
Adjacency Parameters in Phonology

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ADJACENCY PARAMETERS IN PHONOLOGY

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One motivation for nonlinear phonology is the potential for eliminating the devices of linear phonology needed to allow rules to apply to nonadjacent segments. Imposing hierarchical structure on the organization of features within a segment and allowing segments to be unspecified for certain features makes it possible to view apparently long-distance rules as rules operating between segments which are adjacent at a specified level, even though the segments are not adjacent at all levels of representation. This paper presents a theory of phonological adjacency requirements. Locality Theory is defined by a universal Locality Condition, which requires elements to be local within a plane, the Adjacency Parameter, which in turn allows rules to impose further constraints on the maximal distance between interacting segments, and by Transplanar Locality, which bans certain types of relations across featural planes. A survey of phonological processes demonstrates the generality of this theory across feature tiers.*

1. INTRODUCTION. The notions focus, determinant, and intervening material in rules have played an important role in phonological theory. These terms are typically illustrated as follows:

(1)	X	→	Y	/	—	(W)	Q
	focus		structural			intervening	determinant
			change			material	

A fundamental problem in phonological theory has been that of accounting for intervening material.

Linear phonology includes devices which allow indefinitely long sequences of arbitrary elements to stand in any position in a rule. Nonlinear phonology has largely reanalyzed intervening material as resulting from other principles, and does not provide tools that directly characterize it. A nonlinear theory of intervening material is built on two principles. The first is that some features are unspecified in some segments. In the typical case of vowel harmony, where a feature spreads from vowel to vowel, consonants generally have no effect on the rule. The irrelevance of consonants results from the assumption that they have no representation on the tier where the assimilation takes place. The

* Earlier versions of this paper were presented at the 1989 Annual Meeting of the LSA in Washington, DC, and at the University of Washington. Data on Bukusu, Kihehe, Kikongo, Kikuria, Kipare, and Makonde come from my own notes. I would like to thank Jill Beckman, Roderic Casali, Nick Clements, John Daly, Laura Downing, Paul Fallon, Jose Hualde, Beth Hume, No-Ju Kim, Patrick McConvell, Nasiombe Mutonyi, Frederick Parkinson, Robert Poletto, Sharon Rose, Lisa Selkirk, Donca Steriade, and an anonymous referee for discussion of the examples and issues raised here.

The following abbreviations are used in this paper: 1 = first person, 2 = second person, 3 = third person, sg = singular, du = dual, pl = plural, indef = indefinite number (Basque examples), 1EXCL.pl = first person exclusive plural, 1INCL.pl = first person inclusive plural; ABL = ablative case; ABS = absolutive case, ACC = accusative case, AUX = auxiliary, DAT = dative case, DET = determiner, FEM = feminine, GEN = genitive case, INDEF = indefinite, LOC = locative case, MASC = masculine, NOM = nominative case, NOMZ = nominalization, OBJ = object, PART = partitive case, PRET = preterit, and SUB = subject.

second component of a nonlinear theory of intervening material is a set of adjacency conditions, which impose a further requirement that the elements affected by a rule must observe a certain closeness.

The purpose of this paper is to articulate Locality Theory, a parametric theory of adjacency conditions in phonology. Section 2 discusses previous work on intervening material. In §3 the principles of Locality Theory are spelled out. All phonological relations (rules and constraints) are subject to the Locality Condition, which requires elements mentioned in a rule to be local within a plane. Relations may also be constrained by adjacency conditions which limit the distance between the target and trigger segments, by requiring segments to be adjacent at the level of the syllable or at the level of the root node. A further condition may be imposed on rules, to the effect that relations must be local across planes. Section 4 presents crosslinguistic support for this model, and §5 concludes with a comparison of this theory and previous theories of intervening material. Section 6, finally, is a brief summary and conclusion.

2. PREVIOUS RESEARCH ON INTERVENING MATERIAL. Phonological rules must include some account for the fact that they can apply to segments which are not adjacent. The well-known vowel harmony rule of Finnish which assimilates suffix vowels to the backness of a preceding vowel will apply whether the two vowel segments are adjacent or separated by one or more consonants.

- (2) *ulko-a* 'from outside'
maa-ta 'from land'
kirves-tä 'from axe'

2.1. LINEAR THEORIES. The notational system of Chomsky & Halle 1968 includes a number of abbreviatory metarules which allow such generalizations to be expressed in a single rule schema, for example by employing the expression C_0 .

- (3) $V \rightarrow [\alpha_{\text{back}}] / \quad V \quad C_0 \quad _$
[α_{back}]

This rule expands to the infinite sequence of rules in 4:

- (4) $V \rightarrow [\alpha_{\text{back}}] / \quad V \quad _$
[α_{back}]
 $V \rightarrow [\alpha_{\text{back}}] / \quad V \quad C \quad _$
[α_{back}]
 $V \rightarrow [\alpha_{\text{back}}] / \quad V \quad CC \quad _$
[α_{back}]
 :

There are no constraints in the Chomsky & Halle 1968 theory on what may stand between the triggering segment (determinant) and the target segment (focus), so rules such as the following would be possible:

- (5) a. $V \rightarrow [+nasal] / \# _ V_0 [+nasal]$
 b. $V \rightarrow [+nas] / _ ([+hi] [+voice] [+son])_0 [+nas]$
[+low]

By application of 5a, /oian/ would become [ōian], despite the considerable distance between the target and trigger. Similarly, 5b nasalizes a low vowel only if it is separated from a nasal by nothing, or by a string analyzable as a multiple of three segments having the stipulated properties in the stated order. Thus the rule would apply to the first vowel of *an*, *akewn*, and *akbrivrnr*, but not to *awken*, *akewen*, or *abkriwrnr*.

Such formally simple but highly specific conditions on intervening material have never been attested, showing the need to constrain the mechanisms used in accounting for intervening material. As a consequence of adopting the directional (iterative) theory of rule application, Howard (1972:95) proposes an important constraint on intervening material, the Crossover Constraint:

- (6) THE CROSSOVER CONSTRAINT: No segment may be matched with an element in a rule other than the focus or the determinant if that segment meets the internal requirements of the focus of the rule.

Rules such as 5a thus become impossible, since the Crossover Constraint prohibits vowels from serving both as focus and as intervening material in a rule.

While the Crossover Constraint curbs the expressive power of phonology to some extent, the theory remains insufficiently constrained. The constraint does not prohibit rules such as 5b, since it merely prohibits low vowels—potential foci—from intervening. Thus *akawn* will not undergo 5b to become [ākawn], but *akewn* could undergo the rule, giving [ākewn].

A more powerful constraint, the Relevancy Condition, is proposed in Jensen 1974:

- (7) THE RELEVANCY CONDITION: Only IRRELEVANT segments may intervene between focus and determinant in phonological rules. The class of segments defined by the features common to the input and determinant of a rule is the class of segments RELEVANT to that rule, provided at least one of the common features is a major class feature. If there is no common major class feature, then ALL segments are relevant.

This constraint predicts that rules such as 5a–b are impossible: the focus and determinant segments share no major-class features, so all segments are relevant and cannot intervene. An important and correct prediction of this condition is that intervening material should be defined in terms of the class of segments allowed to intervene. Strings are never parsed into complex patterns in which certain segments may appear only in certain positions.

While the Relevancy Condition constitutes a significant advance over the Crossover Constraint, it cannot be accepted on technical grounds: see Odden 1977, 1980 and Jensen & Stong-Jensen 1979 for discussion. The theory is too powerful in disallowing classes of actually attested intervening material. For example, it disallows intervening material in rules where consonants and vowels interact, as are actually found in Karok, Votic, and Tigre. Furthermore, it incorrectly disallows neutral vowels in the vowel-harmony rules of Eastern Chermis and Menomini. The theory is also too weak in allowing arbitrary conditions to be imposed on intervening material by factoring the conditions

out of an explicit characterization of intervening material, and reconstructing those conditions by manipulating the features used to specify the determinant and focus.

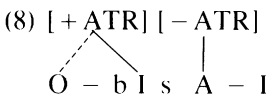
2.2. NONLINEAR THEORIES. One goal of nonlinear phonology is stating rules so that expressions such as $(C_0V_0)_0$ are avoided. Halle notes (1979:vi) that the notion of projection ‘makes it possible to eliminate variables from a large class of phonological rules and, in turn, leads one naturally to explore the possibility of dispensing with variables altogether’. Liberman & Prince observe (1977:333) that a linear analysis of certain stress rules

‘had to be equipped with essential variables, so that they could have the power to search through unlimited stretches of string in order to find a 1-stressed vowel. In the present theory, such rules are rendered as very local conditions on the labelling of nodes that are strictly adjacent in metrical structure.’

Hayes (1981:4) echoes this observation, noting that Liberman & Prince 1977 is ‘a step on the way to making phonological rules LOCAL’.

A typical autosegmental approach to intervening material is Clements 1976. Certain segments are defined as potential bearers of a given feature (PBUs, where ‘U’ = ‘unit’). As an example, vowels are the segments eligible to bear the feature [ATR] (Advanced Tongue Root) in Akan. The harmony rule of Akan which spreads [ATR] from vowel to vowel does not specifically mention that consonants can stand between target and trigger vowels. Rather, the rule spreads [ATR] to any bearer of that feature. Since consonants do not bear [ATR], they are not considered by the rule.

The No Crossing Constraint (NCC), which prohibits crossing association lines, forms the fundamental constraint on the autosegmental analysis of intervening elements—namely, that no segment specified for the harmonizing property may be skipped. In Clements’ analysis of Akan, the vowel /a/ is always specified for the feature [−ATR]. Consequently, [+ATR] cannot spread past the vowel /a/ to the final vowel in [o-bisa-ɪ] ‘he asked (it)’ (Clements 1976:61–63). (In 8, capital letters indicate archiphonemes not specified for [ATR].)



For this reason, the neutral vowels *i*, *e* in Hungarian front/back vowel harmony must be analyzed as being incapable of bearing a specification for the feature [back], at least at the point where vowel harmony applies.

As §4 will demonstrate, the NCC, in conjunction with the assumption that some segments are unspecified for the spreading feature in assimilation processes, still does not explain the range of attested facts regarding intervening material. One illustration of this problem comes from comparison of nasal spreading in Chukchi, a Paleo-Asiatic language of Siberia, and Kikongo, a Bantu language of Zaire (see §4.1 for detailed discussion). In Chukchi, a stop nasalizes immediately before a nasal consonant. Hence /rəpn-ət/ becomes *rəmnət* ‘flesh sides of hide’, but *rəpən* does not undergo this rule, since the stop and the triggering nasal are separated by a vowel. In Kikongo there is a

similar rule nasalizing *l* to *n* when *l* is preceded anywhere in the stem by a nasal consonant, whereby /ku-kinis-il-a/ becomes *kukinisina* ‘to make dance for’. The question is how to account for the difference between these two languages in terms of the material allowed to intervene between target and trigger: in Chukchi no segments are allowed to stand between target and trigger, whereas in Kikongo any number of segments are allowed to intervene. An appeal to differences in specification of the feature [nasal] in the two languages is not likely to succeed, since in neither language is the feature [nasal] distinctive for vowels—which means that vowels should not differ in specification for nasality. Explicit adjacency conditions are therefore necessary in a complete account of intervening material.

Steriade (1987b) makes a number of proposals relevant to the theory of adjacency. She proposes that ‘phonological rules may be subject only to positive, prosodically expressed locality conditions’, and that ‘it may also be necessary to stipulate that two segments participating in a rule must be syllabically or skeletally adjacent, in the sense that they are linked to adjacent syllables or adjacent syllabic positions’ (1987b:600). This does not rule out the possibility of imposing other prosodically-based conditions, such as the condition that interacting elements must be in adjacent rimes or feet. Steriade’s general approach will be supported here, and it will be shown that the only prosodic conditions allowed are syllable adjacency and root adjacency. The difference between Kikongo and Chukchi would be that Chukchi imposes a further condition on the nasal spreading rule—namely, that the segments involved must be associated to adjacent skeletal positions—whereas the Kikongo rule lacks that condition.

A more fully articulated theory of adjacency requirements is set forth in Archangeli & Pulleyblank 1987. That theory is based on the Locality Condition, which states that the target and trigger of phonological rules must be adjacent, and on the notion of scansion, which is that a representation is scanned for satisfying the Locality Condition at one of two positions in the feature hierarchy. These options are referred to as Maximal Scansion and Minimal Scansion:

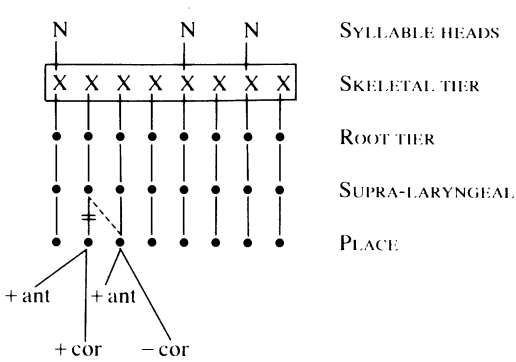
(9) MAXIMAL SCANSION: A rule whose target is node or feature α scans the highest level of syllabic structure providing access to α .

MINIMAL SCANSION: A rule whose target is node or feature α scans the tier containing α .

Three cases illustrate these scansions. First, the nasal place assimilation rule of English in 10 operates under Maximal Scansion, and spreads place features from an obstruent to a preceding nasal in words like *improper*. Assimilation is possible only between strictly adjacent segments; since the rule involves segments which are not syllable heads, scansion takes place at the skeletal level, which is the highest level providing access to consonantal features.¹ As viewed at that level, only strictly adjacent consonants satisfy the Locality Condition.

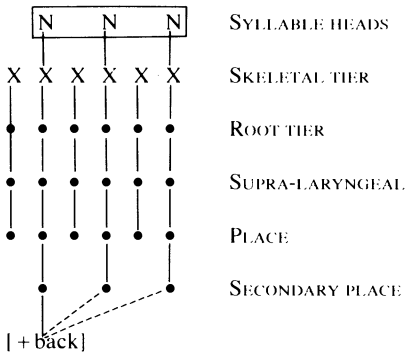
¹ It is an arbitrary stipulation of the theory that the syllable node and higher prosodic levels such as the foot do not provide access to consonantal features.

(10) i n p r o p e r



By contrast, for a rule such as Turkish Vowel Harmony in 11 (the word is *kadine* 'woman (DAT)'), Maximal Scansion takes place at the level of syllable heads (the highest level available for scansion), so the skeletal slots of consonants are ignored. A vowel harmony rule with neutral vowels, as in Finnish

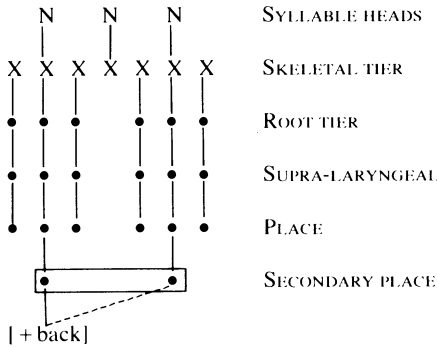
(11) k a d i n e



or Mongolian (cf. ex. 12), is subject to Minimal Scansion. This requires that the node which immediately dominates [back] (Secondary Place) be adjacent for target and trigger. The neutral vowel must be unspecified for all vowel place features in order to lack a Secondary Place node (i.e. the node which dominates place of articulation features for vowels).²

² Ex. 12 is from Archangeli & Pulleyblank and is from Mongolian (the word is *zaxirax* 'to direct'), which supposedly has frontness harmony with a single neutral vowel *i*. However, Riialand & Djamouri 1984 and Svantesson 1985 both show, using instrumental evidence, that the alternations involved are in [ATR], not [back]. The supposedly neutral vowel *i* actually harmonizes—but this is not indicated in the orthography, which is the basis for most studies of Mongolian vowel harmony. As Archangeli & Pulleyblank recognize, multiple neutral vowels in Finnish and Hungarian pose a significant problem for this theory.

(12) z a x i r e x



This model predicts the following typology of intervening material:

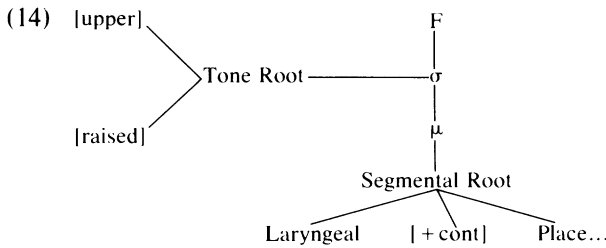
(13) TARGET	TRIGGER	MAXIMAL SCANSION	MINIMAL SCANSION
C	C	adjacent segments	unbounded
V	V	adjacent syllables	unbounded

The predictions for rules in which consonants and vowels interact are unclear.

3. LOCALITY THEORY. While Archangeli & Pulleyblank 1987 constitutes a significant improvement in understanding intervening material, in that explicit, falsifiable proposals are set forth, there are unresolved problems with the theory. The most important problem is that it incorrectly predicts that there are no rules in which consonants affect consonants separated by segmental material, provided that they are in adjacent syllables. This is a consequence of the fact that, in order to allow intervening skeletal positions, the rule must apply under Minimal Scansion; yet Minimal Scansion provides no mechanism which could constrain a rule so that target and trigger are in adjacent syllables. The theory also predicts that there could be no rules in which vowels affect vowels which are strictly adjacent. A rule operating under Minimal Scansion would incorrectly allow any number of segments to intervene, and a rule operating under Maximal Scansion would allow consonants to intervene. The theory thus lacks a mechanism to require that no segments intervene. However, such rules do exist, as shown in §4. This section therefore sets forth a theory of adjacency conditions which addresses these and other problems.

3.1. BACKGROUND ASSUMPTIONS. Two issues regarding feature organization must be considered. Some of the evidence bearing on the model comes from tone, so the location of tone in a representation is important. It is assumed that phonological representations contain the three major structures seen in 14—the segmental, tonal, and prosodic representations (comprised of the foot *F*, the syllable σ , and the mora μ). At the highest level in each featural representation is a root node. Tones are thus represented on a separate plane, one linked to the syllable mediated by a root node.³ This captures fundamental

³ Alternatively, the tonal root node could link to the mora. See Odden 1993 for discussion of some of the issues involved. For present purposes it does not matter what element tones link to.



asymmetries between tone and segments, such as the fact that tones are preserved when segments delete; and it also provides a basis for explaining (in §4.3) why segmental rules which are subject to the Root Adjacency parameter have the requirement that target and trigger cannot be separated by any segment, while tone rules subject to that condition are never blocked from applying when a segment intervenes.

The second issue relates to features for place of articulation. Earlier theories of feature organization (Clements 1985, Sagey 1986) suffered from defects in the treatment of these features, since the features describing consonants and vowels came from largely disjoint sets. This has proven unsatisfactory, since there is a functional equivalence between certain consonantal and vocalic place features. One such equivalence links consonantal labial and vocalic [round]. For example, word-final /i/ in Tulu becomes [u] when preceded by a round vowel or a labial consonant (Bright 1972, Clements 1990):

- (15) *ari-n-ī* → *āri-n-ū* 'rice (ACC)'
ūru-n-ī → *ūrunu* 'country village (ACC)'
kappi → *kappu* 'blackness'

These alternations are nonproblematically described as assimilations if consonantal labiality and vocalic roundness were governed by the same feature.

Another interaction between consonantal and vocalic place features is fronting of vowels near coronal consonants. Hume 1992 shows that in Maltese the prefix vowel of the 'first measure' imperfective (right-hand column in 16) is a copy of the stem vowel. If the initial consonant is a coronal obstruent, the prefix vowel is [i].

- (16) a. *kotor* *yo-ktor* 'to abound, increase'
ħebel *ye-ħbel* 'to rave'
*bidel*⁴ *yi-bdel* 'to change'
ʔabad *ya-ʔbad* 'to catch'
- b. *šorob* *yi-šrob* 'to drink'
seħet *yi-sħet* 'to curse'
dalam *yi-dlam* 'to grow dark'

This rule (like other phenomena discussed in Hume 1992) reduces to assimilation if front vowels and coronal consonants involve the same feature, coronal. (For detailed discussion of the acoustic and articulatory justification for unifying coronal and front, see Hume 1992.)

⁴ The underlying form of this stem is /bidil/; unstressed /i/ in a final syllable is reduced to [e].

However, consonants are commonly transparent to vowel harmony, so rounding harmony can pass over labial consonants and front/back harmony can pass over coronal and velar consonants:

(17) a. TURKISH LABIAL HARMONY (Clements 1989):

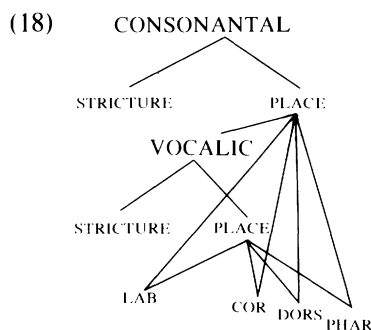
pul 'stamp' : *pulun* 'stamp (GEN sg.)'
mum 'candle' : *mumun* 'candle (GEN sg.)'
dip 'bottom' : *dipin* 'bottom (GEN sg.)'

b. HUNGARIAN FRONT/BACK HARMONY (Hume 1992, Vago 1980):

olvasunk 'read (1 pl. PRES. INDEF)'
va \ddot{u} nk 'be (1 pl. PRES. INDEF)'
me \ddot{u} nk 'go (1 pl. PRES. INDEF)'
haldoklunk 'be dying (1 pl. PRES. INDEF)'
öreg \ddot{s} ünk 'grow old (1 pl. PRES. INDEF)'

Such transparency would seem to motivate the segregation of features for place of articulation in consonants and vowels.

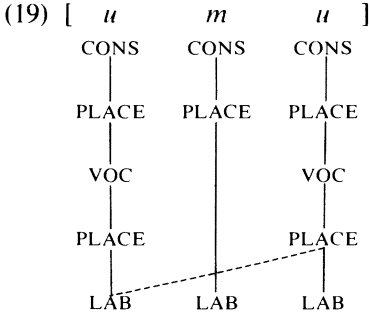
The Unified Features framework (Clements 1989, Herzallah 1990, Hume 1992, and Clements & Hume 1993) provides a reconciliation of these observations. In this theory, [labial] describes articulation with the lips, as in [u] and [p], and [coronal] describes fronting of the tongue, as in [i] and [t]. All occurrences of a given articulator feature reside on a single tier; there is therefore only a single coronal tier, and it is employed for both [i] and [t]. Consonants and vowels differ in that the place features of consonants are generally immediately dominated by the Consonantal Place node, whereas those of vowels are immediately dominated by Vocalic Place. The relation of [labial] to C-place in a consonant thus defines a different plane⁵ from the relation of V-place to [labial] in a vowel. Following Hume 1992, I adopt the organization of place features in 18.



The geometry in 18 resolves the seeming contradiction that consonantal and vocalic place features need to be disjoint and yet draw on the same place features. All occurrences of an articulator feature reside on a single tier, so rounding in the context of [p] or vowel fronting in the context of [t] can be

⁵ 'Plane' is the relation between a given tier and the tier immediately dominating it, specifically all pairs of nodes (A, α) such that α is on Tier_i, A is on Tier_j, and A immediately dominates α .

expressed as feature spreading. The disjointness of consonantal and vocalic place features follows from the fact that place features for consonants and vowels define different planes. Spreading of vocalic labial across consonantal labial does not violate the NCC, since line-crossing is only defined within a plane (Coleman & Local 1991); Clements 1990 states the NCC as follows: ‘Association lines may not cross on a plane.’ Spreading of vocalic labial over a labial consonant in Turkish *mumun* does not result in crossed lines, since the immediately dominating nodes are on different tiers, thus defining different planes:

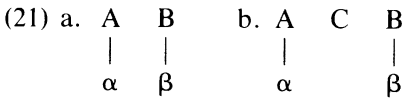


While the issues raised in this paper are largely independent of the representation of place features, §4.7 shows that one of the language-specific adjacency conditions which may be imposed on a rule is the prohibition of such transplanar relations.

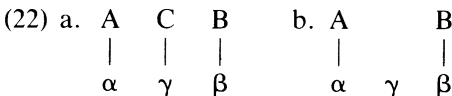
3.2. THE PROPOSAL. The central tenet of the theory of adjacency developed here is that phonological relations respect the Locality Condition. This condition holds of rules which insert or delete association lines or feature values, and also constrains the operation of filters such as lexical versions of the Obligatory Contour Principle (OCP), which constrain acceptable underlying representations. The essence of the Locality Condition is that intervening material must lie on a distinct plane from that of the target and trigger nodes. Local relations obey 20:

- (20) LOCALITY CONDITION: In a relation involving A,B and the nodes α, β which they immediately dominate, nothing may separate α and β unless it is on a distinct plane from that of α or β .

Now consider the representations in 21:

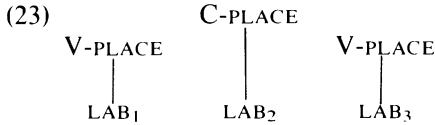


In 21a–b, α and β are adjacent—nothing separates α and β , so they are local within their planes. The presence of higher C is immaterial. By contrast, α and β are not local in 22a–b.



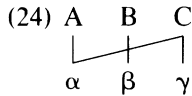
The presence of γ , be it linked to C or floating, makes the relation between α and β nonlocal, since in either event γ is not on a distinct plane from α or β .

In the cases considered so far, the representation contains only a single plane. A relevant multiplanar representation would be 23:

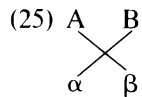


All occurrences of Labial reside on the same tier; the first and third reside on the same plane. Labial₂ is on a separate plane because it is dominated by C-place. Since nothing separates Labial₁ and Labial₃ within their plane, they may interact.

The Locality Condition is similar to the NCC, since it prohibits rules from creating structures like 24:

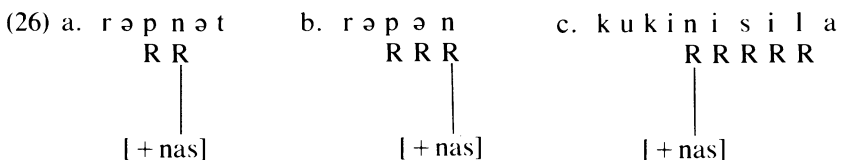


However, the Locality Condition imposes constraints not imposed by the NCC. The Locality Condition will block a rule from deleting α before γ across β where the NCC does not, since deletion across β does not result in crossed lines. The Locality Condition blocks spreading or deletion of an element over an unlinked element as in (22b), while the ban on crossing lines does not constrain sequences containing a medial unassociated element. The NCC cannot be entirely eliminated in favor of the Locality Condition, however, because certain line-crossing configurations do not violate the Locality Condition.



To prohibit such structures, the NCC is also assumed, subject to the aforementioned provision that line-crossing is defined only within a plane.

The Locality Condition establishes the basic constraint on intervening material. Now consider the contrast between nasal spreading in Chukchi, which applies only between adjacent segments, and nasal spreading in Kikongo, which applies between segments separated by an arbitrary number of consonants. The Locality Condition is satisfied both in the Chukchi examples 26a–b and in the Kikongo example 26c, since in no case is an element on the [nasal] tier being ‘crossed’ (there being only one element on that tier in these cases). ‘R’ in 26 is Root.



As we have noted, nasal spreading is allowed between nonadjacent segments in Kikongo (26c) but not in Chukchi (26b). The Locality Condition alone allows skipping of an unbounded sequence of elements as in Kikongo, and yet it does not handle the further restriction imposed on the rule in Chukchi.

Beyond the Locality Condition, further conditions on separation of target and trigger may be imposed on a rule, stated in 27.

(27) ADJACENCY PARAMETERS:

SYLLABLE ADJACENCY: Target and trigger must be in adjacent⁶ syllables.

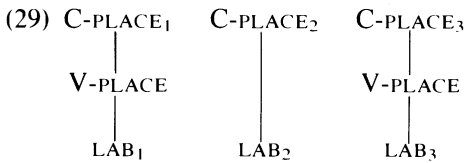
ROOT ADJACENCY: The root nodes of target and trigger must be adjacent.

Accordingly, nasal spreading in Chukchi is subject to root adjacency, whereas nasal spreading in Kikongo is not subject to any distance condition. And as shown in §4.1 below, Lamba has a nasal spreading rule which is identical to that of Kikongo save that it is subject to Syllable Adjacency.

The second language-specific component of my theory is Transplanar Locality, which in effect collapses planar distinctions.

(28) TRANSPLANAR LOCALITY: Nothing which separates the nodes dominating target and trigger may also dominate an element on the target tier.

Transplanar Locality is distinguishable from the Locality Condition in case a tier may define more than one plane, viz. with rules affecting place of articulation feature. The type of structure which distinguishes these conditions is 29:



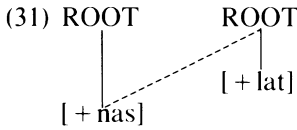
A relation involving the first and third labial nodes satisfies the Locality Condition since the intervening labial node is on a different plane—it is immediately dominated by C-Place, not V-Place. Thus rounding harmony can apply across labial consonants in Turkish. But a rule subject to Transplanar Locality would not apply to this structure, since C-place₁ and C-place₃ are separated by C-place₂, which also dominates an element on the labial tier.

4. EVIDENCE FOR THE MODEL. This section motivates the model presented in §3 by investigating sets of similar rules in various languages, where the rules differ in selecting Syllable Adjacency, Root Adjacency, Transplanar Locality, or the Locality Condition alone. This survey will cover rules which affect nasality, laryngeal features, tone, and place features for vowels and consonants, in order to demonstrate the generality of the proposal across feature tiers. In §4.7 evidence for Transplanar Locality will be presented.

⁶ Nodes α and β are adjacent iff they are on the same tier and no element on that tier intervenes between α and β .

4.1. NASAL SPREADING. We begin by considering in more detail rules that spread [nasal] from a nasal consonant to another consonant. As noted above, Kikongo has a rule (discussed in Ao 1991) which changes suffixal *l* to *n* when *l* is preceded by a nasal within the stem. The same rule is found in the Bantu language Tshiluba (Johnson 1972:75–76). Ex. 30 illustrates the alternations with the applicative suffix *-il*, and the rule is formulated in 31.

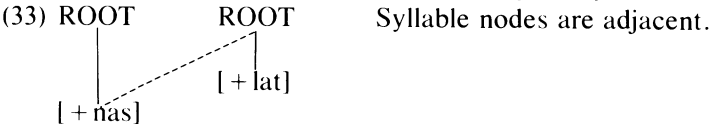
- | | | | | |
|------|-------------------|-----------------|---------------------|---------------------|
| (30) | <i>kutoota</i> | 'to harvest' | <i>kutootila</i> | 'to harvest for' |
| | <i>kukina</i> | 'to dance' | <i>kukinina</i> | 'to dance for' |
| | <i>kukinisa</i> | 'to make dance' | <i>kukinisina</i> | 'to make dance for' |
| | <i>kudumuka</i> | 'to jump' | <i>kudumukina</i> | 'to jump for' |
| | <i>kudumukisa</i> | 'to make jump' | <i>kudumukisina</i> | 'to make jump for' |



This rule operates with no specific distance constraint beyond the universal Locality Constraint. The fact that target and trigger may be nonadjacent does not entail using variables such as 'X' or '...'; the lack of a distance constraint on the rule itself means that the distance between target and trigger segment is unbounded (see Schein & Steriade 1986:696 for related discussion).

Syllable Adjacency can be illustrated with Lamba, a Bantu language of Zambia (Doke 1938), which also has a rule turning *l* into *n* if there is a preceding nasal. However, in Lamba the rule does not apply if a syllable separates target and trigger. Relevant Lamba forms are illustrated in 32; 33 gives the Lamba rule, which is identical to the Kikongo rule, except for the distance condition: target and trigger must be in adjacent syllables in Lamba.

- | | | | | | | |
|---------|------------------|------------|--------------------|-------------------------|-----------------|-------------|
| (32) a. | <i>fisa</i> | 'hide' | <i>fisuluka</i> | 'get revealed' | <i>fisulula</i> | 'reveal' |
| | <i>masa</i> | 'plaster' | <i>masuluka</i> | 'get unplastered' | <i>masulula</i> | 'unplaster' |
| | <i>mina</i> | 'swallow' | <i>minunuka</i> | 'get unswallowed' | <i>minununa</i> | 'unswallow' |
| b. | <i>sompoloka</i> | 'slip out' | <i>sompolokele</i> | 'slip out (perfective)' | | |
| | <i>nwa</i> | 'drink' | <i>nwine</i> | 'drink (perfective)' | | |
| | <i>uma</i> | 'dry' | <i>umine</i> | 'dry (perfective)' | | |
| | <i>masa</i> | 'plaster' | <i>masile</i> | 'plaster (perfective)' | | |



The third case of [+nasal] spreading involves strictly adjacent segments in Chukchi (Krause 1980, Odden 1987). In Chukchi [+nasal] spreads to a stop standing immediately before a nasal, subject to the Root Adjacency parameter. Similar rules exist in Korean and Kimatuumbi. Chukchi alternations are illustrated in 34 (in which suffixes indicate 'infinitive' and 'plural' and a prefix-suffix combination marks past tense).

- | | | | | |
|------|---------------|----------------------|--------------------|------------------------|
| (34) | <i>pəne-k</i> | 'to grind' | <i>ɣe-mne-lin</i> | 'it ground' |
| | <i>rəpən</i> | 'flesh side of hide' | <i>rəmn-ət</i> | 'flesh sides of hides' |
| | <i>pəjəl</i> | 'news' | <i>ɣa-mjət-len</i> | 'having news' |
| | <i>təm-ək</i> | 'to kill' | <i>ɣa-nmə-len</i> | 'he killed' |

- c. *ɲaci-wuɲca* 'with father'
ɲarin-kuɲca → *ɲarin-kuca* 'with meat'
paŋku-wuɲca → *paŋku-wuca* 'with the paternal cross-cousin'
cawuraŋkari-wuɲca →
cawuraŋkari-wuca 'with another thief'

The rule does not apply if the target and trigger are separated by a nasal consonant or an oral stop. Thus, the 3pl. subject clitic *ɲkulu* undergoes the rule in 39a because only oral sonorants intervene, but the rule is blocked in 39b by an intervening *p* and in 39c by an intervening *ɲ*. Similarly, the rule applies to the allative suffix *-ɲkura* in 39d, since only oral sonorants intervene, but not in 39e, because of the intervening oral obstruent.

- (39) a. *ɲu-ɲcura-kulu* (*ɲaɲa*) 'they (saw) you lot'
 AUX-3pl.OBJ-3pl.SUB see
 b. *ɲu-ɲantipa-ɲkulu* (*ɲaɲa*) 'they (saw) us'
 AUX-1EXCL.pl.OBJ-3pl.SUB see
 c. *ɲampa-ɲala-ɲkulu* (*cayiyku*) 'what will they (give) us'
 what-1INCL.pl.OBJ-3pl.SUB give
 d. *kaŋti-kura* 'towards a tree'
 e. *paŋkuɲi-ɲkura* 'towards a cross-cousin'

To understand why nasals and oral obstruents block this rule, consider the consonantal inventory of Gurindji:

(40)	Bilabial	Alveolar	Retroflex	Lamino-Alveolar	Velar
Oral stop	p	t	ʈ	c	k
Nasal	m	n	ɳ	ɲ	ŋ
Sonorant	w	l, r	ʎ, ʀ	y	

If this inventory primarily opposes stops (oral and nasal) and sonorant continuants, the further distinction between oral stops and nasals would be encoded by the contrast [\pm nasal]. McConvell (1993) notes that this can be treated as rightward spreading of [$-$ nasal]. On the assumption that homorganic nasal plus obstruent sequences are prenasalized consonants (a single segment containing the sequence [$+$ nasal] [$-$ nasal]), this spreads [$-$ nasal] to a prenasalized stop, eliminating the nasal component of the prenasalized stop.

McConvell 1988 also documents a denasalization rule in Kija that changes a verb-initial nasal to an oral stop when the preceding word ends in an oral stop:

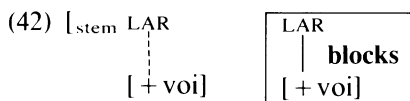
- (41) *maran ɲaniyi* 'she went away'
walikaa ɲaniyi 'and then she went in'
walik caniyi 'she went in'

This rule thus operates under the Root Adjacency condition, which prohibits any segment, and specifically a vowel, from standing between target and trigger.

4.2. LARYNGEAL FEATURES. The next illustration of the adjacency parameters involves laryngeal interaction between consonants. When no condition is imposed on a rule, the rule applies to targets separated from the triggering segment by an unbounded sequence of elements. Such an effect appears in

Japanese, in the form of a constraint on the Japanese rule that assigns [+voice] in compounds (Itô & Mester 1986). The initial obstruent of the second member of a compound voices, e.g. *onna-kokoro* → *onna-gokoro* 'feminine feelings', but no voicing occurs if a voiced obstruent appears anywhere in the stem (*kami-kaze* 'divine wind', *onna-kotoba* 'feminine speech').

Following Itô & Mester 1986, I assume that a floating [+voice] feature is present in compounds, and that this feature docks to a stem-initial consonant, subject to the condition that there is no other specification of voicing in the word.⁹



Since this rule is not subject to any adjacency conditions, the blocking effect of a voiced consonant is felt regardless of the phonological distance between target and blocking segment.

Ebert (1979:9) observes that Kera (a Chadic language of Chad) disallows a mixing of voiced and voiceless stops within a word, and shows that the nominal *k-* prefix surfaces as *g* if the stem contains a voiced consonant. (In these examples, *j* represents a palatal affricate.)

(43) <i>ki-sír-kí</i>		'black (MASC)'
<i>kə-sár-káŋ</i>		'black (COLLECTIVE)'
<i>sár-ká</i>		'black (FEM)'
<i>ki-jír-kí</i>	→	<i>gi-jír-gí</i> 'colorful (MASC)'
<i>kə-jar-káŋ</i>	→	<i>gə-jar-gáŋ</i> 'colorful (COLLECTIVE)'
<i>jar-ká</i>	→	<i>jar-gá</i> 'colorful (FEM)'

These examples can be handled either by an unbounded rule spreading [voice] or by a syllable-bounded rule. I have been unable to locate examples of the form $kV[+son]V[+son]V[+voice]$ to determine if this rule can skip a syllable.

Rules which involve laryngeal features and are subject to Syllable Adjacency can be found in a number of Bantu languages that have Dahl's Law, a rule which dissimilates *k* to *g* when it is followed by a voiceless obstruent.¹⁰ The examples in 44, from Kikuria (Kenya and Tanzania), involve the infinitive prefix *oko-*. The unmodified prefix is seen in 44a, and the effects of dissimilation are seen in 44b.

(44) a.	<i>oko-ráára</i>	'to sleep'
	<i>oko-ménénékánya</i>	'to make each other shine'

⁹ Since there is no commonly accepted format for indicating how blocking conditions are included in phonological rules, blocking conditions will be written here by including the phonological blocking condition in a box with 'blocks'. The meaning of this is that if a string contains the structure included within the box—subject to whatever locality conditions there are for the rule—then the rule does not apply to that string.

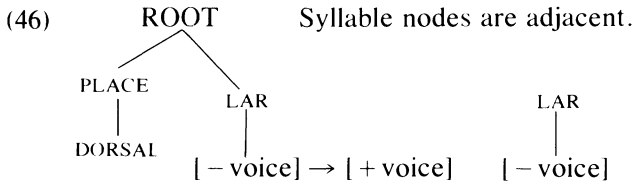
¹⁰ In Kikuria, a voiced velar obstruent not preceded by a nasal surfaces as γ by a later weakening process. The same weakening of *g* to surface γ is found in Kikuyu, and *b* is also weakened to β .

<i>oko-bára</i>	'to count'
<i>oko-hágaacha</i> ¹¹	'to build'
b. <i>ogo-téma</i>	'to hit'
<i>ogo-sóóká</i>	'to respect'
<i>ogo-kónjóónta</i>	'to slap'
<i>ogo-ótyá</i>	'to split (tr.)'
<i>ugw-ítá</i>	'to kill'

Underlying /oko-téma/ undergoes Dahl's Law to become [ogotéma] because the target *k* and the trigger *t* are in adjacent syllables. In contrast, the rule does not apply in [okoménénekánya], because the two voiceless consonants are not in adjacent syllables. Note also that Dahl's Law applies in the examples of 45a, where an onset nasal from the 1sg. object prefix intervenes between target and trigger (the nasal is phonetically fully voiced), though not in 45b, where the onset of the following syllable does not contain a voiceless consonant:

- (45) a. *ogoó-n-térekéra* 'to cook for me'
ogoó-n-káraángéra 'to fry for me'
- b. *okoó-m-bára* 'to count me'

These examples make it clear that consonantal segments can stand between the target *k* and the triggering consonant. Dahl's Law (for Kikuria and Kikuyu) is formulated in 46.



Davy & Nurse (1982) provide examples of Dahl's law in Kikuyu (Kenya) which make a similar case for Syllable Adjacency. In Kikuyu (unlike Kikuria), heterosyllabic vowel clusters are possible and, as predicted, Dahl's Law does not skip over a syllable which contains only a vowel. Note the variation in 47 in the form of the prefixes *kaa* ~ *gaa* and *ke* ~ *ge* (syllable boundaries are marked with a dot).

- (47) *ndo.kaa.e.kwa.nde.ka* 'don't on any account write'
ndo.gaa.ke.e.ko.go.ra 'now, whatever you do, don't buy'
a.ke.o.ki.ja 'and he trod on them'
a.geo.ke.ra 'and he got up'

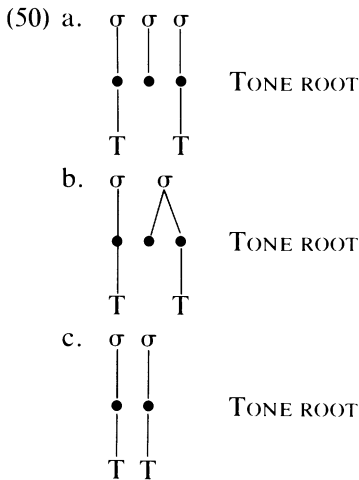
The last pair is particularly interesting, since it clearly demonstrates the relevance of syllabification. Davy & Nurse note that the fusion of vowel sequences into a single syllable is usually resisted when the second vowel is a vocalic prefix (*o-* 'them'), in contrast to fusion with a vowel-initial verb root (*-okera* 'get up'). However, for some speakers the syllable hiatus in [a.ke.o.ki.ja] disappears in fast speech, in which case we find [a.geo.ki.ja], where Dahl's Law applies.

¹¹ The phonetically voiceless consonant *h* does not trigger this rule; I assume that *h* is specified only with the feature [+spread], and, not being specified [-voice], cannot trigger Dahl's Law.

A typical example illustrating Root Adjacency with laryngeal features is regressive voicing assimilation in English, whereby suffixal *z* and *d* devoice only after immediately preceding voiceless obstruents. (48); the rule is formulated in 49.

- (48) /kæt-z/ → [kæts] 'cats'
 /pæs-d/ → [pæst] 'passed'
 /pay-z/ ↘ *[pays] 'pies'
 /pɔ-d/ ↘ *[pɔt] 'pawed'
- (49) LAR LAR Root nodes are adjacent.
 |
 └──┬── [- voi]

4.3. TONE. The next group of examples involves adjacency requirements in tone rules, focusing on deletion of H (High) after H. The relevant examples require considering tone configurations of the following types, where T represents some tone. Ex. 50a gives two toned syllables separated by a toneless syllable; 50b gives two adjacent syllables, with the tones separated by an empty tone node; and 50c gives two tones on adjacent tone nodes.



If a language allows interaction between tones in configurations such as 50a–c, then no adjacency parameter is invoked. If a language allows interaction only between tones in configurations 50b and 50c, then Syllable Adjacency is involved. Finally, if tones interact only in 50c, Root Adjacency is at work.

To investigate adjacency relations for tone, one must look at languages where not all tones are specified, so that there might be empty tone nodes in the course of a derivation. In such a language, target and trigger might be separated by tone-bearing units (TBUs) and not violate the Locality Condition. In Arusa (Eastern Nilotic, Tanzania), Makonde (Bantu, Tanzania), and Kihehe (Bantu, Tanzania), for instance, the only phonological distinction is between H-toned and unspecified units. In these languages, TBUs which do not bear H are assigned a L (Low) tone in the postlexical phonology. Consistent with this phonological asymmetry between H and L, and in keeping with the established

practice of the sources, H is marked with an acute accent and L is unmarked. And in Peñoles Mixtec (Otomanguean, Mexico; Daly 1993), H and L are phonologically specified and M (Mid) is unspecified, thus allowing M-toned syllables to be skipped over in a long-distance dissimilation of L tones.

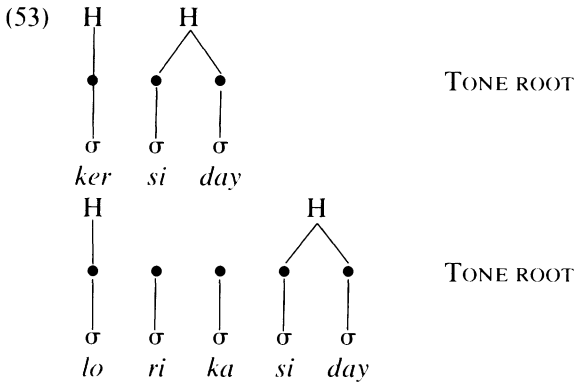
Unbounded tonal interaction in Arusa (Levergood 1987:58ff.) lowers a phrase-final H tone when the H is preceded by another H. The H which conditions this rule on the left may be in the preceding syllable, or it may be separated from the final H by any number of toneless syllables. The deleted H may be linked to a string of syllables, as in *sídáy* below.

- (51) *kití* 'small'
ádól enkér kití → *ádól enkér kiti* 'I see the small ewe'
sídáy 'good'
enkér sídáy → *enkér siday* 'good ewe'
olórika sídáy → *olórika siday* 'good chair'

The rule in 52 handles tone deletion;]₁ indicates that the rule applies prepausally.

- (52) H H → ∅]₁

The deletion of H thus applies to structures like 53.



The involved H tones are not necessarily on adjacent TBUs or syllables; therefore, no adjacency requirement is imposed on the tone-deletion rule.

Long-distance dissimilation of L to M when preceded by L is attested in Peñoles Mixtec, as shown in Daly 1993. This rule skips over M-toned syllables, which are underlyingly (and perhaps phonetically) unspecified for tone.¹²

- (54) *ndè ʔē-sī ñîʔí* → *ndè ʔē-sī ñîʔí* 'she sees the sweat house'
ndè ʔē-sī kùčí → *ndè ʔē-sī kùčí* 'she sees the pig'
ndè ʔē-sī míčí → *ndè ʔē-sī míčí* 'she sees the cat'
ndè ʔē-sī sápu → *ndè ʔē-sī sápu* 'she sees the frog'

A case of Syllable Adjacency, where a TBU within the syllable but not a full syllable may stand between target and trigger, is found in the Chimaraba

¹² What I refer to as L, Daly refers to as Stable L (L'), and what I refer to as M Daly refers to as Drifting L (L), whose pitch value is highly influenced by surrounding tonal context, in contrast to L' and H.

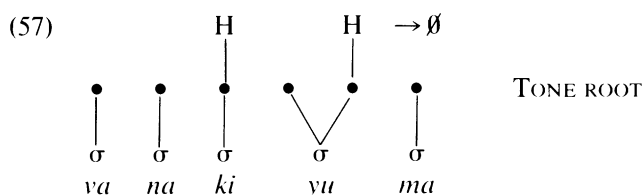
dialect of Makonde. (The tonal structure of Chimaraba is discussed in greater detail in Odden 1990.) All future-tense verbs have H on the second TBU of the penultimate syllable. Verbs with a third-person subject have an additional H on the first TBU of the stem, i.e. the TBU immediately following the future tense prefix *na-*. These patterns are illustrated in 55a. If the stem-initial syllable is the antepenult, as in 55b, the expected H on the penult is deleted by a rule known as Meeussen's Rule.

- (55) a. *nna-chíteleéka* 'I will cook it'
nna-pílikaána 'I will hear'
nna-teleéka 'I will cook'
vana-chíteleéka 'they will cook it'
vana-pílikaána 'they will hear'
- b. *vana-kíyuuma* 'he will buy it' /*vana-kíyuúma*/
vana-téleeka 'they will cook' /*vana-téleéka*/

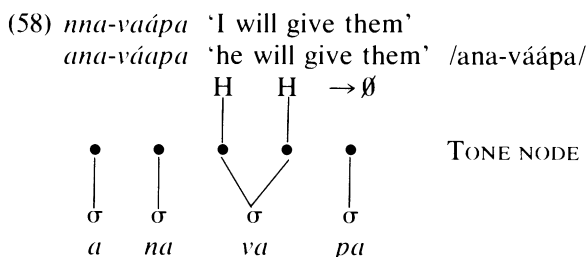
In Makonde the involved H tones are subject to Syllable Adjacency:

- (56) H H → ∅ Syllable nodes are adjacent.

Note in 57 that the deleted H of *vanakíyuuma* is in the syllable next to the triggering H, but is not on the TBU next to the trigger:



The theory makes a further prediction. Since the condition on Meeussen's Rule in Makonde is that the syllable node of the trigger H must be adjacent to the syllable node of the focal H, a H is syllable-adjacent to H in the same syllable. As the data in 58 show, when the stem-initial syllable is the penult, the initial H causes deletion of the following autossyllabic H.



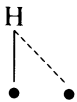
Makonde illustrates another interesting Syllable Adjacency effect. Other examples of the future tense, in 59a, reveal the application of a tone-spreading rule which spreads a tone to the immediately following nonfinal syllable. However, the rule is blocked in 59b, where the target is followed by a H in the next

syllable; note again that the blocking H need not be on the immediately following TBU.

- (59) a. *vana-nífúkuziíla* 'they will chase for me'
vana-télékelaána 'they will cook for each other'
vana-vitélekelaána 'they will cook them for each other'
 b. *vana-chíteleéka* 'they will cook it'
vana-pílikaána 'they will hear'

The doubling of H tone comes about by the following rule.

(60) DOUBLING



Blocking H in syllable adjacent to target

An adjacency condition holds between the focus and a blocking element: a syllabically adjacent H blocks tonal doubling.

To demonstrate Root Adjacency with tone rules, the tones must stand on adjacent TBUs (not adjacent segments in the strict sense). Kihehe presents an example of Root Adjacency. In the infinitive, one H is assigned to the infinitive prefix *ku-* and a second is assigned to the penultimate TBU of the word.

- (61) *kú-ñelegeénda* 'to tickle'
kú-tolokéla 'to run away for'
kú-tu-dága 'to chase us' (*tu-* = 'us')
kú-fwiíma 'to hunt'
kú-taága 'to drop'

Kihehe does not allow H tones to stand on adjacent TBUs, so when the verb stem is bimoraic, the H assigned to the penult is deleted:

- (62) *kú-daga* 'to chase' /kú-dága/
kú-tova 'to hit' /kú-tóva/
kú-gula 'to buy' /kú-gúla/

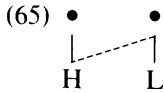
We can account for deletion of the stem H by invoking Meeussen's Rule:

- (63) H H → ∅ Root nodes are adjacent.

Crucially, H is not deleted from a syllable unless the preceding TBU is H-toned. If the triggering H is in the immediately preceding syllable, but not on the immediately preceding TBU, Meeussen's Rule does not apply (*kútaága* versus *kúdaga*). Meeussen's Rule in Kihehe is thus subject to Root Adjacency.

The final tonal effect is the influence of floating tones. As noted in §3, floating elements should block spreading, since they render the target and trigger non-local. In Kenyang, a Bantoid language of Cameroon, a rule spreads H to a following L-toned syllable (Odden 1988). The present-tense examples in 64a show the H verb *tí*, and the L verb *kù* following L-toned subject prefixes only, where there are no alternations. In 64b, however, the L verb *kù* follows H-toned subject prefixes, and the verb surfaces with a falling tone as a result of H-spread. These alternations motivate 65.

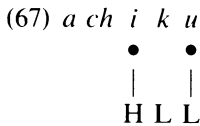
- (64) a. *ɔ-tí* 'you sg. sell'
 à-tí 'he sells'
 sé-tí 'we sell'
 bá-tí 'they sell'
 ɔ-kù 'you sg. buy'
 à-kù 'he buys'
 b. *sé-kù* 'we buy'
 bá-kù 'they buy'



The progressive tense exhibits two anomalies—a downstep (a phonemic lowering of pitch register, indicated with a raised exclamation point) appears between a H verb stem and the progressive prefix *chí-*, and H-spread is blocked.

- (66) *ɔ-chí-tí* 'you are selling'
 à-chí-tí 'he is selling'
 ɔ-chí-kù 'you are buying'
 à-chí-kù 'he is buying'

Both anomalies are explained by postulating a floating tone following *chí-*. Before a H tone the floating L serves as a downstep marker, and before a L tone the floating L blocks H-spread. The structure of *àchíkù* is as follows.



The first and last tones are not local, owing to the intervening floating L.

A reviewer has questioned the assumption that this L tone is necessarily floating, and has suggested the possibility that downstep is the representation of a LH contour. But such an analysis is impossible, because Kenyang also has rising tones:

- (68) *éywār'ék* 'sweet potato'
 tútuú 'cuckoo bird'
 é'kwá 'plantain'
 ěyú 'temper'
 máñ'áj 'Kenyang-speaker'
 áchwì chû 'red car'

As shown in Odden 1988, in one past tense a L tone is inserted at the beginning of the verb root, with the result that H tones become rising tones:

- (69) *sé-ghó betâ* 'we see calabashes'
 bé'-ghó betâ 'to see calabashes'
 sé-ghǒ betâ 'we saw calabashes'

Thus, presence of downstep in 66 cannot be explained by a linked L tone.

A similar argument for floating tones blocking tone spreading is offered by Pulleyblank (1986:36), who motivates a rule in Tiv (Benue-Congo, Nigeria)

spreading H rightward to a L-toned syllable. This rule applies to /á-kààndé/ and gives *ákáàndé* ‘type of shellfish (pl.)’; cf. singular *ì-kààndé*. The displaced L is realized as a downstep if it is itself followed by a H tone, as in *á-gbǐ’sé* ‘type of tuber (pl.)’ from /á-gbìsé/; cf. singular *ìgbìsé*. The Recent Past tense similarly illustrates this rule: *vé vé’ndé* ‘they refused (recently)’ derives from underlying *vé vèndé* by H-spread. The General Past tense exhibits the two anomalies that a H stem is preceded by a downstep, viz. *vé ’úngwà* ‘they heard’, and a L stem does not undergo H-spread, viz. *vé vèndè* ‘they refused’. Pulleyblank explains this in the same way I explain the similar facts of Kenyang: the General Past tense has a floating L prefix whose presence blocks H-spread.

Finally, Rialland & Badjimé (1989) demonstrate that in Bambara the definite nominal suffix is a floating L tone which triggers downstep before H tones and blocks rightward spreading of H, in a manner exactly analogous to Tiv and Kenyang.

4.4. VOWEL PLACE. Examples involving the adjacency conditions in rules affecting vowel place features are also available. Cases of vowel harmony with neutral vowels illustrate spreading of vowel features subject to no adjacency constraint. For instance, the Hungarian forms in 70 (with a colon instead of the orthographic length-marking accents) show that the ablative suffix *-to:l* agrees in backness with the preceding nonneutral vowel, and skips over the neutral vowels *i*, *i:*, and *e*: (Vago 1980).

- (70) *ha:z-to:l* ‘house (ABL)’
öröm-tö:l ‘joy (ABL)’
si:n-tö:l ‘color (ABL)’
ta:nye:r-to:l ‘plate (ABL)’
sege:ny-tö:l ‘poor (ABL)’

Neutral vowels are also found in the back harmony rules of Finnish (Kiparsky 1982) and Votiç (another Finnic language, spoken in Russia; Odden 1980), and neutral vowels in height harmony are found in Montañes (Spanish, Spain; McCarthy 1984, Vago 1988) and Menomini (Algonquian; Howard 1972, Odden 1980, Jensen & Stong-Jensen 1979). Neutral vowels in rounding harmony occur in Khalkha Mongolian (Odden 1980, Steriade 1987a); neutral vowels in ATR harmony occur in Wolof (West Atlantic, Senegal and Mauritania; Ka 1988); a neutral vowel for spreading of [back] and [round] is found in Cheremis (Odden 1991); and a neutral vowel with respect to spreading of place features is found in Efik and Ibibio (Benue-Congo languages of Nigeria; Parkinson 1993). In all of these cases the neutral vowels are unspecified for the harmonizing feature; so, for example *i* and *e* are unspecified for [back] in Finnish and Hungarian. With that assumption, the typical vowel harmony rule with neutral vowels is stated as in 71:

- (71) ● ●
 | \
 α

The ability of vowels to stand between target and trigger is explained by imposing no constraint on the distance between these elements.

- (75) V V Root nodes are adjacent.
 |
 STRICTURE
 |
 [-high] → ∅

A conceivable but incorrect alternative analysis of this process is to assume that the sequence *e* + V is grouped into a single syllable forming a rising diphthong, and that vowel raising only affects *e* followed by a vowel within the syllable. Hualde (1991:11 and personal communication, 1993) states that in the western dialects of Basque, including Gernikan and Lekeitio, such vowel sequences remain heterosyllabic, as in [etxi.e]. In fact, since these dialects do not allow rising diphthongs, at least in the speech of older generations, rising diphthongs in words borrowed from Spanish are restructured with an epenthetic consonant to become bisyllabic. This can be seen in *eñuβeða* 'wheel' from Spanish *rueda* and *suβerte* 'luck' from Spanish *suerte*.

Tonal evidence further supports the heterosyllabic nature of such V-V sequences. In Gernikan Basque, in the unmarked case, all syllables of the word have H tone; in addition, the first in a sequence of H tones is lowered. However, L tone is assigned to the plural affix.

- | | | | |
|------|---------------------|----------------------|----------------|
| (76) | sg.ABS | pl.ABS | GLOSS |
| | <i>gixón-á</i> | <i>gixón-àk</i> | 'man' |
| | <i>gùntzùrrún-é</i> | <i>gùntzùrrún-èk</i> | 'kidney' |
| | <i>lùrr-é</i> | <i>lùrr-èk</i> | 'land, ground' |
| | <i>àrr-á</i> | <i>àrr-àk</i> | 'worm' |

Adjacent vowels are treated tonally just like nonadjacent vowels, in allowing the pitch to fall between them. In contrast, when true vowel fusions (such as a rule /a + a/ → [a]) apply, as in *neska* + *ak*, tone shifts leftward on the surface:

- | | | | | |
|------|--------------|----------------|-----------------|----------|
| (77) | indef.ABS | sg.ABS | pl.ABS | GLOSS |
| | <i>làgún</i> | <i>làgún-é</i> | <i>làgún-èk</i> | 'friend' |
| | <i>ètzé</i> | <i>ètzí-é</i> | <i>ètzí-èk</i> | 'house' |
| | <i>nèská</i> | <i>nèskí-é</i> | <i>nèsk-àk</i> | 'girl' |

Hualde (personal communication, 1993) cites further evidence from the Lekeitio dialect that the vowels involved in Mid Vowel Raising are in separate syllables. Accentually marked words receive a high tone on the penult, and accent cannot precede the penultimate syllable. For instance, Spanish *música* is borrowed as *musika* (indef.ABS), and accent shifts as inflections are added:

- | | | |
|------|------------------------|-------------|
| (78) | <i>musikíe</i> | sg.ABS |
| | <i>musikieréntzat</i> | BENEFACTIVE |
| | <i>musikierentzáko</i> | BENEFACTIVE |

Data such as *marizaláuna* 'wages for fishing for a fourth of the tide', *erréusainy* 'smell of burning (indef.ABS)', and *erreusáinya* 'smell of burning (sg.ABS)' show that /au/ and /ai/ are monosyllabic falling diphthongs. In contrast, forms like *dénda* 'store (indef.ABS)' and *dendía* 'store (sg.ABS)', or *márko* 'frame (indef.ABS)' and *markúa* 'frame (sg.ABS)', demonstrate that the supposed rising diphthongs are actually heterosyllabic vowel sequences.

Levergood (1987:249) motivates a rule in Arusa which illustrates Root Adjacency. The rule raises any nonlow vowel which comes immediately before another vowel, as illustrated in 79 (in which -ak marks plural):

- (79) /ilŋojine-ak/ → *ilŋojiniak* 'hyenas' (*il-* 'MASC.pl')
 /nkare-ak/ → *nkáriák* 'water (pl.)' (*n-* 'FEM.pl')
 /nkoshok-ak/ → *nkóshuak* 'stomachs' (*n-* 'FEM.pl')
 /kitok-ak/ → *kitúak* 'big (pl.)'
 /atVdeka/ → *átédia* 'I cursed' (*a-* '1.sg', *tV-...-a* 'PAST')

The rule does not apply to a vowel that is separated from the following vowel by a consonant, so contrast *atetema* 'I weighed it' with *átédia* from *átédéa*. Moreover, there is a contrast between [CiV] and [CyV] and between [CuV] and [CwV], as shown by *ondyâ* 'dog' versus *ondiâ* 'moan', and *olmarwá* 'liquor' versus *enduâ* 'frog, pregnant woman'; this rules out a reanalysis in terms of syllable reorganization.

4.5. CONSONANTAL PLACE AND MANNER RULES. There are a number of rules involving interactions between coronal consonants, especially liquids, which illustrate the Adjacency Parameters. Latin has an unbounded rule of Liquid Dissimilation (Jensen 1974, Odden 1980, Steriade 1987a) that dissimilates *l* in the adjective suffix *-a:lis* to *r* when preceded by *l*:

- (80) *nav-alis* 'naval'
sol-aris 'solar'
milit-aris 'military'
lati-aris 'of Latium'

The only constraint on this rule is the Locality Condition, which blocks the rule when [–lateral] *r* stands between target and trigger.

- (81) *flor-alis* 'floral'
sepulchr-alis 'funereal'
litor-alis 'of the shore'

Fallon 1993 documents the dissimilation of *r* to *l* when preceded by *r* in Georgian. The ethnonymic suffix *-uri* appears unmodified when no *r* precedes, as in 82a. Dissimilation applies when *r* precedes it within the word, as in 82b, but intervening *l* blocks this dissimilation in 82c:

- (82) a. *dan-uri* 'Danish'
p'olon-uri 'Polish'
somχ-uri 'Armenian'
 b. *asur-uli* 'Assyrian'
ungr-uli 'Hungarian'
aprik'-uli 'African'
p'rusi-uli 'Prussian'
čerk'ez-uli 'Cherkessian'
 c. *avst'ral-uri* 'Australian'
kartl-uri 'Kartvelian'

In compliance with the Locality Condition, intervening [+lateral] blocks dissimilation. Sundanese (West Indonesian, Sunda Islands) also dissimilates *r* to *l* before *r* (Cohn 1992).

In Bukusu (Bantu, Kenya), suffixal *l* becomes *r* after *r*. As 83 shows, [-lateral] spreading applies across unbounded strings.

- (83) *teex-ela* 'cook for'
lim-ila 'cultivate for'
iil-ila 'send thing'
kar-ira 'twist'
rum-ira 'send someone'
reeb-era 'ask for'
resy-era 'retrieve for'

Syllable Adjacency is illustrated by a rule affecting *t* in Chimwiini, a Bantu language of Somalia. The perfective suffix in Chimwiini (Kisseberth & Abasheikh 1975) is *-i:te* (whose vowel surfaces as *e* after a mid vowel):

- (84) *tov-e:te* 'he dipped'
jib-i:te 'he answered'
haq-i:te 'he said'
som-e:te 'he read'

This *t* becomes *l* when the preceding syllable contains a liquid (*r*, *l*, or *t*), as in 85. However, the triggering liquid may not be separated from the target by a syllable, as 86 shows.

- (85) *sul-i:le* 'he wanted'
komel-e:le 'he locked'
faðit-i:le 'he preferred'
gir-i:le 'he moved'
mer-e:le 'he turned about'
- (86) *reb-e:te* 'he stopped'
gorom-e:te 'he roared'
tum-i:te 'he bit'

In Kipare (Bantu, Tanzania), *y* optionally assimilates to certain coronal consonants of the preceding syllable, becoming *l* after *l*, *r* after *r*, and *j* (a palatal stop) after *ʃ*, *j*, or *ɲ*. The examples in 87a show the unassimilated form of the perfective suffix *-iye*, and 87b shows the unassimilated applied suffix *-iya*; optional assimilation of these suffixes is illustrated in 88a–b.

- (87) a. *ni-kund-iye* 'I liked' (*ni-* = 1sg.SUB)
ni-big-iye 'I beat'
ni-tet-iye 'I said'
ni-tonɔg-iye 'I went'
ni-dik-iye 'I cooked'
ni-von-iye 'I saw'
- b. *ku-tet-iya* 'to say for' (*ku-* = INFINITIVE)
ku-big-iya 'to beat for'
ku-dik-iya 'to cook for'

- (88) a. *ni-zor-iyē ni-zor-irē* 'I bought'
ni-tal-iyē ni-tal-ilē 'I have counted'
ni-oj-iyē ni-oj-ijē 'I washed'
ni-banj-iyē ni-banj-ijē 'I healed'
ni-vuš-iyē ni-vuš-ijē 'I put up'
ni-maŋ-iyē ni-maŋ-ijē 'I have known'
- b. *ku-zor-iyā ku-zor-irā* 'to buy for'
ku-tal-iyā ku-tal-ilā 'to count for'
ku-oj-iyā ku-oj-ijā 'to wash for'
ku-miŋ-iyā ku-miŋ-ijā 'to press for'

There is no assimilation if the triggering consonant is not in the immediately preceding syllable:

- (89) *ni-šig-iyē* 'I left behind'
ni-rong-iyē 'I made'
ni-jeng-iyē 'I built'
ku-jink-iyā 'to run away for'
ku-šukum-iyā 'to push for'
ku-rumb-iyā 'to make pots'

A similar rule exists in Kishambaa (Roehl 1911, Besha 1989).

While this assimilation rule is subject to Syllable Adjacency, it is not clear how to describe the change itself. There may be two rules, one assimilating *y* to *l* and *r*, and a second assimilating *y* to a preceding palatal. Both rules would be optional and would be subject to Syllable Adjacency. Assimilation of *y* to *r* and *l* could be accounted for by spreading [lateral] to *y*. This presupposes that only *r* and *l* are specified for [lateral], a supposition which enjoys cross-linguistic support (as seen in previous examples of lateral dissimilation). Spreading either value of [lateral] would entail structure-preserving readjustments of [consonantal], since only [+consonantal] segments may be specified for [lateral]. It is less clear why *y* becomes *j* after palatals. A possibility suggested by Beth Hume (personal communication, 1993) is that [–anterior] spreads. The glide *y* would be underlyingly unspecified for [anterior], and by a feature co-occurrence constraint, assigning [–anterior] to *y* makes it [+consonantal].

In Yimas, a Papuan language of New Guinea, *r* dissimilates to *t* when the preceding syllable contains *r* (Foley 1991:54). The examples in 90 illustrate the application of this rule to the inchoative suffix *-ara*.

- (90) *pak-ara* 'break open'
kkrak-ara 'loosen'
araŋ-ara 'tear into pieces'
wurpi-ara 'slacken'
apr-ata 'open, spread'

It is relevant to note that, according to Foley, orthographic *r* varies freely between an apical lateral [l] and an alveolar tap [r]. This segment contrasts with orthographic *l*, which acts phonologically as part of the palatal series and is realized as palatal-laminal [ɭ] or a palatalized apical [lʲ]. I thus assume that

both orthographic *r* and *l* are lateral consonants. The change of *r* to *l* is therefore describable as dissimilation of laterality.

Root Adjacency is illustrated by assimilations and dissimilations which require the interacting segments to be strictly adjacent. One example is the Tashihyt Berber rule of Root-Adjacent Labial Dissimilation, discussed in Selkirk 1988, 1993. A labiovelar consonant delabializes when immediately preceded by a labial—either a labial consonant or a round vowel:

- (91) *g^wra* ‘gleaned’ *im-gra* ‘gleaners’
gg^wra ‘trained’ *im-grad* ‘those trained’
aq^wlil ‘rabbit (free form)’ *uqlil* ‘rabbit (construct form)’
amddak^wl ‘friend, pal’

In /*im-g^wra*/, the rounded dorsal dissimilates because of the immediately preceding *m*, and in /*uq^wlil*/, /*q^w*/ dissimilates to [q] because of the immediately preceding [u]. There is no dissimilation in [amddak^wal], because the preceding labial is not root-adjacent.

Sanskrit has a rule assimilating coronal consonants to the place of the following coronal consonant; this rule only applies between adjacent segments (Schein & Steriade 1986).

- (92) /*indras*/ ‘Indra’, *śūrah* ‘hero’: *indras śūrah* ‘hero Indra’
/tat/ ‘that (NOM.SG.NEUT)’, *caṣṣuḥ* ‘eye’: *tac caṣṣuḥ* ‘that eye’
/tās/ ‘those (NOM.SG. FEM)’, *ṣāṭ* ‘six’: *tāṣ ṣāṭ* ‘those six’
/pādas/ ‘foot’, *ṭalati* ‘stumbles’: *pādaṣ ṭalati* ‘the foot stumbles’
 Cf. *tāḍayati* ‘he beats’ and *tejate* ‘it is sharp’.

4.6. INTERACTIONS BETWEEN CONSONANTS AND VOWELS. It has not proven possible to unambiguously demonstrate unbounded, syllable-adjacent, and root-adjacent rules in which features spread between vowels and consonants. Rules spreading features from vowels to nonadjacent consonants do exist, and a number are discussed in Odden 1977. For example, in Karok *s* becomes *š* when preceded by *i* either immediately or when separated by a consonant (Bright 1957, Odden 1977):

- (93) *mu-spuk* ‘his money’ *išpuk* ‘money’
tapak-suru ‘to slice off’ *ikrivip-šuru* ‘to run off’

Similar nonadjacent assimilations between vowels and consonants are discussed in Odden 1980, including a rule in Luiseño turning *ʃ* into *s* when preceded by a front vowel, one in Choapan Zapotec deretroflexing *ʃ* and *ʒ* when followed by *i*, a rule in Chimalpa Zoque palatalizing *s* and *c* to *š* and *č* when followed by *i*, and a rule of Votic velarizing *l* before a back vowel: each of these rules will apply across an intervening consonant. In addition, Barrow Inupiaq has a rule palatalizing *t*, *l*, *l̥* and *n* to *s/č*, *ʃ*, *č*, and *ñ* (Kaplan 1981, Archangeli & Pulleyblank 1992) which propagates over consonants. In none of these languages does the rule skip a syllable, which may indicate that the rules are subject to Syllable Adjacency. However, it is possible that no explicit condition on the distance between target and trigger is required. The fact that the rule does not skip syllables may be explained by the fact that the vocalic nucleus

of any potentially intervening syllable would bear a specification for the spreading feature.

It has been suggested (for example in Jensen 1974) that the Karok sequence transcribed as *ips̥* might represent a string where both consonants have been affected by palatalization—which would mean that no consonant has been skipped, and that palatalization iteratively affects all consonants after *i* or a palatal consonant. There are a number of reasons for rejecting this interpretation (see Odden 1977 for detailed discussion). Bright 1957 gives no evidence that palatalization affects any consonant other than *s*. Harrington (1930), using a phonetic rather than a phonemic transcription, only records palatalization of *k* (and *s*) after *i*. Bright explicitly compares this to what he heard from his consultants, and notes that pronunciations such as *ʔimk'á:nvan* 'greensgatherer' occurred only rarely in the speech of his consultants. Finally, Bright states (1957:7):

'/č/ is an alveo-palatal affricate [tʃ] in position like English *ch* of *church*: [tʃ'i:ʃ] 'younger sister', [kaʃ'aká:tʃ] 'blue jay'. It is clearly distinct from the sequence /tʃ/, in which the /t/ lacks palatalization (a feature marked by the subscript /s/ above)...'

Since Bright explicitly comments on the lack of palatalization in these cases, the hypothesis that palatalization iterates through the consonant sequence must be rejected. While data on the phonetics of intervening consonants is not generally available, it is unlikely that all of these cases of nonadjacent vowel-consonant interaction reduce to spreading to strictly adjacent segments. That approach predicts, for example, that in Barrow Inupiaq all consonants are palatalized after *i* and that the author simply failed to hear palatalization on any consonant other than coronals, which is highly improbable.

There is an allophonic rule in Tigre (Ethiopian Semitic) which changes the short front vowel *ä* to [a] when it is followed by a pharyngeal or ejective consonant. The basic variant of this phoneme is seen in 94a, and the back variant is found in 94b in the presence of a pharyngeal or ejective: this rule skips over syllables (see Palmer 1956:569ff., Odden 1980). This results in alternations, so the gerund is formed with the basic vocalism *ä..i*: (cf. *käti:b* 'writing'), but *ä* becomes *a* when a pharyngeal or ejective follows within the word (*fati:h* 'opening').

- (94) a. *mäbrähät* 'lamp'
wälät 'girl'
käti:b 'writing'
nädi:ʔ 'sending'
däbe:la: 'he-goat'
täko:bata: 'her mat'
- b. *sinat* 'backpack'
tadiʕ 'sternum'
fati:h 'opening'
sandu:k' 'box'
barne:t'a: 'hat'
maše:k'na:y 'miser'

This rule thus illustrates unbounded interaction between consonants and vowels, i.e. the lack of any language-specific adjacency condition. The formal statement of this rule is problematic, although it is clear that the rule operates long-distance. I know of no theory of features under which ejectives and pharyngeals (but not ʔ —cf. *nādi:ʔ*) are a natural class. The ejectives of Ethiopian Semitic are cognate with pharyngealized consonants elsewhere in Semitic (Moscati et al. 1980), so the rule makes sense from a historical perspective, given that in Arabic the front vowel *ā* (usually transcribed *a*) is back in the context of pharyngeal and pharyngealized consonants. It is also surprising that this rule propagates over *i*, *e*:, *i*:, *u*:, and *o*:. The vowel *i* is arguably always epenthetic, and it is possible that *u*: and *o*: are specified as labial vowels, not as back vowels.¹⁵

4.7. TRANSPLANAR LOCALITY. In this section I will show the necessity for a further adjacency parameter, Transplanar Locality. As noted in §3, the distinction between the Locality Condition and Transplanar Locality arises with features for place of articulation in the Unified Features framework of Clements & Hume 1993. Transplanar Locality requires that target and trigger be adjacent across planes, whereas the Locality Condition only requires adjacency within a plane.

In §4.5 we examined a rule of root-adjacent labial dissimilation in Tashlhiyt Berber in which labiovelar consonants are delabialized when immediately preceded by a labial vowel or consonant. There is also a long-distance dissimilation between consonantal labials (hence, not *w*), discussed in Selkirk 1988, 1993. In this dialect of Berber, prefixal *m* dissimilates to *n* when followed by any labial consonant; the rule is morphologically restricted so that it applies only to derivational morphology. The data in 95 show the reciprocal prefix *m*-.¹⁶

(95) <i>ɣza</i>	'dig'	<i>m-ɣza</i>
<i>siggɫ</i>	'look for'	<i>m-saggal</i>
<i>!šawr</i>	'ask for advice'	<i>m-!šawr</i>
<i>fra</i>	'disentangle'	<i>n-fara</i>
<i>ħššm</i>	'be shy'	<i>n-ħaššam</i>
<i>xalf</i>	'place crosswise'	<i>n-xalaf</i>

Round vowels may intervene between target and trigger. Compare the examples with the agentive prefix *am* in 96:

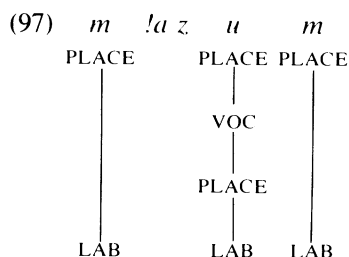
(96) <i>las</i>	'shear'	<i>am-las</i>	'shearer'
<i>agur</i>	'remain'	<i>am-agur</i>	'abandoned'
<i>!rmi</i>	'be tired'	<i>an-!rmi</i>	'tired person'
<i>bur</i>	'remain celibate'	<i>an-bur</i>	'bachelor'
<i>!azum</i>	'fast'	<i>an-!azum</i>	'faster'

In /*am-!azum*/, both target and trigger [labial] features are local, since the in-

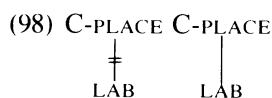
¹⁵ Classical Mongolian may provide a similar rule backing *k* and *g* when preceded or followed by a back vowel, where consonants and *i* may stand between target and trigger; see Poppe 1964 and Grønbech & Krueger 1955. However, see Zimmer 1967 for speculations regarding the interpretation of Classical Mongolian orthography.

¹⁶ The exclamation mark indicates that all following segments are emphatic.

tervening [labial] of *u* is immediately dominated by Vocalic Place, not by Consonantal Place:



Assuming that consonants lacking a place of articulation are assigned [coronal] by default, the following rule accounts for these patterns of dissimilation.

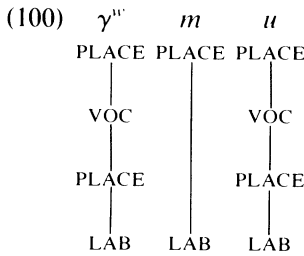


It is not possible to account for the transparency of the labial vowel *u* to this process by positing that *u* is only specified as a back vowel. As shown in §4.5, *u* and labial consonants act as a natural class in triggering dissimilative delabialization of labiovelars.

Selkirk also demonstrates that labiovelars dissimilate to plain labials in case *u* follows in the stem (and she says that the dissimilation occurs before *w* too, but provides no examples):

- (99) a. PERFECTIVE AORIST
- | | | |
|--------------------------|-------------|------------------|
| <i>g^wnali</i> | <i>gnu</i> | ‘sew’ |
| <i>γ^wmali</i> | <i>γmu</i> | ‘dye’ |
| <i>qq^wla</i> | <i>qqlu</i> | ‘fry’ |
| (Cf. <i>rka</i> | <i>rku</i> | ‘become moldy’ |
| <i>yna</i> | <i>ynu</i> | ‘make rich’ |
| <i>xfa</i> | <i>xfu</i> | ‘escape notice’) |
- b. VERB DERIVED NOMINAL
- | | | |
|----------------------------|-----------------|--------------------|
| <i>zdr</i> | <i>azddayru</i> | ‘be located below’ |
| <i>x^wšn</i> | <i>axššaynu</i> | ‘be ugly’ |
| (g) <i>g^wžm</i> | <i>agžžaymu</i> | ‘be amputated’ |

Dissimilation is allowed to apply over a primary labial consonant, as in /*γ^wmu*/ → [*γmu*] and /*ag^wžžaymu*/ → /*agžžaymu*/. Both effects are predicted, since the target and trigger labials are local within their plane. In the case of dissimilation of consonantal labials across labial vowels, the target and trigger are on the C-place plane and the intervening vowel is on the V-place plane. In the case of unrounding across a primary labial, target and trigger are on the V-place plane and the intervening consonant is on the C-place plane.



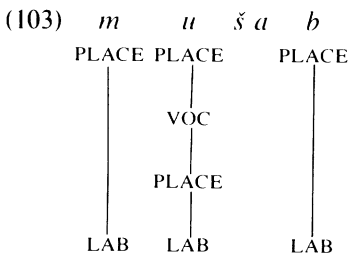
Both rules illustrate labial dissimilation subject only to the Locality Condition. However, there is another kind of labial dissimilation illustrating Transplanar Locality in Akkadian (von Soden 1969:64–66, McCarthy 1979:126, Hume 1992), where prefixal m becomes n if followed by a labial consonant in the stem (the suffix m does not trigger dissimilation).

- (101) *ma-š²al-t-u* ‘question’ (NOMZ-ROOT-FEM-NOM)
ma-škan-u-m ‘place’ (NOMZ-ROOT-NOM-DET)
na-p^har ‘totality’ (NOMZ-ROOT)
ne-ereb ‘entrance’ (NOMZ-ROOT)
na-rkab-t ‘chariot’ (NOMZ-ROOT-FEM)
na-raam-u-m ‘favorite’ (NOMZ-ROOT-NOM-DET)

A labial vowel or glide does not trigger the rule. Unlike the Berber rule, in Akkadian an intervening labial vowel or glide (which may later be deleted; cf. *maamiitum* from /mawmiitum/) blocks dissimilation:

- (102) *ma-zuuk-t* ‘mortar’ (NOMZ-ROOT-FEM)
mu-ušab-u-m ‘seat’ (NOMZ-ROOT-NOM-DET)
ma-amii-t-um ‘oath’ (from /ma-wmii-t-u-m/, root *wmii*)

This too is explained by deleting labial before labial. The rule of Akkadian differs from that of Berber in that the Akkadian rule is subject to Transplanar Locality, according to which the Place node of intervening segments cannot dominate Labial. Although the labial nodes of m and b are local within a plane in *muušabum*, they are not local across planes:



It is conceivable in the case of *muušabum* that m and u share a labial specification and might be exempt from dissimilation due to the Linking Constraint (Hayes 1986). This fails to explain, however, why dissimilation is blocked by a nonadjacent labial glide in /mawmiitum/ → *maamiitum*.

The vocalic counterpart of this effect is found in the contrast between Turkish and Nawuri (Kwa, Ghana; Casali 1993). As noted in §3.1, rounding harmony

in Turkish propagates across labial consonants because consonantal labial resides on a different plane from vocalic labial. Casali 1993 argues for a rule in Nawuri that rounds *i* and *ɪ* to [u] and [ʊ], respectively, when a round vowel or the glide *w* follows. The examples in 104 illustrate the rule with the nominal prefix /gl/ (which has the [-ATR] vowels [ɪ] and [ʊ] before [-ATR] vowels and the [+ATR] vowels [ɨ] and [u] before [+ATR] vowels). However, this rule is blocked if the intervening consonant is a labial, as in 105.

- (104) *gɪ-ba*: 'hand'
gi-ke:li: 'kapok tree'
gU-sU 'ear'
gU-lɔ 'illness'
gu-ku: 'digging'
gU-wa: 'doing'
gu-wiya 'bone'
- (105) *gi-mu* 'head'
gɪ-mU 'it'

The same effect is observed in the Australian language Walpiri (Nash 1986). The difference between Nawuri and Turkish is that labial harmony in Nawuri is constrained by Transplanar Locality, according to which place nodes intervening between those of the target and trigger may not dominate the feature [labial].

Rose 1994 shows that in Chaha (Semitic, Ethiopia) velar fronting is blocked by an intervening coronal (see also McCarthy 1986). Palatalization changes alveolars to palatoalveolars and velars to front velars in forms with a 2sg. feminine subject. Such forms contain the suffix vowel /-i/, but that vowel is not associated with a prosodic position, so it does not appear on the surface. The features of the suffix are realized as palatalization of an appropriate stem consonant. This affects the rightmost palatalizable consonant, allowing the second or third consonant from the right to be palatalized if it is followed by a labial:

- (106) 2sg.MASC 2sg.FEM
- | | | |
|--------------|---------------|--------------------------------|
| <i>kɪft</i> | <i>kifč</i> | 'open!' |
| <i>nikɪs</i> | <i>nikiš</i> | 'bite!' |
| <i>dɪrg</i> | <i>dɪrgʷ</i> | 'hit!' |
| <i>nixəβ</i> | <i>nixʷəβ</i> | 'find!' |
| <i>gimim</i> | <i>gʷimim</i> | 'chip the rim of the utensil!' |

Rose notes an important constraint on this rule: it only applies to a coronal if the coronal is the final stem consonant. When fronting cannot affect a consonant, it affects the last stem vowel.

- (107) 2sg.MASC 2sg.FEM
- | | | |
|---------------|----------------------------------|----------------|
| <i>nixəβ</i> | <i>nizeβ</i> (* <i>nizəβ</i>) | 'be flexible!' |
| <i>tʰiməm</i> | <i>tʰimem</i> (* <i>cʰiməm</i>) | 'be scared!' |

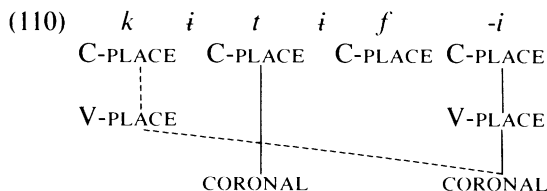
Furthermore, a coronal consonant between a velar and the suffix *-i* blocks palatalization from applying to the velar:

- (108) 2sg.MASC 2sg.FEM
kitif *kitif* (**kičif*, **kʷitif*) 'chop (meat)!'
gidif *gidif* (**giʃif*, **gʷidif*) 'stop the fast!'

Finally, palatalization does not spread across a front vowel, though it does spread across other vowels:

- (109) 2sg.MASC 2sg.FEM
nixəβ *nixʷəβ* 'find!'
təkʷɔ *təkʷʷɔ* 'drink coffee!'
ək'e *ək'e* (**əkʷ'e*) 'crunch!'
xi *xi* (**xʷi*) 'make a hole!'

As can be seen in 110, spreading of V-place coronal to a velar across another coronal is a violation of Transplanar Locality.



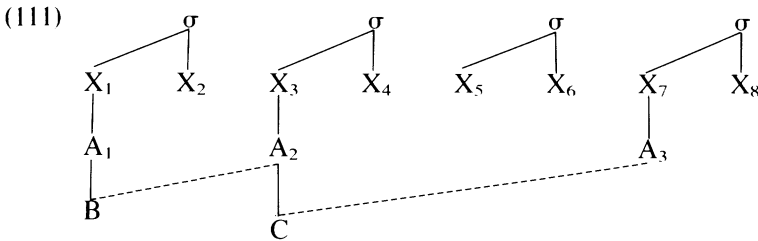
Thus palatalization in Chaha is subject to Transplanar Locality. Since long-distance spreading from vowels to consonants is rare enough as it is, it has not proven possible to cite a language with the same rule which is not subject to Transplanar Locality; nevertheless, the transparency of coronal consonants for frontness harmony is well attested, for example in Hungarian, as discussed in §3.1 above.

5. COMPARISON WITH PREVIOUS THEORIES. Locality Theory differs from linear accounts of intervening material in fundamental ways, since the underlying assumptions of nonlinear phonology differ radically from those of linear phonology. Locality Theory permits no abbreviatory devices which govern intervening segments. The theory differs from the Crossover Constraint in being much stronger: as we saw in §2, the Crossover Constraint prevents potential foci from being skipped, but it still allows complex parsings of intervening material. The present theory differs from the Relevancy Condition in empirical adequacy—the Relevancy Condition is untenable, as shown in Odden 1977, 1980. The examples discussed there (and in relevant sections above) are fully compatible with Locality Theory, however. The Relevancy Condition also cannot capture the three-way distinction among unbounded, syllable-adjacent, and root-adjacent rules.

Similarly, Locality Theory differs from naive autosegmental locality, which postulates that multitiered representations of features and the No-Crossing Constraint suffice to account for problems of intervening material. Locality Theory goes beyond the naive autosegmental account in constraining feature deletions where no line crossing could be involved, and it explains why nasal spreading can apply to adjacent segments in one language, elements in adjacent syllables in another language, and elements separated by an unbounded sequence of segments in yet other languages. The theory is similar to that of

Sterjade 1987b in being founded on the notion of supplementary adjacency conditions, but the present theory specifies what those conditions are.

Locality Theory is also similar in some ways to the theory presented in Archangeli & Pulleyblank 1987 (henceforth Scansion Theory). There are a number of architectural differences between the two theories. Scansion Theory has no mechanism that accounts for Syllable Adjacency requirements in rules affecting consonants, e.g. nasal spreading in Lamba (§4.1) or Dahl's Law in Kikuria and Kikuyu (§4.2). A typical relevant configuration is the following:



The goal is to describe rules that affect consonants and are subject to the Syllable Adjacency parameter. Therefore, we want to allow spreading of B from X₁ to X₃, since those skeletal positions are in adjacent syllables, and we want to block spreading of C from X₃ to X₇, since those skeletal positions are not in adjacent syllables.

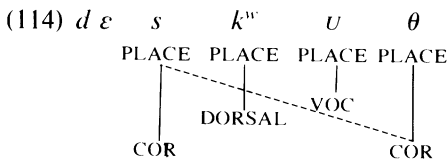
Since, as we saw in §2.2, Maximal Scansion for rules involving consonants scans the skeletal tier, under Maximal Scansion B may spread only to X₂, because when one scans the highest level of representation dominating B, only X₂ is adjacent to X₁. Under Minimal Scansion, B could spread from X₁ to X₃ because the immediately dominating nodes, A₁ and A₂, are adjacent. But for the same reason, C would incorrectly spread from X₃ to X₇ across a syllable because A₂ and A₃ are adjacent: Minimal Scansion describes unbounded spreading. Also, no parameter can account for rules affecting strictly adjacent vowel sequences, such as the vowel raising rules of Arusa and Basque (§4.4). Maximal Scansion is used to account for vowel harmony in adjacent syllables across consonants, and Minimal Scansion to account for vowel harmony with neutral vowels; no third option is available.

A further difference between the two theories lies in their predictions about how immediately dominating nodes affect rules. Minimal Scansion is driven by the presence of the immediately dominating mother node in a mother/daughter pair of nodes: Minimal Scansion requires that the mother nodes be adjacent. Locality Theory has no such condition. Scansion Theory therefore predicts that unbounded rules of consonant or vowel harmony will not apply across an intervening segment which bears the relevant mother node. But there is evidence that the presence of intervening mother nodes does NOT block rule application—as predicted by Locality Theory. A very clear case of this type is presented in Shaw 1991, in the form of a coronal harmony rule in Tahltan (Athabaskan, British Columbia). Tahltan has a contrast between three series of nonlateral fricatives and affricates—namely, dental [t^h] [d^h] and [θ], alveopalatal [t^ʃ] [d^ʃ] and [ž], and plain [t^ʰ] [d^ʰ] and [z]. When one of these

segments is followed in the word by another sibilant, the first sibilant assimilates to the place of articulation of the second. The unassimilated form of the 1sg subject prefix /s-/ is seen in 112a; in 112b we see the assimilation of that prefix to a following sibilant. This rule also affects the 1du subject prefix /θi(d)-/, as illustrated in 113.

- (112) a. ε -s-k'a: 'I am gutting fish'
nadεde:-s-ba:tʰ 'I hung myself'
sε-s-xεt 'I'm going to kill it'
- b. $\theta\varepsilon$ -θ-θεt 'I'm hot'
dε-θ-kʷUθ 'I cough'
hudi-š-tʰa 'I love them'
ya-š-tʰεtʰ 'I splashed it'
noʔede:-š-tεdʰi 'I melted it over and over'
- (113) a. *dε-θi-gitʰ* 'we threw it'
na-θi-ba:tʰ 'we hung it'
- b. *i-ši-tʰotʰ* 'we blew it up'
dε-si-dʰel 'we shouted'
ni-si-tʰa:tʰ 'we got up'

A similar constraint on the co-occurrence of sibilants within roots exists in Basque, according to Hualde (1991), who observes that roots cannot mix apico-alveolar, 'dorsoalveolar', and palatal sibilants. Given that both [anterior] and [distributed] spread, the node which spreads must be the coronal node. But the node immediately dominating the coronal node is Place.



As Shaw 1991 observes, the Adjacent Mother Node Condition incorrectly prohibits Place from standing between target and trigger. In the case above, the intervening place nodes of k^w and U should block spreading, but they do not.¹⁷

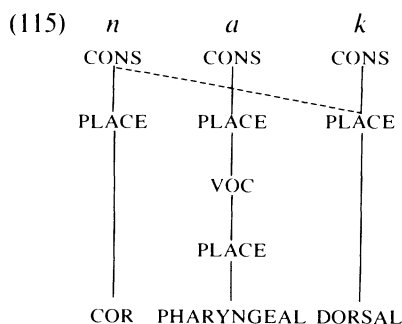
6. CONCLUSIONS. The arguments in this paper have motivated a theory of what may stand between determinant and focus in a phonological relation. The most basic constraint of this theory is the Locality Condition, which extends concepts involved in the No-Crossing Constraint beyond the issue of crossing association lines. Supplementing that constraint, phonological rules may im-

¹⁷ A similar problem is posed by the two neutral vowels in Finnish and Hungarian. One neutral vowel poses no problem, since it could be assumed to lack any features, hence a place node. But in Finnish and Hungarian both *i* and *e* are neutral, which poses the problem that at least one of these vowels must have a place node to bear a height specification. This could be resolved by assuming the geometry of Odden 1991, where [back] and [round] are dominated by the Back-Round node and [high] and [low] are dominated by the Vowel Height node. The neutral vowels *i* and *e* would lack specifications under Back-Round (which would therefore also be unspecified); hence two neutral vowels would be allowed. Still, this approach fails to explain why *ä* is not also neutral.

pose constraints on the maximum distance between target and trigger segment and on the interaction of features across planes.

The approach taken here sets forth a simple and minimalist theory of adjacency parameters. Questions still remain regarding adjacency relations. I have not been able to document every adjacency parameter for spreading and deletion, affecting every node in a feature tree. Long-distance spreading of vowel-place features occurs in Cheremis and Efik, but no examples of long-distance total consonantal-place harmony have been uncovered. Long-distance place dissimilation of labial consonants occurs in Akkadian and Berber, but I have found no case of long-distance dissimilation of velar consonants. Similarly, strictly root-adjacent deletion of vowel height has been motivated in Basque and Arusa, but no example of strictly root-adjacent spreading of height has been found. Furthermore, while I have documented long-distance spreading of [nasal] from consonant to consonant, my theory does not explain why such rules appear to be rare compared to the nearly garden-variety rule spreading [nasal] between strictly adjacent consonants. The question arises as to whether the lack of a rule illustrating a particular combination of adjacency parameter, operation, and node indicates that the combination is truly impossible, or merely that the combination is rare and we simply have not yet discovered an example.

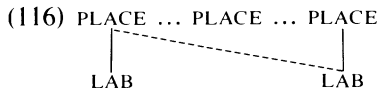
Theoretical considerations of feature geometry dictate that the consonantal place node cannot spread long-distance. As seen in (115), spreading consonantal place across a vowel (not to mention another consonant) is impossible because target and trigger are not local, and because such spreading would result in crossed association lines.



Thus we should never find rules with the effect /nak/ → [ŋak] or /ŋop/ → [mop], and we should also never find rules with the effect /ŋap/ → [nap], /map/ → [nap], or /mak/ → [nak], which could be described as the long-distance deletion of a consonantal place node (with default instantiation of coronal) before a consonant.

The Unified Features theory also explains why long-distance rules involving consonantal place affect coronals and not other articulator nodes. This is a consequence of the special status of the feature [coronal]; it is the only consonantal node which dominates additional features ([anterior] and [distributed], and possibly [lateral]). As the discussion of Tahltan has shown, spreading of

the coronal node has an observable phonetic effect. It is logically possible to construct a rule spreading labial from one labial consonant to another, as in 116:



Such spreading has no surface effect, however, since both consonants remain labial.

The theory does not state that long-distance spread of nasal is uncommon, and that is not the purpose of the theory. One could list various rule types and hypothesize, based on a count of examples of each type, what is marked and what is unmarked. Rules in which place features of vowels are affected in the context of other place features of vowels are most often subject to Syllable Adjacency; otherwise, most rules are subject to Root Adjacency.¹⁸ Other observations can be extracted from the languages surveyed here:

- (117) • Long-distance spreading of [+voice] is marked.
 • Root-adjacent dissimilation of vowel height is marked.
 • Long-distance dissimilation of [lateral] is common, but long-distance spreading of [lateral] is rare.
 • Spreading of vocalic place features to a consonant skipping a consonant is somewhat rare, and long-distance spreading over vowels is quite rare.

This list of observations could be appended to the theory, but listing such facts does not explain them. Presumably, a true understanding of why certain features tend to assimilate or dissimilate under certain adjacency conditions will rely largely on considerations of historical linguistics, acoustics, and articulation. The explanation for asymmetries in adjacency conditions therefore probably lies outside of the domain of phonological theory proper.

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¹⁸ It is not clear whether the unmarked case for tone is Root or Syllable Adjacency. To make this determination, one must gather a number of rules from different languages, preferably in different language families. As noted in §4.3, such languages must have unspecified tone-bearing units, to guarantee that restrictions on distance between tones are the result of an adjacency parameter, and not a consequence of an intervening tone. Furthermore, the language would typically have to allow a contrast between rising and falling tones to distinguish properly between Root and Syllable Adjacency. Unfortunately, the existing database on tonal systems is not sufficiently rich that such statistical surveying can be carried out meaningfully.

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