for further discussion.

[5] Given Sproat & Fujimura's (1993) discovery of tongue dorsum involvement in all English laterals, it may be the case that all laterals are most properly viewed as complex coronodorsal segments. A thorough investigation of this view is outside the scope of this paper.

Another topic not dealt with here is whether [lateral] is binary-valued or privative. A binary-valued feature is assumed for the purposes of exposition, following Steriade's (1987) analysis of Latin liquid dissimilation, but one could just as well adopt privative [lateral] for all lateral contrasts discussed in this paper.

encoding of articulatory capacity and independence within the feature hierarchy, parallel to the positioning of [+round] as a terminal feature of the labial node. Just as lip rounding can only be implemented by the labial articulators, so laterality can only be implemented by definitive movements of the tongue blade.

However, as suggested by Clements (1985) and further stressed by McCarthy (1988), the empirical basis of feature geometry lies not in its modelling of the articulatory properties of speech, but rather in the demonstrable role it plays in determining the limited class of possible phonological representations and operations. Definitional relationships between features may be encoded structurally, as appears to be the case with [+round] and LABIAL. However, such relationships may also be encoded via redundancy rules. For instance, while all [−consonantal] segments appear by definition to be [+sonorant], and all [+high] segments are by definition [−low], there is little evidence that these relationships are structurally encoded within the segment. Rather, redundancy rules of the sort [−cons] → [+son] and [+high] → [−low] are assumed. Only by a close investigation of the phonological behaviour of lateral segments cross-linguistically can we determine whether the definitional relationship between lateral and coronal as suggested in (6) is valid and if valid, whether it should be encoded as a universal redundancy rule of the form [+lateral] → [coronal] or, as suggested in the CLH, as a configurationally encoded feature-dependency in which CORONAL dominates [lateral].

Before turning to such an investigation, a brief justification of [lateral] as a distinctive feature is presented.

2.4 *Lateral as a distinctive feature*

I will briefly discuss the status of [lateral] as a distinctive feature since in many languages its functional load is quite low or nonexistent. Within the class of non-nasal consonantal sonorants, [lateral] is used to distinguish rhotics ([−lateral]) from lateral approximants ([+lateral]). However, other features have been used to accomplish this same function.

Halle & Clements (1983), as well as many others, classify rhotics as [+continuant] and laterals as [−continuant] thereby eliminating the distinctive function of [lateral] in this context.⁶ However, arguments for

classifying all laterals as [−cont] are greatly weakened when properties of lateral fricatives [ɬ] and [ɮ] are inspected. These laterals have the high frequency noise characteristic of other fricatives, and on acoustic grounds could be classified as [+strident].⁷ Further, examination of the phonological behaviour of lateral fricatives in many languages affirms their [+cont] status. For instance, in Misantla Totonac (MacKay 1991), with underlying /lɬtsɬ sɬ/, in both possessive and imperfect prefixes, /ɬ/ → /k/ before root-initial /sɬɬ/; and /sɬɬ/ are the only obstruents which may appear as the final member of word-final triconsonantal clusters. In both cases, the class of [+cont] obstruents or [+cont, +strid] appears to be involved. It seems then that while continuancy may be useful in distinguishing lateral approximants from rhotics, it is not the case that all laterals are [−continuant]. Rather, lateral fricatives function as [+continuant] segments in many languages.⁸ But, if lateral fricatives are specified as [+cont], what distinguishes them from sibilants at the same place of articulation? The only feature available to distinguish /s/ from /ɬ/ in Totonac is [+lateral], and we are left to conclude that [lateral] is a necessary distinctive feature after all.

A proposal by Spencer (1984) contends that [lateral] can be eliminated from the universal feature inventory with redefinition of the feature [distributed]. Spencer's (1984: 29) central claim is that laterals, due to the airflow along the long constriction between the side of the tongue and the side of the cheeks, are '[+distributed] par excellence'. Within his system, all rhotics are [−dist], while all laterals are [+dist]. Problems arise in this system: one can no longer specify the natural class of retroflex sounds as [−anterior, −dist] coronals, since retroflex laterals, like all others, are treated as [+distributed]; further, since all laterals are treated as [+dist], there is no longer a way to distinguish apical laterals from laminal laterals, nor to refer to the natural class of apical or laminal consonants, as is necessary in many Australian languages (Dixon 1980). Spencer attempts to solve these problems by using [+back] to specify retroflexion, and by introducing two new place features: [apical] formed using the apex of the tongue as primary articulator; and [dental] formed using the upper teeth (or possibly the gum ridge) as passive articulator.

There are numerous problems with Spencer's revised feature system. First, it overgenerates. This is clear when his definition of [dental] is examined: 'Dental sounds will involve contact between an articulator and at least one

[6] The definition of continuant sounds in these instances is articulatory: [−continuant] sounds are those where airflow through the midsagittal region of the vocal tract is impeded enough to cause turbulent airflow. Arguments for treating lateral approximants as [−cont] centre on the fact that they appear to function in natural classes with other [−cont] segments. In Spanish, for example, spirantization of voiced stops is blocked when a homorganic non-continuant sonorant (i.e. nasal or lateral, but not trilled/tapped rhotic) precedes the stop. In Korean, only the non-continuants (stops, nasals and the lateral approximant) may occur in syllable final position. In the idiolect of English reported in

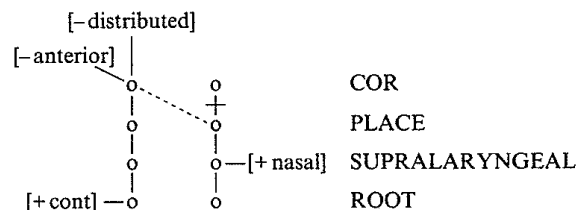
McCawley (1979), vowels are shortened before oral stops, nasals, and laterals – the class of [−cont] segments.

[7] However, unlike sibilants, the noise pattern in lateral fricatives is not as random. In Bura (Ladefoged 1964: 29) the alveolar lateral fricative shows low intensity fricative noise in two major energy bands centred at 2,400 and 4,400 Hz.

[8] It is not necessary that a system with underlying lateral approximant and lateral fricative make distinctive use of the feature [continuant]. The feature [sonorant] can also be used to distinguish these two segment types.

set of teeth (or teeth and anterior part of gum ridge together)' (p. 36). The fact that no language makes use of all combinations of [apical] and [dental] (with other features remaining constant) is indicative of overgeneration. The dental or interdental place of articulation is uniformly laminal in the case of Australian languages exhibiting the apical/laminal contrast for anterior sounds. This system also overgenerates in use of [dist] and [apical]. The feature [dist] is claimed to be contrastive for continuants only, so that all four feature combinations of [dist] and [apical] are expected for continuant sounds. However, [+dist, +apical] and [−dist, −apical] are unattested for non-lateral continuants. Where [dist] is available, then [apical] is redundant for sibilants. Another inadequacy of this system is its ability to state unattested natural classes and its inability to state natural classes. A simple unattested natural class would be [+distributed], or [+distributed, +coronal]. On the other hand, treating lateral approximants as well as lateral fricatives as [+continuant] makes reference to natural classes in the Spanish, Korean and English phonological rules and constraints mentioned in footnote 6 impossible. A final point concerning the inadequacies of Spencer's system relates to assimilatory processes. As an example, take the rule of Sanskrit *n*-retroflexion. By this rule, a coronal nasal becomes retroflex following a retroflex continuant (/ʂ/ or /ɽ/). This rule is unbounded, provided that no coronal sound intervenes between the target and the trigger. Schein & Steriade (1986: 718) state the rule as in (7).

(7) *Sanskrit n-retroflexion*



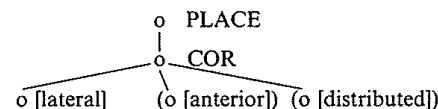
In this formulation of the rule, the blocking effect of coronals between the target and the trigger is due to the fact that it is CORONAL which spreads. Rightward spreading past a non-nasal coronal violates Goldsmith's (1976) Well-Formedness Condition which explicitly prohibits crossing association lines in autosegmental representations (see 2d). In Spencer's system, Sanskrit *n*-retroflexion cannot involve the feature [distributed], since this feature is only applied to continuants, and /*n*/ is [–cont]. Retroflexion in Spencer's terms is defined by the feature [+back], so one might replace [–dist] by [+back] in the rule statement in (7). However, spread of [+back] predicts incorrectly that intervening values of [back] will block the rule, and leaves unexplained why blocking segments are just the coronals (marj-a:na 'wipe'),

while neutral segments are non-coronals (k_{sub}⁶-a:ŋa 'quake'), since [+back] is a feature which is not dominated by the coronal node. I conclude that a feature system incorporating [lateral] is better equipped to handle the facts of natural language than one attempting to do without it, and turn to investigate just where this feature belongs.

3. REPRESENTATIONS

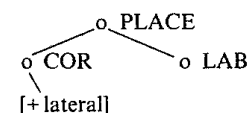
Place of articulation for pure coronal laterals of the world's languages is straightforwardly specified by combinations of the features CORONAL, [anterior] and [distributed], as shown in Table 1. Such place distinctions combined with different combinations of [sonorant] and [voiced] yield the full set of attested pure coronal lateral approximants and fricatives. In conformity with the CLH, all such segments will have the simple place feature geometry shown in (8).

(8) *Coronal geometry*

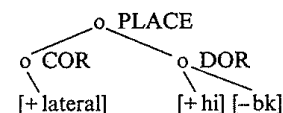


In addition to such pure laterals, the segments defined in Table 1 can, like all pure coronals, be combined with secondary articulations of labialization, palatalization, velarization, uvularization and pharyngealization. The resulting complex segments are represented with multiple place features under the place node, as in (9).

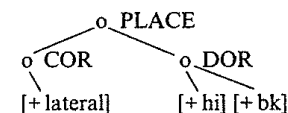
(9) (a) labilized lateral



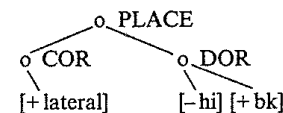
(b) palatalized lateral



(c) velarized lateral



(d) uvularized lateral



As discussed earlier, for each complex segment in (9), one articulator will be designated as major. In the case of laterals with secondary articulations like those depicted in (9), CORONAL is designated as major.

	l	l	l	l	ɬ	ɸ
Lateral	+	+	+	+	+	+
CORONAL	✓	✓	✓	✓	✓	✓
Anterior	+	+	—	—	+	+
Distributed	+	—	+	—	—	—
Sonorant	+	+	+	+	—	—
Voiced					—	+

Table 1
Feature specifications for pure coronal laterals

3.1 Velar laterals

Given this range of representations for laterals, pure velar laterals, having no evidence of a coronal component, are problematic. Pure velar laterals are segments which involve primary constriction of the dorsum at the velum in addition to simultaneous lateral airflow in the vicinity of the back molars. Instead of the sides of the tongue sitting on the lower teeth, as would occur in pronunciation of [g] or [k], one or both sides of the tongue are lifted off the lower teeth. Unlike the coronal laterals in Table 1, there is no central obstruction or constriction produced with the tongue tip or blade.

Perhaps the best-known velar laterals are those of the Papuan languages due to the influential phonetic study of Ladefoged, Cochran & Disner (1979). In this study, Mid-Wahgi and Medlpa velar laterals are classified as velar lateral approximants, with the following articulatory description for Mid-Wahgi:

...his tongue was bunched up in the back of the mouth, with the tip retracted from the lower front teeth. The body of the tongue was visibly narrowed (from side to side) in the central region, and presumably also further back where we could not see. The only articulatory contact was in the post-velar region, and (according to the speaker) air escaped around both sides of this contact in the region of the back molars. (47)

Similar articulation types are noted for Medlpa and Kanite, and velar laterals are also reported in the Move dialect of Yagaria (Renck 1967, 1975), Kanite (Young 1962), Kuman (Trefry & Trefry 1967; Nilles 1969), and the Southern dialects of Mid-Wahgi (Luzbetak 1956; Phillips 1976).

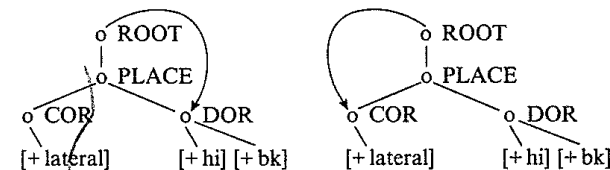
However, velar laterals do not appear to be restricted to Papuan languages. Doke's (1926) classic work on Zulu phonetics reports an ejective velar lateral affricate, and various sketches of Chulupi (alias Chunupi, Ashushlay), a Mataco language, report the existence of velar lateral sonorants (Susnik 1954; Junker, Wilkskamp & Seelwische 1968; Stell 1972). Abaza, a North-West Caucasian language, is said to have a velar lateral

affricate, and the Avar-Andi-Dido subgroup of North-East Caucasian has plain and ejective velar lateral affricates in addition to non-velar lateral fricatives (Troubetzkoy 1922; Comrie 1981; Colarusso 1988). A velar lateral allophone of English /l/ has also been reported by Caffee (1940) and Wells (1982, v.3: 551) in postvocalic preconsonantal position for some Southern American dialects.⁹

Given the CLH, the only representation available for place specification of velar laterals is that given in (9c): under the CLH velar laterals are claimed to have a coronal component at some level of representation. Velar laterals, such as those found in Mid-Wahgi, can be distinguished from the more common velarized laterals of Bulgarian, English, Georgian and Khmer by specifying DORSAL as opposed to CORONAL as the major articulator as depicted in (10). (The IPA symbol adopted in 1989 for the voiced velar lateral is a small capital el: [L]. I will use this symbol throughout to symbolize the voiced velar lateral, with the under-ring to mark voicelessness: [L̥].)

(10) (a) velar lateral [L]

(b) velarized lateral [ɭ]



In velar laterals, the dorsum is the major articulator, whereas in velarized laterals, the tongue blade is the major articulator.¹⁰

The root-node in (10a) may dominate at least three distinct manner specifications: velar laterals may be [—cont], where velar closure is complete; [+cont], where velar closure is incomplete; and [—cont][+cont], where an affricate articulation is involved. In this last case, the resulting laterally

[9] Maddieson (1984: 77), citing Paul Newman (p.c.), mentions Kotoko, a Chadic language, as having velar laterals. However, Paul Newman (p.c.) does not confirm this, and Bouny (1977) describes the Kotoko lateral as a voiceless alveolar fricative.

[10] While Sagey (1986) allows the representations in (10a) and (10b) to be distinctive within a given language, in none of the cases reviewed in this study is such an underlying distinction necessary.

Further, it is not necessarily the case that the major articulator in velar laterals be identified as dorsal. For instance, the English lateral approximant can be considered a complex coronal-dorsal segment with major coronal constriction, despite the fact that certain of its allophones may have a secondary coronal constriction, or may lack a central coronal constriction altogether (see section 5). Because the major/minor specification of articulator-nodes is not distinctive for velar laterals in any language studied thus far, the question of whether CORONAL or DORSAL is major is decided based on degree of stricture and phonological behaviour of such segments, and is orthogonal to the arguments presented for the CLH.

Yagaria						Kanite					
p	f	t	s	k	ʔ	p	f	t	s	k	ʔ
b	v	d		g	h	b					h
m		n		l	j	m		n		l	j

Table 2

Underlying consonants in two East New Guinea Highlands languages

released affricate can be released with coronal-velar articulation, or with a pure coronal articulation, depending on the phonetic instantiation of minor or secondary articulations in a particular language.¹¹

In all cases, the representation in (10a) suggests that velar laterals should show evidence of coronality in some languages, and that they should behave as phonologically complex segments as well.¹² In the following subsections, I present phonological evidence for a coronal component in velar laterals, thus supporting the CLH.

3.1.1 Alternations in Yagaria and Kanite

The Move dialect of Yagaria (Renck 1967, 1975, 1977) and Kanite (Young 1962) are related languages within the Kamano-Yagaria-Keigana Subfamily of the East-Central Family of the East New Guinea Highlands Stock (Wurm 1961). In both the Move dialect of Yagaria (from hereon referred to simply as Yagaria) and Kanite, there is only a single lateral, and that lateral is velar. Renck (1975, 1977) describes the Yagaria phoneme as a voiced velar lateral.¹³ In Kanite (Young 1962: 93), a velar lateral phoneme is also found, and is classified as a voiced velar lateral continuant and as a sonorant. In both languages then, there appears to be a phoneme /L/. I turn now to evidence for the CLH by demonstrating that this phoneme shows evidence of a coronal component phonologically.

In Table 2 the underlying consonant inventories of Yagaria and Kanite are listed, and in (11) examples of minimal pairs are provided for the Yagaria velars. Voiced velar laterals are transcribed as [L] throughout.

[11] In velar lateral affricates with pure coronal release, like some of those reported in the Caucasian languages, the representation of place features in (10a) is supported by direct phonetic evidence.

[12] In languages with only a single lateral segment, a single velar segment, or both, a velar lateral could be highly underspecified in underlying representation, and not exhibit evidence of multiple place nodes in the phonology.

[13] In earlier work, Renck (1967: 9) describes the Yagaria velar lateral as a heterorganic voiced affricate, consisting of a velar stop followed by an alveolar lateral. This description is explicitly replaced with that of a voiced velar lateral in his 1975 grammar.

(11) Yagaria velar contrasts

bogo	'one'
boLo	'put it (down)!'
ageta	'his ear'
aketa	'his back'

In both languages, the coronal component of the velar lateral segment reveals itself in alternations which result when /L/ is preceded by a glottal stop. While these alternations in Kanite are only alluded to in Young (1962), they are described in great detail by Renck (1975), along with other aspects of the phonology, and I will therefore focus on Yagaria forms in the remainder of this discussion.¹⁴

In Yagaria, all /L/-initial suffixes have [t]-initial allomorphs following glottal stop. Examples of such alternations are provided in (12).

(12) [L] ~ [t] in Yagaria suffixes

UR	SR	gloss
(a) /-Lata/		'DUAL'
(b) /bade-Lata/	badeLata	'two boys'
(c) /aʔ-Lata/	atata	'two women'
(d) /-Loʔ/		'ADESSIVE'
(e) /igopa-Loʔ/	igopaLoʔ	'on the ground'
(f) /gipaʔ-Loʔ/	gipatoʔ	'at the door'
(g) /-Lotiʔ/		'ABLATIVE'
(h) /hoja-Lotiʔ/	hojaLotiʔ	'from the garden'
(i) /gumaʔ-Lotiʔ/	gumatotiʔ	'from the village'

A preliminary informal statement of this rule appears in (13).

(13) Yagaria fortition

$L \rightarrow t / _ _$

Following (13), glottal stop is deleted before all voiceless obstruents, as stated informally in (14).

(14) Yagaria glottal-deletion

$_ _ \rightarrow \emptyset / _ _ [-\text{sonorant}, -\text{voiced}]$

Examination of /ʔ/-final prefixes indicates that rule (13) must be confined to the stem+suffix domain. In (15) the negative prefix /aʔ-/ and the

[14] I assume that a similar analysis holds for Kanite, in light of Young's (1962: 109) observation that 'In Kanite [gl] and [t] occur in complementary distribution: [t] occurring initially and [gl] medially ... [t] which occurs initially is in allomorphic alternation with [gl] which occurs medially', where [gl] writes the velar lateral.

progressive prefix /noʔ-/ are shown to have no effect on following /L/-initial verbs, though rule (14) does apply across this boundary.

(15) *Fortition as a lexical rule*

UR	SR	gloss
(a) /noʔ-L-am-i-e/	noʔLamie	'he is giving to us'
(b) /noʔ-toLo-e/	notoLoe	'I am throwing away'
(c) /aʔ-Ligi/	aʔLigi	'don't pick (fruit)'
(d) /aʔ-toLo/	atoLo	'don't throw away!'

Further evidence bearing on the proper formulation of rule (13) is given in (16). Here underlying /v/ surfaces as [p] in precisely the same environments that /L/ surfaces as [t], – when preceded by glottal stop across a suffix boundary, but not across a prefix boundary.¹⁵

(16) *Fortition of /v/*

UR	SR	gloss
(a) /-viʔ/		'LOCATIVE'
(b) /igopa-viʔ/	igopaviʔ	'into the land'
(c) /joʔ-viʔ/	jopiʔ	'into the house'
(d) /-vitiʔ/		'ELATIVE'
(e) /hoja-vitiʔ/	hojavitiʔ	'out of the garden'
(f) /joʔ-vitiʔ/	jopitiʔ	'out of the house'
(g) /aʔ-veiʔ-o/	aʔveio	'don't be angry!'

(cf. 15c)

In addition to the alternations shown in (12) and (16), the surface distribution of ʔC sequences is suggestive of general rules of sonorant fortition and glottal-deletion. In Table 3, the non-syllabic segments of

UR	p	t	k	b	d	g	f	s	h	m	n	L	v	j	ʔ
i. # __	p	t	—	b	d	k	f	s	h	m	n	L	v	j	—
ii. V __ V	p	t	k	ʔb	ʔd	g, y	f	s	h	m	n	L	v	j	ʔ
iii. ʔC	p	t	—	ʔb	ʔd	k	f	s	ʔh	b	ʔn	t, ʔL	p, ʔp	g, ʔj	ʔ

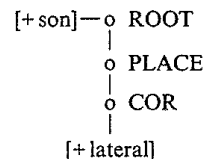
Table 3
Yagaria phonotactics

Yagaria are listed as they occur in word-initial position (i), intervocalically (ii) and in clusters with glottal stop (iii). Since only glottal stop can close the

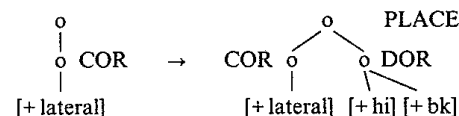
[15] The /v/ is a labial sonorant with surface allophones [w o β]. The glide /j/ is usually realized as [j] but can also surface as a voiced dental affricate [dz]. The glides appear as transitional segments in heterosyllabic VV sequences, where [v] appears following a round vowel, and [j] following a non-round vowel.

syllable in Yagaria, these general environments are exhaustive. As is clear from (iii) in Table 3, glottal stop occurs only before voiced obstruents and sonorants, where /L/, /v/, and /j/ are all [+sonorant] underlyingly, with a general prohibition against glottal stop-voiceless obstruent sequences. The distributional data in Table 3 coupled with the alternations in (12) and (16) suggest that the lexical fortition rule in (13) be generalized to all non-nasal sonorants: when preceded by glottal stop within the stem + suffix domain, non-nasal sonorants become obstruents with the same place of articulation.¹⁶ But if this is so, then the realization of /L/ as surface [t] under fortition suggests that underlyingly the velar lateral is a pure coronal.¹⁷ For Yagaria and Kanite then, I posit the geometry in (17) for /L/, with the redundancy rule in (18), and feature delinking rule in (19).

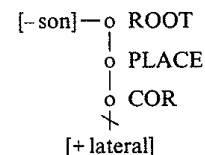
(17) */L/ in UR (Yagaria and Kanite)*



(18) *Lateral-Dorsal Redundancy Rule (LDRR)*



(19) *Delateralization*

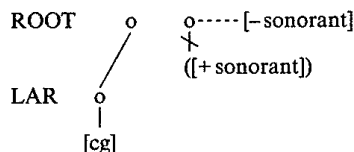


[16] There is only one /j/-initial suffix: /-ja/, a conjunctive suffix. It appears to surface as [ga] after glottal stop, but there are only two examples of this alternation in the corpus. I assume that /j/ is simply specified as [+high] in underlying representation; hence, it has a DORSAL node. Sonorant strengthening obeys structure preservation, and a velar stop is derived. I have no explanation for why the velar stop derived from /j/ is voiced on the surface.

[17] Alternatively one could posit an underlying complex coronal-dorsal lateral, with dorsal-node deletion under fortition. As I am unable to motivate a rule of dorsal-node deletion, I have developed the analysis in the text. However, both analyses are consistent with the CLH.

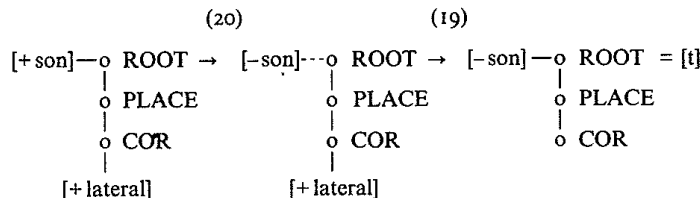
Rule (18), LDRR, provides coronal laterals with dorsal feature specifications [+high, +back]. Rule (19), which delinks the feature [+lateral] from obstruents, precedes and bleeds rule (18). In Yagaria, as in many other languages, the features [+lateral] and [–sonorant] are incompatible. Given rules (18) and (19) and the representation in (17), the preliminary fortition rule in (13) can be replaced with the more general rule in (20).

(20) Sonorant fortition (domain: stem+suffixes)

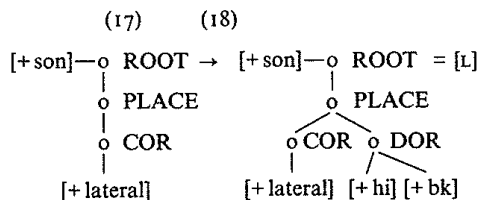


Sonorant fortition states that the feature [–sonorant] is inserted when a segment is preceded by glottal stop. Schematic derivations of surface [t] and [L] from /L/ are shown in (21a) and (21b) respectively.

(21) (a) / ... ?L ... /



(b) /# L ... /



In addition to rules (14), (18), (19), and (20), several additional rules are needed to account for the distribution of surface segments in Table 3. These

UR	/haniʔ-geva/	/aʔ-maʔ/	/bade/	/noʔ-L-am-i-ε/
(22a)	haniʔkeva	n.a.	n.a.	n.a.
(22b)	n.a.	n.a.	baʔde	n.a.
(22c)	n.a.	abaʔ	n.a.	n.a.
(14)	hanikeva	n.a.	n.a.	n.a.
SR	hanikeva	abaʔ	baʔde	noʔLamis
	'great darkness'	'woman'	'boy'	'he is giving to us'

Table 4
Yagaria derivations

rules are stated informally in (22), with derivations provided in Table 4 to illustrate the necessary order of rule application.

(22) Other ʔ-related rules (post-lexical)

- (a) /g/ → [–voice] / ʔ__
- (b) Ø → ʔ / V__ [+voice, –son, –cont] V
- (c) ʔ + m → b

Rules (22a,b) provide additional limited support for treatment of /L/ as a simple coronal sonorant underlyingly with acquisition of its dorsal component later in the derivation via redundancy rule. Rule (22a), which devoices velar stops when preceded by glottal stop, does not apply to /L/. If the natural class targeted by this rule is the class of [+cons,DORSAL] segments, then /L/ must not have a DORSAL node at the time of rule application.¹⁸ Similarly (22b), which results in preglottalization of all voiced stops, does not affect /L/. Assuming that targets of this rule are [–sonorant], one cannot analyze /L/ as a complex segment which contains /g/, an obstruent, as a submember: at the time (22b) applies either the DORSAL node is not present for /L/, or this segment is specified as [+sonorant], or both, as argued above.¹⁹

To summarize, in both Yagaria and Kanite, the velar lateral /L/ may surface as [t] as a result of sonorant fortition, rule (20). This rule changes sonorants to obstruents when followed by glottal stop. The pure coronal

[18] By reference to [+cons] segments, /j/ is properly excluded. This is not a strong supporting argument, as the natural class could also be stated as [–son,DORSAL], which would also properly exclude the velar lateral which is [+son].

[19] The fact that there is only a single liquid in these languages allows for many variations on the above analysis. Armin Mester has suggested one alternative which is based on the assumption that the unspecified place of articulation in Yagaria is CORONAL. Then, it is not that lateral implies coronal in this analysis, but rather that the lateral sonorant is unspecified for place in UR, and receives its place specification by redundancy rule. This conceivable alternative does not seem to weaken the force of the argument: it admits that velar laterals do contain a coronal component which is accessible to the phonology, and it does not bear on the issue of feature geometry.

which surfaces from /L/ suggests that the simplest analysis is one in which /L/ is underlyingly coronal, as in (17), and acquires DORSAL later in the derivation by redundancy rule (r8). The fact that rules (22a,b) do not target /L/, but do target velars, obstruents and voiced obstruents respectively might be taken as further evidence that /L/ is a sonorant which lacks a DORSAL node underlyingly. Analysis of these alternations lends support to the CLH: surface velar laterals of Yagaria and Kanite are underlyingly pure coronal laterals, and surface as complex coronal-dorsal segments as a result of a simple redundancy rule, one which harks back to the articulatory definitions in (6).

Further evidence bearing on the representation of velar laterals as complex coronal-dorsal liquids is found in languages of the Chimbu Group, which, unlike Yagaria, have more than one surface liquid. I turn now to examination of a number of alternations in the Chimbu language Kuman.

3.1.2 Alternations in Kuman

Kuman (Trefry & Trefry 1967; Nilles 1969; Trefry 1969; Lynch 1983) is an East-Central Highlands language of the Kuman Chimbu Group of the Chimbu-Hagen family (Wurm 1975). Kuman is just one of several Chimbu languages with velar laterals; others are Medipa and Mid-Wahgi, which is discussed further in section 3.1.3. These three Chimbu languages have more complex liquid systems than the Gorokan languages Yagaria and Kanite examined above. In Kuman, surface forms exhibit instances of [L], [l], and [r]: [muLo] 'point', [kulu] 'young', [kera] 'aunt'.²⁰ Based on such forms, Trefry (1969) posits the consonant phonemes /L/, /l/ and /r/, as well as the others shown in Table 5.

p	t	k	m	n		
b	d	g		[r]	[l]	L
	s		w	j		

Table 5
Kuman consonants (Trefry 1969)

However, Lynch (1983) casts doubt on the phonemic status of both /l/ and /r/, demonstrating that they can be analysed as conditioned allophones

[20] Trefry & Trefry (1967: 4-6) describe these sounds as follows: for the velar lateral, 'the sound... is made by commencing to sound our "g"... but instead of completely releasing the hump (back) of the tongue from the velum the edges are only raised. The resultant flow of air under the edges creates the lateral sound'; for the alveolar lateral, 'This is the same as the English "l"'; and for the rhotic flap, 'It is made by the tip of the tongue flapping once against the alveolar ridge'. /L/ is voiceless word-finally and before a voiceless consonant.

of /L/ and /t/ respectively. A first indication of the suspect status of /l/ is the fact that Nilles' (1969) dictionary contains only 40 cases of intervocalic /l/, as opposed to 314 cases of intervocalic /L/.²¹ Second, Lynch illustrates cases where surface [l] is arguably derived from /L/. In Table 6 conjugations

	/ju-/ 'bring'	/pr-/ 'hear'	/jaL-/ 'plant'
sg./-o/	juo	pro	jaLo
du./-iro/	juiro	priro	jaltro (~ jaLtro)
pl./-io/	juio	prio	jalo

Table 6
Kuman imperative verbs

for Kuman imperative verb forms are illustrated. Kuman verbs fall into three conjugation classes: vowel-final, 'r'-final (though see below), and L-final. The verb /jaL-/ 'plant', as in jaLka 'I planted' and jaLkwa 'he planted', has imperative dual and plural forms with surface [l].²² Lynch accounts for such alternations with the rule in (23), whereby a velar-lateral followed by /i/ becomes devalarized, with possible intermediate stages of palatalization, and loss of /i/.

$$(23) \text{ Devalarization} \\ L+i \rightarrow \Lambda+i \rightarrow \Lambda \rightarrow l$$

Further, Lynch points out that of the 40 intervocalic /l/s in Nilles' dictionary none is followed by /i/. Given this fact, it is possible to derive surface [l] from underlying or derived /Li/ clusters via (23). With this step, /l/ is eliminated from the phoneme inventory.²³

The first argument for /L/ as a complex coronal-dorsal (as opposed to pure dorsal) segment is the existence of a rule like (23). If, as for Yagaria and Kanite, /L/ is represented underlyingly as a pure coronal lateral as in (17), a rule of devalarization is not necessary. Rather, I suggest that palatalization

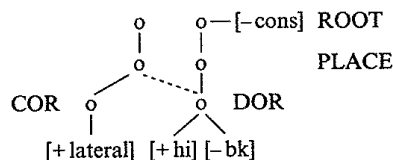
[21] All consonants with the exception of the three liquids, may occur word-initially. Word finally, the velar lateral and the flap are found, but not the alveolar lateral.

[22] See Lynch (1983: 108) for discussion of the alternate form [jaLtro]. The [l] occurring in this and other /L/-final dual imperative forms is excrement.

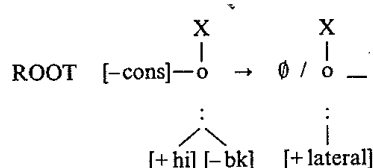
[23] Application of (23) to underlying and derived strings will not result in a violation of the Strict Cycle Condition or of Structure Preservation (Mascaró 1976), since (23) is not cyclic, and can apply (non-cyclically) at the word level. Even if one chooses not to derive every one of the 40 intervocalic alveolar laterals in Nilles' Dictionary in this way, this phone clearly has the status of a 'marginal phoneme' and, as suggested by Lynch, may be the result of borrowing.

of the lateral bleeds LDRR (18), which otherwise applies in Kuman, as in Yagaria and Kanite. Following palatalization, /i/-deletion occurs. But the dorsal node of /i/ is now shared with the preceding lateral: deletion of /i/ results in 'depalatalization' of underlying /L/, with a pure coronal lateral surfacing. Assuming for Kuman then the UR in (17) and the LDRR in (18), palatalization is formulated in (24), and /i/-deletion is stated in (25).²⁴

(24) *Lateral palatalization*

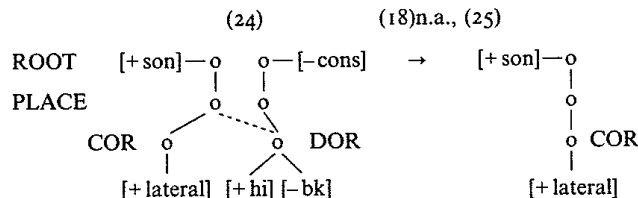


(25) */i/-deletion*



In (26) a schematic derivation of [l] from /L/ is shown.

(26) /... Li .../



Notice in (26) the crucial ordering of redundancy rule (18) which supplies underlying coronal laterals with dorsal nodes: this rule follows palatalization (24), but must precede /i/-deletion (25). To this point, then, the analysis of velar laterals in Yagaria and Kuman is surprisingly similar: both segments are best treated as underlying coronal laterals which only acquire DORSAL fairly late in the derivation.

[24] Rule (25) of /i/-deletion targets [-cons, +hi, -back] segments, with no explicit reference to the DORSAL node. Hence, it is not blocked by the Linking Constraint (Hayes 1986), which requires that association lines be interpreted exhaustively.

Further evidence for a coronal component of laterals in Kuman is found in alternations between /L/ and [t]. On the surface, [r] and [t] are in complementary distribution: [r] occurs prevocally in non-word-initial position, and [t] occurs elsewhere. In addition, there are alternations between [t] and [r] in the verbal and nominal paradigms. For instance, one finds prika 'I hear, AORIST' but pitnga 'you hear, AORIST' from the stem /pt-/ 'hear'. On this basis, Lynch suggests eliminating /ɛ/ and accounting for the surface distribution of this flap via phonological rule. The rule is informally stated in (27).

(27) *Flapping* $t \rightarrow \varepsilon / X_V$ (X ranges over C,V)

Having established the allophonic relationship between [t] and [r], the alternations between /L/ and [t] illustrated in Table 7 may be viewed as

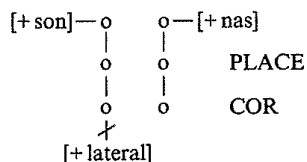
	/kaL-/ 'leg'	/jobuL-/ 'bone'	/mabuL-/ 'forehead'	/sitaL-/ 'thing'
1sg.	katna	jobutna	mabutna	siratna
2sg.	katn	jobutn	mabutn	siratn
3sg.	kale	jobulo	mabulo	siraLmo

Table 7
Kuman nominal possessive paradigm

perhaps the most common of lateral alternations – that between /L/ and /ɛ/.²⁵ In Table 7, /L/ is realized as [t] when followed by /n/. This alternation is not found before /m/ (siraLmo 'his/her thing') or /ŋ/ (konduLŋgoL 'fear'). Given the complementary distribution of [t] and [r], and the representation of /L/ as a pure coronal-lateral underlyingly, this process can be viewed as a simple case of delateralization. The rule of delateralization which basically states that $l \rightarrow \varepsilon / _n$ is formalized in (28).²⁶

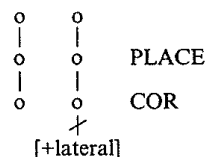
[25] Table 7, as well as other paradigms are taken from Lynch (1983). Trefry & Trefry (1967: 8), who write the velar lateral as 'gl', note that: 'The grammatical structure of the language is such that "gl" coming before "n" becomes "ti", e.g. kumugl "youngman", kumutino "young man plus question suffix". NOTE: In conversation the "i" usually drops out and the "n" lengthens. A form like Lynch's [katna] then may be derived from /katina/ from underlying /kaL-na/ 'my bone'.

[26] A reviewer has suggested that this is an obvious case of the nasal triggering assimilation of place and stricture, but not nasality, i.e. that CORONAL and [-cont] spread from /n/ to the preceding /L/, resulting in [t]. Aside from the fact that such assimilatory processes cannot be expressed as natural spreading rules (unlike general rules of place-assimilation) this rule is restricted to /n/. I view this restriction as evidence of a rule targeting coronal sequences. Furthermore, as noted in the text, the complementary distribution of [t] and the rhotic flap in Kuman makes it possible to view this alternation as one between the velar lateral and the flap, where [-cont] is not involved.

(28) *Kuman delateralization*

Because [+lat] is lost via (28), redundancy rule (18), which inserts a DORSAL node, is not applicable. Due to the fact that [ɾ] is illicit in preconsonantal position, the segment derived by (28) is spelled out as [t], i.e. a subsequent rule changes [+sonorant] to [–sonorant] in line with Kuman phonotactics.

It should be noted here that rules like (28) are not uncommon. For instance, in Ewe (Ansre 1961) /l/ is delateralized to [ɾ] when preceded by alveolar and palatal consonants, but not when preceded by labials or velars. The Ewe delateralization process, shown in (29), is simply the mirror image of (28), the only difference being that in Ewe, all coronals trigger the rule, not just coronal nasals.

(29) *Ewe delateralization*

The last alternation to be examined in Kuman is that between [L] and [ɾ]. In (30) future indicative forms of the verb stem /jaL-/ 'plant' are shown.

(30) *Dissimilation in Kuman verbs*

UR	SR	gloss
(a) /jaL-aL-Ø-ka/	jaLaLka	'I will plant'
(b) /jaL-aL-n-ka/	jaLatnga	'you will plant'
(c) /jaL-aL-b-ka/	jaLabuka	'he/she will plant'

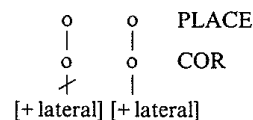
In all cases, when two laterals are separated by a single vowel, the first dissimilates to [ɾ].²⁷ Unlike the delateralization rule in (29), this process can

[27] The forms in (30) have also undergone other phonological rules. In (30b), rule (28) applies after dissimilation, as does post-nasal obstruent voicing. In (30c), after dissimilation applies, the velar lateral is deleted before the /bk/ cluster, and a subsequent rule of epenthesis inserts [u] between the two consonants.

be viewed as instantiation of the OCP which prohibits the occurrence of adjacent identical segments (McCarthy 1986, 1989; though see Odden 1986, 1988 on potential counterexamples.) However, dissimilation does not apply if a consonant intervenes between the two laterals: *kondulŋgoL* 'fear', *gaLpuLa* 'hat', etc. In order for vowels, but not consonants, to be transparent in the determination of adjacency, I assume (without independent evidence) that vowels and consonants in Kuman are on separate planes (McCarthy 1989). With this assumption, the OCP-triggered rule of dissimilation can be stated as in (31).

(31) *Kuman lateral dissimilation*

(assuming planar separation of Vs and Cs)



Delinking of [+lateral] via (31) results in [ɾ], a coronal sonorant, rather than a segment with primary dorsal articulation, confirming the presence of CORONAL in the representation of /L/. Like rule (29), rule (31) precedes and bleeds the LDRR.

The OCP-based analysis in (31) predicts the absence of tautomorphemic /...L(V)L.../ sequences: indeed, Lynch (1983: 105) has not elicited any words with such sequences, nor do any appear in Nilles' (1969) dictionary or the Trefry & Trefry (1967) word list. Further, the existence of /g(V)g/ and /k(V)k/ sequences in Kuman, as in *gogino* 'knee', indicate that the rule responsible for the alternations in (30) is not one of DORSAL dissimilation or delinking. As with rule (29), Lateral Dissimilation in (31) supports the representation of /L/ as an underlying coronal lateral (17) whose dorsal features are supplied via redundancy rule (18). In Kuman, as in Yagaria and Kanite, surface velar laterals appear to be complex coronal-dorsal segments derived from underlying simplex coronal laterals.

3.1.3 *Wahgi laterals*

Another Chimbu language with velar laterals is Wahgi (or the Middle Wahgi dialects), a language spoken in the Papua New Guinea Western Highlands.²⁸ Middle Wahgi dialects are divided into Northern and Southern. The Northern Dialect is described by Luzbetak (1956) as having two distinct lateral sounds: a dental lateral, and an alveolar lateral. Given the feature

[28] The remaining Chimbu language with velar laterals is Medlpa. I have been unable to obtain detailed information on the phonology of this language.

specifications in Table 1, these two coronal sounds are distinguished by the feature [distributed]. A velar lateral is reported to contrast with the dental lateral in dialects on the south side of the Wahgi River. Luzbetak (1956: 21) mentions that [L] and [l] occur as allophones of a single lateral phoneme, the lateral alveolar flap /l/. Here the underlying distinction appears to be, as in Northern dialects, one between dental and alveolar laterals, with velar laterals derived from pure coronal alveolar laterals via a redundancy rule like that in (18).²⁹ However, in other dialects, the velar lateral appears to be primary, with pure coronal laterals as derived allophones.

As least one Southern Wahgi dialect appears to have a contrast between dental, velar and alveolar laterals. Phillips (1976), in his detailed account of Mid-Wahgi phonology and morphology, reports the existence of alveolar laterals in the Kuma dialect. Phillips' phoneme inventory for the Kuma dialect is given in Table 8. This report of three distinct laterals, including a

p	s	t	k
b	z	d	g
m	n	ɳ	
	l	l	L

Table 8

Consonant inventory of the Kuma dialect of mid-Wahgi

velar lateral, is consistent with Ladefoged, Cochran & Disner (1979), who present phonetic evidence for a three-way contrast in one Mid-Wahgi dialect. Phillips contrasts the three laterals of the Kuma dialect with two of the Danga dialect. The Danga alveolar lateral corresponds to Kuma alveolar and velar laterals, with the dentals in the two dialects in full correspondence, as shown in (32).

(32) *Lateral correspondence in two major Mid-Wahgi dialects*

Kuma		Danga
l	↔	l
(l)	↔	l
L	↔	l

[29] The velar lateral of the Southern dialects corresponds to the alveolar lateral of the Northern dialects. The correspondence between Northern alveolar and Southern velar laterals has some exceptions: Banz-Nondut /se noyl/ 'friend' has a final velar lateral in Southern Kup-Minj dialects.

The Kuma alveolar lateral is quite rare. Phillips speculates that it might be the result of Danga borrowings which have yet to be fully integrated into the Kuma phonological system. If this is the case, then the dialect split reported by Phillips is the same as that reported by Luzbetak (1956) above, and the alveolar laterals in Kuma are marginal phonemes at best.³⁰

Nevertheless, unlike the single lateral systems viewed this far, in Kuma it will be necessary to distinguish dental and velar laterals in underlying representation. There are two possibilities in line with the CLH. One is to maintain the Danga distinction which is clearly between [+dist] and [-dist] CORONAL laterals, and to supply velar laterals with their dorsal component by redundancy rule, as in Yagaria and Kuman. The alternative is to represent velar laterals as complex coronal-dorsal segments underlying. If the second possibility was in fact the correct one, then Kuma velar laterals might reveal their dorsal halves somewhere in the phonological component. Based on the available evidence, this does not appear to be the case. Rather, as in Yagaria and Kuman, the Kuma velar lateral alternates with pure coronal segments, and aside from its phonetic realization shows no velar component.

As in other Southern Wahgi dialects, the Kuma velar lateral surfaces as an alveolar lateral before following alveolar consonants. Examples are given in (33).^{31, 32}

(33) *Kuma Coronal Assimilation*

UR	SR	gloss
(a) /wul-te/	[wule]	'westwards'
(b) /al-to/	[alto]	'eastwards'
(c) /noL nondil/	[nol nondil]	'you will drink water'

If, as argued in related languages, velar laterals are underlying pure coronals, the data in (33) suggests that the redundancy rule inserting a dorsal-node, rule (18), is blocked in these coronal sequences. I suggest that this is in fact the case. In coronal sequences, coronal nodes are merged, with merger defined as in (34).³³

[30] As marginal phonemes, these segments must still be differentiated from dental and velar laterals. I suggest that this is accomplished via full feature specification. Whereas redundant features are absent in dental and velar laterals, these features are present in alveolar laterals, which will not only be specified as CORONAL and [+lateral] in UR, but also as [-high] and [-back]. Underlying specification of these dorsal features will block application of the regular LDRR (18).

[31] A later rule deletes the initial /t/ of the locative /-te/.

[32] Velar laterals are also reported to alternate with alveolar laterals before dental consonants. Because of the limited number of examples, inconsistencies between Phillips' and Luzbetak's descriptions, and the rarity of alveolar+dental coronal clusters cross-linguistically, I refrain from analyzing these alternations.

[33] See Schafer (1988) for a general unification-based model of feature merger.

(34) *Node-merger*

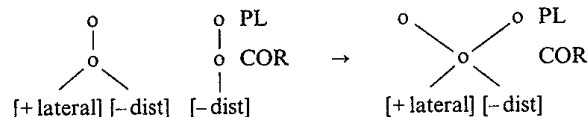
Given two identically labelled nodes A and B, merger results in node C which preserves the labelling, dominance and precedence relations of A and B. That is (i) C has the same label as A and B; (ii) if A dominates α then C dominates α , and if B dominates β then C dominates β ; and (iii) if α precedes β in the pre-merger representation, then α precedes β under C.

Given this definition, (35) is proposed for Kuma.

(35) *Kuma Merger*

Merge adjacent non-distinct CORONAL nodes, where nodes A and B are distinct iff there is some feature F such that A dominates $[\alpha F]$ and B dominates $[-\alpha F]$.

Rule (35) precedes and bleeds redundancy rule (18): since the output of merger has a doubly linked CORONAL node, this structure fails to undergo (18) due to the Linking Consonant (Hayes 1986) which demands that autosegmental association lines be interpreted exhaustively.³⁴ Relevant structure for the input and output of merger for CORONAL sequences in (33) is shown in (36).

(36) *Merger of CORONAL nodes in /...Lt.../*

The doubly linked CORONAL in the output of merger blocks rule (18) under the Linking Constraint, since rule (18) specifies a single association between CORONAL and PLACE.³⁵

The CLH then is supported by both negative and positive evidence in the Southern Wahgi dialects: no phonological process yet described in these languages treats /L/ as a member of the natural class of dorsals,³⁶ while alternations like those in (33) reveal the underlying identity of /L/ as a pure

[34] This may be viewed as an overly technical solution; however, it expresses the phonologization of a plausible earlier phonetic coarticulatory effect: the alveolar lateral, from which the velar lateral derives historically, was not velarized in these assimilatory contexts due to coarticulation with the following alveolar. Such alveolar clusters have given rise to the synchronic rule of merger, which blocks insertion of the dorsal-node.

[35] The output of merger deserves further comment, as the feature [+lateral] is now associated with both [+son] and [-son] ROOT nodes. I assume here and elsewhere that realization of [+lat] on the [+son] (or [-nas]) component of an assimilated cluster is due to the fact that Mid-Wahgi and other languages with only sonorant laterals contain positive statements including [+lat] → [+son] and [+lat] → [-nas] in the grammar.

[36] Rules of rounding and vowel lowering apply exclusively to and before /k/ respectively.

coronal, whose velar allophones are the result of the same rule of dorsal node insertion, LDRR (18), proposed for other Chimbu languages. Up to this point then, the velar laterals of the Papuan languages provide only phonetic evidence of a velar component, behaving in all phonological respects as coronal segments. One area where the phonetic aspects of such segments might reveal themselves is in loan-word phonology, to which I now turn.

3.1.4 *Loan-word phonology in Yagaria*

Non-native phones or phone sequences in loan words will often be matched with the closest phonetic target, in contrast to a matching of phonological distinctive features. As an example, the Korean stops [p^h], [p], and [p'], heavily aspirated voiceless, lightly aspirated voiceless, and glottalized voiceless are categorized by English speakers as either /p/ or /b/, but not apparently by a match of distinctive features. Only the heavily aspirated phone is consistently treated as voiceless; the lightly aspirated and glottalized series are usually substituted with English voiced obstruents, due apparently to their short voice-onset-time. That is, it is voice-onset-time, and not the distinctive feature [\pm voiced] which English speakers appeal to in categorizing these non-native phones. In the realm of loan-word phonology, then, one might find evidence of the velar-component of the Papuan velar laterals, despite its apparent inertness within the isolated synchronic phonological systems examined above.

In (37) Yagaria loan words from Melanesian Pidgin gathered from Renck (1977) are listed with their source forms (Mihalic 1971; Murphy 1973).

(37) *Yagaria loan phonology*

Yagaria	Mel. Pidgin	gloss	rules applied
(a) Laesenisi	laisens	'license'	(38a)
(b) Lipitina	lip ti	'tea leaves'	(38a)
(c) niLi	nil	'nail'	(38a)
(d) aposoLo	apostel	'apostle'	(38a)
(e) Laesi	rais	'rice'	(38b)
(f) giLiSi	gris	'grease'	(38b, d, f)
(g) giLoKu	klok	'clock'	(38a, c, e)
(h) abaLaRa	ambrela	'umbrella'	(38a, b)
(i) itaotaLaLi	australia	'Australia'	(38a, b)
(j) igiLiSi	inglis	'English'	(38a, d, f)
(k) Leseni	stesen	'station'	(38g)
(l) teseni	tesin	'station'	
(m) simeli	simen	'cement'	(38h)

Consonant correspondence rules accounting for these forms are stated informally in (38), where [x]_p indicates a Melanesian Pidgin phone.

(38) *Correspondence rules for Yagaria loans*

- (a) [l]_p → /L/ (e) [kl]_p → /kL/
 (b) [r]_p → /L/ (f) [gl]_p → /gL/
 (c) [k]_p → /k/ (g) [st]_p → /L/ (irregular)
 (d) [g]_p → /g/ (h) [n]_p → /L/ / _# (irregular)

Rule (38a) appears to match donor [+lateral] with Yagaria [+lateral] segments, despite their surface differences in place of articulation. More interesting is rule (38b): here, a donor alveolar flap is mapped onto the Yagaria velar lateral. The correspondence here appears to be liquid to liquid, again despite apparent phonetic differences in place of articulation. Rules (38c,d) are expected, since velars have the same approximate values in Yagaria and Melanesian Pidgin. The correspondences expressed by (38e,f) are really combined instances of (38a) and (38c,d); they are listed separately because of their theoretical significance. Given the phonetic properties of the Yagaria velar laterals and the ill-formedness of consonant clusters in Yagaria, one might expect these velar+lateral sequences to be simply realized as velar laterals, but they are not.³⁷ Rather, each segment in the source is given a segmental value in the loan, with the resulting cluster triggering epenthesis. Finally, (38g) and (38h), while perhaps optional or sporadic, show correspondences between non-lateral coronals and the velar-lateral [L]. It seems from the rules in (38) that there is no more evidence for the velar component of /L/ in loan word phonology than in native Yagaria phonology: velar laterals pattern as simple laterals, as liquids, and as pure coronals, but not as velars.

3.1.5 *Papuan diachronic evidence*

The only area in which the velar component of velar laterals appears to play a role in Papuan phonology is in the historical sound shifts which may have taken place in the Gorokan and Kainantu languages, two of the best studied Papuan language groups. In addition to Move (dialect of Yagaria) and Kanite, the two Gorokan languages with velar laterals, other languages in this family are Hua (dialect of Yagaria), Kamano, Bena Bena, Siane, Gahuku, Asaro, Gende, Gimi, Fore, Zavezufa and Yate. The first major effort at reconstruction of Gorokan proto-forms appears in Scott (1978). Bee (1973) presents a comparative study arguing for genetic relations among the Kainantu languages which include Usarufa, Gadsup, Awa and Auyana/Kosena.

The pre-history of /L/ is illuminated in Haiman's (1987) study of syllable-structure in Proto-Gorokan. In this work Haiman attempts to come to a deeper understanding of a common alternation among the Gorokan

	*LV 'two'	*Lank 'fruit'	*naL 'wife'	*mul 'egg'
[L]	LOLE [Y]	Laga [Y]	naLu?a [Y]	moL [Y]
[k],[ʔ]	kandaa [G]	aka [G]	aanaak [G]	muʔ [G]
[ɾ]	rori [H]	za-rga [H]	naruʔ [H]	mur [H]
[l]	lele [S]	—	olo [S]	mul [A]

Table 9

*L correspondences (Haiman 1987), where Y = Yagaria, S = Siane, G = Gadsup, H = Hua, A = Asaro

Affricates					
Velars	k'	k	k ^h	x	g
					ɸ
		l	ɬ		ts'
		Laterals			tʃ

Table 10

Some Zulu consonants

languages which takes /ɾ/ to glottal stop when followed by an obstruent, as in the Gende Weakening rule shown in (39).

(39) *Gende weakening* (Haiman 1987: 12)

/ɾ/ → ʔ / _ + obstruent

Note: similar rules found in Usarufa, Auyana, Hua, Kamano and Siane.

Haiman notes that the segment transcribed as /ɾ/ has different phonetic values in these languages, occurring as [l], [L] and [ɾ]. Based on correspondences and reconstructions like those shown in Table 9, he suggests that Move and Kanite are conservative in preserving the velar lateral of the proto-language, and that this velar lateral underwent two distinct developments shown in (40).

(40) *Historical development of *L*

(a) *L > k > ʔ

(b) *L > l ~ ɾ

Actually, Haiman proposes a preliminary stage of diphthongization in which the velar lateral becomes a [kl]/[gl] cluster. I assume that this step can be

[37] Recall that the only clusters allowed in Yagaria are ʔC.

eliminated given the treatment of surface velar laterals as complex corono-dorsal segments from the start. Rule (40a) then involves place-simplification via deletion of the coronal node (with delateralization as an expected result), and rule (40b) is the parallel simplification where the dorsal node of complex corono-dorsals is deleted, leaving a pure coronal liquid. These diachronic developments then support the CLH under which velar laterals are represented on the surface as complex corono-dorsal segments.

The representation of Papuan velar laterals as underlying pure coronal laterals and surface complex corono-dorsal segments argued for in this section is consistent with the CLH: if the feature [+lateral] is present in a representation, the coronal node is present as well. Evidence for the coronal component of velar laterals is grounded in the phonology: alternations between velar laterals and pure coronals in the Gorokan and Chimbu languages suggest that velar laterals have CORONAL nodes in underlying representation. The most compelling evidence for DORSAL in velar laterals is the phonetic realization of these segments: in the five Papuan languages in which they occur, there is most certainly a major dorsal constriction. Additional evidence for the dorsal component are the velar reflexes of */L/ in Usarufa and Gadsup discussed above.

2.1.6 Remaining cases

The facts available from other languages with velar laterals are consistent with the CLH, as velar laterals in these languages also seem best represented as complex corono-dorsal segments.

The ejective velar lateral affricate in Zulu (Doke 1926) differs quite dramatically from the velar laterals of the Papuan languages in behaving as a pure (non-lateral) velar within the phonology. As illustrated in Table 10, the ejective velar lateral affricate [kɿ'] is one of three underlying affricates, one of four laterals, and one of six non-nasal velars in Zulu.³⁸ The view of [kɿ'] and [kx'] as allophones was first suggested by Doke (1926: 115), who remarks that some Zulu speakers always use [kx'] instead of [kɿ'] and that the

[38] Catford (1976) agrees with Doke's classification of this sound as a glottalic velar lateral affricate, though Ladefoged (1971) defines it as a palatal lateral glottalic stop. According to Doke, velar lateral affricates are found in neighbouring Cape Bushman, Cape Hottentot and !Kora Hottentot.

I do not include lateral clicks in Table 10. Sagey (1986) represents clicks as complex segments with dorsal nodes and does not distinguish them from non-clicks by an airstream mechanism feature. Rather the distinction between major and minor articulators is used to render otherwise identical representations distinct. I assume an airstream mechanism feature distinguishes clicks from non-clicks: velar lateral affricates are pulmonic, while lateral clicks are specified as velaric. One piece of evidence in favour of this treatment is the restriction noted by Doke (1926: 173): 'It is seldom that one finds in any one word more than one positional type of click sound; in fact I have not found one hitherto.' As in Semitic languages (see McCarthy 1985), the OCP in Zulu is sensitive to place of articulation within a given major class, where the major class in Zulu is that defined by the velaric airstream mechanism.

two sounds are generally interchangeable and not phonemically distinct. For instance one finds [kɿ'e:za] or [kx'e:za] 'milk into the mouth' and [kɿ'we:ba] or [kx'we:ba] 'scratch'.

How then should the velar-lateral affricate be represented? By the CLH, this segment should be a complex corono-dorsal segment on the surface. However, alternations involving place-assimilation like those in (41) suggest that underlying the velar affricate is a pure velar, with no coronal (or lateral) component.

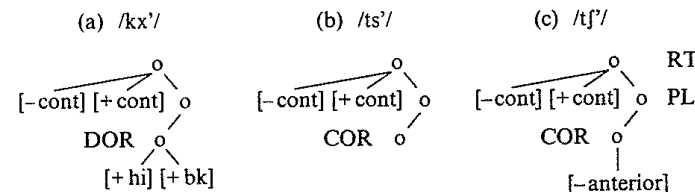
(41) Nasal place-assimilation

singular	plural	gloss
(a) u:p ^h a:p ^h e	izimp'a:p ^h e	'feather'
(b) u:fu:du	izimpf'u:du	'tortoise'
(c) u:ɣu:bu	izindɣu:bu	'ground-nut'
(d) u:fiki:fi	izinf'iki:fi	'quarrelsome person'
(e) u:k ^h e:zo	izink ^h e:zo	'spoon'
(f) u:gu	izi:nggu	'bank of river'
(g) u:kɿ'angakɿ'a:ngga	izinkɿ'angankɿ'a:ngga	'watery food'

In the plural forms in (41), the nasal of the nominal prefix /iziN-/ assimilates in place features to the following consonant. The rule involved appears to be simple place-node spread, where the prefixal nasal has no underlying place specification. In (41g) the output of place-assimilation for /Nkɿ'/ is [ŋ], not [n] or [ɲ], suggesting that [kɿ'] is a simple DORSAL segment at the time of rule-application.

Given this, I propose the underlying representations in (42) for Zulu affricates.

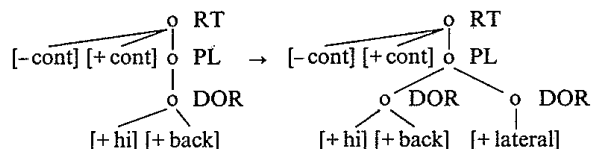
(42) Underlying representations of Zulu affricates



All Zulu affricates are voiceless and all are ejectives. This information is predictable and need not be present underlyingly. The affricates are distinguished from non-affricates at the same place of articulation by their underlying [-cont][+cont] contours. They are distinguished from each other by place of articulation. Nasal assimilation involving place-node spread applies to the representations in (42), resulting in forms like those in (41). Subsequently, the velar affricate in (42a) undergoes the optional

redundancy rule stated in (43), which gives rise to the surface coronal-dorsal lateral affricate.

(43) *Dorsal-affricate Lateral Redundancy Rule (optional)*



In sum, Zulu velar-lateral affricates are best represented as pure velars in underlying representation, with a CORONAL-[+lat] component optionally supplied by rule (43). The phonology gives no evidence of CORONAL in these sounds, and when a non-lateral phone occurs, it is non-coronal as well. Such facts are consistent with the CLH.

Velar laterals are also reported for a number of Caucasian languages. Caucasian velar-lateral affricates, like those found in Zulu, are described by Troubetzkoy (1922: 187) as having a dorsal occlusion followed by a partial lateral release which results in the same lateral friction as that occurring in [ɸ] and [tʰ].³⁹ Troubetzkoy suggests that the lateral fricatives in some of these languages are best viewed as complex coronal-dorsal segments: in Adyghe and Avar, the voiceless lateral fricative is described as having a /x/ component and a /t/ component (ibid. p. 203). This view is supported by Colarusso's (1988) phonetic descriptions of certain Northwest Caucasian laterals. For instance, in describing the articulation of lateral spirants /tʰ ɸ ɸ'/ in Bzhedukh, Colarusso notes that the tongue is raised tightly against the roof of the mouth, with friction in the anterior region for /tʰ ɸ/ but friction further back upon the dorsum and back molars for /ɸ'/ 'nearly making the latter a non-coronal lateral in that most of the friction is made between the side of the tongue body and the rear molars' (p. 69). A more appropriate symbol for this sound then would be /L'/.

[39] These segments, occurring in such languages as Avar and Andi, clearly behave as affricates with respect to the phonetic realization of intensity. Intensive stops in Avar and Andi are affricated, while intensive affricates have a lengthened continuant phase and are unaspirated (Catford 1977: 289). The intensive velar laterals pattern in these languages with other affricates: they are unaspirated with a lengthened continuant release phase.

The prevalence of velar lateral affricates like those in Zulu and the Caucasian languages over velar central affricates is likely to be due to the greater intensity of [t] as opposed to [x]. In phonological systems, strident continuants are preferred over non-strident ones and it is not surprising that such a preference should show itself in the fricative release portion of affricates as well. Hence, I speculate that velar-lateral affricates could actually arise from pure velar fricatives through acoustic strengthening of the fricative portion of the articulation. Compare this with Troubetzkoy's (1922: 199) articulatory account whereby lateralization of velar spirants is viewed as natural since 'il suffit de raccourcir un peu les muscles circulaires de la langue, sans la déplacer, pour diriger l'air expiré le long du côté de la langue pour obtenir le frottement latéral caractéristique'.

The view of velar laterals in Caucasian languages as complex coronal-dorsal segments is supported mainly by diachronic evidence. Troubetzkoy (1922: 203), in his comparative study of laterals within the Caucasian family, concludes that 'les latérales caucasiennes ne présentent donc d'affinité qu'avec les dorsales...'. This view of velar laterals as pure dorsals phonologically is based on the numerous correspondences he demonstrates between proto-velar laterals and pure velars, uvulars and palatals. For instance, Proto-Lak /*k_l*/ corresponds with Avar /k_l^h/ but with Lak /x^h/ kx^h/. On the other hand, as pointed out by Colarusso (1988: 70), the continuation of /*k_l*/ in Abaza and the Abkhaz languages as the lamino-palato-alveolar spirant /š^v/ (see Troubetzkoy 1922: 188-189), suggests a loss of laterality with coronal place of articulation maintained. Both types of historical change are accounted for under the view of velar laterals as complex coronal-dorsal segments: loss of the coronal component results in pure (non-lateral) velars, while loss of the velar component results in pure coronal segments, which, at least in Abaza and the Abkhaz languages, have undergone a further process of delateralization.

The velar lateral reported for Chulupi (Junker, Wilkskamp & Seelwische 1975) is the only lateral in the language. Phonological and phonetic material on this Mataco language is quite scarce. Susnik (1954) lists pure alveolar lateral allophones of /L/, which might indicate that Chulupi velar laterals are similar in their phonological composition to those found in the Papuan languages.

In summary, examination of reported velar laterals in the world's languages provides striking confirmation of the CLH: in all cases, such segments are represented on the surface as complex coronal-dorsal segments, with [+lateral] under the coronal node. In the Papuan languages, phonological alternations provide evidence for velar laterals as pure CORONAL laterals underlyingly, while in Zulu, the velar lateral behaves as a pure non-lateral DORSAL segment phonologically. In these languages, the surface coronal-dorsal segment can be viewed as the result of a redundancy rule inserting dorsal and coronal nodes respectively. Such insertion processes are the inverse operations of the historical simplifications of velar-laterals evidenced both in the Gorokan and Kainantu families, as well as in the Caucasian languages: in such cases, complex coronal-dorsal segments are reduced to pure coronals and pure dorsals by deletion of the DORSAL and CORONAL nodes respectively.

3.2 *Palatal laterals*

Numerous languages have underlying palatal laterals which must be distinguished from dental, alveolar, alveo-palatal and/or retroflex laterals. These languages include Basque, Cheremis, Diyari, Malayalam, and Quechua to name a few. If palatal sounds involve activation of the tongue

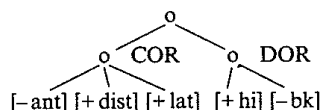
blade, then such sounds will be classified as coronal, and palatal laterals are expected under the CLH. If, on the other hand, the tongue blade is not involved in the production of palatal segments, then palatal laterals, like velar laterals, represent potential counterevidence to the CLH.

Though this latter view was the one originally taken by Chomsky & Halle (1968), the view of palatals as coronal segments is now supported by a great deal of phonological and phonetic evidence. Phonological evidence is summarized in Keating (1988a), while phonetic evidence is presented in Keating (1988b): palatal segments do pattern together phonologically with other CORONAL sounds, and in terms of articulation both the blade and the front of the tongue are used to produce the very long constriction typical of palatals.

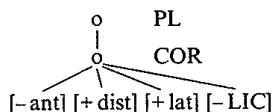
As coronal segments, palatals are specified as $[-\text{ant}, +\text{dist}]$. In cases where it is necessary to distinguish pure palatals from palato-alveolars, one of two strategies is taken. First, as suggested in Keating (1988a), palatals can be treated as complex corono-dorsal segments with specifications $[+\text{high}, -\text{back}]$ as opposed to alveo-palatals which are represented as simplex CORONAL segments. Alternatively, as suggested by Halle (1992), a new feature [Lower Incisors Contact], can be introduced to capture the fact that a sublingual cavity is present in alveo-palatals ($[+\text{LIC}]$), and absent in pure palatals ($[-\text{LIC}]$). These two alternatives are depicted in (44) for palatal laterals.

(44) Palatal laterals

(a) as complex segments



(b) as pure coronals



Keating (1991) suggests that both these strategies might ultimately be necessary to capture the phonetic properties of palatals, though phonological evidence would be necessary to support such an enriched representational system. In sum, palatal sounds involve activation of the tongue blade, and are therefore coronal sounds. As such, palatal laterals can be represented as in (44) and pose no problems for the CLH.

4. PHONOLOGICAL RULES AND CONSTRAINTS

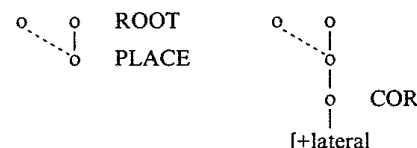
The phonological postulates and constraints in (2) combined with the CLH give rise to four specific predictions: first, assimilation rules which spread CORONAL or PLACE will also spread [lateral] if present (2a); second, rules of dissimilation or neutralization involving delinking of CORONAL or PLACE will result in elimination of the feature [lateral] if present (2b); third,

OCP constraints on $[+\text{lateral}]$ segments will pick out adjacent instances of $[+\text{lateral}]$, where adjacency may be defined on the lateral tier, on the coronal tier, on the place tier, or on the root tier (2c); and fourth, spreading of the terminal feature $[+\text{lateral}]$ may only target CORONAL segments, and may only be blocked by CORONAL segments (2d). While it is difficult to find an exact match between real language data and the types of rules mentioned above, the following subsections investigate similar rule types which support the view of [lateral] as a terminal feature of CORONAL.

4.1 Place assimilation

By the CLH, assimilation rules which involve place-node spread will entail spread of the feature [lateral]. A typical rule of place-assimilation is shown in (45a), with a token of $[+\text{lateral}]$ -assimilation implied by this general rule statement shown in (45b).

(45) (a) Place assimilation (b) under the CLH



A rule of this type is in evidence in the Western Austronesian language Selayarese as described by Mithun & Basri (1986). Data in (46) shows assimilation of $/\eta/$ to place features of a following obstruent, and to $[l]$ when followed by $/l/$.

(46) Selayarese place assimilation (Mithun & Basri 1986)

Stem	Redup	gloss
(a) pekaŋ	pekampekaŋ	'hook'
(b) soron	soronsoron	'push'
(c) rongan	ronganrongan	'loose'
(d) jaŋaŋ	jaŋaŋjaŋaŋ	'chicken'
(e) keloŋ	keloŋkeloŋ	'sing'
(f) lamuŋ	lamullamuŋ	'grow'
annan 'six'	Noun	gloss
(g) annam	poke	'6 spears'
(h) annan	tau	'6 persons'
(i) annan	rupa	'6 kinds'
(j) annan	jaran	'6 horses'
(k) annan	koko	'6 gardens'
(l) annal	loka	'6 bananas'

In (46a–f) place assimilation applies word-internally, while in (46g–l) it applies across a word boundary. The forms in (46f, l) illustrate that lateral assimilation takes place under the same conditions as place assimilation. Although it appears that only /ŋ/ undergoes assimilation, the rule need not be restricted to /ŋ/ since this is the only nasal which appears morpheme or word finally. I assume that /ŋ/ is unspecified for place features in Selayarese, and additionally that partial feature specifications for other consonantal sonorants are as shown in Table 11. The rule of place assimilation⁴⁰ for

	ŋ	n	ɲ	m	r	l
Nasal	+	+	+	+	–	–
PLACE		✓	✓	✓	✓	✓
CORONAL		✓	✓		✓	✓
Lateral						+
Anterior			–			
LABIAL				✓		

Table 11

Selayarese partial feature specifications for consonantal sonorants

Selayarese then can be formulated as in (45a).⁴⁰ When /ŋ/ is followed by /l/, the rule applies as in (45b), resulting in a surface [l]. The output of place-assimilation in this case is a segment specified as [+nasal, +lateral]. As in many other languages, this feature combination is not a licit one in Selayarese, and the [+nasal] specification is deleted.⁴¹

Another language instantiating place assimilation as formulated in (45) is Klamath (Barker 1963, 1964). In Klamath with underlying nasals /n, m/, /n/ is unspecified for place features, and takes on the place features of a following consonant. Examples are given in (47)

(47) *Klamath place assimilation*

- | | | |
|------------------|----------|------------------------|
| (a) /qen-qan/ | qenqan | 'grey squirrel' |
| (b) /p'nan-ksi/ | p'nanksi | 'burying-place' |
| (c) /hon-ptʃi/ | homptʃi | 'that kind' |
| (d) /hon-li:n-a/ | holli:na | 'flies along the bank' |

[40] The target will need to be specified as [+nasal] if other consonants in Selayarese are also represented as lacking place features underlyingly.

[41] Alternatively, [+nasal] may be absent in UR, with only [–nasal] specified for sonorants in Table 11, but see footnote 40.

As in Selayarese, place assimilation (45a) applies, with laterals triggering lateralization of /n/ as in (45b).⁴²

In both Selayarese and Klamath, laterals trigger lateralization under place-assimilation, as predicted by the CLH. However, there are other languages in which place assimilation appears to occur without lateralization in the expected contexts. Chukchee (Kenstowicz 1986, 1994) is one such case. Chukchee has underlying nasals /n, m, ŋ/, with /ŋ/ assimilating in place to a following consonant as shown in (48).

(48) *Chukchee place assimilation (Kenstowicz 1986)*

- | | |
|------------------|-------------------|
| (a) teŋ-əlp-ən | 'good' |
| (b) tam-pera-k | 'to look good' |
| (d) taŋ-tʃottʃot | 'good pillow' |
| (e) taŋ-ləmŋə | 'good story' |
| (f) taŋ-rʔarqə | 'good breastband' |

However, forms like (48e) suggests that the feature [+lateral] is not involved in this assimilation, appearing to contradict the CLH. I propose that in languages like Chukchee, place assimilation applies as pictured in (45a, b). However, in Chukchee, as in Selayarese, the resulting [+nas, +lat] combination does not constitute a well-formed segment. Rather than delete [+nasal], Chukchee instantiates a different strategy: the feature structure with shared place-node is maintained, with [+lateral] realized temporally on the non-nasal portion of the shared feature structure, i.e. on the original 'l/' only. In other words, the [n] derived from place assimilation in (48e) is phonologically [+lateral], or part of a coronal gesture involving lateral airflow, and while the articulatory instantiation of [+lateral] may be simultaneous with nasal airflow, its acoustic realization is not.⁴³

While the assimilation rules above are consistent with the CLH, only a rule of coronal-spread which included lateralization (or delateralization) as a subcase would single out the coronal node as the mother of [lateral]. However, phonological rules of coronal-spread are quite rare. The Sanskrit retroflexion rule given in (7) is one case, but the triggers of this rule are retroflex segments, and Sanskrit lacks a retroflex lateral, so the question of

[42] If /n/ is specified as [+nasal] underlyingly in Klamath, then as in Selayarese, [+nasal] must be deleted from the assimilated [+nas, +lat] segment. However, there is no need to specify [+nas] underlyingly in Klamath, as the only [+cons, +son] segments are /m, n, l/ and their glottalized and voiceless counterparts. I assume /m/ is specified as LABIAL, and that /l/ is [+lateral], while /n/ is unmarked for place and manner.

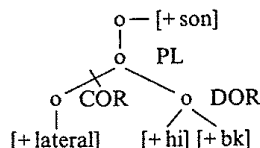
[43] Such feature instantiation strategies are not limited to the output of phonological rules. In contour segments like pre-nasalized stops and laterally released affricates, the features [+nasal] and [+lateral] must be associated with features [+sonorant] and [+continuant] respectively, though this is not directly encoded in the feature geometry of such contour segments.

lateralization does not arise.⁴⁴ In fact, there appears to be only one clear case of coronal-assimilation in the literature which bears on the CLH, and that is the case of Tahltan coronal harmony as described by Nater (1989) and Shaw (1989, 1991). As this case appears to run counter to the predictions of the CLH, it is reviewed along with other problematic cases in section 5.

4.2 Delinking rules

Rules delinking PLACE or CORONAL should result in delateralization under the CLH, since [+lateral] is a daughter of the coronal node. One case of such coronal-node delinking is that exhibited by the alternations between velarized laterals and back glides and vowels, as in the alternation between [ɨ] and [uɨ] in English, and [ɨ] and [o] in Serbian. In such cases, a complex coronal-dorsal articulation loses its coronal component, with delateralization as a concomitant change.⁴⁵ The rule suggested for English is shown in (49).

(49) Coronal delinking



While consistent with the CLH, rules like (49) cannot be taken as strong evidence for the placement of [lateral] within the feature geometry. A redundancy rule of the form [+lateral] → CORONAL (where [lateral] is a daughter of the root node) would make the same predictions: delinking of CORONAL would result in a non-licensed [lateral] feature, which would in turn be deleted by rule or convention.

4.3 The OCP

Languages in which the OCP appears to hold on the [+lateral] tier include Kuman, Latin and Laz. Recall that in Kuman rule (31), which eliminates sequences of [+lateral], can be viewed as an instantiation of the OCP on the [lateral] tier. Morpheme structure constraints in Arabic, as analyzed by McCarthy (1985, 1988) are also instantiations of the OCP. The basic observation is that homorganic consonants do not occur in Arabic roots. The

[44] However, as expected, laterals, like other coronal segments do block retroflexion, as expected under the CLH.

[45] Note that this is the same change discussed in a historical context in 3.1.5 for Papuan languages, and in 3.1.6 for Caucasian languages. Delinking of CORONAL from /*L/ results in a pure (non-lateral) velar.

OCP is active on each articulator plane, where these include CORONAL, LABIAL and DORSAL. Furthermore, the OCP is sensitive to the sonorant/obstruent distinction. As a result the coronal sonorants /l r n/ do not cooccur in a root. These findings are consistent with a geometric dependency relationship between [lateral] and CORONAL. Though again, as with the delinking rules discussed above, such facts are also consistent with models in which this dependency relationship is instantiated via redundancy rule.

4.4 Spreading of [+lateral]

Identification of rules of [+lateral] spread is not a simple matter. Alternations between [n] and [l] or [r] and [l] could involve the features [nas] or [cont], or [ant], [dist], [cont], [cons] respectively with values for [lateral] being entirely redundant.

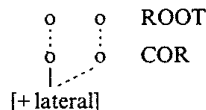
One fairly clear case of lateral assimilation occurs in the Teralfene dialect of Flemish (de Reuse 1984; McClellmore 1987). Here /n/ assimilates to a preceding /l/ as long as there are no intervening non-coronal segments.

(50) Lateral-assimilation in Teralfene Flemish

(a) /spe:l-n/	spe:l	'to play'
(b) /smelt-n/	smelt	'to melt'
(c) /vals-n/	vals	'filings'
(d) /elp-n/	elpen	'to help'
(e) /pluner-n/	pluneren	'to plunder'
(f) /mo:k-n/	mo:ken	'to make'
(g) /zwolme/	zwoleme	?

In (50a) /n/ surfaces as [l] when preceded by /l/; (50b,c) show that intervening coronal segments are transparent to this process, while (50d) indicates that non-coronal segments are opaque. In (50e-g) schwa is epenthesized in the absence of assimilation, and (50g) demonstrates that only coronals are targets of the assimilation rule. The transparency and opacity of coronals and non-coronals respectively follows from the CLH, with the rule of lateralization as stated in (51).

(51) Lateralization (iterative)



Coronal segments appear to be transparent because they are carriers of laterality, and rule (51) can propagate across them. Non-coronals are not

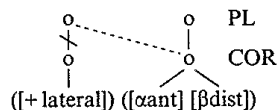
targets of (51), and so appear to block rule application. To arrive at the correct surface representations, a late rule delinking [lateral] from non-sonorants must be assumed.⁴⁶ Lateralization in Teralfene is not easily handled by models in which [lateral] is higher up on the feature tree. In particular, the opacity of non-coronals does not follow if [lateral] is a daughter of PLACE or ROOT.

In sum, rules of place-assimilation, coronal-delinking, lateralization and delateralization are consistent with the CLH. Of the cases examined above, place assimilation and lateralization together provide strong support for the CLH: only models in which [lateral] is a daughter of the coronal node or the place node are able to predict lateralization as a subcase of place-assimilation as in Selayarese and Klamath. Of these models, only that in which lateral is a daughter of coronal node also predicts the opacity of non-coronals in rules like Teralfene lateralization.

5. POTENTIAL COUNTEREVIDENCE TO THE CLH

One prediction of the CLH is that rules of CORONAL spread will spread the feature [lateral] if it is present. Inversely, such a rule if stated as in (52), should also result in delateralization of the assimilated segment.

(52) Hypothetical coronal assimilation



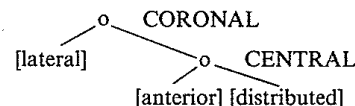
However, rules like that in (52) do not appear to result in delateralization. For instance, in English rhymes, there is regressive assimilation of place features in coronal clusters, as illustrated by the forms in (53). Assuming dentals are specified as [+dist, +ant], alveolars as [−dist, +ant] and palato-alveolars as [−ant, +dist], English coronal assimilation cannot be captured by a spread of a single terminal feature. However, this does not look like CORONAL spread as in (52), since laterals are not delateralized.

(53) English coronal assimilation

	/θ/	/t/	/tʃ/
/n/	te ⁿ θ	tent	be ⁿ tʃ
	tenth	tent	bench
/l/	we ^l θ	welt	wel ^t tʃ
	wealth	welt	welch

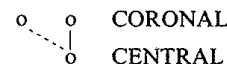
In order to account for such facts, I suggest that the substructure of the coronal node is actually more complex than the flat structure originally proposed in (8). The facts of natural language seem to point to a subdivision in coronal articulations between the sides and central portion of the tongue blade, as depicted in (54).

(54) Coronal geometry (revised)



Instead of rule (52), rules with the properties of English coronal assimilation can be simply stated as spread of the CENTRAL node as shown in (55).

(55) Coronal assimilation



The structure proposed in (54) also allows the CLH to be maintained in light of perhaps one of the most serious counterexamples reported in the literature, the case of Tahltan coronal harmony (Shaw 1989, 1991). The Tahltan coronal consonant inventory is given in Table 12. The affricates and fricatives in columns III, IV and V in Table 12 take part in a coronal harmony process whereby the rightmost segment from this class determines the dental, alveolar, or alveopalatal articulation of all other class members to its left within the word. Interestingly, the stops and lateral affricates and fricatives in columns I and II are transparent to this harmony process.

Shaw (1989, 1991) argues that the rule involved is CORONAL spread, and formulates the rule as in (52). The transparency of column I and II segments is claimed to follow from their underspecified representations: Shaw argues that segments in columns I and II lack place features underlyingly. If, she argues, a place node is lacking, then surely [+lateral] cannot be a daughter of CORONAL, for [+lateral] is necessary in Tahltan to distinguish the affricates and fricatives in column II from the non-lateral affricates and fricatives in columns III, IV and V. If [+lateral] is present, and is a daughter of CORONAL, then laterals are predicted to block coronal harmony, but they

[46] Alternatively, there is no delinking, and laterality, as suggested for Chukchee, is realized on sonorants and not obstruents by convention. That is, the [tʃl] and [sʃl] clusters in Flemish can be viewed articulatorily as pre-lateralized laterally released segments, with a single shared [+lateral]-CORONAL. Phonetic evidence involving lateral airflow, or raised tongue side(s) throughout the production of such clusters would lend support to this analysis.

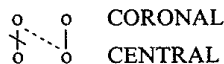
I	II	III	IV	V
d	dl	dð	dz	ɖ
t	tʰ	tθ	ts	tʃ
t'	tʰ'	tθ'	ts'	tʃ'
	ʈ	θ	s	ʃ
	l	ð	z	ʒ
n n'				

Table 12
Tahltan coronals

do not. Shaw concludes that [lateral] is immediately dominated by ROOT, and that the relationship between [lateral] and CORONAL is best expressed as a redundancy rule [+lateral] → CORONAL, not in terms of dominance relations within the feature tree.

I suggest that Tahltan coronal harmony, like English coronal assimilation, is a rule which spreads the CENTRAL node dominating the features [anterior] and [distributed]. However, whereas the English rule stated in (55) is a feature-filling process, the Tahltan rule stated in (56) is feature-changing.

(56) *Tahltan coronal harmony*



Adjacency for rule (56) is determined by adjacent CENTRAL nodes. Because the features [anterior] and [distributed] are not distinctive for segments in columns I and II of Table 12, these segments will not have CENTRAL nodes underlyingly, and will neither block nor undergo rule (56).⁴⁷

Rice & Avery (1991) argue that Catalan data (Mascaró 1976, 1989) is also problematic for the CLH. In Catalan /l/ assimilates in place of articulation to a following consonant, giving rise to labialized, labiodentalized, dental, alveolar, postalveolar, laminopalatal, palatal and velarized allophones. This assimilation they state is 'problematic if the coronal lateral co-occurrence

restriction is accounted for by structural dependency: The lateral is already coronal, so assimilation to the labial and velar is unexpected' (p. 116). There are two flaws in this argument. First, it is based on the assumption that [+lateral] must be present underlyingly in Catalan to distinguish laterals from rhotics. However, as discussed in section 2.4, there are other features which can be used to accomplish this same function. Unless strong arguments can be made that [+lateral] must be present underlying, the features [+lateral] and CORONAL for /l/ can both be supplied by redundancy rule in Catalan. Under such an account, /l/ is expected to undergo place-assimilation, as it lacks place features underlying.⁴⁸ Second, Rice & Avery assume that the segments resulting from assimilation to labials and velars are pure labials and velars, but this is not at all obvious. The laterals resulting from assimilation to labials and velars appear to be complex coronal-labials and coronal-dorsals respectively. But this is exactly the expected result if the rule in question is one of place-node spread WITHOUT place-node delinking of the target segment.

6. SUMMARY

In this paper I have argued that [lateral] is a necessary distinctive feature, and that all lateral segments, including velar laterals, are coronal at some level of representation. I have hypothesized that this relationship is one which is structurally encoded: [lateral] is a daughter of the CORONAL node. Evidence in favour of this structural encoding includes: rules of place-assimilation, like those in Selayarese and Klamath, where [lateral] acts as a natural class with other place features; decoronalization with concomitant delateralization, as in English [ɪ]/[ʊ]/[u] alternations; and lateral-assimilation in Teralfene Flemish, which targets coronals and is blocked by non-coronals.

The failure of laterals to delateralize under coronal assimilation as in English, or to block rules of coronal harmony as in Tahltan, is inconsistent with a model in which [lateral], [anterior] and [distributed] are all immediately dominated by the CORONAL node. Rather than move [lateral] higher up on the feature tree and lose the seemingly correct predictions of the CLH presented in section 4, I suggest that the substructure of the coronal node is more complex. The structure in (54), with distinct nodes for central and

[47] Alternatively, coronals in columns I and II could be claimed to undergo harmony, and subsequently lose their CENTRAL nodes under structure preservation (see McCarthy's 1984 analysis of Montañés vowel harmony), though this solution seems more complex.

In the Iskut dialect of Tahltan described by Nater (1989), [ʃ] is not common, and is in some cases the surface realization of /j/ when /j/ is preceded by a member of series V. This progressive assimilation, while clearly distinct from the general regressive harmony process, targets /j/, a segment which under Shaw's analysis would also be underspecified for place of articulation. This fact suggests one of two things, neither consistent with Shaw's analysis: that the CORONAL node is not underspecified, or that underspecification of CORONAL is not the correct way to eliminate targets of coronal harmony.

[48] The arguments against the CLH in work of Paradis & Prunet (1989, 1990) are similarly flawed. They suggest that the transparency of laterals and other coronal segments to vowel harmony in Mau and Guere is due to the fact that the place node is unspecified for these segments (and, they claim, for all unmarked coronals). However, both of these languages have only the non-nasal sonorant consonants /ɾ/. As a result, [+lateral] need not be present underlyingly, since [continuant] or [consonantal] (with the flap specified as [-consonantal]) would accomplish the same function. Furthermore, in Guere the lateral approximant is in complementary distribution with the flap precisely in the contexts in which it is claimed to be transparent, while in Mau these two phones are in free variation in the same contexts. Clearly then, in the contexts in which harmony crosses [l], the feature [+lateral] is non-distinctive, and need not be present at the time of rule application.

lateral articulations allows for a treatment of these cases of coronal assimilation and harmony as spreading of the CENTRAL node. In this way, the maintenance of laterality in English and the transparency of laterals in Tahlitan result from the fact that it is not CORONAL which is spreading. The separation of lateral and central tiers under the coronal node in (54) is motivated purely by phonological considerations; it is not meant to model the articulatory mechanisms associated with coronal sounds. In this light, it is striking that the lateral/central branching in the feature geometry closely parallels the physiological independence of the tongue tip and the tongue sides in speech production, while the placement of these features under the CORONAL node mirrors the physiological dependency between tongue tip and tongue side movements and activation of the tongue blade (Stone 1991). Only with further detailed study of distinctive features and their phonetic correlates will the ultimate basis of such parallels be revealed.

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