

LABIAL OPACITY AND ROUNDNESS HARMONY
IN NAWURI*

Recently, a number of linguists (cf. Clements, 1991; Odden, 1991; Hume, 1992; Clements and Hume 1992) have proposed models of segment structure in which the place features of consonants and vowels are arrayed on different planes. As a consequence of this arrangement, these models predict that vowel-to-vowel place feature assimilation processes should not be blocked by intervening plain consonants (i.e., consonants with no distinctive secondary articulation).

In this paper, I discuss the implications for these theories of a process of roundness harmony that occurs in Nawuri, a Kwa language of Ghana. Of crucial interest is the fact that the process may be blocked, though not triggered, by the presence of an intervening plain labial consonant. I show that while the treatment of this blocking effect is straightforward in a framework such as that of Sagey (1986), in which labial consonants and round vowels are specified for a [labial] articulator node on the same plane, it is problematic for the more recent theories in which consonantal and vocalic place features are segregated.

1. INTRODUCTION

Recently, a number of phonologists (cf. Clements, 1991; Odden, 1991; Hume, 1992; Clements and Hume 1992) have proposed models of segment structure in which the place features of consonants and vowels are arrayed on different planes. By segregating the place features of consonants and vowels as they do, these models predict that vowel-to-vowel place feature assimilations should not be blocked by intervening plain consonants (i.e., consonants with no distinctive secondary articulation). In this paper I present evidence from Nawuri, a Kwa language of Ghana,¹ to show that

* I am indebted to the Nawuri speakers of the village of Kitare who provided the data on which this paper is based, especially Mr. Chris Okumtey-Oklas (now Nana Nkpanibakey II). An earlier, different version of this paper, appeared as Casali (1993). Earlier versions were also presented at the UCLA phonology seminar during the Winter 1993 quarter and at the 24th Annual Conference on African Linguistics at Ohio State University on July 23, 1993; I am grateful for the comments I received on both occasions. I would also like to thank the following persons for their helpful comments and suggestions: Mike Cahill, Bruce Hayes, Pat Keating, Michael Kenstowicz, Robert Kirchner, David Odden, Jaye Padgett, Aaron Shryock, Dan Silverman, Keith Snider, and an anonymous *NLLT* reviewer. Special thanks are due to Donca Steriade for a great many valuable suggestions. Any shortcomings which remain are my own responsibility.

¹ More specifically, Nawuri belongs to the Guang subfamily of Tano (Stewart, 1989). Previous work on Nawuri includes Sherwood (1982); Casali (1988, 1990); and Snider (1989, 1990).

this prediction is not universally correct. The evidence concerns a process of lexical roundness harmony in which a high vowel becomes round before a round vowel in a following syllable. Of crucial interest is the fact that the process may be blocked, though not triggered, by the presence of an intervening plain labial consonant.

2. LANGUAGE BACKGROUND

The consonant system of Nawuri is given in (1) (segments in parentheses are extremely rare).

(1)	labial	alveolar	palatal	velar	labiovelar
	p p ^w	t	č (č ^w)	k k ^w	kp
	b b ^w	d	j	g	gb
	f f ^w	s s ^w		(h)	
	m (m ^w)	n	ɲ	ŋ	ŋm
		l			
		r			
			y	w	

The vowel system, a nine-vowel system of the type found in many other Kwa languages, is given in (2):

(2)	i	u
	ɪ	ɔ
	e	o
	ɛ	ɔ̄
	a	

The language has a full system of ATR-based vowel harmony in which the non-low vowels are divided into two harmony sets: the [+ATR] vowels /i, u, e, o/ and the [-ATR] vowels /ɪ, ɔ, ɛ, ɔ̄/. In morphemes containing only non-low vowels, all the vowels will be drawn from a single set. Non-low affix vowels harmonize in their value of [ATR] with the nearest root vowel.

Underlying short front vowels become centralized interconsonantly. This is illustrated in (3),² where [ɪ̄, ɛ̄, ɔ̄, ʌ̄] are centralized allophones of /i, ɪ, e, ɛ/ respectively. Note that the process takes place in open as well as closed syllables. (Certain irrelevant phonetic details are ignored.)

² The Nawuri examples are from my own field notes.

- (3) /leɪ
/o-li
/tek
/ɔ-k
/gɪ-t̄
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(3)	/ləmbiri/	[lɔmbiri]	'black'
	/o-liŋ/	[olɪŋ]	'root'
	/tekperi/	[tɔkperi]	(type of grass)
	/ɔ-kuŋ/	[ɔkɪŋ]	'fish'
	/gɪ-ba:/	[gɪba:]	'hand'
	/t͡ʃe-mɪnɛ:/	[t͡ʃɛmɪnɛ:]	'friend'

Long vowels never centralize i.e., we have [bɪ:la] 'learn' and not *[bɛ:la]. Postlexically, word-final vowels are also subject to centralization between consonants, e.g., /natɪba/ 'walk and come' is realized as [natɛba]. Within single words at least, centralization is obligatory, even in very deliberate speech. I propose that centralization in Nawuri involves the delinking of [-back] from short front vowels interconsonantly.

3. LABIAL SPREADING

As stated above, affix vowels in Nawuri harmonize in their value of [ATR]. In addition, there is one affix which generally harmonizes in roundness with the nearest stem vowel. The harmonizing behavior of this morpheme, a singular noun class prefix /gɪ/ (where I represents a high vowel whose roundness and [ATR] value are determined by the following stem vowel), is illustrated in (4).

- (4)a. Before [-ATR, -round] stem vowel:
 [gɪ-ba:] 'hand'
 [gɪ-sɪbɪta] 'sandal'
- b. Before [-ATR, +round] stem vowel:
 [gɔ-sɔ] 'ear'
 [gɔ-lɔ] 'illness'
- c. Before [+ATR, -round] stem vowel:
 [gɪ-nɪ] 'tooth'
 [gɪ-ke:li:] 'kapok tree'
- d. Before [+ATR, +round] stem vowel:
 [gu-jo] 'yam'
 [gu-ku:] 'digging'

Rounding also occurs when the stem begins with /w/, regardless of whether or not the following vowel is round:

- (5)a. [g ω -wa:] 'doing'
 b. [g ω -w ϵ :] 'sympathy'
 c. [g ω -w ω \mathring{o}:] 'hat'

Rounding of this prefix vowel before a round vowel in the following syllable (as well as before stem-initial /w/) is obligatory even in careful speech, with one exception. When the prefix vowel is immediately followed by a stem-initial labial (or labiovelar) consonant other than /w/, as in the examples in (6), it will tend to be pronounced with little if any rounding in careful speech, although it may be at least somewhat rounded in more casual speech.

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|-----|-------------------|---|--|
| (6) | (more likely) | | (more likely) |
| | in casual speech: | ~ | in careful speech: |
| | [gu-mu] | ~ | [g $\dot{\text{i}}$ -mu] 'heat' |
| | [gu-fufuli] | ~ | [g $\dot{\text{i}}$ -fufuli] 'white' |
| | [gu-pula] | ~ | [g $\dot{\text{i}}$ -pula] 'burial' |
| | [gu-bo:to:] | ~ | [g $\dot{\text{i}}$ -bo:to:] 'leprosy' |
| | [gu-kpo:] | ~ | [g $\dot{\text{i}}$ -kpo:] (type of dance) |

Although the prefix vowels in the left-hand column have been symbolized here as [u] or [ω], my impression is that they usually have only an intermediate degree of rounding, i.e., they are generally phonetically distinct from the fully round prefix vowels in (4b), (4d), and (5).

Instrumental measurements support the claim that the rounding which occurs before labial consonants is gradient. Using a tape-recorded word-list made in 1988 by an adult male native speaker from Kitare, I measured the second formant frequency of the /gI/ prefix vowel in three different contexts: before a stem-initial labial consonant plus non-round vowel sequence, before a labial consonant plus round vowel sequence, and before a non-labial consonant plus round vowel sequence.³ The results of these measurements are presented in (7). The values in (7a) were obtained for the 12 words in the list in which the /gI/ prefix occurs before a stem-initial labial consonant immediately followed by one of the non-round [-ATR] vowels /u/ or / ϵ /. The values in (7b) are for the 11 words in which /gI/ precedes a stem-initial labial consonant followed by a round [-ATR] vowel, while the values in (7c) are for 15 of the 16 words in which /gI/

³ Each word on the tape is repeated three times; all measurements were made on the first token of each word. The rate of speech is somewhat fast but not unnatural. The formant frequencies were measured using a Kay 5500 digital spectrograph. In order to minimize the influence of the following (i.e., stem-initial) consonant, the spectrum was computed over the first half of the vowel as determined by visual inspection of the wide-band spectrogram.

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- (i) /a- fi
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precedes a stem-initial velar or alveolar consonant immediately followed by a round [-ATR] vowel (one word, for which a clear measurement could not be obtained, was excluded).

(7)		Mean F ₂ :	Std Deviation:
a.	— C _{lab} V _{non-rnd}	1377	130
b.	— C _{lab} V _{rnd}	1040	91
c.	— C _{non-lab} V _{rnd}	845	92

Here we see that the average F₂ value of the prefix vowel before stems beginning in C_{lab} V_{rnd} is intermediate between the higher value obtained before C_{lab} V_{non-rnd} and the lower value before C_{non-lab} V_{rnd}. Two-tailed t-tests show the C_{lab} V_{rnd} group to be statistically differentiable from each of the other groups at the $p < 0.0001$ level. Given that the major acoustic correlate of lip rounding is a lowered F₂, this strongly confirms my auditory impression that rounding before labial consonants often yields only an intermediate degree of rounding. This, together with the fact that rounding before labial (but not non-labial) consonants is highly dependent on rate of speech, argues that this rounding is due to a different process from the one which produces the fully rounded vowels that result before non-labial consonants (as in the examples in (4b,d)) or /w/ (as in (5)). In view of this, I conclude that the rule responsible for the obligatory rounding in the examples in (4b,d) is blocked by a stem-initial labial consonant and that the optional, gradient rounding that occurs before labial consonants, as in (6), is due to an additional, postlexical (or perhaps even phonetic) process.⁴

I state the rule responsible for the (obligatory) rounding of the /gl/ prefix vowel parametrically (cf. Archangeli and Pulleyblank, 1986) as in (8). (I set aside here the issue of how the blocking effect of labial consonants is achieved.)

⁴ Evidence of such an additional postlexical process is clearly manifested elsewhere in the language. Word-final high front vowels may optionally become somewhat rounded before a round vowel in the first syllable of the following word, as in the examples below.

(i)	/a-fitiri lo:sa/	'grass for entering'	----->	[aʔit̪ru lo:sa]
(ii)	/ku:ri mɔ:sa/	'a pig for killing'	----->	[ku:ru mɔ:sa]
(iii)	/na:t̪ g@sə/	'cow's ear'	----->	[na:t̪g@sə]

Example (iii) shows that the rounding of the prefix vowel may feed this postlexical process, as would be expected if the former is due to a lexical rule. Although I have transcribed the final vowels of the leftmost words as [u] or [ɔ], here again my impression is that they generally bear only an intermediate degree of rounding.

- (8) *Labial Spread* (lexical):
- | | |
|----------------------|----------------------------|
| Focus: | [labial] |
| Action: | spread |
| Direction: | R to L |
| Target: | [+high] vowel |
| Source: | [-consonantal] |
| Adjacency Condition: | between adjacent syllables |

It is not necessary to specifically restrict Labial Spread to the morpheme /gI/. In the first place, the fact that no other prefixes display actual roundness alternations must be attributed to the simple fact that there are no other prefixes that happen to meet the structural description of the rule. Second, all root-internal sequences conform to the pattern predicted by Labial Spread, in that a high non-round vowel never precedes a round vowel in the following syllable unless the two vowels are separated by a labial consonant (other than /w/). Thus for example while root-internal [+pɔ] sequences are attested, as in [ga-bɔ-ɪpɔ] 'sheep', sequences like *[+tɔ] or *[+kɔ] are not. (Root-internal sequences in which a round high vowel precedes a non-labial consonant followed by a round vowel, on the other hand, are not at all uncommon.) Third, there are no suffixes of the form $C_{\text{non-lab}} V_{\text{rnd}}$ which might conceivably trigger the rounding of a preceding root-final high vowel.⁵ Finally, although I have only a few relevant examples in my data, it appears that loanwords also conform to Labial Spread, e.g., we have [sɪta:tɪ] 'start', [sɪpi:di] 'speed', but [suku] 'school' and [sɔtɔ:] 'store'. (Unfortunately, I have no examples of loans based on English words beginning with [sC_{lab} V_{rnd}], although my prediction is that the epenthetic vowel breaking up the [sp] cluster would be non-round.)

It should be noted, moreover, that /gI/ is an extremely common morpheme, which, in addition to attaching to noun roots, may be productively prefixed to virtually any verb root to form a deverbal noun, as in the examples below:

- (9)
- | | | | | |
|----------|------------|--------|----------|---------------|
| gI + di: | 'to climb' | -----> | [gɪ-di:] | 'climbing' |
| gI + suŋ | 'to work' | -----> | [gu-suŋ] | 'work' (noun) |
| gI + wa: | 'to do' | -----> | [gɔ-wa:] | 'doing' |

Hence there are a great many words in the language which exhibit the

⁵ The only suffix with a round vowel is an agentive suffix [pu]/[pɔ]. Here we would expect the labial consonant /p/ to block the rounding of a preceding high non-round vowel. This is indeed the case, e.g., we have [o-tiri-pu] 'pauper', where the root final vowel [ɪ] exhibits at most an intermediate degree of rounding (in fast speech).

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alternations predicted by Labial Spread. This means that the child learning Nawuri is confronted by a considerable body of positive evidence on which to base such a rule.

At first glance, there seems to be a clear exception to the claim that there are no prefixes other than /gI/ which happen to meet the structural description of Labial Spread. This involves word-initial prefixes of the form /i/ or /u/ (of which there are several in the language, e.g., a plural noun class prefix). These prefixes systematically fail to undergo Labial Spread, e.g., we have [ɫ-kɔ] 'wars' and never *[ɔ-kɔ]. The failure of these prefix vowels to undergo Labial Spread has a straightforward explanation, however, if we assume that Labial Spread cannot apply to vowels which are [-back], due to a general prohibition against front rounded vowels in the language. Its application will thus be limited to non-round vowels which have first lost their [-back] specification through Centralization. The fact that the /i/ ~ /u/ prefixes occur word-initially (and thus not between consonants) will exempt them from the lexical application of Centralization,⁶ and they will therefore be unable to undergo Labial Spread (which, it will be recalled, is a lexical rule). The vowel of /gI/, on the other hand, *will* undergo Centralization lexically, since it occurs between consonants.

To sum up the discussion so far, Nawuri has an obligatory lexical rule of Labial Spread which causes a high non-round vowel to become round before a round vowel in the following syllable. This rule is blocked when a plain labial consonant (other than /w/) intervenes between the trigger and the target. The degree of rounding which does occur preceding labial consonants in faster speech is due to a postlexical, presumably phonetic process.

4. BEHAVIOR OF LABIALIZED (ROUNDED) CONSONANTS

Among the segments in the Nawuri consonant inventory given in (1) are seven labialized (rounded) consonants, /k^w, č^w, s^w, p^w, b^w, f^w, m^w/, which contrast with their non-labialized counterparts before non-round vowels.⁷

⁶ For reasons that are not clear, word-initial vowels fail to undergo Centralization postlexically as well. (Recall that *word-final* vowels do undergo Centralization postlexically, when followed by a word-initial consonant.) This fact is not relevant to the issue at hand, however, since whether or not word-initial vowels undergo Centralization postlexically can have no effect on the lexical application or non-application of Labial Spread.

⁷ Before *round* vowels, consonants bear significant lip-rounding. On the basis of spectrographic evidence, I proposed (Casali 1990) that consonants undergo a rule that spreads [+round] from a following round vowel.

Since these consonants are presumably [+round], it is natural to expect that they should pattern with /w/ in triggering the rounding of a preceding high vowel. Snider (1988) in fact explicitly states that rounding of the vowel in the /gI/ prefix (or its cognates) in Guang languages occurs before both /w/ and /C^w/. While the relatively small number of relevant examples in my data makes it difficult to draw a firm conclusion, I believe that the precise facts are actually somewhat more complex, however. Specifically, it seems that whereas rounding of a high vowel is obligatory before /w/ and the "non-labial" /C^w/s (/k^w, ɕ^w, s^w/), it is optional and gradient before the "labial" /C^w/s (/p^w, b^w, f^w, m^w/). If this is so, then this latter rounding must be attributed not to the lexical rule of Labial Spread but to the postlexical process responsible for the rounding of a high vowel before a plain labial consonant followed by a round vowel, as in (6).

Evidence that labial /C^w/s do not trigger Labial Spread onto a preceding vowel comes from several sources. First, consider the examples in (10), which contains an exhaustive list of the words in my data in which a high vowel immediately precedes a /C^w/ in the following syllable within the same morpheme:

- (10) *Examples with non-labial /C^w/s:*
- [ga-sɔs^wa:] 'nest'
 - [gɔ-sɔns^wɛ:] 'worm'
 - [sɔs^wa:] 'to grease'
 - [kɔk^wɪ] 'to be sufficient'
 - [kɔk^wɪ:] 'different'
- Examples with labial /C^w/s:*
- [pɔp^wɛ:] 'new'
 - [la:tɛp^wɛ:] 'afternoon'

All five of the examples (10a-e) with non-labial /C^w/s are pronounced with a fully round [ɔ] preceding the /C^w/. In one of the two examples with labial /C^w/s, (10g), on the other hand, the preceding high vowel is typically pronounced with little if any discernible rounding. (I assume that the vowel preceding [p^w] in (10f) is round underlyingly; thus this example does not involve Labial Spread at all.) Indeed the phonetic difference between the high vowels preceding [p^w] in (10f) and (10g) (both of which are very common words) is unmistakable. Thus it would appear that labial /C^w/s do not trigger Labial Spread.

A second piece of evidence comes from nouns in which a stem-initial labialized consonant is preceded by the /gI/ prefix. The tape-recorded

wordlist referred three times, in w

- (11) /gI-p^wɛ
/gI-b^wɛ
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In listening to the me that the prefix none of the tokens clearly round pre prefix vowel defini reasonably consis are given below:

- (12) Word
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/gI-b^wɛ
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⁸ Also of some interest six words in which the a non-round vowel. In cases, the prefix vowel labial. In each of the the quantity of data in /C^w/s fail to trigger Labial Spread is identical in every which can be drawn and Chumburung is in /C^w/.

wordlist referred to in Section 3 contains four such words, each repeated three times, in which /gI/ precedes a stem-initial labial /C^w/:

- (11) /gI-p^wε:/ 'guilt'
 /gI-b^wa:ru:/ 'water yam'
 /gI-b^wɛ:ba:/ 'guinea corn'
 /gI-f^wɛ/ 'bodily gas'

In listening to these words as they occur on the tape, it does not seem to me that the prefix vowels are consistently round in all cases. In particular, none of the tokens of 'guilt' and 'guinea corn' impresses me as having a clearly round prefix vowel, and in at least one token of each word the prefix vowel definitely seems closer to [ɛ] than [ɔ]. This impression is reasonably consistent with measurements I made for these vowels, which are given below:

(12) Word	1st token	2nd token	3rd token
/gI-p ^w ε:/	1080 hz	1160 hz	1000 hz
/gI-b ^w a:ru:/	760 hz	760 hz	880 hz
/gI-b ^w ɛ:ba:/	800 hz	1080 hz	1240 hz
/gI-f ^w ɛ/	720 hz	880 hz	920 hz

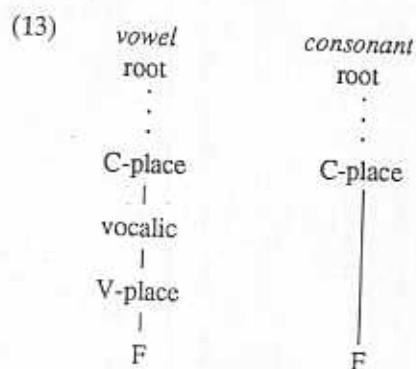
A final source of evidence bearing on the issue comes from Snider's (1989) word-list of about 800 words from five closely-related Guang languages: Nawuri, Chumburung, Krachi, Gichode, and Gonja. His Nawuri data contains a single example with a stem-initial /C^w/ following the /gI/ prefix. The example is a phrase meaning 'proclaim guilty' (literally 'eat guilt'); Snider's phonetic transcription, [ji gɪp^wε:ʔ], has a non-round prefix vowel preceding the labialized [p^w].⁸

⁸ Also of some interest in this connection is Snider's Chumburung data. He has a total of six words in which the cognate of the Nawuri prefix /gI/ precedes a stem-initial /C^w/ before a non-round vowel. In three of these words, the stem-initial /C^w/ is a non-labial; in all three cases, the prefix vowel is round. In the remaining three words, the stem-initial /C^w/ is a labial. In each of these words, the prefix vowel has been transcribed as non-round. While the quantity of data is not overwhelming, these examples point to the conclusion that labial /C^w/s fail to trigger Labial Spread in Chumburung. Given that the behavior of the process is identical in every discernible respect in the two languages, the most natural conclusion which can be drawn from the limited available facts is that Labial Spread in both Nawuri and Chumburung is initiated by a round vowel, /w/, or a non-labial /C^w/, but not by a labial /C^w/.

5. LABIAL SPREAD AND CURRENT FEATURE GEOMETRIES

Several recent feature geometries posit a fundamental segregation between consonantal and vocalic place features, assigning them to different structural positions in the segment. Among these theories are those of Clements (1991); Odden (1991); Hume (1992); and Clements and Hume (1992).⁹ Since the differences among these theories do not significantly affect the issue at hand, I henceforth discuss only the model of Clements and Hume (which has to a large degree superseded the other models in any case).

Clements and Hume propose a model in which consonantal and vocalic place features are linked to different structural nodes, as in the partial representations in (13) (ignoring nodes not directly relevant to our purposes):



The place features (F) in Clements and Hume's model are drawn from a unified set which characterizes both consonants and vowels. Thus, for example, labiality in consonants and roundness in vowels are both represented by the same feature [labial]. A further aspect of their model is that the vocalic and consonantal instances of a given place feature are considered to reside on the same tier, even though they are dominated by different structural nodes (C-place in consonants and V-place in vowels).

This model allows for cases in which an intervening consonant bearing a secondary specification for a feature [F] (where "secondary" refers, in their model, to a feature specification under the V-place node) may block vowel-to-vowel assimilation, as in (14), where the leftward spreading of

⁹ Two other important theories that have been proposed recently are Ni Chiosáin and Padgett (1993) and Selkirk (1993). I will not treat these models (both of which depart in some significant respects from the theories referred to in the text) here, but will simply note that I can see no obvious way to accommodate the Nawuri facts within either of these approaches.

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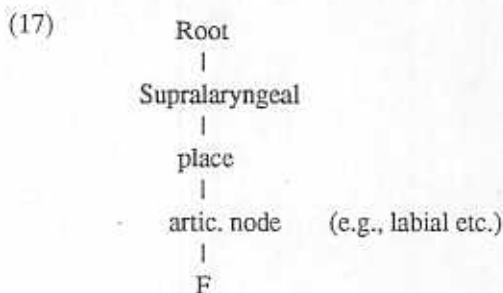
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- (16) *No-Crossing Constraint* (Clements and Hume, 1992, p. 30):
Association lines linking elements on the same tiers may not cross.

As empirical evidence in favor of allowing configurations like (15), Clements and Hume cite a Turkish harmony process in which a high suffix vowel becomes round (i.e., [labial], in their system) following a round stem vowel, even when a plain labial consonant intervenes. The impossibility within their model of a plain labial consonant blocking vowel-to-vowel labial assimilation is not the result of an oversight on their part; rather it stems from a deliberate and indeed well-justified response to the problem of accounting for the overwhelming cross-linguistic tendency for plain consonants to be transparent to vowel-to-vowel place feature assimilation. Unfortunately, the Nawuri data show that the prediction that plain consonants should always be transparent to such assimilation is simply too strong.¹⁰

In contrast to the more recent geometries just considered, the earlier model of Sagey (1986) proposed a feature geometry with a single place node that occupies the same position in both consonants and vowels. Located under this place node are nodes corresponding to the various articulators, e.g., [labial] and [coronal]. The articulator nodes in turn dominate terminal place features such as [anterior] and [round]. The basic structure of the model is shown in (17).



¹⁰ An alternative means (pointed out to me by David Odden) of accounting for the opacity of labial consonants within a model like Clements and Hume's would be to assume that Labial Spread *does* in fact apply across these consonants but that its effects are undone by a later dissimilation rule which causes a high round vowel to unround before a labial consonant. This approach is rendered untenable by the fact that surface [u]/[ɔ] plus labial consonant sequences (in which the high round vowel is fully rounded even in careful speech) are well-attested both intramorphemically (cf. [ga-dufa:] 'tail', [gu-kufe:] 'sheath', [dɔkuba] 'type of yam') and across morpheme boundaries (cf. [a-ku:-pu] 'relatives', [kuru-kuru-pa:] 'type of yam', [ga-yu-bi:] 'small stick').

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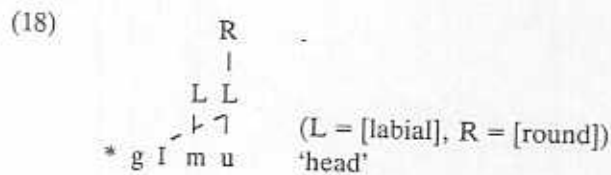
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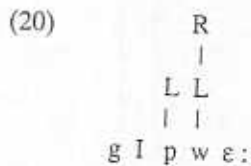
This model clearly predicts that the vowel-to-vowel spreading of an articulator node should be blocked by an intervening consonant specified for the same articulator node since such spreading would lead to crossed association lines. Thus, under the assumption that Labial Spread in Nawuri involves the spreading of the [labial] node, rather than just the terminal feature [round], the blocking effect of labial consonants is predicted automatically. This is illustrated in (18), where the labial node of the round vowel in the stem /mu/ 'head' is unable to spread leftward beyond the stem-initial labial consonant without yielding crossed association lines (irrelevant intervening nodes are omitted):



Where the stem-initial consonant is non-labial, on the other hand, no crossing of association lines results, and spreading is free to apply:



The failure of the labial /C^w/s/p^w, b^w, f^w, m^w/ to trigger Labial Spread could also be readily accommodated under a Sageyan approach, provided that these consonants are reanalyzed as bisegmental /C^w/ sequences. This may be illustrated in the case of a word like [gɪp^wε:] 'guilt', which would have the representation in (20):



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This representation clearly predicts that Labial Spread should not be able to apply to this form since spreading of the [labial] node of /w/ onto the prefix vowel would be blocked by the intervening labial node of /p/.

On the other hand, it is well known that Sagey's model makes wrong predictions about other phenomena, for example the fact that plain consonants in most languages are transparent to vowel harmony processes. We are thus led to a dilemma; while the opacity of labial consonants to rounding harmony in Nawuri seems to favor the geometry of Sagey's model, other phenomena seem to warrant the planar segregation that exists within the more recent geometries. At present, I see no way of resolving this dilemma in terms of a formal geometric solution that derives opacity effects by means of the ban on line crossing. One thing at least is clear, however: any adequate theory of feature geometry must allow not only for the common transparency of plain consonants to vowel-to-vowel feature spreading but also for cases like Nawuri in which plain consonants behave opaquely. The claim that plain consonants are universally transparent to vowel-to-vowel feature spreading is simply too strong.

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