

TONE POLARITY IN KŌNNI NOUNS

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Since Kenstowicz *et al*'s analysis of Mooré (1988), a widespread view is that tone polarity does not exist; apparent polarity is actually dissimilation. This paper shows that an OCP-based dissimilation analysis cannot account for the full range of Kŏnni data, and presents a morpheme-specific **POLAR** constraint referring to the Noun Class 1 plural suffix. **POLAR** is satisfied in two or possibly three ways: the polar tone may be inserted, be already present in the input, or possibly spread from the definite suffix. The polar tone is not always on the word's edge, and for some words may even be floating. The analysis here thus supports the assertion of Newman (1995) that tone polarity is a natural pattern of language.

1. Introduction to Kŏnni Tone

Tone polarity is a pattern in which a tone-bearing unit, generally in an affix, shows a tonal value opposite to that immediately adjacent to it. Since the analysis of Mooré and Lama by Kenstowicz, Nikiema & Ourso (1988), it has been often assumed that tone polarity is an epiphenomenon due to dissimilation of a particular underlying tone, usually High. In this paper, I show the tone polarity of the Noun Class 1 suffix in Kŏnni cannot be analyzed as this type of dissimilation.

The remainder of this section will lay out general observations about tonal patterns in Kŏnni, including the reasons for choosing the representations used in the paper. Section 2 reviews previous analyses of polar tone in related languages, particularly the influential Kenstowicz, Nikiema, and Ourso paper. Section 3 presents the analysis of Kŏnni polarity in terms of Optimality Theory, first reviewing general tonal constraints used in Kŏnni, then analyzing in some detail the polar-toned plural suffix of Noun Class 1, and examining alternative hypotheses. Finally, Section 4 offers some concluding remarks.

1.1 Basic facts of Kɔnni. Kɔnni is a Gur language, Central Oti-Volta branch, spoken in the Northern Region of Ghana by about 2500 people. Transcriptions of segmental material in this paper are phonemic. Long vowels are transcribed as sequences of two identical vowels.

Consonantal and vocalic phonemic inventories are given below. There is also a length contrast in vowels, and ATR harmony within words. Long mid vowels diphthongize, thus the vowel “sequences” [ie, ia, uo, ua] are surface manifestations of /ee, ee, oo, oo/, contained in a single syllable.

(1) *Kɔnni consonants*

	<i>labial</i>	<i>alveolar</i>	<i>palatal</i>	<i>velar</i>	<i>labial- velar</i>	<i>glottal</i>
stops	p, b	t, d		k, g	kp, gb	
affricates			tʃ, dʒ			
fricatives	f, v	s, z				h
liquids		l, r				
nasals	m	n	ɲ	ŋ	ŋm	
glides			j		w	

(2) *Kɔnni vowels*

	+ATR		-ATR	
high	i	u	ɪ	ʊ
mid	e	o	ɛ	ɔ
low			a	

Kɔnni’s level tones are transcribed as High (á), Low (à), and downstepped High (’á). These can be combined to form one rising tone (Low to High) and two falling tones (High to Low, and High to downstepped High). The H¹H contour on a single TBU reported here is rare in the literature.¹ These are illustrated in the forms below, with syllables illustrating the tone type bolded. The gaps with the

¹ I am only aware of three published cases. Essien (1990:55) briefly notes for Ibibio a “type of falling tone consist[ing] of a sequence of high and downstepped tones rather than high and low tones”. Casali (1995, fn. 22) mentions the verb ‘walk’ is [ná’á] in the incomplete for Nawuri. Finally, Bakweri (Hawkinson 1986, Kagaya 1992) is reported to have such. (Thanks to David Odden for pointing out the latter references.) It remains to be seen how many other languages of West Africa have this feature. What seems unusual at present may turn out to be merely underreported.

CV pattern are systemic; the falling (HL) tone is the only contour that appears on CV syllables. For more details on contour tones and their relation to TBU duration, see Zhang (2001).

(3)	CV	CVV	CVN	CVVN
L	kà 'it'	dàà gbúgíŋ 'stump'	dà m-pàlí 'dog'	dù ùmbú 'the horse'
H	ká 'not'	zú útjásíŋ 'comb'	wí ŋ 'face mark'	kpá áŋ 'oil'
LH	—	bù á 'child'	tǎ ŋ 'stone'	kpà áŋ 'back of head'
H ¹ H	—	ù tá 'á 'his sister'	kó 'ŋ 'fallow area'	kpá 'áŋ 'guinea fowl'
HL	kú úbâ 'bowl'	lí à 'daughter'	á gbîŋ 'to tie'	tʃí àŋ 'chair'

The following generalisations may be made about the Kɔnni tone system:

- (4) a. The syllable is the tone-bearing unit. (The most common syllable types are CV, CVV, CVN, CVVN; V occurs only in various particles.) Evidence for this, besides the distributions in (3) which are described in terms of syllables, is that, in spreading and other processes, the tone of the whole syllable is affected, not just the tone of a mora. Other Gur languages have also been analyzed with the syllable as TBU (Kenstowicz, Nikiema & Ourso 1988, Antilla & Bodomo 1996, Crouch 1985, and Hyman 1993).
- b. There is no HLH sequence phonetically within a word. When one would be created by concatenation of morphemes, the second H spreads, resulting in H!HH surface pattern, as seen in Sec. 1.3.
- c. Contour tones are only found on the final syllable of a word, as seen in (3).

- d. A contour in Kɔnni has a maximum of two pitch levels: HL, LH, or H¹H.
- e. Underlying High tones do not remain floating, but Low tones can float between Highs, causing downstep. This will be seen in several places in the course of the paper.

1.2 High-toned nominal suffixes. The table below contains examples from all noun classes. These classes are defined by the forms of the definite articles and plurals they take. The most obvious generalization to be noted is that an overwhelming majority of nouns, whether singulars or plurals, definite or indefinite, end with a High tone, whether this is a downstepped High or non-downstepped High (the exceptions are some plurals in Classes 1 and 3, and a very few singulars in Class 3).²

(5)	<i>Class</i>	<i>Singular</i>	<i>Sg. Def.</i>	<i>Plural</i>	<i>Pl.+ Def.</i>	
	NC1	bìis-íŋ	bìis-ìrí	bìis-á	bìis-á-há	‘breast’
	NC2	gbàá-ŋ	gbàà-kú	gbàà-tí	gbàà-tí-tí	‘courtyard’
	NC3	nánjú-ŋ	nánjú-ká	nánjú-sí	nánjú-sí-sí	‘fly’
	NC4	nǎ-ŋ	nòm-bú	nòn-tí	nòn-tí-tí	‘meat’
	NC5	tʃùá	tʃùà-wá	tʃùà-líŋ	tʃùà-lì-bá	‘father’

I conclude, then, that nominal suffixes (except for the plural /-A/ in NC1) are lexically High-toned. These include the singular indefinite suffix /-ŋ/, the singular definite suffixes /-rI/, /-kU/, /-kA/, /-bU/, /-wA/, the plural suffixes /-hA/, /-tI/, /-sI/, /-lIŋ/, and the plural definite suffixes /-tI/, /-sI/, /-bA/. (Capital letters indicate the morpheme is not lexically specified for ATR value, and the [ɪ] appearing in the singular suffixes of NC1 is epenthetic.) More evidence supporting the notion that the singular suffix [-ŋ] has a High tone in underlying representation can be seen from the fact that several singular nouns without [-ŋ], such as [líà] ‘daughter’ from NC5, end in a Low tone, while every noun ending in [-ŋ] also ends in a High tone. The plural suffixes of NC1, which manifest a tone opposite to the previous stem tone, will be examined below, but all other inflectional noun suffixes have a High tone.

² No attempt has been made to relate the Kɔnni noun classes to the larger picture of Niger-Congo; the numbering of these classes here is arbitrary.

1.3 Downstep as floating Low tone. In some languages, downstep can be shown to be the result of the adjoining of two High tones, that is, two morphemes that are independently known to have High tones, when abutted, are phonetically H¹H, for example KiShambaa (Odden 1982), Supyire (Carlson 1983), and Namwanga (Bickmore 2000). In many other languages, however, a downstep can be traced to a floating Low tone between two associated High tones. Kɔnni is of the latter type. Consider the forms below.

- (6) a. pón-íŋ, pón-ké 'tree; the tree (sp.)'
 b. zàsíŋ, ù zá'síŋ 'fish; his/her fish'

As pointed out in the previous section, the [-ŋ] singular suffix has a High tone. In the forms [pón-ké] 'the tree (sp.)' the stem [pón-] sponsors a High tone, with the Highs of the second syllables coming from the suffixes [-ŋ] (with an epenthetic *i*) and [-ké]. (Cf. [bùnínŋ], [bùŋká] 'donkey' for a Low on the stem.) Thus both the stem [pón-] and the suffixes [-ŋ] and [-ké] have High tones. Their concatenation brings these two Highs together. If downstep in Kɔnni were the result of bringing two Highs together, we would expect H¹H patterns: *[pón¹-íŋ], *[pón¹-ké]. However, the attested forms are [pón-íŋ], [pón-ké], with level High tones. A H¹H pattern is indeed possible on a disyllabic noun, as shown by forms such as [gá'nínŋ], [gán¹ká] 'drum rope', where the downstep arises from a Low that is part of the noun stem. Thus downstep is not the result of concatenation of High tones.

More positively, the presence of downstep in [ù zá'síŋ] in (6b) implies the existence of a floating Low. Third person possessives are marked by a floating High tone that associates to the head noun on the right. Thus all head nouns in this construction begin with a High tone. The isolation form [zàsíŋ] has a LH sequence. When the associative High is added, the result is a H¹H pattern on the word. A H-H concatenation produces no downstep, but a Low tone between the Highs does produce it:

- (7) a. $\begin{array}{cc} \text{L} & \text{H} \\ | & | \\ \text{z} & \text{a} & \text{s} & \text{i} & \text{ŋ} \\ \text{fish} \end{array}$ b. $\begin{array}{ccc} \text{L} & \text{H} & \text{L} & \text{H} \\ | & & | & | \\ \text{u} & & \text{z} & \text{a} & \text{s} & \text{i} & \text{ŋ} \\ \text{3s ASSOC} & & \text{fish} \end{array} \rightarrow \begin{array}{ccc} \text{L} & \text{H} & \text{L} & \text{H} \\ | & & \diagdown & / \\ \text{u} & & \text{z} & \text{a} & \text{s} & \text{i} & \text{ŋ} \end{array}$

This is also seen in the case of the downstep created by the addition of a definite article to a noun ending with a Low tone. Many plurals in Noun Class 1

end in Low tones, and when the High-toned plural definite suffix [-há] is added, the result is a downstepped High on the last syllable. The representations for ‘chest; the chest’ is given below. The Low that is present and associated in ‘chest’ is still present but floating in ‘the chest,’ the result of a constraint against a HLH sequence discussed in Sec. 3.3.

- (8) a. júrá ‘chest’ b. $\text{jú}^1\text{rá-há}$ ‘the chest’
- | | |
|---|--|
| $\begin{array}{cc} \text{H} & \text{L} \\ & \\ \text{jú} & \text{ra} \end{array}$ | $\begin{array}{ccc} \text{H} & \text{L} & \text{H} \\ & / \ \backslash & \\ \text{jú} & \text{ra} & \text{há} \end{array}$ |
|---|--|

With this background, we see that a word like [kpá'áŋ] ‘guinea fowl’ has an underlying HLH tone pattern, with a floating Low causing downstep. The noun stem has HL tone, and the final H is contributed by the suffix [-ŋ]. Note that this word consists of one syllable, with two High tones associated to it.

- (9)
- | | | |
|--|---|--|
| $\begin{array}{cc} \text{H} & \text{L} & \text{H} \\ & & \\ \text{kpaa} & & \text{-ŋ} \end{array}$ | → | $\begin{array}{ccc} \text{H} & \text{L} & \text{H} \\ / \ \backslash & & / \ \backslash \\ \text{kp} & \text{a} & \text{a} \ \text{ŋ} \end{array}$ |
|--|---|--|

1.4 The OCP and Kɔnni. There is no phonetic difference between two distinct High tones and one High multiply associated to the two syllables. In some languages, sequences of two identical tones are not allowed, a result of the Obligatory Contour Principle (OCP). They either merge, as in $\text{HH} \rightarrow \text{H}$, or one dissimilates, as in Meeussen’s Rule where $\text{HH} \rightarrow \text{HL}$, or a phonetic downstep (possibly a floating Low) is inserted between them. However, in Kɔnni, it does not appear that the OCP is active with regards to either High or Low tones. We can see cases in which sequences of LL or HH are allowed.

For High tones, consider the forms [dʒágâ] ‘shades’ and [múgà] ‘rivers’ (singulars [dʒág-íŋ], [múg-úŋ]). Both have the tonally polar plural suffix [-a], which contains a Low tone here, since the previous tone is High. The question is how to explain the difference between the final Low tone in [múgà] and the final falling tone (HL) in [dʒágâ]. This fall is not the result of a spreading pattern, since it does not occur in the phonologically-similar [múgà]. The most straightforward solution is that [dʒágâ] has two adjacent High tones in underlying representation, and [múgà] has one:

- (10) a. $\begin{array}{c} \text{H H} \\ | \\ \text{dʒag} \end{array} \xrightarrow{-a} \begin{array}{c} \text{H H L} \\ | \quad / \\ \text{dʒ a g a} \end{array}$ b. $\begin{array}{c} \text{H} \\ | \\ \text{m u g} \end{array} \xrightarrow{-a} \begin{array}{c} \text{H L} \\ | \quad | \\ \text{m u g a} \end{array}$

An alternative is that [dʒáǵâ] has a HL input tone, with the High pre-linked to the second syllable, and a multiply-linked High in the output. However, given this input, the expected output would be the unattested *[dʒǵâ], with a default Low on the first syllable.

- (11) *Hypothetical input* $\begin{array}{c} \text{H L} \\ | \\ \text{dʒa g a} \end{array}$ *predicts output* $\begin{array}{c} \text{L H L} \\ | \quad / \\ * \text{dʒa g a} \end{array}$

Such a default Low does occur with nouns which have toneless stems and a High-toned suffix, such as [kpìbíŋ] ‘louse’ (cf. [ù kpìbíŋ] ‘his/her louse,’ where the absence of downstep indicates that a Low is not present in the input). The alternative of a multiply-linked input High is discussed below.

Neither does the OCP seem active in the domain of Low tones. The word [dàmpàlá] ‘bench’ (lit. ‘logs’) contrasted with [bùrímíŋ] ‘bush donkey’ shows the difference between words with a single multiply-linked Low and two adjacent Lows. When [dàmpàlá] and [bùrímíŋ] have a High-toned word preceding, the tonal behavior differs:

- (12) $\begin{array}{l} \text{dàmpàlá} \\ \text{bùrímíŋ} \end{array}$ $\begin{array}{l} \grave{\eta} \text{ wó dàmpàlá} \\ \grave{\eta} \text{ wó 'bùrímíŋ} \end{array}$ ‘bench; I lack bench’
‘donkey; I lack donkey’

In Kɔnni, a HLH underlying tone on a trisyllabic word is realized as surface H'HH (see discussion in Sec. 3.2). A single Low between Highs is always floating and manifested as phonetic downstep. However, if more than one Low is present between Highs, then they are pronounced as Low tones. I propose that the difference in tonal behavior between ‘bench’ and ‘donkey’ is the result of the presence of two lexical Low tones versus one:

- (13) a. $\begin{array}{c} L & L & H & & H & L & L & H^3 \\ | & | & | & & | & | & | & | \\ \text{dampala} & & \text{wo} & & \text{dampala} \end{array}$ b. $\begin{array}{c} L & H & & H & L & H \\ \wedge & | & & | & \wedge & \wedge \\ \text{burimɪŋ} & & \text{wo} & & \text{burimɪŋ} \end{array}$

Multiply-associated Low tones are unusual in nouns. While there are at least thirty words with the pattern of [dàmpàlá], I have only four examples of the [bùrímíŋ] pattern.⁴

Since a doubly-associated Low tone is posited for [bùrímíŋ] above, one might wonder about the possibility of a doubly-associated High tone to also represent [dʒágâ], as in (b) below, which would be OCP-compliant.

- (14) Possible output representations for [dʒágâ] ‘shades’
- a. $\begin{array}{c} H & H & L \\ | & / \\ \text{dʒa} & \text{ga} \end{array}$ or b. $\begin{array}{c} H & L \\ \wedge \\ \text{dʒa} & \text{ga} \end{array}$

Multiply-associated tones seem to be rare in Kɔ̀nni nouns, as noted above. Also, (14b) would be the only case in Kɔ̀nni to have a High tone demonstrably deleted, and we will see later in 3.4 that this leads to a constraint ranking paradox when the entire tone system of Kɔ̀nni is considered.

Since identical adjacent tones may exist for both High and Low tones, it is evident that the OCP cannot be an all-pervasive constraint in Kɔ̀nni. It is possible, of course, that the OCP is active in some restricted context, and alternative analyses based on this will be examined in 3.4. But since the OCP is not active in the contexts above, it is quite possible that it is never active and that we never need to invoke the OCP to explain tonal phenomena in Kɔ̀nni.

³ The alert reader might consider another possibility, that *dampala* is toneless in the first two syllables, with only a pre-linked High on the last syllable. The presence of lexical Low on this is shown by the form [ù dàm'pá] ‘his bench.’ The associative construction contributes the initial High on [dám'pá], but the downstep indicates the presence of a Low tone. Compare this to [ù kpìbɪŋ] ‘his louse’ (cf. [kpìbɪŋ] ‘louse’) in which the first syllable is truly lexically toneless, but the associative construction has no downstep.

⁴ Since /I/ is the epenthetic vowel in Kɔ̀nni, one might surmise that the [ɪ] in [bùrímíŋ] is epenthetic and the doubly-associated Low has spread from the first to the second syllable. At present I have no data to decide on this vs. a lexically doubly-associated Low, but there are no cases where Low unambiguously spreads.

2. Previous Polarity Analyses

The very term “polarity” assumes a binary contrast in tonal qualities, that is, a contrast between only High and Low tones. Indeed, to my knowledge, the only cases in which tone polarity has been discussed in the literature are two-tone systems, with the possible exception of Mono (Olson in press).⁵ Tone polarity has been reported for a number of African languages. These include Margi (Hoffman 1963, Pulleyblank 1983, 1986), Bambara (Dwyer 1976, Creissels & Grégoire 1993), Mooré and Lama (Kenstowicz, Nikiema, & Ourso 1988), Dagbani (Hyman 1993, Olawsky 1996), Hausa (Newman 1995), Dagaare (Antilla & Bodomo 2000, 2001), and Fur (Kutsch Lojenga 2002). Schuh (1978) also mentions Ngizim, Igbo, and Hausa examples of tone polarity. The only non-African case I am aware of to date is Mundurukú of Brazil, in which nouns acting as independent words as well as suffixes may be polar (Picanço 2002). Historical causes of tone polarity are discussed in Hyman & Schuh (1974).

The analysis of Mooré and Lama in Kenstowicz, Nikiema & Ourso (1988) has been most influential, leading to the interpretation of polarity as an epiphenomenon rather than a true process. In this section I briefly review this analysis, as well as the only OT analysis of a Gur language other than *Kɔ̀nni* that has been produced to date.

2.1 Mooré. Mooré, like *Kɔ̀nni*, is a Gur language. The relevant alternations from Kenstowicz, Nikiema & Ourso (1988) (henceforth KNO) for disyllabic words are given below. Each noun class has tonal patterns of HH, HL, and LH, but not LL.

(15) *Mooré tonal alternations, occurring in all noun class suffixes:*

	<i>tone</i>	<i>singular</i>	<i>plural</i>	
Noun Class A	LH	kòr-gó	kòr-dó	‘sack’
	HL	wób-gò	wób-dò	‘elephant’
	HH	bíd-gó	bí-tó	‘sorrel’
Noun Class B	LH	tì-gá	tì-sé	‘tree’
	HL	sáá-gà	sáá-sè	‘broom’
	HH	báá-gá	báá-sé	‘dog’

⁵ Though Chumbow (1982) speaks of “polarization” in the three-tone system of Ogori, it is not clear that this is in fact tone polarity rather than some other process.

Noun Class C	LH	tùb-ré	tùb-á	‘ear’
	HL	kúg-rì	kúg-à	‘stone’
	HH	wám-dé	wám-dá	‘calabash’

In a traditional generative framework, a tone polarity rule of the form $\text{ Tone } \rightarrow [-\alpha\text{HI}] / [\alpha\text{HI}]_$ was used to give a suffix the opposite tone of the prefix (Schuh 1978). However, in Mooré, this rule changing a tone to the opposite of the previous one does not account for the presence of the HH pattern. KNO proposed a different analysis: all suffixes are High-toned, and the apparent polarity can be reduced to a Meeussen’s-type dissimilation: $\text{ HH } \rightarrow \text{ HL }$. KNO’s analysis of the HH pattern is that the stem is underlyingly toneless, and the suffix has a High tone which spreads to the stem:

$$(16) \quad \begin{array}{ccc} & \text{H} & \\ & | & \\ \text{baa} & \text{-ga} & \end{array} \quad \rightarrow \quad \begin{array}{ccc} & \text{H} & \\ & / \quad \backslash & \\ \text{baa-ga} & & \end{array} \quad \text{‘dog’}$$

Thus an underlying LH pattern undergoes no change, an underlying HH pattern dissimilates to HL, and the H in an underlying $\emptyset\text{H}$ pattern spreads to give HH:

(17) Underlying and surface tone patterns:
nouns are lexically H, L, or \emptyset , and suffixes are all H

$$\text{L-H} \rightarrow \text{LH} \quad \text{H-H} \rightarrow \text{HL} \quad \emptyset\text{-H} \rightarrow \text{HH}$$

The conclusions KNO draw for Mooré, therefore, are that the so-called “polar” toned suffixes actually have underlying High tones, the “polarity effect” is a result of a High-dissimilation rule, and thus there is no tone polarity *per se*. (Hyman 1993 proposes a similar analysis for Dagbani.)

2.2 Dagaare. Antilla & Bodomo (2000, 2001, hereafter AB) give an Optimality Theory analysis of the Gur language Dagaare, which has the same tonal patterns as Mooré (LH, HL, and HH, but not LL), as seen in the data below, for which I have divided the nouns into classes to match the Mooré ones, and inserted morpheme breaks.

(18) *Tonal alternations with nominal class suffixes:*

	<i>tone</i>	<i>Singular</i>	<i>Plural</i>	
Class A	LH	̀̀n-gó	̀̀n-ní	‘rat’
	HL	kóg-ò	kóg-rì	‘mahogany’
	HH	dún-gó	dún-ní	‘animal’
Class C	LH	wì-rí	wì-é	‘horse’
	HL	bí-rì	bí-è	‘seed’
	HH	ɲág-rí	ɲág-á	‘root’

Antilla and Bodomo’s (2000) analysis differs from KNO’s in a number of ways. First, contrary to KNO’s Mooré analysis, AB posit that all suffixes are toneless, not High. Furthermore, they claim that High, not Low, is the default tone in final syllables of Dagaare. Finally, in AB’s OT analysis, the OCP is active and is ranked higher than the above preferences. Thus in Dagaare, the surface patterns result from the following:

(19) LH surface: lexical Low, inserted High	LØ	→	LH
HL surface: lexical High, inserted Low	HØ	→	HL
HH surface: inserted High, which spreads	ØØ	→	HH

For both Mooré and Dagaare, some version of the OCP drives the analysis; apparent polarity can be analyzed cleanly as OCP-driven dissimilation, and tone polarity can be regarded as an epiphenomenon.⁶ However, the question of adequate scope of data arises; neither set of scholars cites trisyllabic or longer nouns, which as we will see for Kɔ̀nni, have a significant impact on the analysis. (These do exist in the languages, e.g. Dagaare [nímirì] ‘eye’, [nàmìné] ‘chief’, Mooré [léɲgèré] ‘bowl’.) In the remainder of this paper, I argue that in Kɔ̀nni there actually exists a polar suffix, concurring with Newman (1995) in his arguments for polarity as a natural and genuine pattern.

3. Analysis of Polarity in Kɔ̀nni

The analysis presented here is couched in the Correspondence Theory version of Optimality Theory (McCarthy & Prince 1995), in which various output “candi-

⁶ In a more recent manuscript, Antilla & Bodomo (2001) reanalyze Dagaare suffixes as High-toned rather than toneless. Their new analysis thus is quite similar to that of Mooré, and comes very close to being a direct translation of KNO’s schema into Optimality Theory.

dates” are generated from an input form. These output candidates are evaluated in parallel by constraints, which are ranked with respect to each other. The output candidate which violates the fewest and lowest-ranked constraints is the one which is actually pronounced. I adopt a somewhat conservative approach in proposing constraints in this work; for the most part, the constraints proposed here will either be parallel to well-established input-output constraints, such as the **MAX** and **DEP** family of Correspondence Theory, or closely tied to surface-true generalizations about Kɔ̀nni and other tone languages.

An autosegmental representation of tones is assumed in this work, as in the extensive literature arising from Goldsmith (1976). This is distinct from a theory such as Optimal Domains Theory (Cassimjee & Kisseberth 1998), which eliminates formal association lines between tones and TBU's. The distinction between floating and associated Low tones is crucial in the analysis of downstep in Kɔ̀nni. Also, a detailed representation of tonal features such as [\pm raised, \pm upper] (e.g. Pulleyblank 1986), or the representation of pitch register and pitch height on separate tiers (e.g. Yip 2002, Snider 1999) is not necessary for our purposes here. While the Kɔ̀nni analysis is translatable into such systems, these extra enrichments of representation are not illuminating in this case, and the tones will be abbreviated simply as H for High tone and L for Low tone.

3.1 Basic constraints. From the beginning of autosegmental theory (Goldsmith 1976), it was seen that the optimal configuration, or at least the starting configuration in a derivational framework, was one tonal autosegment associated to one tone-bearing unit (TBU). When there were more tones than TBU's, more TBU's than tones, or some language-specific spreading rule, this pattern was violated, but the one-to-one mapping of tones to TBU's was the general default case. Constraints against toneless TBU's, floating tones, multiply-linked tones, and contour tones all reflect this one-to-one ideal. As with many analyses in OT, constraints are split into families with separate constraints for specific features, or in this case, tones. Splitting of constraints between High and Low tones in Kɔ̀nni is crucial due to their different behaviors: High tones spread, but Low tones do not. Low tones can remain floating, but High tones do not. The following are the members of these families that will be referred to in this work.

- (20) *Basic Tone Mapping (Well-Formedness) Constraints*⁷
- a. ***TONELESS**: every TBU is linked to at least one tone.
 - b. *(**L**): every Low tone is linked to at least one TBU (no floating Low).
 - c. ***H-SPREAD**: a High tone is not linked to more than one TBU.
 - d. ***CONTOUR**: a TBU is not linked to more than one tone.

In our view of tones as autosegments, we also use the common **MAX** and **DEP** constraints, again specified for High and Low tones. The following will be referred to in this paper.

- (21) *Tone Faithfulness Constraints*
- a. **DEP (H)**: every High tone of the output has a correspondent in the input (prohibits insertion of H).
 - b. **DEP (L)**: every Low tone of the output has a correspondent in the input (prohibits insertion of L).
 - c. **MAX (H)**: every High tone in the input has a correspondent in the output (prohibits deletion of H).

3.2 The polar plural suffix of noun class 1. In this section I go beyond the basic constraints listed in the previous section, and analyze the tonal behavior of the class 1 plural suffix in Kɔnni in terms of a constraint **POLAR**, specific to that morpheme.

Recall that in Mooré, disyllabic nouns have one of the patterns LH, HL, or HH (but never LL). Kenstowicz, Nikiema, & Ourso (1988) analyze this and a related pattern in Lama as a result of all suffixes having a High lexical tone, and the stems being either High, Low, or toneless. The apparent tone polarity is analyzed as being the result of dissimilation.

We have seen that suffixes on most nouns in Kɔnni are also High-toned. It is possible that all suffixes were High-toned in proto-Gur, or at least the branch that contains Kɔnni, Dagaare, Mooré, and Lama. However, the behavior of the plurals of Noun Class 1 in Kɔnni is inconsistent with the idea that they are synchronically High-toned. These plurals are exemplified by the forms below. While the singular suffix for each is a High-toned [-ŋ], the suffix of the plural form is either [-a] or [-e], depending on ATR vowel harmony, and this suffix is not surface High-toned, but surfaces with a tone opposite to the preceding stem tone.

⁷ In the total picture of Kɔnni, *(**H**) and ***L-SPREAD** are also active. However, these are not necessary in analyzing tone polarity. For the same reason, I have not listed **MAX (L)** in (21).

(22) <i>singular</i> ⁸	<i>plural</i>	<i>stem tone</i>	<i>pl.suffix tone</i>	
tǎ-ŋ	tǎn-á	L	H	‘stone/s’
sí-ŋ	sí-à	H	L	‘fish/es (sp.)’
bììs-íŋ	bììs-a	L	H	‘breast/s’
tíg-íŋ	tíg-è	H	L	‘house/s’
zùnzú-ŋ	zùnzú-à	LH	L	‘maggot/s’

Since the assuredly High-toned suffix /-ŋ/ yields a different tonal result than the plural suffix, the Mooré analysis using underlying High tones for all suffixes and using a general **OCP(High)** schema cannot apply here. At the very least, an OCP constraint would need to be specific to the Noun Class 1 plural rather than being general. However, as discussed in 1.4, the OCP is never otherwise demonstrably needed in Kɔnni, and data and a ranking paradox that rule out **OCP(High)** are discussed in 3.4.

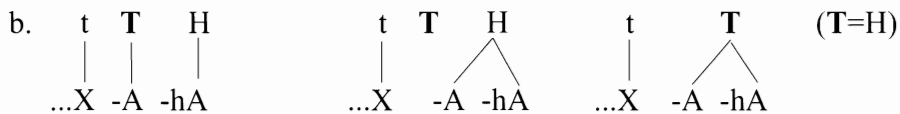
Thus this particular suffix of Kɔnni is apparently polar-toned, in contrast with Mooré, where most noun suffixes were apparently polar. In Mooré, both the “polar” nouns and those that do not exhibit polarity could be analyzed with the same rules, to give a unified account of all Mooré nouns. In Kɔnni, most nouns do not have apparent polarity; only one suffix exhibits such. Positing a lexical High tone with no other stipulations to account for these is inadequate, since this leads to the same behavior as the other suffixes, which are definitely High-toned. I propose a constraint expressing this surface polarity, formulated as follows.

- (23) **POLAR**: in a Noun Class 1 plural, the last tone of the plural is opposite in value to the immediately preceding tone.

Note that by the “last tone of the plural” I mean the tonal autosegment T of the plural form that either (a) is word-final in nondefinite forms, or (b) in definite forms, immediately precedes the tone of the definite suffix. **POLAR** thus has a specific domain, and (22a, b) below give configurations that satisfy it.

- (24) a.
$$\begin{array}{ccc} \text{t} & \text{T} & \\ | & | & \\ \dots\text{X} & \text{-A} \# & \end{array} \qquad \begin{array}{ccc} \text{t} & \text{T} & \\ | & | & \\ \dots\text{X} & \text{-A} \# & \end{array}$$

⁸ Some singular suffixes appear as /-íŋ/ rather than /-ŋ/ due to an epenthetic vowel. Also, the true noun stem of [tǎ-ŋ] is actually /tan-/, but the final /n/ elides before the suffix.



The constraint refers to a surface pattern, and so potentially has several ways to satisfy it, given a variety of inputs. As we will see below, there are in fact at least two, and possibly three, ways to satisfy this constraint: the polar tone T may be inserted, be already present in the input, or possibly spread from the definite suffix tone.

The segmental portion of the NC1 plural is *-a/-e*, which I analyze as toneless.⁹ The word [tàná] ‘stones’ has a Low-toned stem (cf. [tǎŋ] ‘stone’, [tàníní] ‘the stone’, both with High-toned suffixes). A High tone is inserted on the NC1 plural suffix.

(25)

	UR	L-∅	POLAR	DEP(H)	DEP(L)
		tan-a			
a.	☞	tana		*	
b.		tana	*!		
c.		tana	*!		*

The above tableau is given to illustrate the rankings of **POLAR** and **DEP(H)**. The winning candidate (a) must insert a High tone to avoid violating **POLAR**. The tableau for a Low-toned polar suffix as in [tíg-è] ‘houses’ is similarly straightforward, and would show that **POLAR** also outranks **DEP(L)**.¹⁰ In many nouns, however, there are additional complexities present.

⁹ Underlying toneless representations are needed in other cases of the nominal phonology as well; see fn. 3.

¹⁰ Actually, simple cases such as these two can actually be accounted for without **POLAR**. For [tàná], a High tone is inserted on the suffix as a result of an independently needed constraint **H-PRES**, which requires a High tone in a word. For [tígè], a Low tone is inserted on the suffix

Recall that [dʒágâ] ‘shades’ has a HH stem tone (see Sec.1.4). Here, a polar Low tone is inserted on the suffix, even though a normal mapping of tones to syllables would satisfy ***TONELESS**. The **MAX(H)** constraint is ranked above **POLAR** because as far as is known, **MAX(H)** is never violated, while in one case **POLAR** is, as we will see in Sec. 3.2.

(26)

UR	HH-∅	MAX(H)	POLAR	* CONTOUR	DEP (L)
	 dʒag -a				
☞	H H L a. dʒaga			*	*
	H H b. dʒaga		*!		
	H L c. dʒaga	*!			*
	H L d. dʒaga	*!		*	*

The above tableau shows the ranking of **MAX(H)** and **POLAR** over ***CONTOUR**. In [dʒágâ], the winning candidate (a) satisfies **POLAR** by inserting a Low tone, without deleting an underlying High, which would violate **MAX(H)**. Candidate (b) retains its input tones, but does not satisfy **POLAR** and is therefore ruled out. Candidate (c) satisfies **POLAR**, but incurs a fatal violation of **MAX(H)** by deleting the second underlying High tone. Candidate (d) is phonetically identical to (a) but has achieved that at the cost of deleting the input High, which we showed in Sec. 1.4 is an untenable representation.¹¹

as the normal default. However, the more complex cases considered below cannot be so treated.

¹¹ An additional candidate, *dʒágá`*, would be even more optimal, given these constraints but has the shortcoming of being phonetically equivalent to candidate (b). The **POLAR** constraint assumes a surface effect, either an associated, pronounced tone, or a floating Low that causes downstep, again having a phonetic effect.

The next case, [káǵílà] ‘crops (of bird),’ is similar in tonal output (HHL tones) to [dzǵáǵâ], but dissimilar in input: every tone present in the output is already present in the input, as we see by considering the singular form [káǵí¹líŋ]:

- (27)
- | | |
|-----|-----------|
| H | H L H |
| | |
| k a | g í l í ŋ |

In the singular form, the stem provides the HHL tones, and the [-ŋ] suffix provides the final High tone. (The *l* preceding the [-ŋ] suffix is epenthetic.) In the case of [káǵílà] ‘crop (of bird),’ **POLAR** is satisfied with no tone insertion at all; all tones are present in the input.

(28)

	UR	MAX(H)	POLAR	*CONTOUR	DEP(H)
	HH L -∅ kagil-a				
☞	HHL a. kagila				
b.	HHLH / kagila				*!
c.	HHHL / kagila			*!	*!
d.	HL L kagila	*!	*		

Above, the HHL tonal pattern sponsored by the root associates not only to that root, but also to the final syllable of the word, which includes the plural suffix. Since the final tone on the plural is opposite to that of the preceding tone, the winning candidate (a) satisfies **POLAR**, and violates no other relevant constraints. Candidate (b), in which another tone H is added, is ruled out by **DEP(H)**. Candidate (c) not only inserts a High tone, but also has a contour, which is disfavoured. Since I have no data to determine the relative ranking of ***CONTOUR** and **DEP(H)**, violations of both are marked fatal for (c). An additional candidate [káǵí¹l-ǎ] with

LH rather than HL on the final syllable would be similarly ruled out. Candidate (d) deletes a High tone and is ruled out by **MAX(H)**.

Thus far, we have accounted for the data by merely adding **POLAR** to faithfulness and very basic well-formedness constraints. However, in [dʒáǵá'há] 'the shades,' there is a new pattern. The polar tone is inserted, as has been seen above with [tàná] 'stones,' but the inserted polar tone in [dʒáǵá'há] is floating. To account for this pattern, we must present a well-formedness constraint that deals with a pattern previously noted for Kɔ̀nni in (4): a surface HLH tone is not licensed. Rather, when morphemes that would have produced such a sequence are concatenated, the result is H¹HH.

A possible reason for this ban on HLH can be traced to the nature of communication. A language must have "texture" to it, a variation in whatever parameters are relevant, in order to communicate any information. However, these parameters must not vary so rapidly that it presents excessive difficulty either in processing the information or producing the articulations. What counts as "rapid" may vary with the type of sound, of course; a reviewer points out that the most salient cues for consonant identification are contained in the 10 ms or so of release burst. However, tones are neither articulated nor perceived in so short a time frame. In at least some tonal languages, then, it is plausible that a HLH sequence involves a rate of alternation that the speakers are not "willing" to make. The constraint expressing this is as follows.

(29) ***HLH** = no Low can be associated when between two High tones¹²

$$\begin{array}{c} * \quad H \quad L \quad H \\ \quad \quad | \\ \quad \quad X \end{array}$$

The citation form of the constraint, ***HLH**, is shorthand for the fuller representation of the unlicensed configuration at the bottom of (27) above. With this in place, we may now present the tableau for [dʒáǵá'há] 'the shades.'

¹²This constraint seems to be active in a variety of languages, as expected if there is any connection to the communicative function discussed above. (Of course, Optimality Theory would simply rank *HLH low in languages where it is not active.) Quite a few African languages prohibit HLH (Odden 2000), and Mianmin and some other tonal languages of Papua New Guinea also disallow HLH. There is an asymmetry in the relation between High and Low, in that a LHL sequence is much more common cross-linguistically than HLH. This likely relates to the fact of High as prominent, but the reasons for this asymmetry deserve further investigation.

(30)	UR HH -Ø -H	MAX (H)	*HLH	POLAR	*CONTOUR	*(L)
	 dʒag -a -ha					
	♪ H H L H a. dʒa ga ha					*
	H H H b. dʒ a ga ha			*!		
	H H LH c. dʒa ga ha		*!		*	
	H L H ^ d. dʒa ga ha	*!				*
	H H L e. dʒa ga ha	*!		*		

The winning candidate (a) violates no constraints except ***(L)** (and also **DEP(L)**, which is ranked so low in Kɔnni as to not be listed in the tableau above). Candidates (b) and (e) violate **POLAR**, while (c) violates ***HLH** by having a Low associated between two Highs. Candidates (d) and (e) violate the top-ranked **MAX(H)** by deleting a High tone. Thus the optimal candidate inserts a Low tone, which is floating.

The relation of **POLAR** to the floating Low tone in (28) deserves a bit more comment, since the constraint refers to “the last tone of the plural.” This floating tone, even though not associated to the segmental part of the plural morpheme, can be considered as belonging to that morpheme rather than to the definite suffix because of the dependency involved. When the plural suffix is present, the Low tone is inserted, as much in (28) as in (24), where there was no definite suffix. Without the presence of the plural morpheme, the Low tone would not occur.

Thus far we have seen surface polar tones that are inserted, and one that has already been present in the input. In some cases, the tone in question may be an inserted one, as in the previous case, but spreading as a third source of polar tone

is also a distinct possibility. One of the forms illustrating this uncertainty is [tànáhá] ‘the stones.’

(31)

UR	L -∅- H	POLAR	*H-SPREAD	DEP (H)	DEP (L)
	<pre> L -∅- H tan-a-ha </pre>				
☞	<pre> L H H a. tanaha </pre>			*	
☞	<pre> L H / \ b. tanaha </pre>		*		
	<pre> L L H c. tanaha </pre>	!*			*

Candidates (a) and (b) are phonetically indistinguishable, and I know of no phonological test in Kɔ̀nni to differentiate these. The issue of ranking of *H-SPREAD vs. DEP(H) depends on whether it is better to spread a High onto an empty TBU or insert a new High. Both constraints are active in Kɔ̀nni, and are visible in constraining possible outputs. On the other hand, both are also known independently to be violated in some cases. High tones do spread, as we have seen in (6), for example, violating *H-SPREAD. Also, High tones can be inserted on a noun, as in the case of the toneless [hògú] ‘woman,’ which surfaces with a High tone. This violates DEP(H), but satisfies the higher-ranked H-PRES, which requires a High tone in a word.¹³ The only cases of High insertion we have seen in Kɔ̀nni involve words that have no underlying High, and it is quite possible that High insertion is indeed limited to those. In the unambiguous cases, High-spreading is definitely more common than High-insertion, and it may be more

¹³ Some of the evidence that leads to the conclusion that [hògú] ‘woman’ is underlyingly toneless is in the associative construction [ù hògù] ‘his woman/wife.’ The High tone in this phrase comes from a High tonal associative morpheme. If the High in [hògú] were present in the input, we would expect the unattested *[ù hògù]. Also, in Noun-Adjective constructions such as [hògù-bián] ‘bad woman,’ *hògù* has no High tone at all, in contrast to nouns which do have high tones. Suggestive is also the fact that the related Gur languages Mooré and Dagaare have also been analyzed as having the cognate noun as underlyingly toneless. (Kenstowicz, Nikiema & Ourso 1988, Antilla & Bodomo 1997).

probable here. However, at this point, I have no clear empirical evidence to decide the ranking and we must live with the indeterminacy.

3.2 A Violation of POLAR. Since constraints by their nature are violable in Optimality Theory, one should not be surprised to find cases in which **POLAR** is violated. In the plural forms below, **POLAR** is satisfied, but in the plural definite forms, it is not. This pattern is restricted to nouns that are vowel-final. Thus when the plural /-A/ is added, the result is a CVV final syllable for the plural:

(32)	<i>plural</i>	<i>plural definite</i>	
	sìsì-é	sìsìè-hé	‘grasscutter (an animal)’
	dʒù-á	dʒùà-há	‘tail’
	nì-á	nìà-há	‘rain’
	bì-é	bìè-hé	‘goat’

If **POLAR** were satisfied in the plural definites, we would expect forms like the unattested *[sìsìéhé] ‘the grasscutters.’ The problem here is a nonfinal contour, which except for a very few exceptional forms never occurs in Kɔnni. (Recall that the syllable is the TBU in Kɔnni and even though *sisi-* and *-e* are separate morphemes, the *ie* that results from their combination is a single syllable.) Outranking **POLAR**, then, is a constraint penalizing nonfinal contours. Contours in general are dispreferred to level tones, but nonfinal contours are especially disfavoured:

(33) **CONTOUR-NONFINAL (*CONT-NF):** nonfinal contour tones on a TBU are prohibited¹⁴

(34)	<p>UR L-Ø-H bi-e -he</p>	*CONT-NF	POLAR	*CONTOUR
	<p>a. L H bie he</p>		*	
	<p>b. LH H bie he</p>	*!		*

¹⁴This constraint is from Zhang 2000, and is better motivated than the similar ***CONT-INTERNAL** which I have previously used.

3.3 OCP-based alternative analyses. In the presentation thus far, the most plausible alternative to a **POLAR** constraint, an analysis based on some version of the OCP, has not been examined. In this section, I show that an OCP-based analysis, whether a High- or Low-toned suffix is assumed, encounters considerable difficulty with the Kɔ̀nni data. I will consider three possible proposals.

First, if we assume High tone for the suffix /-Á/, then when the preceding tone is High, an OCP(H)-based analysis involves deleting this High tone and replacing it with a Low:

(35) hypothetical: /tíg-Á/ → [tígè] ‘houses’

There are several complications with this scenario. First, the OCP appears not to be active in Kɔ̀nni in any other context. As discussed in Sec. 1.4, the case of [dʒág-â] ‘shades’ vs. [múg-à] ‘rivers’ shows the presence of two adjacent High tones. A further complication is that a High-toned /-Á/ would entail an input of /múg-á/ for [múg-à] ‘rivers,’ and the High on the suffix would be deleted and a Low inserted. However, a High tone is never demonstrably deleted in Kɔ̀nni; this would be a violation of **MAX (H)**, which is undominated in every circumstance examined. It would be possible to assume a High tone is deleted only for the Noun Class 1 plural suffix, but this adds unnecessary complexity.

Furthermore, assuming a High tone for the plural suffix /-A/ leads to a constraint ranking paradox. From other tonology, we know that **MAX(H)** outranks ***CONT-NF**, that is, **MAX(H) >> *CONT-NF**. The only case in which ***CONT-NF** is violated is in five plural forms such as [nàá'líŋ] ‘chiefs’ (NC5), all with the plural suffix *-liŋ*. A sample paradigm is given below.

(36)	<i>singular</i>	<i>sing. definite</i>	<i>plural</i>	<i>pl. definite</i>	
	nàáj	nàájwa	nàá'líŋ	nàá'lí'ba	‘chief’

The noun stem *naaj* has a lexical Low tone, with the H on the LH surface tone on [nàáj] being inserted, since any word in Kɔ̀nni requires a High tone (Cahill 1999). The singular definite suffix [-wá] is High-toned, as with most suffixes in Kɔ̀nni.

(37)	a.	L	→	LH		b.	L	H	→	L	H
				∨							
		naaj		naaj			naaj	wa		naaj	wa

Given these data, it is evident that it is the plural indefinite suffix [-lɪŋ] which causes this unusual tonal pattern, and indeed, a non-final contour tone is found only with this one suffix. It is best explained by positing a complex HLH underlying tone for [-lɪŋ], which associates in the surface form as follows (the ? is noted because it is not certain how the tones may be associated to the segments in input form, though at least two tones are assumed to be associated).

$$(38) \quad \begin{array}{ccc} \text{L} & \text{HLH} & \\ | & ? & | \\ \text{naa} & & \text{lɪŋ} \end{array} \quad \rightarrow \quad \begin{array}{ccc} \text{L} & \text{H} & \text{LH} \\ & \vee & | \\ \text{n} & \text{aa} & \text{lɪŋ} \end{array}$$

A tableau for this form is as follows.

(39) [nää́lɪŋ] ‘chiefs’

MAX(H) >> *CONT-NF

UR	L - HLH	MAX(H)	*HLH	*CONT-NF	*CONTOUR
	$\begin{array}{ccc} \text{L} & \text{HLH} & \\ & ? & / \\ \text{naa} & & \text{lɪŋ} \end{array}$				
☞	$\begin{array}{ccc} \text{L} & \text{H} & \text{L} & \text{H} \\ & \vee & & \\ \text{naa} & & & \text{lɪŋ} \end{array}$			*	*
a.	$\begin{array}{ccc} \text{L} & & \text{L} & \text{H} \\ & & \vee & \\ \text{naa} & & & \text{lɪŋ} \end{array}$	*!			*
b.	$\begin{array}{ccc} \text{L} & \text{H} & \text{L} & \text{H} \\ \vee & & \vee & \\ \text{naa} & & & \text{lɪŋ} \end{array}$		*!	*	**
c.	$\begin{array}{ccc} \text{L} & \text{H} & \text{L} & \text{H} \\ & & \vee & \vee \\ \text{naa} & & & \text{lɪŋ} \end{array}$		*!		*
d.	$\begin{array}{ccc} \text{L} & \text{H} & \text{L} & \text{H} \\ & & \vee & \vee \\ \text{naa} & & & \text{lɪŋ} \end{array}$		*!		*

Since a LH contour is preserved in the initial syllable, it is evident that MAX(H), preserving the H input tone, outranks *CONT-NF.¹⁵ But consider the

¹⁵The candidate [nää́lɪŋ], with a HLH on the last syllable, is a possible configuration as well (cf. [jàjú'ón] ‘flying ant’, with the same tonal configuration on the final syllable). The difference between the illicit candidate *[nää́lɪŋ] and the attested [jàjú'ón] is that the latter has only one tone contributed by the suffix, while *[nää́lɪŋ] has three. Thus it is probable that the

forms in (30) such as [sìsìè-hé] ‘the grasscutters,’ assuming a High tone for the plural suffix. In this case, the High of /-A/ (which is *-e* here due to vowel harmony) is deleted to avoid a nonfinal contour. So here ***CONT-NF** >> **MAX(H)**, the reverse of the ranking above. In this tableau the morphemes are split in the input to show underlying tonal associations, but in output candidates, the syllables, as TBUs in Kɔnni, are the relevant divisions.

(40) [sìsìè-hé] ‘the grasscutters’ ***CONT-NF** >> **MAX(H)**

UR	L L H H	*CONT-NF	MAX(H)	*CONTOUR
	 si si -e -he			
☞	L L H a. si sie -he		*	
	L L H H b. si sie -he	*!		*

Thus if we assume a High tone for the /-A/ suffix, we must have a ranking of **MAX(H)** >> ***CONT-NF** in (37), but the reverse ranking in (38).

The most telling argument, however, against a High-toned suffix changed by the OCP is illustrated by forms like [káǵílà] ‘crops (of bird)’. As shown by the singular form [káǵí¹lǐŋ], repeated below from (25), the noun stem [kǵí¹l-] has a HHL tone pattern. In the singular citation form, the [-ŋ] suffix adds the High tone to give the surface form schematised below.

(41)

H	H	L	H
k a	ǵ í	l	ŋ

If the plural suffix /-A/ were indeed High-toned, this plural High tone would not be adjacent to another High, and the OCP would not apply. All the tones in the input would be present in the output, and we would get a tonal configuration as below, which would be phonetically [káǵí¹lá].

key to the ill-formedness of *nàálí¹ŋ* is a result of multiple violations of **MAX(ASSOC)**, a constraint independently needed for Kɔnni (Cahill 1999).

- (42) * H HLH (unattested)
- | | |
- k a g ɪ l a

This is a perfectly legal configuration in Kɔ̀nni (it is the same mapping of tones to TBUs as the singular [káǵí'líŋ] in (39)). The fact that [káǵí'là] rather than [káǵí'lá] is actually the output demonstrates that the plural suffix is not High-toned.

The second and third alternative proposals both posit the NC1 suffix as lexically Low-toned. No one in Gur studies to my knowledge has proposed a Low-toned plural suffix, so it would be areally quite unusual. However, the suffix often surfaces as Low, so the possibility of a lexical Low tone on this suffix deserves consideration.

Probably the most plausible alternative scenario with an underlyingly Low NC1 suffix involves two new constraints: **FINAL-H**, which is satisfied by having a High tone word-finally, and **OCP(High)**, which is violated by two adjacent High tones. **FINAL-H** is a plausible proposal, since most Kɔ̀nni nouns, as well as verb forms, end in a High. The domain of **OCP(High)** would be limited to the NC1 plural suffix, since there are demonstrable occurrences of HH elsewhere in Kɔ̀nni. **FINAL-H** would force the NC1 suffixal Low to be High if preceded by a stem Low, and **OCP(High)** would prevent a suffixal High if the preceding stem tone was High.

Forms like [tígè] ‘houses’ show that **OCP(High)** >> **FINAL-H**, and this approach works for much of the data.

- (43) hypothetical: /tíg-À/ → [tígè] ‘houses’
 /tàn-À/ → [tàna] ‘stones’

UR tíg-è	OCP (High)	FINAL-H	DEP(H)
☞ a. tíg-è	*!	*	
b. tíg-é			*
UR tàn-à			
☞ a. tàn-á			*
b. tàn-à		*!	

However, again the form [káǵí'là] ‘crops (of bird)’ shows this proposal to be untenable. The singular form [káǵí'líŋ] shows that the noun stem has tone HHL. The ranking **OCP(High)** >> **FINAL-H** above would produce a form that inserts a H to satisfy **FINAL-H**. Since the stem and the suffix are Low, inserting a

final High would not violate **OCP(High)** and the optimal form would be the unattested *[káǵí'lá].

(44) hypothetical /káǵíł` - À/ → *[káǵí'lá]

UR	HH L L	OCP (High)	FINAL-H	DEP(H)
	kagıl a H H L L			
a.	HHL kagıla		*!	
☛ b.	HHLH / kagıla			*

The actual attested form (a) violates **FINAL-H**, but this tableau incorrectly eliminates it. The winning candidate (b) is the unattested *[káǵí'lá]. (I assume the extra Low tone is deleted by a Stray Erasure type constraint, though nothing in this analysis hinges on this assumption.) Thus the set of assumptions that can account for many forms makes an incorrect prediction with others.

Finally, the third OCP-based account also assumes Low tone for the suffix /-À/. When the stem-final tone is Low, an **OCP(L)** constraint forces the suffixal Low tone to be replaced with a High. If the stem-final tone is High, the suffixal Low remains. As discussed in Sec. 1.4, the case of [dàmpàlá] ‘bench’ contrasted with [bùrìmíŋ] ‘bush donkey’ shows the existence of two separate adjacent Low tones, so the **OCP(L)** must be restricted to the particular context of the NC1 plural morpheme and its stem.

(45) **OCP(L)** (hypothetical): adjacent Low tones are prohibited in NC1 plurals when one is associated to the noun stem and the other is associated to the plural morpheme.

In the simple hypothetical /tàn-À/ → tǎná ‘stones’ the analysis is straightforward. **OCP(L)** must outrank both **DEP(H)**, since a High has been inserted, and a previously-unmentioned constraint, **MAX(L)**, since a Low has been deleted. Concomitant changes make it impossible to determine which of these two constraints is more highly ranked, as seen in the more complex case below.

(46) hypothetical: /sìsì-À/ → [sìsìé] ‘grasscutters’

UR	LLL	OCP(L)	DEP(H)	MAX (L)
	 sisi-e			
☞	a. sisié		*	*
	b. sisié	*!		
	c. sisié		*	*!*
	d. sisié	*!		*

The winning candidate (a) has replaced the suffixal Low by a High. Candidate (b) definitely violates the **OCP(L)**, and perhaps another constraint forbidding two identical tones on the same TBU. Candidate (c) loses by deleting two Low tones. Candidate (d) deserves closer examination, since it will be relevant to the next tableau as well. Is the final Low in (d) part of the stem or the suffix? Recall that in Kɔnni the TBU is the syllable, so this Low is directly associated to the final syllable *sie*. The syllable contains two morphemes, and so the Low is actually associated through the syllable to both morphemes. Since this Low is associated to the suffix, **OCP(L)** looks to see if there is an adjacent Low associated to the stem. There is, and so **OCP(L)** is violated. Note that it does not matter which of the two last input Lows have been deleted; the output (d) would be the same in either case. This scenario adequately accounts for [sìsìé], but predicts the wrong output when the definite article is added, as below. The ranking of ***CONT-NF** and **OCP(L)** is indeterminate, but this does not affect the selection of the winning candidate.

(47) hypothetical: /sìsì-À-hÁ/ → [sìsìèhé] ‘the grasscutters’

UR	LLL H	*CONT-NF	OCP(L)	DEP(H)	MAX (L)
	↓ ↓ ↓ ↓ sisi-e-he				
a.	L L H ↓ ↓ ↓ sisi-e-he		*!		*
b.	LL LH ↓ ↓ ↓ sisi-e-he	?	*!		
b.	LL HH ↓ ↓ ↓ sisi-e-he	*!		*	*
d.	L H H ↓ ↓ ↓ sisi-e-he			*	**

Critically, the actual attested candidate (a) is ruled out by **OCP(L)**, by the same reasoning we applied above, and the unattested (d) is selected as optimal. We therefore reject this final OCP-based alternative analysis.

The Dagaare, Mooré and Dagbani analyses all rely on the OCP as the crucial factor in accounting for apparent tone polarity. In Dagaare, A&B are explicit that the OCP prevents two like tones from occurring on the surface. In Mooré and Dagbani, the driving force for the rule changing a HH to a HL is implicitly the OCP. However, in Kɔnni, as we have seen, the OCP is unnecessary to account for tonal phenomena, and it is possible that the other Gur languages could also be re-analyzed without it.

4. Discussion

In this section I briefly discuss several theoretical issues that the polarity analysis here pertains to and I hope illuminates.

As mentioned, the KNO analysis of Mooré has been interpreted as obviating the need for true polarity (even beyond Mooré), and in fact many plural forms in Kɔnni NC1 can also be accounted for without invoking a specific **POLAR** constraint. For example, on the toneless suffix of the NC1 plural, a High tone is inserted if there is not a High in the word. A Low is inserted otherwise, as the general default tone. However, this approach will not work with more complex

words, as we have seen. This raises the question whether the analyses of KNO and AB would work as well if given a fuller range of data from these languages. KNO mention one trisyllabic word, [lénggèré] ‘bowl,’ and though they do not specifically analyze it, it does fit well into their analysis. The High-toned suffix [-ré] is not adjacent to another High, and so remains as High. There is also a disyllabic H¹H tone pattern that KNO did not note, in words like [wá¹fó] ‘snake’ (Nikiema 1980), in which presumably the downstep is due to a floating Low tone. In that case, the High of the suffix [-fó] is again not adjacent to another High on the tonal tier, and so remains High. What would be problematic for KNO’s analysis is the existence of trisyllabic words with a HLL pattern. The last syllable would necessarily be the underlyingly High suffix. Since it would be adjacent to a Low, the KNO rule HH → HL would not apply, and we would expect surface HLH, but there would be no way to generate HLL. Some expressions with this pattern are listed in Nikiema (1980: 38), but it is unclear there whether all of these are single words or not. For Dagaare, AB acknowledge the existence of words longer than disyllabic, mention that most of them are probably compounds, but specifically exclude these from the scope of their study. The Dagaare definite morpheme is not a suffix as it is in Kɔ̀nni, but a separate word that precedes the noun, so there is not the opportunity to test Dagaare in the same way as was done for Kɔ̀nni.

Another topic worthy of comment is the location of polarity. Pulleyblank (1986) observes that polarity effects occur at the edges of domains. This is indeed true in every case cited in the works I have referred to here, but we have seen cases in Kɔ̀nni where the polar tone occurs not at the edge of the whole noun word, but occurs immediately preceding the edge tone. This is the case, for example, in [dʒágá¹há] ‘the shades’, where the polar tone is the floating Low of the downstep. It is also the case in [tàn-á-há] ‘the stones,’ where the High of the plural morpheme [-á] is either inserted or spread from the definite suffix [-há]. The Kɔ̀nni case shows that to retain this statement as a universal, we must redefine “domain”, possibly to something like “the edges of morphemes.”

The constraint **POLAR** is morphologically-based; it must refer to one specific morpheme, the Noun Class 1 plural in Kɔ̀nni. In the larger picture of tone polarity, this is consistent with the claim in Anderson (1974) that all polarity rules (termed “exchange rules” there) are either morphologically or lexically restricted, and with Schuh’s (1978) observation that all tone polarity rules known to him are marked for specific morphemes, rather than being a part of the general phonology. Moreton (1999) makes the observation that classical OT, if it is limited to only faithfulness and markedness constraints, does not handle these “exchange rules” that are morphologically based. The limits must evidently be extended.

Finally, the constraints of Optimality Theory appear most advantageous when compared to a derivational account when they deal with “conspiracies,” in which a constraint expresses a surface generalization that may be generated from an input form in a number of different ways. One example is the well-known **NOCODA** constraint. If an underlying representation is CVC, **NOCODA** may be satisfied by any of several paths, such as deletion of the final C or epenthesis of a final V. In a similar fashion, the Kɔnni constraint **POLAR** is an expression of a surface pattern. This pattern may be generated from an input in at least two, and possibly three independent paths. In [kágílà] ‘crops (of bird),’ the polar tone is present in the input. In [džágâ] ‘shades,’ as well as many other nouns, a polar tone must be inserted. And in [tànáhá] ‘the stones,’ it is possible that the polar tone comes from spreading. Thus the surface polar tone can be generated from underlying representations in several distinct ways, and so is quite in the spirit of Optimality Theory. Such an analysis offers a principled explanation of the position of Newman (1995) when he says that polarity is a natural pattern to be found in languages, not one to be always reanalyzed as dissimilation.

REFERENCES

- Anderson, Stephen. 1974. *The Organization of Phonology*. Academic Press: New York.
- Antilla, Arto, & Adams Bodomo. 1996. “Stress and tone in Dagaare”. MS, Stanford University. [Also ROA-169-1296.]
- Antilla, Arto, & Adams Bodomo. 2000. “Tone polarity in Dagaare”. *Advances in African Linguistics*, ed. by Vicki Carstens & Frederick Parkinson. Proceedings of the 28th Annual Conference on African Linguistics at Cornell University. Africa World Press: Trenton, NJ. Pp. 119-134. [Also ROA-169-1296.]
- Antilla, Arto, and Adams Bodomo. 2002. “Tone and morphology in Dagaare”. MS, NYU & University of Hong Kong.
- Bickmore, Lee. 2000. “Downstep and fusion in Namwanga”. *Phonology* 17: 297-331.

- Cahill, Michael. 1999. *Aspects of the Morphology and Phonology of Konni*. Columbus: Ohio State University, Ph.D. dissertation.
- Casali, Roderic F. 1995. "An overview of the Nawuri verbal system". *Journal of West African Languages* 25.1: 63-86.
- Carlson, Robert. 1983. "Downstep in Supyire". *Studies in African Linguistics* 14: 35-45.
- Cassimjee, Farida, & Charles Kisseberth. 1998. "Optimal Domains Theory and Bantu tonology: a case study from Isixhosa and Shingazidja". *Theoretical Aspects of Bantu Tone*, ed. by Larry Hyman & Charles Kisseberth. CSLI Publications: Stanford. Pp. 33-132. [Also ROA-176-0297].
- Chumbow, Beban Sammy. 1982. "Contraction and tone polarization in Ogori". *Journal of West African Languages* 12.1: 89-103.
- Creissels, Denis, & Claire Grégoire. (1993). "La notion de ton marqué dans l'analyse d'une opposition tonale binaire: Le cas du mandingue". *Journal of African Languages and Linguistics* 14: 107-154.
- Crouch, Marj. 1985. "A note on syllable and tone in Vagla verbs". *Journal of West African Languages* 15.2: 29-40.
- Dwyer, David. 1976. "The analysis of Bambara polarization". *Studies in African Linguistics*, supplement 6: 27-38.
- Essien, Okon E. 1990. *A Grammar of the Ibibio Language*. University Press: Ibadan.
- Goldsmith, John. 1976. *Autosegmental Phonology*. Cambridge, MA: MIT, PhD dissertation.
- Hawkinson, Ann. 1986. *Bakweri Verb Morphology*. Berkeley: University of California, Ph.D. dissertation.
- Hoffman, Carl. 1963. *A Grammar of the Margi Language*. Oxford University Press: London.

- Hyman, Larry. 1993. "Structure preservation and postlexical tonology in Dagbani". *Studies in Lexical Phonology*, ed. by Sharon Hargus & Ellen Kaisse. Academic Press: San Diego. Pp. 235-254.
- Hyman, Larry, & Russell G. Schuh. 1974. "Universals of tone rules: evidence from West Africa". *Linguistic Inquiry* 5: 81-115.
- Kagaya, Ryohei. 1992. "A tonal system of verbs of the Bakueri language". *Studies in Cameroonian and Zairean Languages, Bantu Linguistics*, Vol 3. Institute for the Study of Languages and Cultures of Asia and Africa. Pp. 1-38.
- Kenstowicz, Michael, Emmanuel Nikiema & Meterwa Ourso. 1988. "Tone polarity in two Gur languages". *Studies in the Linguistic Sciences* 18.1: 77-103.
- Kutsch-Lojenga, Constance. 2002. "Tone polarity in Fur". Paper presented at the 33rd Annual Conference on African Languages, Ohio University, Athens, Ohio.
- McCarthy, John, and Alan Prince. 1995. "Faithfulness and reduplicative identity". *Papers in Optimality Theory*, ed. by Jill Beckman, Laura Walsh Dickey & Suzanna Urbanczyk. GLSA: University of Massachusetts, Amherst. Pp. 249-384
- Moreton, Elliot. 1999. "Non-computable functions in Optimality Theory". ROA-364-1199.
- Newman, Paul. 1995. "Hausa tonology: complexities in an 'easy' tone language". *The Handbook of Phonological Theory*, ed. by John Goldsmith. Basil Blackwell: Cambridge, MA. Pp. 762-781.
- Nikiema, Norbert. 1980. *Moor Gulsg Sebre: Manuel de Transcription du Mooré*. Ouagadougou: Université de Ouagadougou.
- Odden, David. 1982. "Tonal phenomena in KiShambaa". *Studies in African Linguistics* 13: 177-208.
- Odden, David. 2000. "Overview of African tone systems". Paper presented at Tromsø Tone Symposium, University of Tromsø, Norway, June 5-8, 2000.

- Olawsky, Knut J. 1996. *An Introduction to Dagbani Phonology*. Arbeiten des Sonderforschungsbereichs 282, Nr. 76. Heinrich-Heine-Universität, Düsseldorf.
- Olson, Kenneth S. In press. *The Phonology of Mono*. SIL and University of Texas at Arlington Publications in Linguistics. Dallas: SIL and UTA.
- Picanço, Gessiane L. 2002. "Tone polarity as phonologically conditioned allomorphy in Mundurukú". Paper presented at Berkeley Linguistics Society meeting.
- Pulleyblank, Douglas. 1983. "Extratonicity and polarity". *Proceedings of the West Coast Conference on Formal Linguistics 2*, ed. by Michael Barlow, Daniel Flickinger & Michael Wescoat. Stanford Linguistics Association: Stanford. Pp. 204-216.
- Pulleyblank, Douglas. 1986. *Tone in Lexical Phonology*. Reidel: Dordrecht.
- Schuh, Russell G. 1978. "Tone rules". *Tone: A Linguistic Survey*, ed. by Victoria Fromkin. Academic Press: New York, NY. Pp. 221-256.
- Snider, K. 1999. *The Geometry and Features of Tone*. Dallas: SIL.
- Yip, Moira. 2002. *Tone*. Cambridge: Cambridge University Press.
- Zhang, Jie. 2000. "The phonetic basis for tonal melody mapping in Mende and elsewhere". Paper presented at the 19th West Coast Conference on Formal Linguistics, UCLA.
- Zhang, Jie. 2001. *The Effects of Duration and Sonority on Contour Tone Distribution - Typological Survey and Formal Analysis*. Los Angeles: University of California, Ph.D. dissertation.

