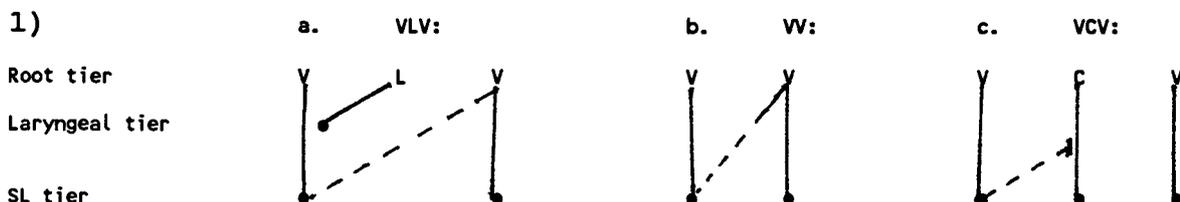


**TUNICA PARTIAL VOWEL HARMONY
AS SUPPORT FOR A HEIGHT NODE¹**

Wendy J. Wiswall
University of Arizona

0.0 Introduction

Steriade (1987) proposes that translaryngeal harmony (spread of vowel features across an intervening [h] or [ʔ] (glottal stop)) is best represented as spreading the Supralaryngeal Node, to account for translaryngeal harmony resulting in identical vowels on either side of the laryngeal. Because the laryngeals [h] and [ʔ] are commonly assumed to be specified with only a Laryngeal Node, and crucially without a Supralaryngeal Node, vowels flanking laryngeals (1a) and strictly adjacent vowels (1b) are both predicted to undergo Supralaryngeal Node Spread; that is, identical vowels result in both cases. Spread from one vowel to another across an intervening laryngeal is not blocked by that laryngeal, under the assumption that crossing association lines in a representation results in an ill-formed structure (Goldsmith, 1976). (1c) illustrates blocking of Supralaryngeal Node spread by a non-laryngeal consonant; the association line connecting the consonant's Root node with the Supralaryngeal Node blocks left-to-right spreading from vowel to vowel:



I show here that Tunica partial vowel harmony takes place across the laryngeals [h] and [ʔ], as well as between adjacent

¹I am indebted to Tom Bourgeois, Megan Crowhurst, Lee Fulmer, Michael Hammond, Raquel Mejia, James Myers, Jane Tsay, and especially Diana Archangeli for their helpful discussions about the data here, and their insightful comments on prior drafts. Thanks also go to Dick Demers, the participants in the Linguistics Workshop, and the participants in the Fourth Annual Arizona Phonology Conference for helpful suggestions. Finally, I am grateful to Andy Stewart (formerly of Silly Wizard) and Manus Lunny for supplying the Celtic and Scottish folk music played while this paper was written. Any errors are, of course, my own. (A more detailed analysis of Tunica partial vowel harmony is found in my dissertation and can be furnished upon request.)

vowels, indicating that Tunica vowel harmony is translaryngeal harmony. However, in contrast to Steriade's prediction that harmony results in identical vowels on either side of [h] or [ʔ], the surface effect in Tunica is that the vowels flanking [h] and [ʔ] agree in roundness and backness (or frontness), but may differ in height. Based on these observations, I follow Hyman (1988), Odden (1989), and Clements (1990, 1991) in proposing a height node. I differ from these proposals in the following ways: (1) the Height Node descends from the Supralaryngeal Node (i.e. is a sister to the Place Node); (2) the Height Node dominates the features [high] and [low]; and (3) the Height Node is relevant for both consonants and vowels.²

In Tunica³ partial vowel harmony (Haas, 1940; Odden, 1977; Jensen and Stong-Jensen, 1979; Hammond, 1984), an underlying low central vowel (/a/) and mid front vowel (/e/) surface as rounded and backed ([o] and [o] respectively) following a round back vowel, and are fronted ([E] and [e] respectively) following a front vowel. (2) shows that these harmony patterns surface across [h] and [ʔ] (2a) and between adjacent vowels (2b) (a single apostrophe (') after the vowel indicates that vowel is stressed). (2.a.i) and (2.b.i) illustrate that the suffix vowel surfaces as [a] when the stem-final vowel is /a/; (2.a.ii) and (2.b.ii) show that when the stem-final vowel is /u/, the underlying low vowel of the suffix surfaces as [o], a rounded low back vowel; (2.a.iii) and (2.b.iii) show a stem-final rounded mid vowel (/o/) also conditioning the change of the underlying low vowel to the rounded low back vowel [o]. Finally, (2.a.iv) and (2.b.iv.) demonstrate that the low front vowel [E] surfaces as the suffix vowel when the stem-final vowel is /i/ (in (2a) the stem-final vowel deletes when unstressed, and in (2.a.iv.) [h] deletes after consonants; in (2b), spreading first takes place, then the stem-final vowel deletes):

- 2) a. Round and Front spread across Laryngeals
- | | | | | | |
|------|------------------|---|--------------|----|----------------------|
| i. | ?us?E'pa | + | ?aha | -> | ?us?Ep?aha |
| | 'he was pleased' | | 'neg' | | 'he was not pleased' |
| ii. | mo'lu | + | ?aha | -> | mo'l?OhO |
| | 'full' | | 'neg' | | 'not full' |
| iii. | po' | + | ?a'ki | -> | po'?Oki |
| | 'to look' | | 'she did' | | 'she looked' |
| iv. | ?u'wi | + | hat | -> | ?u'wEt |
| | 'he' | | 'on X's part | | 'on his part' |
- b. Round and Front spread between adjacent vowels
- | | | | | | |
|----|---------|---|----------------------|----|-----------------|
| i. | na'ra | + | a'ni | -> | nara'ni |
| | 'snake' | | 'it is said that...' | | 'it is a snake' |

²Thanks to Diana Archangeli for pointing out that making the Height Node relevant for vowels only is stipulatory, and can be derived from independent considerations (i.e. prosody).

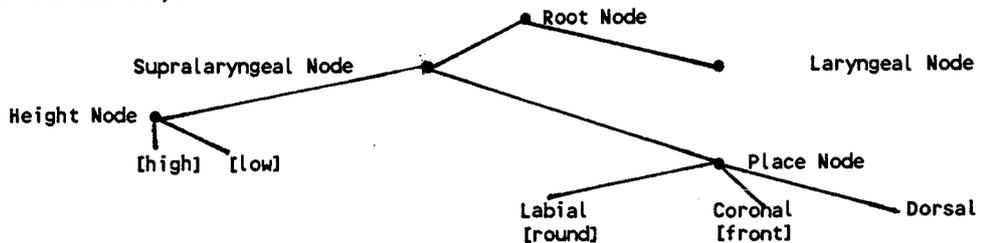
³Tunica is a Native American Language formerly spoken in Louisiana. The data in this paper are taken from Haas' work on Tunica, in her Tunica Grammar (1940) and Tunica Dictionary (1953).

- ii. ni'ku + a'ni -> niku + Oni -> niko'ni
 'he says' 'he says'
- iii. mo'l?OhO + a'ni -> mol?OhO + Oni -> mo'l?OhO'ni
 'not full' 'it is not full'
- iv. mi'li + a'ni -> mili + Eni -> milE'ni
 'red' 'it is red'

Thus, Tunica partial vowel harmony appears to involve [round] and [front] spread without concomitant spread of [high] or [low], as indicated by the examples in (2).

The term 'partial vowel harmony' refers to spread of more than one vowel feature, but less than all of them (i.e. without identical vowels surfacing). Paradoxically for Steriade (1987), Tunica partial vowel harmony is translaryngeal harmony, but Tunica does not have the surface effect of identical vowels across the laryngeals. Three possibilities arise to resolve the paradox, so that Steriade's claims about translaryngeal harmony can be maintained: (1) alter the representations (i.e. the feature geometry); (2) alter the rule; or (3) demonstrate that Tunica vowel harmony is not a case of true translaryngeal harmony (if Tunica vowel harmony is not translaryngeal harmony, then the paradox simply does not arise). I argue in this paper for the first option. In particular, I suggest that a Height Node dominating the features [high] and [low] is a dependent of the Supralaryngeal Node. I call this geometry "Height Node Geometry" (1) because the height features have been removed from the Dorsal Node and placed under a separate Height Node and (2) I assume Pulleyblank (1989) where the Dorsal feature [back] has been replaced with the Coronal feature [front]:⁴

3) Height Node Geometry:



This change in the feature geometry allows upholding Steriade's claims that translaryngeal harmony is multiple-feature spread, and that consonants with a Place node block spread. The following types of harmony are predicted to occur (in each case I first provide a definition of harmony in terms of which/how many features spread, then I give the theoretical consequences for the feature

⁴Where the feature ATR ('advanced tongue root') fits in the geometry and whether ATR is a dependent of a fourth Radical node (Ladefoged and Halle, 1988) cannot be determined by the alternations examined here, and is left for future research. (See also Clements, 1989; McCarthy, 1989; and Pulleyblank, 1989, for discussion of the node/features relevant for pharyngeals.)

geometry in (3)):⁵

- 4) a. Total vowel harmony: all vowel features spread; in the proposed geometry, Supralaryngeal Node spread.
- b. Partial vowel harmony: more than one, but less than all vowel features spread; in the proposed geometry, Place Node spread or Height Node spread.

Because all consonants have a Place Node, spreading either the Supralaryngeal Node or the Place Node between vowels will be blocked by an intervening nonlaryngeal consonant (see (1c)).

This paper is organized as follows. In the following section (0.1) I provide background on feature geometry. Then, in (1.0), I identify the crucial assumptions concerning the specification of underlying segments in Tunica. In section (2.0), I present data illustrating Tunica partial vowel harmony across laryngeals and between adjacent vowels, and present an analysis for Tunica partial vowel harmony. In (3.0) I show that Steriade's analysis of translaryngeal harmony cannot account for Tunica. I also provide evidence showing that Tunica partial vowel harmony is a case of translaryngeal harmony. Finally, I demonstrate that Tunica partial vowel harmony cannot be accounted for by extending the parameters for rules.

0.1 Feature Geometry and the Height Node

Clements (1985), and later Sagey (1986), argued that phonological features are best arranged hierarchically as in (3), to account for the fact that certain groups of features frequently pattern together in phonological rules. The Root Node provides the anchor which mediates between featural representations and prosodic representation. The Supralaryngeal Node and the Laryngeal Node are generally agreed to each branch from the Root Node (Clements, 1985; Sagey, 1986; among others): The Supralaryngeal Node in turn dominates the Place Node. In Sagey (1986), three articulator nodes (Labial, Coronal, and Dorsal) dock directly into the Place Node: the purpose of the Place Node is to capture the commonality of place assimilation in languages (i.e. spreading of all place features). The Labial Node dominates features associated with gestures involving the lips; the Coronal Node dominates features governing gestures involving the front of the tongue; and the Dorsal Node groups features associated with movements of the tongue body. In the works cited, it was claimed that C's and V's had the same nodes and features. Recent work, however, has questioned the assumption that place features for vowels and place features for consonants are the same.

Steriade (1987) and Odden (1989), for example, propose that the Dorsal Node dominates the vowel place features [high], [low], [round], and [back], and that velar consonants have a distinct Velar node. Clements (1989), on the other hand, proposes that

⁵Single feature/node spread is also predicted to occur. I do not address that issue because I focus here on harmonies in which more than one feature/node spread.

consonants and vowels are described by the same sets of features, but that consonants have their own place node and vowels a separate place node (the C-Place and V-Place nodes respectively are proposed to stem from the Supralaryngeal Node). Clements further observes that there is no uniform definition of Dorsal that is valid for all segment types, indicating that the "Dorsal" Node is somehow different in vowels and consonants. My proposal differs from these recent proposals in that the Height Node dominates features relevant for tongue height ([high], and [low]), and that these features are relevant for both consonants and vowels.⁶ I assume here that prosody differentiates consonants from vowels, and that the phonetics spells out the different physical manifestations of the features [high] and [low] for consonants and vowels.

Based on Tunica partial vowel harmony, I argue for the feature geometry in (3).⁷ The purpose of this paper is simply to address the question of [round] and [front] spreading without the additional spread of vowel height features.⁸ Now that I have provided above a brief introduction to feature geometry, in the next section I review the aspects of Combinatorial Specification (Archangeli and Pulleyblank, 1991, in progress) assumed in this paper, and give the underlying representation for Tunica vowels.

1.0 Theoretical Assumptions and Underlying Representation

In this paper I assume the feature theory Combinatorial Specification (Archangeli and Pulleyblank, 1991, in progress), although nothing in the proposed analysis of Tunica partial vowel harmony hinges on that assumption. Below I first discuss vowel cooccurrence patterns, and then provide the underlying feature values for Tunica vowels.

The surface vowel inventory for Tunica is given in Figure (5) below. Note that Tunica has two three-way distinctions at the surface: (1) Tunica has three low vowels (front, central, and back

⁶The features [high] and [low] are normally assumed to be relevant for vowels only, but are relevant for consonants in languages that make a distinction between, for example, velars and uvulars.

⁷Hyman (1988) proposes a Height Node dominating [high] and [low] stemming from a "Vowel Node", but does not discuss placement of the Height Node with respect to any other nodes in the geometry. The geometry argued for here is consistent with Hyman's (1988) arguments for a Height Node for Vowels. In addition, I follow Sagey's (1986) proposals with respect to other nodes/features dominated by the Supralaryngeal Node (e.g. the Soft Palate Node dominating [nasal]) and the Laryngeal Node (e.g. [constricted glottis]). So as not to obscure the representations in this paper, I do not include these nodes/features in them.

⁸For other views on spreading [round] and [back] together, see Archangeli (1985) and Mester (1988) for discussion of features represented on dependent tiers.

respectively); and (2) a three-way distinction in tongue height (high, mid, and low):

5) Tunica vowels (Haas, 1940):

i					u	high vowels
	e					mid vowels
		E	a	o		low vowels

Figure (6) below shows the vowel cooccurrence patterns in underived lexical items in Tunica; that is, vowel sequences in adjacent syllables, with intervening consonants ("+" means that the sequence occurs in underived lexical items, "0" means the sequence is not found) (see also Hammond, 1984).⁹ The mid and low versions of front and back vowels are shown to occur in complementary environments: [E] and [o] only occur when the vowel in the next syllable is the low mixed (or central) vowel [a], and [e] and [o] only occur when followed by [i] and [u]:

6) Vowel Cooccurrence Patterns:

	V ₂	i	e	E	a	o	o	u
V ₁								
i		+	+	0	+	0	+	+
e		+	0	0	0	0	0	+
E		0	0	0	+	0	0	0
a		+	+	0	+	0	+	+
o		0	0	0	+	0	0	0
o		+	0	0	0	0	0	+
u		+	+	0	+	0	+	+

Summarizing the distribution of mid and low front and back vowels, the following cooccurrence patterns do (7a) and do not (7b) occur:¹⁰

- 7) a. eu ei ou oi Ea Oa
 b. *ee *eo *oe *oo

The first four patterns in (7a) comprise [+ATR], [-low] vowels, and the latter two patterns comprise [-ATR], [+low] vowels. Thus, the distribution of vowel sequences can be accounted for with a rule

⁹Allowable syllables in Tunica are CV, CVC, and to a lesser extent, CVCC. Triconsonantal clusters are usually either NCC or CC?. See section 3.1 for some examples.

¹⁰A caveat is in order here. The chart in Figure (6) represents the overwhelming patterns of vowel cooccurrence. I have found some twenty forms that show /e-e/, /e-o/, /e-a/, and /o-a/; I assume these are exceptions to the general pattern. Also, many of the forms used in determining the vowel cooccurrence patterns are trisyllabic or larger. I found some forms with [E] as the second vowel in a sequence; however, since [E] is always followed by [a] and argued to derive from an underlying /e/, I recorded such forms as having [e] as the second vowel.

spreading either [ATR] or [low]. Because [ATR] values are shown later to play no role in partial vowel harmony, I follow Hammond (1984) by proposing a rule of Vowel Lowering, (i.e. spreading [+low]) deriving the front and back vowels from an underlying mid vowel. Before providing the rule and derivations, I first give the underlying system of feature values and constraints on that system.

1.1 Underlying F-elements in Tunica

Having shown that the occurrence of low front and low back vowels are predictable in Tunica, I propose here an underlying system of five vowels. In Combinatorial Specification, underlying feature values may combine freely, subject to constraints. Sixteen combinations are logically possible from four underlying feature values (8a). Because the low front and low back vowels are derived, I propose the first two constraints in (8b) to prevent the free combination of [+low] with either [+front] or [+round]. Likewise, because Tunica has no surface front, rounded vowels, I propose the third and fourth constraints preventing free combination of [+front] with [+round]. Finally, the last two constraints prohibit [+high] and [+low], two conflicting tongue gestures, from cooccurring (note that the first two constraints are applicable to underlying representation only, because the combination of [+low] with [+round] and [+front] is just that allowed by [+low] spread and partial vowel harmony; the remaining constraints are relevant throughout the phonology). In (8c) I provide the resulting feature combinations of the logically possible feature combinations restricted by the constraints in (b):

8) Underlying System for Tunica Vowels:

a.	*	*	*	*	*	*	i	u	*	*	*	*	a	e	o	*
high	+	+		+	+	+	+	+				+				
low		+	+	+		+	+			+	+			+		
front	+	+	+	+			+		+		+			+		
round	+		+	+	+			+		+	+					+

b. Constraints on Feature Combination in Tunica:

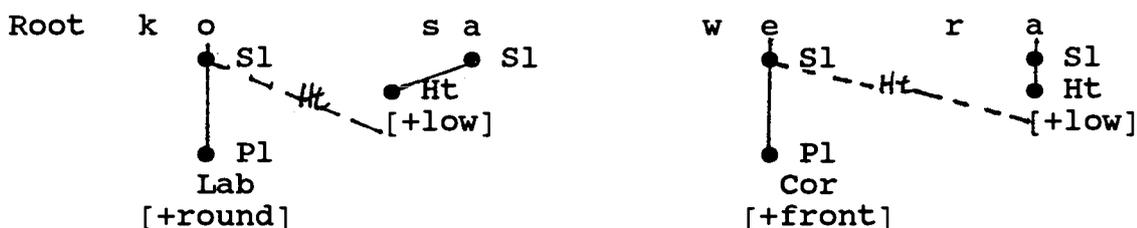
- i. If [+low] then not [+round]
- ii. If [+low] then not [+front]
- iii. If [+round] then not [+front]
- iv. If [+front] then not [+round]
- v. If [+low] then not [+high]
- vi. If [+high] then not [+low]

c. Underlying Feature Combinations:

	i	e	a	o	u
high	+				+
low				+	
front	+	+			
round				+	+

While it may seem unwarranted to propose four feature values to differentiate five underlying combinations, accounting for vowel distributions in Tunica requires such complexity. Recall that Tunica has two three-way distinctions: (1) three levels of vowel

b. [+Low] Spread:



c. Surface Representation:

kOsa

wEra

I have proposed here that the rule of [+low] spread supports the underlying feature value [+low], and discuss [+high] next.

I propose an underlying [+high] in order to differentiate high and mid vowels from the low vowels, and because there is independent support for an underlying [+high]. Haas (1940) and Hammond (1984) propose that high vowels are optionally deleted after a fricative and stop sequence (Hammond, 1984; 143) (these examples also show evidence of an H-deletion rule that is discussed later in the paper):

- 11) a. hikuwa + nahku + pita + ku + ani ->
 'panther' 'like' 'walk' '3m.sg.' 'quotative'

hikuwanah_pitakOni
 'He walks like a panther'

- b. ta + hali + hxi + hekina + ani ->
 'the' 'land' 'f.sg.' 'far-away' 'quotative'

tahali_hekinani
 'The land was far away'

Unfortunately, Tunica does not appear to have rules of either palatalization or rounding to support the underlying values [+front] and [+round]. However, either [+front] and [+round], or [-front] and [-round] are needed to differentiate the front, central, and back low vowels in Tunica. Figure (12) below shows all logically possible combinations of [front] and [round] with respect to the low vowels. (12a) shows that underlying values of [-round] and [-front] allows contrasting all three low vowels; (12b) shows the reverse, underlying values of [+round] and [+front]. (12c) and (12d) are the problematic cases; they illustrate that choosing some minus and plus combination of underlying feature values for [front] and [round] results in either [O] and [a] being indistinguishable, or [a] and [E] being indistinguishable:

12) Underlying [Front] and [Round]

	E	a	O
a.	[+low] [-round]	[+low]	[+low] [-front]
b.	[+front]		[+round]
c.	[+front] [-round]		
d.			[-front] [+round]

I follow Pulleyblank (1989) in assuming the unmarked default values [+front] and [+round].

Above I have proposed the underlying system for Tunica vowels assumed for this analysis. I now turn to describing and accounting for Tunica translaryngeal harmony.

2.0 Tunica Partial Vowel Harmony

Here I provide data and discuss alternations that surface between vowels that occur on either side of a laryngeal; and, I show that the same alternations surface between adjacent vowels, with subsequent deletion of one of the vowels. I demonstrate that an underlying low or mid vowel remains low or mid after harmony, but takes on the preceding vowel's value for [front] and [round]. I also discuss several deletion rules that interact with forms undergoing harmony to derive surface forms.

2.1 Tunica Translaryngeal Harmony

Translaryngeal harmony (Steriade, 1987) refers to cases of harmony where identical vowels surface on either side of an intervening laryngeal, [h] or [ʔ]. Tunica represents a case where some assimilation takes place across laryngeals, but without complete identity of vowels on either side of the laryngeal. Figure (13) summarizes the alternations that surface with front vowels; Figure (14) provides data illustrating surface patterns in Tunica when vowels become strictly adjacent at the juncture of harmony, and when a laryngeal intervenes.¹¹ All examples with the central low vowel /a/ as the target vowel involve suffixation; examples with /e/ as a target vowel involve prefixation.¹² (14a-h)

¹¹Translaryngeal harmony happens in derived environments in Tunica. Examples of intervocalic [h] in underived lexical items is common, but word-internal occurrences of VʔV are rare (e.g. cuhki?elu 'm. acorn'; ninita?eri 'fish hawk').

¹²That /e/ does not appear to be a target vowel when laryngeals intervene is partially explained by the fact that no /?e-/ or /he-/ initial suffixes occur in Tunica. /?e/ and /he/-initial lexical items do occur, but none were found where they would be a potential target for vowel harmony. Also, no suffixes or lexical items are

show alternations when /a/ is the target vowel; and, (14a) through (d) provide examples with intervening laryngeal consonants, whereas (14e) through (h) provide examples of alternations involving strictly adjacent vowels. (14i & j) provides alternations with /e/ as a target vowel.¹³

13) Summary of Alternations with Front Vowels:

i	(h,?)	a	->	i	(h,?)	E
e	(h,?)	a	->	e	(h,?)	E
i		e	->	∅		e

14) Examples of Translaryngeal harmony with Front Vowels:

- | | | | | |
|----|-----------------------------|------------------------|-----------------|--|
| a. | ?a'mi
'to go' | + ?a'hkini
'I did' | -> | ?a'm?Ehkini
'I went' |
| b. | me'
'to search' | + ?a'ki
'she did' | -> | me'?Eki
'she searched' |
| c. | ?u'wi
'he' | + hat
'on X's part' | -> | ?u'wEt
'on his part' |
| d. | ti'hči
'she' | + hat | -> | ti'hčEt
'on her part' |
| e. | ?a'či
'she was sitting' | + aha
'not' | + a'ni
quot. | -> ?a'čEhE'ni
'she was not sitting' |
| f. | ?u'yasiti
'he got angry' | + aha
'not' | -> | ?u'yasitEhE
'he did not get angry' |
| g. | mi'li
'it is red' | + a'ni
quotative | -> | miE'ni
'it is red' |
| h. | ta'šle
'it is beautiful' | + a'ni
quotative | -> | tašlE'ni
'it is beautiful' |
| i. | ?i
'ls person' | + e'rusa
'to know' | -> | ?e'rusa
'I know' |
| j. | ti
'3fs' | + e'yu
'arm' | + si
loc. | -> te'yusi
'her arm' |

In examples (14a) through (14h) we see that the low central vowel /a/ is simply fronted ([E]) when preceded by a high or mid front vowel, with no change in vowel height. Example (14b), where no unstressed vowel deletion occurs, shows that the second vowel in a sequence takes on the frontness of the preceding vowel (i.e. is the target vowel). Based on this observation, it is expected that no alternation occurs in the sequence /ie/, since both vowels are front and unrounded (i.e. application of harmony is redundant).

found that begin with a high vowel, thus I have no evidence for their behavior in a VV[+high] sequence. However, if high vowels did occur in the environment for harmony, the following sequences are possible inputs to the rule: i-i, i-u, u-i, u-u. Harmony is shown later to apply to target vowels not marked for [+high].

¹³Many of the examples here and given later include deletion of unstressed vowels, as seen when comparing the surface output of (14a) with (14b). I discuss deletion of unstressed vowels later.

harmonizes with stem-final vowels in roundness and frontness, while retaining its height value of [+low]. When the stem-final vowel is /a/, no change occurs in the suffix vowel (or, alternatively, suffix /a/ harmonizes redundantly with stem-final /a/), exhibited in the following data. Examples (17a) and (b) include an intervening [ʔ]; (17c) through (f) include an intervening [h]; finally, examples (17g) and (h) involve strictly adjacent vowels:

17) Evidence for /a/ as underlying suffix vowel:

a.	ha'ra 'to sing'	+	<u>ʔa</u> 'ki	->	ha'r <u>ʔa</u> ki 'she sang'
b.	ya'ka 'to come'	+	<u>ʔa</u> 'hkini 'I did'	->	ya' <u>kʔa</u> hkini 'I have come'
c.	<u>ʔu</u> 'nima 'we'	+	<u>hat</u>	->	<u>ʔu</u> 'nimat 'on our part'
d.	sa'ma 'to cook'	+	<u>hapa</u> 'already'	->	sa'm <u>apa</u> 'finished cooking'
e.	<u>na</u> ' 'to lie down'	+	<u>hapa</u>	->	na' <u>hapa</u> 'already lie down'
f.	<u>ma</u> ' 'you'	+	<u>hat</u>	->	ma' <u>hat</u> 'on your part'
g.	na'ra 'snake'	+	<u>a</u> 'ni quotative	->	nara' <u>ni</u> 'it is a snake'
h.	ni'sara 'young person'	+	<u>a</u> 'ni quotative	->	nisa <u>rani</u> 'it is a young person'

Again, the stem-final vowel deletes when it is unstressed, and when it is not the only vowel in that lexical item (the stem-final vowel does not delete in (17e) and (17f); Hammond, 1984).¹⁴

Finally, the remaining data in (18) below demonstrates that spread continues past the suffix-initial /ʔa/ when the following suffix consonant is the laryngeal /h/ (as predicted), in contrast with the examples above where harmony stopped when the next consonant was a non-laryngeal:

18) Continuous spreading:

a.	m'ili 'red'	+	<u>ʔaha</u> 'not'	->	mi'l <u>ʔEhE</u> 'not red'
b.	ka'si 'true'	+	<u>ʔaha</u>	->	ka' <u>sʔEhE</u> 'not true'
c.	mo'lu 'full'	+	<u>ʔaha</u>	->	mo'l <u>ʔOhO</u> 'not full'

¹⁴Hammond (1984) proposes a general rule of deletion of unstressed vowels before glottals in a derived environment. Also, see Chapter 4 of Hammond (1984) for detailed discussion of stress-related phonological rules in Tunica, and for detailed discussion of H-deletion. Here I mention the stress facts only as they relate to vowel harmony. In the following section I briefly address Vowel Deletion and H-deletion as they relate to Tunica vowel harmony, as evidenced in such surface forms as ʔuwEt, derived from ʔuwi + hat.

phrasal boundaries:¹⁶

20) Vowel Deletion:

- a. wi'wana + ?i + hč -> wi'wan?ihč
'you (m) want' 'if' 'when' 'if you want'
- b. lo'ta + hila + wi + hč -> lo'tilawihč
'to run' 'to be about to' '3ms' 'when' 'when he
was about to go'
- c. sa'ku + hila + wi + hč -> sa'kilawihč
'to eat' 'to be about to' '3ms' 'when' 'when he
was about to eat'
- d. tu'waku ?u'wakO'ni -> tu'wak ?u'wakO'ni 'the owl hooted'
'owl' 'hooted' (?uwaku + ani -> ?uwakOni)
- e. ?u'wi ?onE'ni -> ?u'w ?onE'ni 'he was a person'
'he' 'was a person' (?oni + ani -> ?onEni)

The deleted vowels above are morpheme-final (20a-c) or phrase-final (20d-e) unstressed vowels, followed by a laryngeal. Recall that morpheme-final stressed vowels do not delete (e.g. po'?uhki 'he looked' <- po' 'to look' + ?u'hki 'he did'). Because of the patterns exemplified here, Hammond (1984) motivates a rule of unstressed vowel deletion (the rule given here differs slightly from Hammond's rule, but captures the same intuition, that an unstressed vowel deletes before an optional laryngeal; that is, the leftmost unstressed vowel in the sequence VV, VhV, and V?V deletes):

21) Vowel Deletion Rule:

$$\begin{array}{c} m \\ | \\ V \end{array} (h, ?) V \rightarrow \emptyset (h, ?) V$$

I assume here that when the unstressed mora deletes, segmental material originally linked to that mora is erased by Stray Erasure (Ito, 1986).¹⁷ Furthermore, Tunica appears to have a rule of H-

¹⁶See Haas (1940) and especially Hammond (1984) for details. For example, the high vowel deletion rule discussed earlier is argued to be a separate rule from the general rule of unstressed vowel deletion.

¹⁷As D. Archangeli points out, the rule of Vowel Deletion as formulated does not indicate such an assumption. In fact, we could claim that the unstressed vowel deletes, and that the segmental material left behind automatically links up to the following vowel, making the rule of vowel harmony superfluous. However, we would still need a rule of vowel harmony to account for cases where a

deletion. No /Ch/ sequences ever surface in Tunica, so Tunica presumably has a constraint prohibiting this sequence. Note in (20b) above that once Vowel Deletion applies, the resulting form has such a sequence: *lothilawihç. The surface form shows deletion of the /h/ in the /th/ sequence, motivating a rule of H-deletion postconsonantly given in (22a) (Hammond, 1984). (22b) illustrates the derivation of ?uwet:

- 22) a. H-Deletion:
 h -> \emptyset / C ____
- b. Derivation of ?u'wi 'he' + hat 'on X's part':
 Vowel harmony -> ?u'wihEt
 Vowel Deletion -> ?u'whEt
 H-deletion -> ?u'wEt

Now that Vowel Deletion and H-deletion have been discussed, all relevant phonological processes that interact to give surface forms noted previously have been addressed. I turn to providing a rule and derivations for partial vowel harmony.

2.1.3 Summary

The following observations recapitulate what a rule for Tunica partial vowel harmony must account for:

- 23) Tunica partial vowel harmony comprises:
- high and mid vowels spreading their values for [front] and [round];
 - high and mid vowels not spreading their vowel height onto a following low (/a/) or mid (/e/) vowel;
 - the low central vowel /a/ and mid front vowel /e/ being the only possible targets for harmony;
 - underlying /a/ surfacing as [E] following a front vowel, and [O] following a round vowel;
 - underlying /e/ surfacing as [e] following a front vowel, and [o] following a round vowel;
 - the environment for harmony is V (h,?) V;
 - high vowels can occur as the second vowel in a V(h,?)V sequence, but no alternations surface.

In the next section I propose a rule accounting for all of these observations, i.e. accounting for Tunica translaryngeal harmony.

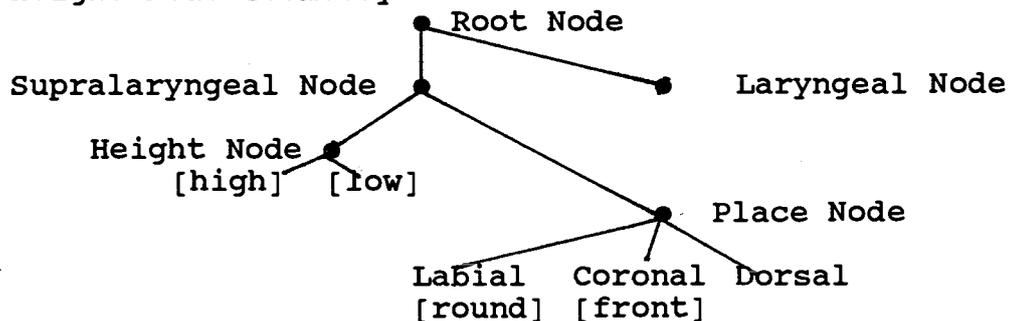
2.2 Formalizing Tunica Partial Vowel Harmony

Recall from section (0.1) that one motivation for feature geometry is that groups of features pattern together in phonological rules. The data provided earlier of derived /VhV/, /V?V/ and /VV/ sequences showed that [round] and [front] spread from left-to-right between these vowels, but without concomitant spread of [high] or [low]; i.e. the vowel targeted by harmony (the

stressed vowel spreads its values for [front] and [round] to a following vowel and does not subsequently delete.

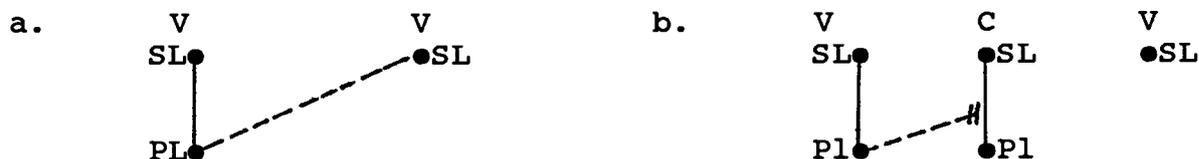
second vowel in the sequence) retains its height (either mid or low). This is possible to represent with a feature geometry in which a Height Node descends from the Supralaryngeal node, dominating the features [high] and [low] and is independent of Place.

24) Height Node Geometry:



Assuming that the features [high], [low], [round], and [front] are relevant for vowels (e.g. Archangeli and Pulleyblank, 1987; Steriade, 1987; Odden, 1989), the proposed geometry predicts that spreading the Supralaryngeal Node results in complete vowel copy (i.e. identical vowels surface as a result of spread). Furthermore, spreading the Place Node results in spread of [round] and [front] only. Because only [+front] and [+round] appear to spread in Tunica, I propose that spreading the Place Node accounts for Tunica partial vowel harmony (23a above). With tongue height features now under a separate Height Node, spreading the Place Node predicts that the vowel triggering harmony does not spread its value for tongue height (23b). Although this rule formulation predicts that /o/ is a target for harmony, recall that /o/ does not surface in the environment of harmony, so the rule has no chance to apply. The rule as formulated also does not apply when a high vowel occurs as the second vowel in a sequence because of the constraint prohibiting [+high] and [+low] from cooccurring. Finally, note that the laryngeals [h] and [ʔ] are not mentioned in the rule, because their presence is not required for the rule to apply (25a). That laryngeals have no Place Node predicts that the rule spreading Place is not blocked by a laryngeal: a consonant with a Place Node blocks spread as noted in (25b), where the Place Node associated to the leftmost vowel cannot cross the association line between the consonant's Supralaryngeal Node and Place Node:

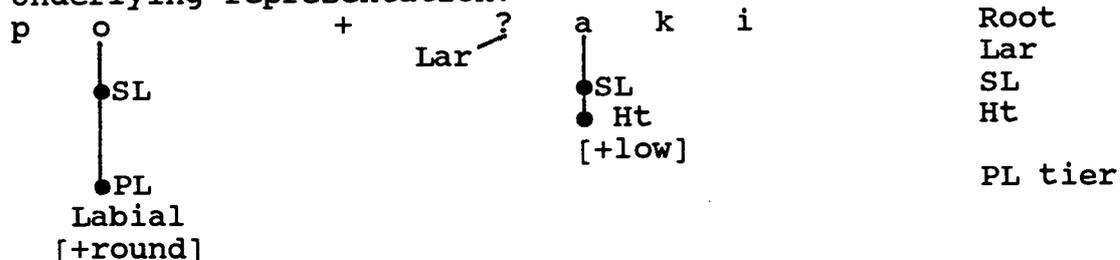
25) Tunica Partial Vowel Harmony:



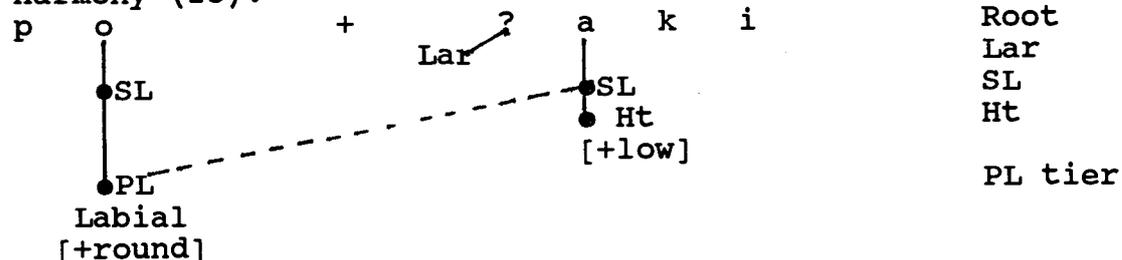
Next I provide a derivation showing application of this rule. (26a) gives the underlying representation; (26b) shows application of the harmony rule:

26) Derivation of po?Oki 'she looked'

a. Underlying representation:



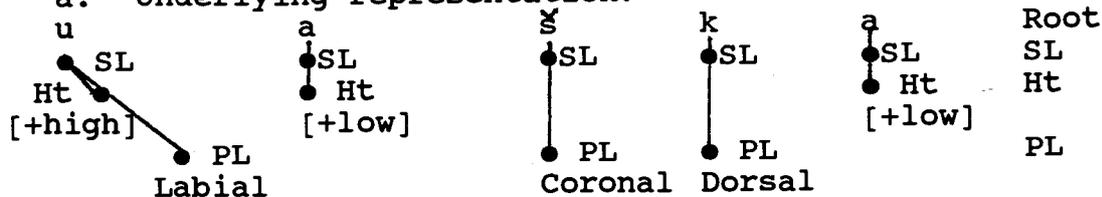
b. Harmony (25):



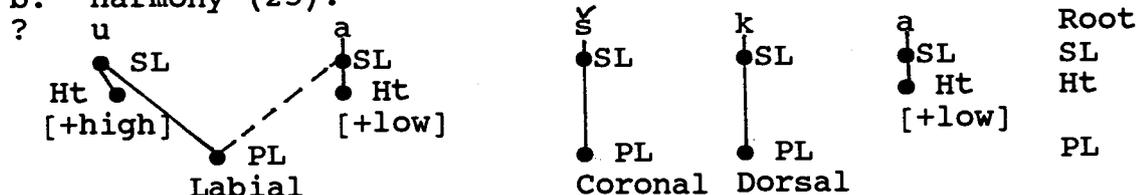
Application of the vowel harmony rule results in spread of the trigger vowel's Place feature [+round] onto the low central vowel /a/, correctly deriving the low round vowel [O] in the surface form po?Oki.

I provide an additional derivation below, illustrating harmony between strictly adjacent vowels and demonstrating that the dichotomy between the Place Node and the Height Node is crucial to accounting for Tunica partial vowel harmony. In particular, the derivation below involves a [+high] vowel spreading its Place features only onto a following vowel. (27a) shows that the input to vowel harmony is the vowel sequence /u-a/; the form being derived is ?oška 'root', from ?u '3ms prefix' and aški 'foot':

27) a. Underlying representation:



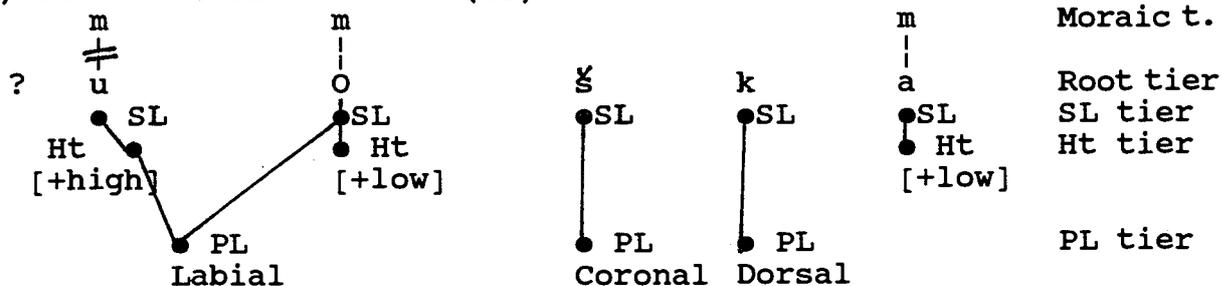
b. Harmony (25):



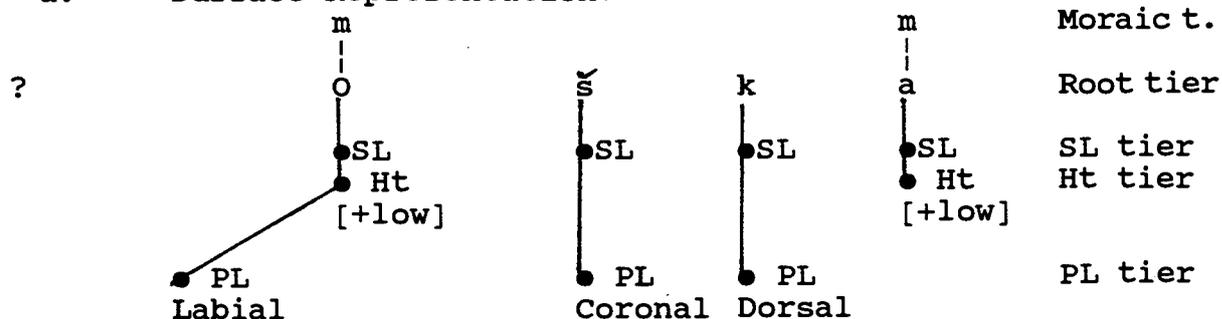
To derive the correct surface form, Vowel Deletion delinks the mora attached to the first vowel in the /u-a/ sequence; Stray Erasure erases the delinked mora and any structure previously linked to that mora (27c). Because the Place Node is doubly linked, only the

structure down to the Place Node deletes, leaving the Place Node with Labial linked to [O] (27d):

27) c. Vowel Deletion (21):



d. Surface Representation:



Above I have provided two derivations where the Tunica Partial Vowel Harmony Rule applied to vowels with an intervening laryngeal, and between strictly adjacent vowels. Tunica partial vowel harmony is argued to be an instance of Place Node spread by the geometry proposed here, capturing the effect of [+front] and [+round] crucially spreading without the additional spread of vowel height features.

2.3 Summary

In section 2.0 I have provided data and derivations showing that the vowel alternations that surface in translaryngeal harmony also occur when vowels become immediately adjacent. In the latter case, the trigger vowel always deletes, because Tunica does not allow vowel clusters (and because the vowel is unstressed). In the case of harmony across [h] and [?], the trigger vowel deletes only when it is unstressed. Tunica partial vowel harmony, shown above to be spread of [+front] and [+round], without spread of tongue height features ([high] or [low]), differs from Steriade's (1987) claim that identical vowels always surface after translaryngeal harmony, resulting in a paradox for Steriade. In order to account for the paradoxical nature of harmony in Tunica, I have altered the feature geometry by adding a Height Node that dominates the features [high] and [low]. The Height Node is itself dominated by the Supralaryngeal Node. In terms of vowel harmony, spreading the Supralaryngeal Node has the effect of deriving identical vowels (thus capturing the cases provided in Steriade, 1987), whereas spreading the Place Node has the effect of spreading [round] and [front], and not affecting tongue height of the vowels, accounting

demonstrate consonant epenthesis is to show that epenthesis breaks up an illicit syllable structure. It has already been demonstrated that Tunica resolves illicit vowel clusters by deleting the leftmost vowel in the sequence, removing vowel clusters as an environment for epenthesis.¹⁸ Furthermore, proving that only one of the laryngeals is epenthetic does not explain why harmony occurs across the other laryngeal, thus proving only one laryngeal to be epenthetic would not resolve the paradox here.

Permissible syllable shapes in Tunica are CV, CVC, and to a lesser extent CVCC, shown below in Figure (28) (all examples taken from Haas (1940) and (1953); '-' indicates a syllable boundary):

28) Permissible Syllables in Tunica:

(a) CV		(b) CVC		(c) CVCC
ha-ha	'to curse'	hah-ku	'cypress'	?ins-?Epa 'we are happy'
cu-la	'fox'	laš-pi	'metal'	?ing-rasa 'American'
le-ka-ti	'in'	wan-ta-ha	'formerly'	ta-wist-?Eku
so-wa	'pregnant'	taš-le	'pretty'	'the Mississippi'

The data and discussion in Haas (1940) indicates that syllables in Tunica must have onsets. In fact, all vowel-initial entries in Haas's (1953) dictionary are prefaced with a hyphen (-), indicating that they always occur with a preceding morpheme. The fact that onsets are required implies that some consonantal segment in Tunica could be epenthetic to fulfill this requirement, however I have found no such evidence to date: both [h] and [ʔ] occur before each of the seven surface vowels.

Other possible evidence for [h] or [ʔ] as epenthetic in Tunica comes from variants of affixes: e.g., suffix variants that surface in one environment with an initial vowel and in a different environment as h-initial or ʔ-initial. The opposite would hold for a prefix; that is, one form of a prefix would end in a vowel when followed by a consonant, and the other form would end in a consonant when followed by a vowel. No examples of affix allomorphy based on the presence and absence of either laryngeal, [h] or [ʔ], was found. Only a small portion of Tunica affixes have allomorphs at all; the affixes that do have allomorphs usually differ by the presence and absence of [k], demonstrated in the examples below. The prefix in Figure (29a) is the reciprocal prefix. The only example of suffix variation evident in Tunica is the conditional postfix in (29b) (the ʔi variant is rare); in this case, note in the morphological breakdown that both variants are preceded by the same vowel, indicating that predicting the distribution of the variants based on the quality of the preceding vowel or syllable structure requirements is not possible:

29)	a. prefix:	<u>?a-</u> , <u>?ak-</u>	'reciprocal'
	?ak?Eh?unihki	<- ?ak + ?Eh?unihki	
	'they kicked each other'		'they kicked'

¹⁸Thanks to Megan Crowhurst for pointing this out.

for Tunica.

Three choices were claimed to be available in order to resolve the paradox created by Tunica partial vowel harmony: alter the representations, alter the rule, or show that Tunica is not an instance of true 'translaryngeal harmony', so the paradox never arises. Thus far I have proposed an alteration in the feature geometry, and proposed a Place spreading rule to account for the alternations that surface in Tunica. Next, section (3.0) first demonstrates that Tunica is a true case of translaryngeal harmony, thus Tunica represents a paradox for Steriade. Then, I show why Steriade's (1987) formulation for translaryngeal harmony does not account for the Tunica data. Finally, I discuss why altering Steriade's rule allows too much freedom to what rules can and cannot do, supporting the argument here that the feature geometry should be altered.

3.0 Other Avenues for Resolving the Paradox

Recall that the paradox arises in Tunica from Steriade's (1987) claims that identical vowels surface on either side of the laryngeals, yet partial vowel harmony in Tunica involves only [+front] and [+round]: identical vowels do not surface flanking the laryngeals. Steriade (1987) proposes that spread of the Place node or the Supralaryngeal node accounts for translaryngeal harmony, based on the observation that the laryngeals are the sole neutral consonants to harmony since they do not have a Place Node or Supralaryngeal Node to block spread. Steriade ultimately argues for Supralaryngeal Node spread to account for translaryngeal harmony, under the assumption that nasalized vowels would spread in translaryngeal harmony (although Steriade has yet to find any such examples). I have argued above for a change in the feature geometry to account for the fact that in Tunica translaryngeal harmony only [+front] and [+round] spread, as opposed to all vowel features as Steriade predicts. In this section I confirm that Tunica vowel harmony is a case of true translaryngeal harmony, maintaining that the paradox exists for Steriade. In addition, I propose a possible rule formulation that would not require an adjustment to the feature geometry, and show why that rule formulation is problematic.

3.1 Tunica Partial Vowel Harmony is Translaryngeal Harmony

Previous discussion of vowel harmony in Tunica has rested on the assumption that Tunica partial vowel harmony is translaryngeal harmony, resulting in the paradox discussed above. Eliminating the assumption that Tunica represents a case of translaryngeal harmony removes the proposed paradox. One possible argument would be to show that the laryngeals are epenthetic and not underlying. In the next section I provide data from Tunica showing that there are no arguments to demonstrate that the laryngeals are epenthetic.

3.1.1 Syllable Structure in Tunica and the Distribution of [h] and [ʔ]

In order to make the argument that this is not a case of translaryngeal harmony, both [h] and [ʔ] would have to be proven epenthetic in Tunica, and the distribution of each shown to be predictable with respect to the other. One possibility to

'spread all vowel features, but do not spread the trigger vowel's Dorsal features'. This view is consistent with Steriade's claims that translaryngeal harmonies (1) always involve multiple-feature spread, (2) cannot be characterized by spreading any one articulator node (i.e. Labial, Coronal, or Dorsal), and (3) that stipulating which feature(s) delink as a result of rule application is allowed. A possible formulation of Tunica partial vowel harmony consistent with Steriade (1987) is:

31) Alternative Formulation of Tunica Vowel Harmony



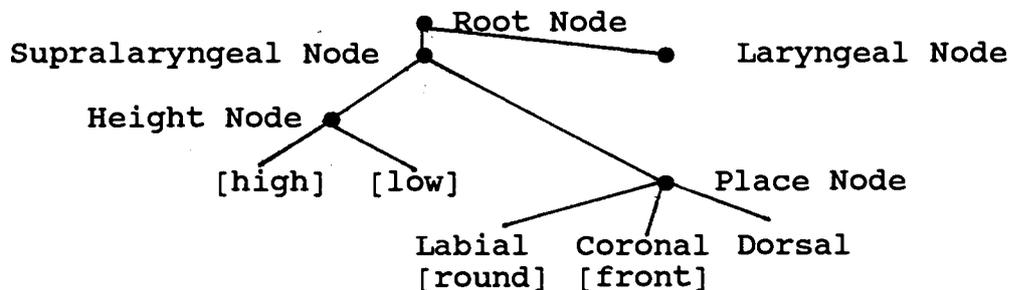
condition: do not delink Dorsal features from the target vowel (or, do not spread Dorsal features from trigger vowel)

However, allowing such a condition on rules predicts that the same condition that prevents spreading or delinking of Dorsal features should apply to Labial or Coronal features. That is, we should find harmony rules where Labial and Dorsal spread and Coronal features remain constant, or where Coronal and Dorsal spread without concomitant Labial spread. To my knowledge, such harmonies do not exist. I suggest, therefore, that placing conditions on rules like the one proposed above is not the best way to account for the Tunica data.¹⁹

4.0 Conclusion

In this paper I have argued that the following feature geometry best accounts for Tunica partial vowel harmony:

32) Height Node Geometry:



I have demonstrated above that Tunica partial vowel harmony takes place across the laryngeals [h] and [ʔ], as well as between adjacent vowels. However, in contrast to Steriade's prediction

¹⁹Odden (1989) also cannot account for Tunica. Although Odden proposes a Height Node (dominating [high] and [ATR]) and a Round-Back node (dominating [round] and [back]) both dominated by the Dorsal Node, like Steriade, Odden proposes that the Dorsal Node is relevant for vowels only. However, spreading the Round-Back Node does not automatically predict that the laryngeals are transparent to spread, which is captured by Place Node spread in the proposed analysis.

that identical vowels occur as a result of translaryngeal harmony, Tunica translaryngeal harmony presents a case of only [front] and [round] spread, without concomitant spread of tongue height features ([high] or [low]). In order to account for the Tunica facts, I adopted the geometry above, and proposed that Tunica translaryngeal harmony is accounted for with Place Node Spread. The proposed analysis of Tunica partial vowel harmony maintains Steriade's (1987) claims that Supralaryngeal Node spread or Place Node spread accounts for laryngeals being the sole neutral segments to vowel harmony, because laryngeals do not have a specified Supralaryngeal or Place Node. The present proposal differs from Steriade because Supralaryngeal Node spread and Place Node spread have different predictions. Supralaryngeal Node spread results in identical vowels after harmony (consistent with the cases discussed in Steriade, 1987), whereas Place Node spread results in [front] and [round] spreading without the simultaneous spreading of tongue height features.

A prediction of the analysis given here is that we should find instances in other languages of [round] and [front] spreading without concomitant spread of tongue height features. In fact, this is exactly what we find. For example, in Eastern Cheremis (Odden (1989)), a [-high] suffix vowel agrees with the preceding vowel in frontness and roundness (Eastern Cheremis has both front and back round vowels). However, cases like Tunica and Eastern Cheremis provide arguments to remove the height features from under the Dorsal Node but do not argue for a Height Node per se or the Height Node as suggested in this paper. Crucial evidence for a Height Node comes from languages where the height features should spread separately from the Place features. One such example comes from Hyman (1988), where Hyman argues for a Vowel Height node dominating [high] and [low] that spreads in Esimbi, accounting for complex height alternations in prefix vowels. A further prediction made here is that velar consonants, if they pattern with any vowels, they will pattern with back vowels, assuming Pulleyblank (1989) who states that back vowels are simply Dorsal without being [-front]. Assuming that the features [high], [low], and [back] are all Dorsal features makes no predictions as to what type of vowel should pattern with velar consonants; or, alternatively, velar consonants should pattern with back vowels, high vowels, or low vowels. Further research is needed to determine whether velar consonants actually pattern with either high or low vowels. Proving that velar consonants generally pattern with back vowels, if any, and not with either high or low vowels supports the Height Node Geometry.

REFERENCES

- Archangeli, D. (1985) Yokuts harmony: Evidence for coplanar representation in nonlinear phonology. LI 16, vol. 3, 335-372.
- Archangeli, D. and D. Pulleyblank. (1991, in progress) Grounded Phonology.
- Archangeli, D. and D. Pulleyblank. (1987) Maximal and minimal rules: Effects of tier scansion. Proceedings of NELS 17.
- Clements, G.N. (1991) Scalar Rules and Feature Representation. Paper given at the Fourth Annual Arizona Phonology Conference, Tucson, Arizona.
- Clements, G.N. (1990) Place of articulation in consonants and vowels: a unified approach. Paper given at NELS 21.
- Clements, G.N. (1989) A unified set of features for consonants and vowels. Cornell University, ms.
- Clements, G.N. (1985) The geometry of phonological features. Phonology Yearbook 2, 225-252.
- Goldsmith, J. (1976) Autosegmental Phonology. Bloomington, IN: Indiana University Linguistics Club.
- Haas, M. (1953) Tunica Dictionary. Berkeley: University of California Press.
- Haas, M. (1950) Tunica Texts. Berkeley: University of California Press.
- Haas, M. (1940) Tunica. Handbook of American Indian Languages IV. New York: J.J. Augustin.
- Hammond, M. (1984) Constraining Metrical Theory: a Modular Theory of Rhythm and Destressing. Ph.D. dissertation, UCLA.
- Hyman, L. (1988) Underspecification and vowel height transfer in Esimbi. Phonology 5.2, 255-273.
- Ito, Junko. (1986) Syllable Theory in Prosodic Phonology. Ph.D. dissertation, University of Massachusetts.
- Jensen, J.T. and M. Stong-Jensen. (1979) The relevancy condition and variables in phonology. Linguistic Analysis, Volume 5, 2, 125-160.
- Ladefoged, P. and M. Halle. (1988). Some major features of the International Phonetic Alphabet. Language 64, 3, 577-582.
- McCarthy, J. (1989) Guttural phonology. University of Massachusetts, Amherst, ms.
- Mester, A.R. (1988) Studies in Tier Structure. New York: Garland Publishing, Inc.
- Odden, D. (1989) Dorsal geometry. Paper given at the LSA.
- Odden, D. (1977) Overspecification and variables in phonology. Linguistic Analysis, Volume 3, 2, 177-196.
- Pulleyblank, E. G. (1989) Articulator based features of vowels and consonants. University of British Columbia, ms.
- Sagey, E. (1986) The Representation of Features and Relations in Autosegmental Phonology. MIT Ph.D. Dissertation.
- Steriade, D. (1987) Locality Conditions and Feature Geometry. NELS 17. 595-617.