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TONE IN BULI*

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The paper analyzes the principal tonal contrasts and alternations in Buli from both synchronic and diachronic, comparative perspectives. The role of tone in the inflectional morphology as well as the phonetic implementation of tonal contrasts is also discussed.

1. Introduction

Buli is a Gur language spoken by some 100,000 persons in the Upper East region of Ghana. Previous study of the language is limited to several papers by the first author [Akanlig-Pare 1994,1997,1999] and the dictionaries by Mélançon and Prost [1972] and Kröger [1992]. In this paper we survey the major tonal contrasts and tonal processes. Next we place the language in a larger context by comparing various features of Buli tone with other, better-studied Gur languages. We then pass on to the inflectional tonology of the nouns and the verbs. The paper closes with a description of the F0 implementation of the major tonal structures discussed in the paper. Our study is based on the speech of the first author, a native speaker of the Central dialect.

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2. Tonal Contrasts

Buli distinguishes three lexical tones: high, mid, and low. There is no downstep. The language has a surface rising tone but it is a predictable variant of an underlying high tone. While nouns and adjectives contrast for the three tonal levels, verbs have no lexical contrasts in tone. However, tense and aspectual distinctions are encoded tonally making for an intricate set of tonal paradigms for verbs. The syllable is the tone-bearing unit in Buli. Even though the language combines a vowel length distinction with an optional coda of one or two consonants, there is no underlying tonal contrast as a function of syllable shape. In (1a) we cite some minimal pairs. The data in (1b) show the independence of tone and syllable shape.

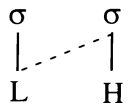
(1)		H		M		L	
a.		*s^{y}úk*	'path'	*s^{y}ūk*	'navel'	*s^{y}ùk*	'fish' sp.
		náːb	'cow'			*nàːb*	'chief'
		bíːk	'child'			*bìːk*	'language'
				bāŋ	'bangle'	*bàŋ*	'lizard'
b.	CV	*lé*	'spinster'	*lō*	'fall'	*mà*	'mother'
	CV:	*mí máː*	'I helped'	*māː*	'help!'	*wà màː mǐ*	'he helped me'
	CVC	*zúk*	'head'	*bāŋ*	'bangle'	*bàŋ*	'lizard'
	CV:C	*bíːk*	'child'	*būːk^{w}*	'goat'	*nàːb*	'chief'

3. Tonal Processes

There are two very general tonal processes in Buli: Low Tone Spread (LTS) and Rising Tone Absorption (RTA); (see Akanlig-Pare [1997] for more discussion). By the first process a high tone syllable becomes rising when it follows a low tone syllable. In autosegmental terms, a low tone spreads to a following high-tone

syllable, as in (2).[1] Low-Tone Spreading applies word internally as well as at the phrasal level across word boundaries, as shown in (3).

(2)



(3) word internally :

bʸé	'seeds'	*bʸéŋá*	'the seeds'
bàŋsà	'lizards'	*bàŋsàŋǎ*	'the lizards'

pronoun plus noun:

bí:k	'child'	*wà bĭ:k*	'his child'

noun plus noun:

àtì:m	personal name	*àtì:m bĭ:k*	'Atim's child'

noun plus adjective:

fí:k	'small'	*bàŋ fĭ:k*	'a small lizard'

subject plus verb:

mí té	'I emph. gave'	*ǹ tě*	'I gave'

verb plus object:

ná:b	'cow'	*wà tè nă:b*	'he gave a cow'

Low-Tone Spread changes a high tone to rising after a low tone regardless of the internal syllabic (moraic) structure of the first (4a) or the second (4b) syllable.

(4)

a.	*mà*	'mother'	*mà fĭ:k*	'small mother'
	bàŋ	'lizard'	*bàŋ fĭ:k*	'small lizard'
	ŋà:ŋ	'back'	*ŋà: fĭ:k*	'small back'
	wà mà:	'he helped'	*wà mà: mĭ*	'he helped me emph.'
b.	*zá*	'millet'	*wà zǎ*	'his millet'
	zúk	'head'	*wà zŭk*	'his head'
	ná:b	'cow'	*wà nă:b*	'cow'
	mí má:	'I (emph.) helped'	*fì mă:*	'you helped'

[1] The data are analyzed in terms of ordered rules instead of Optimality Theoretic constraints for the sake of familiarity and convenience. Our transcriptions abstract away from an ATR differ-ence in the vowels that is unstable and seems to be disappearing from the language.

Mid tones neither initiate nor undergo the process.

(5)	*nūm*	'grind'	*nūm zá*	'grind millet' (imperative)
	lām	'meat'	*wà lām*	'his meat

Rising Tone Absorption, the second general process of Buli tonology, simplifies a rising tone (whose source is always an underlying high tone that has become rising by Low-Tone-Spread) to low when followed by a high tone. Absorption applies in the same range of contexts as Low Tone Spread. Some word-internal examples appear in (6).

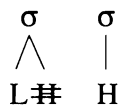
(6)	*náːmú*	'cow' def.	*wà nàːmú*	'his cow'
	níːgà	'cows'	*wà nĭːgà*	'his cows'

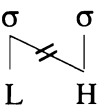
In *wà nĭːgà* 'his cows', the low of *wà* spreads to the first syllable of *níːgà* to create a rise. In *wà nàːmú* 'his cow' the low of *wà* spreads to the first syllable of *náːmú* to create a rising tone /wà nằːmú/ which is then simplified to low by the Absorption process that deletes its high component. Absorption applies regularly in the phrasal phonology as well. (When followed by an adjective many nouns such as *biːk* take a shortened allomorph).

(7)	*bíːk*	'child'	*bí fíːk*	'a small child'
	wà bĭːk	'his child'	*wà bì fíːk*	'his small child'
	bí màŋ	'good child'	*wà bĭ màŋ*	'his good child'

mí ŋmá nàːwă	'I (emph.) blamed the chief'
mí ŋmá bíːká	'I (emph.) blamed the child'
ŋ̀ ŋmă nàːwă	'I blamed the chief'
ŋ̀ ŋmà bíːká	'I blamed the child'
wà ŋmà mĭ nàːb	'he blamed my (emph.) chief'
wà ŋmà mì bíːk	'he blamed my (emph.) child'

Rising Tone Absorption can be expressed as the rule in (8a) that deletes the H portion of a LH sequence on a single syllable when followed by a high tone syllable. The alternative autosegmental delinking formulation in (8b) would require the grammar to include a preceding process that fuses adjacent high tones. Since there is no evidence for this fusion process in Buli, we prefer the formulation in (8a). And, since all rising tones originate from Low Tone Spread, Rising Tone Absorption is intrinsically ordered after it, as illustrated in (9).

(8) a. 

b. 

(9) *wà bí fíːk* underlying
wà bǐ fíːk Low Tone Spread
wà bì fíːk Rising Tone Absorption

'his small child'

The processes of Low Tone Spread and Rising Tone Absorption do not iterate. Only the first H in a LHHH sequence changes to L.

(10) *bíːsáŋá* 'children' (pl. definite)
wà bìsáŋá 'his children' (def.)

bíːká 'child' (def.)
fíːká 'small' (def.)
bí fíːká 'small child' (def.)
wà bìːká 'his child' (def.)
wà bì fíːká 'his small child' (def.)

mí bíːká 'my (emph.) child' (def.)
wà ŋmà mì bíːká 'he blamed my (emph.) child' (def.)

The failure of the processes to iterate creates a rule opacity [Kiparsky 1971]: only an underlying LH sequence becomes LR (R = rising)—a LH sequence resulting from Rising-Tone Absorption does not. This opacity is expected if the processes are expressed as ordered rules. Since both Low Tone Spread and Rising Tone Absorption apply word-internally as well as at the level of the phrase, the rule opacity cannot be circumvented by assigning the processes to different components of the grammar such as Lexical and Post-lexical [Kiparsky 1982].

As a result of Low Tone Spread and Rising Tone Absorption, Buli has two contrasting pitch ascensions on succeeding syllables: Low plus High and Low plus Rising. We investigate the phonetic implementation of this contrast in section 9.

4. Epenthesis

The Low Tone Spread and Rising Tone Absorption processes interact in an interesting way with a vowel-zero alternation prevalent in Buli. We treat this alternation as epenthesis; see Akanlig-Pare (to appear) for further discussion. Examine the paradigms for 'person' below. In (11a,b) we see /núr/ 'person' with the optional epenthesis. Epenthesis is more common at slower speech tempi. In (11c,d) these forms are preceded by the possessive *wà* 'his' that spreads its low tone to the following stem.

(11)	a.	*núr*	'person'	*núrbà*	pl.
		núrwá	def.	*núrmá*	pl. def.
	b.	*núrú*	'person'	*núrúbà*	pl.
		núrúwá	def.	*núrúmá*	pl. def.
	c.	*wà nŭr*	'his person'	*wà nŭrbà*	pl.
		wà nùrwá	def.	*wà nùrmá*	pl. def.
	d.	*wà nùrú*	'his person'	*wà nùrúbà*	pl.
		wà nùrùwá	def.	*wà nùrùmá*	pl. def.

The epenthetic vowel is a high vowel that is typically front but may agree in rounding and backness with the preceding vowel. It generally copies the tone of the preceding syllable. However, there is one complication in its interaction with the tonal spreading and absorption processes that is evident in the paradigms of (11c,d). When followed by a high tone syllable both the stem vowel and the inserted vowel appear as low: *wà nùrùwá*, *wà nùrùmá*. This suggests that epenthesis follows Low Tone Spread and Rising Tone Absorption. The epenthetic vowel takes the tone of the preceding syllable.

(12)	*wà núrwá*	underlying
	wà nŭrwá	Low Tone Spread
	wà nùrwá	Rising Tone Absorption
	wà nùrùwá	Epenthesis and Tone Copy

The problem with this solution is that we appear to be unable to account for the cases where the epenthetic vowel is prepausal (*wà nùrú*) or precedes a low (*wà nùrúbà*). Here the inserted vowel shows the underlying high tone of the stem vowel. If this high absorbs the H component of the preceding rise then epenthesis

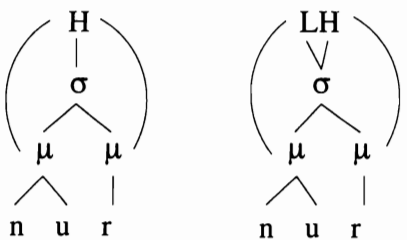
must apparently precede Rising Tone Absorption—contrary to the ordering established in (12).

(13)	*wà núr*	underlying
	wà nŭr	Low Tone Spread
	wà nŭrú	Epenthesis and Tone Copy
	wà nùrú	Rising Tone Absorption

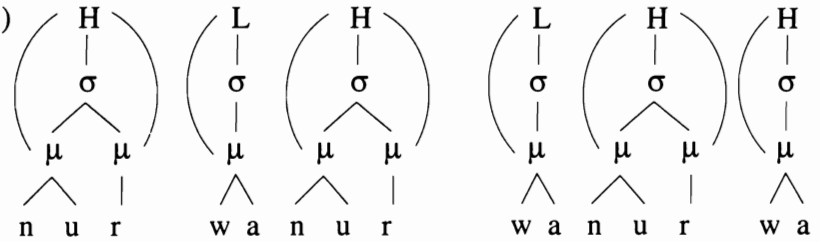
In order to resolve this dilemma we suggest that after the Low Tone Spreading process creates a rising tone, the H component of the rise tone lodges on the second mora of the syllable that is projected from the coda consonant. Rising Tone Absorption will delete this high tone when the following syllable bears a H. But if the following syllable bears a L or if there is no following syllable then Rising Tone Absorption fails to apply. When epenthesis occurs this coda consonant becomes the onset of the epenthetic syllable and supplies the tone for this syllable. If we assume that both moras of a Buli CVC syllable are associated with the tone of the syllable by a kind of inheritance or secondary association [Pierrehumbert & Beckman 1988], as shown in (14), then the epenthetic syllable of *núrú* can acquire its high tone via resyllabification as well. The derivations in (15) illustrate our proposed solution.

The key step in the derivation is at Epenthesis. The mora associated with the coda consonant [r] is reassigned to the epenthetic syllable and drags its tonal association along with it.

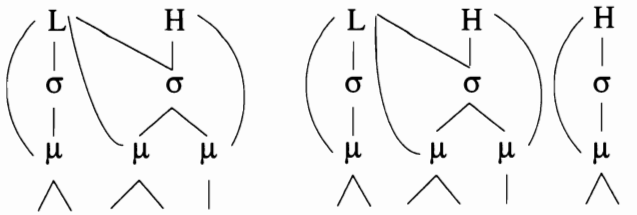
(14)



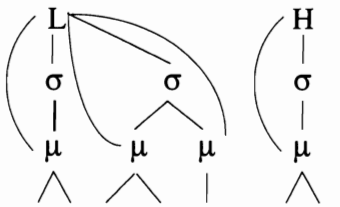
(15)



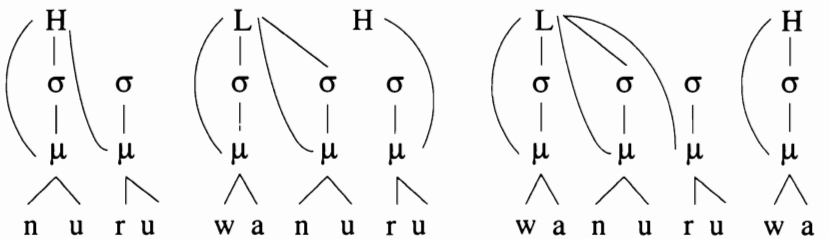
underlying



inappl. Low Tone spread



inappl. inappl. Absorption



Epenthesis

Functionally speaking, the epenthetic syllable wants to be as unobtrusive as possible, presumably because its input source (correspondent) is zero. Promoting the tone of the resyllabified onset is perhaps the perceptually minimal modification of the input that obtains a tone for the emergent syllable. A similar phenomenon in which the epenthetic vowel copies the tone of the preceding syllable is found in Gurma [Rialland 1981].

5. Tonal Correspondences

Buli is unusual among Gur languages in having three levels of tonal contrast and in lacking a downstep. Most other Gur languages we are familiar with—Dagaare [Somé 1995, Bodomo 1997, Anttila & Bodomo 2002], Dagbani [Hyman 1993], Konni [Cahill 1999], Lama [Ourso 1989], and Moore [Kenstowicz, Nikiema, & Ourso 1988]—contrast just high and low tones. But they have extensive downstep. All but Konni also have a rule spreading high tones to a following low tone syllable that produces a downstep. This process is absent in Buli as well.[2]

To illustrate, in (16) we cite data from Moore [Kenstowicz, Nikiema, & Ourso 1988]. Simple nouns fall into three tonal classes: L+H, H+L, and H+H. Conspicuously absent is the L+L pattern.

(16)

	Sg.	Pl.	
L-H	*kòr-gó*	*kòr-dó*	'sack'
	kẹ̀ː-gá	*kẹ̀ː-sé*	'green'
H-L	*wób-gò*	*wób-dò*	'elephant'
	sáː-gà	*sáː-sè*	'broom'
H-H	*móː-gó*	*móː-dó*	'straw'
	báː-gá	*báː-sé*	'dog'

The tone of the noun class suffix is polar with respect to the stem in the L+H and H+L patterns. But what about the H+H pattern? The key to the proper analysis of these data lies in the following fact: when modified by an adjective, the noun loses its noun class suffix. The root tone of L+H and H+L nouns is stable in this context while the root tone of H+H nouns systematically shifts to L.

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2 Typologically this state of affairs could be described in the Optimality Theory Framework by differential ranking of markedness constraints prohibiting floating and contour tones with faithfulness constraints requiring input tones to appear in the output.

(17)	*kòr bédà*	'big sacks'	cf.	*kòr-gó*	'sack'
	sá bédà	'big brooms'		*sáː-gà*	'broom'
	bà bédà	'big dogs'		*báː-gá*	'dog'

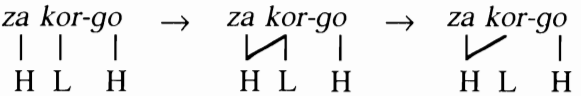
Kenstowicz, Nikiema, & Ourso [1988] propose that the underlying tonal contrast in Moore is a three-way H vs. L vs. Ø opposition. The noun class suffix is underlying H. It dissimilates with a preceding root H by the OCP (tonal polarity). Toneless roots such as *báː-gá* 'dog' copy the tone of the suffix. In the noun+adjective construction when the noun class suffix of the head noun is suppressed, the toneless root is assigned a default low tone. The derivation in (18) illustrates the analysis.

(18)	*kòr-gó*	*sáː-gá*	*baː-gá*	*ba bé-dá*	underlying
	inappl.	*sáː-gà*	inappl.	*ba bé-dà*	Polarity
	inappl.	inappl.	*báː-gá*	inappl.	Tone Copy
	inappl.	inappl.	inappl.	*bà bé-dà*	Default L
	kòr-gó	*sáː-gà*	*báː-gá*	*bà bé-dà*	output
	'sack'	'broom'	'dog'	'big dogs'	

The Moore paradigms in (19) illustrate the rule spreading a H tone to a following L tone syllable. Since Moore lacks falling tones the underlying low tone delinks to create a downstep. The derivation of *zá kór-ꜜgó* 'bring a sack' is illustrated in (20).

(19)	*kò sáː-gà*	'give a broom'
	kò kòr-gó	'give a sack'
	zá sáː-gà	'bring a broom'
	zá kór-ꜜgó	'bring a sack'

(20)



The High Tone Spread process in Moore is restricted to apply across word boundaries. In Dagbani [Hyman 1993], the rule also applies word-internally so that underlying H+L nouns surface as H+H!. They contrast with Ø+H → H+H nouns by downstepping a H that begins the next word.

With this background we return in (21) to Buli where we collect some cognate nouns from Buli and Dagaare (data from Bodomo [1997]). Dagaare shows traces

of the tonal polarity that is more apparent on the surface in Moore. As in Moore, there are three principal tonal patterns on Dagaare nouns: H+L, L+H, and H+H. It is evident that there is a systematic correspondence between Dagaare and Buli: H+L in Dagaare corresponds to H in Buli; L+H in Dagaare corresponds to L in Buli; and H+H in Dagaare corresponds to M in Buli. Buli has lost all trace of the suffixal tone as well as suffered severe segmental erosion of the noun class suffixes. When another vowel appears (as in *núrú* 'person') it is a high vowel that typically harmonizes with the preceding vowel and copies its tone in the manner discussed earlier.

(21)

Dagaare	Buli	
H+L	H	
yírì	*yérí*	'house'
níè	*núrú*	'person'
kógò	*kók*	'mahogany'
zû	*zúk*	'head'
nû	*nísí*	'hand'
bírì	*bírí*	'seed'
nóɔ̀	*núbí*	'chicken'
kyúù	*cí:k*	'month, moon'
mírì	*mí:k*	'rope'
gánì	*gbáŋ*	'hide, book'
káà	*kpá:m*	'oil'
náá'ú	*ná:b*	'cow'
wáá'ú	*wá:b*	'snake'
kpáá'ú	*kpóŋ*	'guinea fowl'
L+H	L	
tìɛ́	*tìb*	'tree'
dìé	*dòk*	'room'
dùó	*dèrì, dwòk*	'pig' (pl)
dòɔ́	*duòk*	fruit sp.
wìrí	*wùsùm*	'horse'
kùùrí	*kuì, kùrì*	'hoe'
bɔ̀ŋɔ́	*bàŋ*	'lizard'
tìì^{n}	*tì:m*	'medicine'
bìrùŋ	*bìsìm*	'milk'
zìì^{n}	*zí:m*	'blood' (exception)
tɔ̀ɔ̀rí	*tūrī*	'ear' (exception)

H+H	M	
dɔ́ɔ́	*dʷōk*	'man, male'
búɔ́, búúrí	*bū:kʷ, bʷō*	'goat'
pégí	*pāwk, pāk*	'shell, tree bark'
váálí	*vā:lī*	'field rubbish'
píé	*pī*	'ten'
pógɔ́	*pōk*	'woman, wife'
tíŋé	*tēŋ*	'town, land'
nyuórí	*ŋʷērī*	'nose'
báagá (Moore)	*bʸāk*	'dog'
kɔ́ɔ́rí	*kōbī*	'bone'
kyííní	*cīn*	'calabash, musical instrument'
támmú	*tōm*	'bow'
móogó (Moore)	*mū:b*	'straw'
íílí	*ŋílī*	'horn' (exception)
bíé	*bí:k*	'child' (exception)

Several explanations are possible for the H+H ≈ M correspondence between Dagaare and Buli. One states that with the erosion of the noun class suffixes and the general prohibition against floating tones, the tonal specification for Buli nouns depended solely on the root tone. Since the root tone in Dagaare H+H nouns derives from the tone of the noun class suffix, the Buli root would have become deprived of a tone and have to seek its tonal specification from another source. The most plausible source is the default rule that inserted a low tone. But in order to maintain the underlying three-way H vs. L. vs. Ø contrast, the default rule was modified to insert a mid tone instead of low. (22) outlines this scenario.

(22)

CVC + V	CVC + V	CVC + V	
H H	L H	H	
CVC	CVC	CVC	loss of final V and tone
H	L		
inappl.	inappl.	CVC	default mid
		M	

The major problem with this analysis is that it cannot explain why the default M did not also appear in the noun-modifier construction where the noun shows up as a bare root. In present-day Buli the mid tone nouns have a low in this

construction—the tone that they must have had all along. The data in (23) illustrate.

(23)	*kpá:m*	'oil'	*kpá nàlɪŋ*	'nice oil'
	tì:m	'medicine'	*tì nàlɪŋ*	'nice medicine'
	tōm	'bow'	*tòm nàlɪŋ*	'nice bow'
	bāŋ	'bangle'	*bàŋ fí:k*	'small bangle'
	mū:b	'straw'	*mù nàlɪŋ*	'nice straw'
	tōm	'bow'	*tòm fí:k*	'small bow'

A plausible alternative explanation appeals to phonetics. In numerous tonal languages, including Hausa [Maddieson 1977], Yoruba [Laniran 1992] and Mandarin [Xu 1993], a high tone is implemented at a higher F0 value before a low tone than in other contexts. Suppose that this phonetic process operated in the earlier history of Buli. The H of a H+L noun would be implemented at a higher F0 value that the tone of the H+H nouns. Upon the erosion of the vowel of the noun-class suffix and loss of suffixal tone, suppose that the higher F0 of the erstwhile H+L nouns is recategorized as underlying. The result is a three-way tonal contrast. Rialland [1983] proposes a similar evolution of the super-high tone in Moba. This historical scenario is sketched out in (24).

(24)	/H+L/	[¯ ˍ]	/H+H/	[- -]	/L+H/	[ˍ -]	before vowel deletion
	/H/	[¯]	/H/	[-]	/L/	[ˍ]	after vowel deletion
	/H/	[¯]	/M/	[-]	/L/	[ˍ]	recategorization

If the mid tone arose from the phonologization process sketched in (24) rather than from a modification of the default rule, then there is no reason to expect a mid to appear on the bare root in the modifier construction of (23). The low tone appearing there in the contemporary language will have to be the product of a systematic but synchronically arbitrary rule changing mid tone to low in this construction.

As far as the relationship between Konni [Cahill 1999] and Buli is concerned, we find a systematic correspondence between high tone roots in the two languages. But Buli mid and low tone roots turn up as low in Konni. Konni has thus largely merged the former three-way H vs. L vs. Ø Gur distinction in root tone into a binary H vs. L opposition. Cahill finds that the majority of Konni nouns in their citation form end in a velar nasal with a floating high tone that docks to the final syllable of the stem. The tone of the plural suffix is polar to the root tone in Konni. In Buli the plural suffix *–e* that appears on nouns in the *–ri*

class copies the tone of the root while the *–a* plural is underlyingly low and changes to mid after a mid tone.

(25)

Konni		Buli		
singular	plural	singular	plural	
H		H		
túŋ	*túò*	*túrí*	*túé*	'bean'
wíŋ	*wíè*	*wírí*	*wíé*	'face mark'
níːŋ	*níè*	*nírí*	*níé*	'grinding stone'
díːŋ	*díè*	*dírí*	*díé*	'forehead'
múgúŋ	*múgà*	*mógí*	*mógà*	'river'
L		M		
dŭŋ	*dùnné*	*dūnūŋ*	*dūnā*	'knee'
sàːmíŋ	*sàːmá*	*sāin*	*sāːmā*	'porcupine'
tăŋ	*tàná*	*tāin*	*tānī*	'stone'
jŭŋ	*jùnní*	*jiūk*	*jiūtā*	'tail'
chìáŋ	*chìàsí*	*chiāk*	*chāːsā*	'waist'
L		L		
bĭŋ	*bìná*	*bèin*	*bènà*	'year'
kŭːŋ	*kùrá*	*kùi*	*kùè*	'hoe'
bìːsíŋ	*bìːsá*	*bĭːsìrì*	*bìːsà*	'female breast'
tĭːŋ	*tìːsí*	*tĭːb*	*tìːsà*	'tree'
dòmíŋ	*dònsí*	*duìŋ*	*duìŋsà*	'mosquito'

Konni shows traces of the former Gur ternary tonal distinction. Cahill reports a score of disyllabic roots with a LH tonal contour that have distinctive behavior in the Konni associative construction that reflects their earlier toneless status. The majority of Konni LH nouns show an internal downstep in the associative due to a rule that docks a floating H tone to the head of the phrase. The paradigms in (26) illustrate.

(26)

tìːsí	'trees' pl.	
hàːgín tíːˈsī	'bushes' trees'	from /*hàːgín ´ tìːsí* /
dăːŋ	'stick'	
bòàwá dáˈáŋ	'the child's stick'	from /*bòàwá ´ dà áŋ* /

But there are some twenty disyllabic LH nouns that fail to produce a downstep in the associative. Cahill analyzes them as underlying /ØH/ with Ø replaced by a default low tone in the isolation form. In the few cases where we have been able to find cognates for these nouns in Buli, the roots have a mid tone that corroborates their toneless ancestry, as in (27). But a significant number of Konni LH nouns with a M correspondent in Buli do show an internal downstep in the associative (28), suggesting that they have been reanalyzed from /ØH/ to /LH/, presumably on the basis of the isolation form.

(27)

kɔ̀bá	'bones'	cf. Buli *kōbī, kōbā* pl.
kpáˈáŋ kɔ́bà	'guinea fowl's bones'	*kpóŋ kōbā*
hɔ̀gú	'wife'	cf. Buli *pōk, pōːbā* pl.
dàːwá hɔ́gù	'husband's wife'	*chōroā pōk*
chùrú	'husband'	cf. Buli *chōrō, chōroābā* pl.
ǹ zùá chúrù	'my friend's husband'	*ǹ duā chōroā*

(28)

Konni		Buli		
singular	plural	singular	plural	
sǎːŋ	*sàːtí*	*sāːb*	*sīrā*	'porridge'
sàːbú (def.)		*sāːmú*		
hɔ̀wwá sáːˈbú		*núpōːmá sīrā*		'woman's porridge'
chìáŋ	*chìàsí*	*chiāk*	*chāːsā*	'waist, bottom'
kúrúbâ		*kúrúbà*		'bowl'
kúrúbáˈ chíˈáŋ		*kúrúbà chiāk*		'bowl's bottom'
jìbíŋ	*jìbìsí*	*gēbīk*	*gēbsā*	'knife'
bùá		*bíːk*		'child'
bùá jíˈbíŋ		*bíː gēbīk*		'child's knife'

One final comparative remark. As we shall see in section 7, Buli has lost lexical tonal contrasts in the verb. However, various nominalizations of the verb exhibit lexical contrasts. Although much more study is required, a preliminary

survey suggests that the contrasting tones in Buli nominalizations correspond to the verbal tone in Dagaare.[3]

(29)

Buli		Dagaare	
Verb	Nominal	Verb	
dā	*dìak dà:sà*	*dà*	'buy, sale'
mī	*mí:k mí:sà*	*mí*	'weave, rope'
kīsī	*kísúk kísítà*	*kyí:rì*	'forbid, taboo'
zū	*zúm*	*zú*	'steal, theft'

6. Nominal Inflection

Nouns in Buli appear in five singular-plural pairs that form a noun class system marked by suffixes. There is no agreement with modifiers, which have their own inherent noun class specification. In many cases the noun stems have fused in various ways with the suffixes creating considerable disparity between the singular and plural. In addition, each noun occurs in a definite form marked by a suffix that is high in tone. In (30) we illustrate each of the noun classes, following the numbering in Kröger [1992].

Several generalizations can be made about the tonology of the nominal inflection. The plural suffix typically terminates in *-à* with a low tone. It is raised to mid after a mid tone: cf. *bàŋsà* 'lizards' vs. *bāŋsā* 'bangles'. It is also raised to high when followed by the definite suffix *–ŋá* and preceded by a high toned root: cf. *bísà* 'children', *bísáŋá* (def.). In other words, the tone of this suffix raises to high between high tones.[4] We formulate these minor rules in (31a). The derivations in (31b) show that they both must precede the general Low Tone Spread rule.

[3] Thanks to Adams Bodomo for supplying us with the Dagaare cognates. Cahill [1999] makes a similar point for Konni.

[4] A reflex of this process also appears in Konni [Cahill 1999] where a HLH tonal sequence is realized as H$^{!}$HH: *ɲúrà* 'chest' pl., *ɲú$^{!}$rá-há* 'chest' (pl. def.).

(30)

CLASS I	SG	PL	
indef.	*bíːk*	*bísà*	'child'
def.	*bíːká*	*bísáŋá*	
pronoun	*wà*	*bà*	
indef.	*pōk*	*pōːbā*	'wife'
def.	*pōːwá*	*pōːmá*	
pronoun	*wà*	*bà*	
indef.	*nàːb*	*nàl ìmà*	'chief'
def.	*nàːwǎ*	*nàl ìmàŋǎ*	
pronoun	*wà*	*bà*	

CLASS II	SG	PL	
indef.	*yérí*	*yié*	'house'
def.	*yénní*	*yiéŋá*	
pronoun	*dì*	*ŋà*	
indef.	*tūrī*	*tʷē*	'ear'
def.	*tūnní*	*tʷēŋá*	
pronoun	*dì*	*ŋà*	
indef.	*bèin*	*bènà*	'year'
def.	*bènǐ*	*bènàŋǎ*	
pronoun	*dì*	*ŋà*	

CLASS III	SG	PL	
indef.	*cíːk*	*cíːsà*	'moon'
def.	*cíːká*	*cíːsáŋá*	
pronoun	*kà*	*sì*	
indef.	*bāŋ*	*bāŋsā*	'bangle'
def.	*bāŋká*	*bāŋsāŋá*	
pronoun	*kà*	*sì*	
indef.	*bàŋ*	*bàŋsà*	'lizard'
def.	*bàŋkǎ*	*bàŋsàŋǎ*	
pronoun	*kà*	*sì*	

CLASS IV	SG	PL	
indef.	*kpóŋ*	*kpí:nà*	'guinea fowl'
def.	*kpóŋkú*	*kpí:náŋá*	
pronoun	*kù*	*ŋà*	
indef.	*bū:k^{w}*	*b^{w}ō*	'goat'
def.	*būkú*	*b^{w}ōŋá*	
pronoun	*kù*	*ŋà*	
indef.	*dòk*	*dì:nà*	'room'
def.	*dòkŭ*	*dì:nàŋă*	
pronoun	*kù*	*ŋá*	

CLASS V	SG	PL	
indef.	*ná:b*	*ní:gà*	'cow'
def.	*ná:mú*	*ní:ŋá*	
pronoun	*bù*	*ŋà*	
indef.	*tōm*	*tīmā*	'bow'
def.	*tōmmú*	*tīmāŋá*	
pronoun	*bù*	*ŋà*	
indef.	*tù:m*	*tù:tà*	'medicine'
def.	*tù:mŭ*	*tùtàŋă*	
pronoun	*bù*	*ŋà*	

(31) a. L → M / M + ___
L → H / H + __ + H

b.

cí:-sà-ŋá	*bāŋ-sà-ŋá*	*bàŋ-sà-ŋá*	underlying
inappl.	*bāŋ-sā-ŋá*	inappl.	L → M / M + ___
cí:-sá-ŋá	inappl.	inappl.	L → H / H + __ + H
inappl.	inappl.	*bàŋ-sà-ŋă*	Low Tone Spread
cí:-sá-ŋá	*bāŋ-sā-ŋá*	*bàŋ-sà-ŋă*	output
'moons' def.	'bangles' def.	'lizards' def.	

Finally, all of the pronouns are low in tone. The only exceptions are the emphatic forms of the first and second person singular, which have a high tone. The non-emphatic form of the first person singular pronoun is a syllabic nasal with low tone that assimilates the point of articulation of a following consonant: *ǹ lă* 'I laughed'. When it precedes a vowel the two syllables contract into a single syllable whose onset is [m] and whose nucleus is a long vowel composed of the mora of the underlying syllabic /m̩̀/ and the mora of the following vowel: /m̩̀ à nágí wâ → *mà: nàgí wáI* hit him'. In direct object position a non-emphatic pronoun is cliticized to the preceding verb. Pronouns of the shape *Ci* such as the first per-son singular pronoun /mi/ reduce their vowel to schwa when cliticized.

(32)

SG	PL	emphatic	
m̀	*tì*	*mí*	first person
fì	*nì*	*fí*	second person
wà	*bà*		third person
đì	*ŋà*		
kà	*sì*		
kù	*tì*		
bù			

The paradigms in (33) illustrate the tonal effect of the pronouns on a following noun. A low tone spreads to a following high creating a rising tone that simplifies to low before a high by the absorption process.

(33)

bí:k	'child'	*m̀ bĭ:k*	'my child'
bísà	pl.	*m̀ bĭsà*	pl
bí:ká	def.	*m̀ bì:ká*	def.
bísáŋá	def. pl.	*m̀ bìsáŋá*	def. pl.
ná:b	'cow'	*ná:mú*	'cow' (def.)
ǹ nă:b	'my cow'	*ǹ nà:mú*	'my cow' (def.)
fì nă:b	'your cow'	*fì nà:mú*	'your cow' (def.)
wà nă:b	'his cow'	*wà nà:mú*	'his cow' (def.)
tì nă:b	'our cow'	*tì nà:mú*	'our cow' (def.)
nì nă:b	'your (pl.) cow'	*nì nà:mú*	'your (pl.) cow' (def.)
bà nă:b	'their cow'	*bà nà:mú*	'their cow' (def.)
mí ná:b	'my (emph) cow'	*mí ná:mú*	'my (emph) cow' (def.)
fí ná:b	'your (emph) cow'	*fí ná:mú*	'your (emph) cow' (def.)
nāgī mí	'hit me (emph)'	*nāgī-mə*	'hit me'

7. Verbal Tone

While tone is lexically contrastive in nouns, adjectives and particles, there is no lexical contrast in verbs. Verbs display a considerable variety of tonal patterns depending on tense and aspect as well as the person of the subject. Cahill [1999] documents a similar state of affairs in Konni. In what follows we present the tonal patterns for the major inflectional categories. We note the major generalizations. After the data have been introduced and tabulated, we turn to a tentative analysis.

7.1 Perfect. In (34) we give paradigms for the verbs /la/ 'laugh' and /nag/ 'hit'. The latter has the optional epenthetic vowel [i]. It is transitive; we show it also when followed by the object suffix *-wa* 'him'.

(34)

ǹ lă	'I laughed'	*tì lă*	'we laughed'
fì lă	'you laughed'	*nì lă*	'you (pl.) laughed'
wà là	'he laughed'	*bà là*	'they laughed'
ǹ nàgí	'I hit'	*tì nàgí*	'we hit'
fì nàgí	'you hit'	*nì nàgí*	'you (pl.) hit'
wà nàgì	'he hit'	*bà nàgì*	'they hit'
ǹ nàgí-wà	'I hit him'	*tì nàgí-wà*	'we hit him'
fì nàgí-wà	'you hit him'	*nì nàgí-wà*	'you (pl.) hit him'
wà nàgì-wā	'he hit him'	*bà nàgì-wā*	'they hit him'

It is apparent that in the third person the verb has low tone while in the first and second it has high tone. The processes of Low Tone Spread and Rising Tone Absorption then derive the surface forms: / ǹ lá / → *ǹ lă* and / ǹ nágí / → *ǹ nàgí*. Anticipating the analysis to be proposed later, let us refer to this tonal alternation between the first and second versus third person as "agreement". In the transitive verbs, the object pronoun suffix appears with a low tone after a high tone root (i.e., in the first and second person) and with a mid tone after the low tone of the third person.[5]

[5] In Konni [Cahill 1999:440] we find the cognate paradigm below for the verb /si/ 'bathe' in the perfective. There is a low in the third person and a H + floating L that downsteps the completive particle *yá* in the first and second person. The Konni and Buli paradigms thus appear to be identical at an abstract level: HL in first and second person and L in third.

ŋ̀ sí ꜜyá	'I bathed'	*tĭ sí ꜜyá*	'we bathed'
sí ꜜyá	'you bathed'	*nì sí ꜜyá*	'you (pl.) bathed'
ù sì yá	'he, she bathed'	*bà sì yá*	'they bathed'

The corresponding negative form of the perfect is marked by the particle *àn* (35). It is associated with an underlying H on the following verb. Any object suffix is L. The "agreement" alternation (low in third person high in first and second) is absent in the negative. This represents a broader generalization: generally when a preverbal particle is present, it blocks this alternation.

(35) *àtì:m àn lă yà* 'Atim did not laugh' (*yà* is a completive particle)
mí àn lă yà 'I (emph.) did not laugh'
màn lă yà 'I did not laugh'
àtì:m àn nàgí-wà 'Atim did not hit him'
mí àn nàgí-wà 'I (emph.) did not hit him'
màn nàgí-wà 'I did not hit him'

7.2 Present. The present tense is marked by the preverbal particle *à*. It has an habitual sense. The following verb is mid in tone except when it is suffixed with an object pronoun. In this case the verb has an underlying high tone and the object suffix a low tone. The corresponding negatives are marked by *kàn*; the verb

(36) *àtì:m à lā* 'Atim laughs'
mí à lā 'I (emph.) laugh'
wà à lā 'he laughs'

àtì:m kàn lā 'Atim does not laugh'
mí kàn lā 'I (emph.) do not laugh'
wà kàn lā 'he does not laugh'

àtì:m à nāgī ná:b 'Atim hits a cow'
mí à nāgī ná:b 'I (emph.) hit a cow'
wà à nāgī ná:b 'he hits a cow'

àtì:m kàn nāgī ná:b 'Atim does not hit a cow'
mí kàn nāgī ná:b 'I (emph.) do not hit a cow'
wà kàn nāgī ná:b 'he does not hit a cow'

àtì:m à nàgí-wà 'Atim hits him'
mí à nàgí-wà 'I (emph.) hit him'
mà: nàgí-wà 'I hit him'

àtì:m kàn nàgí-wà 'Atim does not hit him'
mí kàn nàgí-wà 'I (emph.) do not hit him'
ŋ̀ kàn nàgí-wà 'I do not hit him'

is mid unless it carries an object suffix, in which case the high-low contour appears.

7.3 Imperative. The imperative is characterized by a mid tone on the verb and the object suffix. In the negative imperative the negator is *kán* with a low tone on the following verb and a mid on any object suffix. The negator has an emphatic sense: 'do nót laugh, hit him'.

(37)	*lā*	'laugh!'	*nāgī-wā*	'hit him!'
	kán là	'do not laugh!'	*kán nàgì-wā*	'do not hit him!'

Buli also has an imperative that inflects for continuous aspect. It is marked by the particle *á*. The following verb is mid in tone unless it bears an enclitic, in which case it is high and the clitic is low.

(38)	*á lā*	'keep on laughing'	*á nāgī*	'keep on hitting'
			á nágí-wà	'keep on hitting him'
	kán á lā	'don't keep on laughing'	*kán á nágí-wà*	'don't keep on hitting him'

7.4 Future. The future particle is *lì*. It induces a mid tone on the following verb and hence we have the same verbal tone patterns as in the imperative. There is no future negative form, the present negative being used instead.

(39)	*àtù:m lì lā*	'Atim will laugh'
	àtù:m lì nāgī-wā	'Atim will hit him'

7.5 Stative. Stative verbs consist of a root plus a suffix *–a*. The verb has a mid tone.

(40)	*mí nāl-ā*	'I (emph.) am nice'	*tì nāl-ā*	'we are nice'
	fì nāl-ā	'you are nice'	*nì nāl-ā*	'you (pl.) are nice'
	wà nāl-ā	'he is nice'	*bà nāl-ā*	'they are nice'
	mí àn nāl-ă	'I (emph.) am not nice'	*tì àn nāl-ā*	'we are not nice'
	fì àn nāl-ă	'you are not nice'	*nì àn nāl-ă*	'you (pl.) are not nice'
	wà àn nāl-ā	'he is not nice'	*bà àn nāl-ā*	'they are not nice'

There is an alternative inflection for the stative in which the verb bears an underlying high tone on the root in the first and second (but not the third) person.

The suffix has a low tone. This form has an emphatic interpretation (41). While English distinguishes 'I *am* nice' vs. 'I am *nice'*, Buli lacks this distinction.

(41)

ǹ nǎl-à	'I *am nice'*	*tì nǎl-à*	'we *are nice'*
fí nǎl-à	'you *are nice'*	*nì nǎl-à*	'you (pl.) *are nice'*
wà nāl-ā	'he *is nice'*	*bà nāl-ā*	'they *are nice'*
màːn nǎl-à	'I *am not nice'*	*tì àn nǎl-à*	'we *are not nice'*
fí àn nǎl-à	'you *are not nice'*	*nì àn nǎl-à*	'you (pl.) *are not nice'*
wà àn nǎl-à	'he *is not nice'*	*bà àn nǎl-à*	'they *are not nice'*

The following chart summarizes the tone of the verbal inflection. When the suffix tone is in parentheses this means that it may be absent (as in an intransitive verb or a transitive verb whose object is not a pronominal enclitic).

(42)

	Affirmative			Negative		
	particle	verb	suffix	particle	verb	suffix
perfect 3rd		L	(M)	*àn*	H	(L)
1st, 2nd		H	(L)	*àn*	H	(L)
present	*à*	M		*kàn*	M	
	à	H	L	*kàn*	H	L
imperative		M	(M)	*kán*	L	(M)
contin.	*á*	M		*kán á*	M	
	á	H	L	*kán á*	H	L
future	*lì*	M	(M)	*kàn*	M	
				kàn	H	L
stative		M	M	*àn*	M	M
emphatic		H	L	*àn*	H	L

7.6 Analysis. As is often the case in the analysis of inflectional morphology, the Buli data are limited and thus the analysis is considerably underdetermined by the facts. One runs the risk of drawing parallels that may later turn out to be spurious. With this caveat, we offer the following interpretation of the data that tries to

impose some order on what otherwise appear to be rather arbitrary and chaotic tonal changes.

The imperative, future, and stative seem to form a system separate from the perfect and present. The verbal tone is generally mid in these inflectional categories, which we will assume to be the default tone—at least for the verbs. In the stative the appearance of the HL tonal pattern is associated with an emphatic interpretation. The association of high tone and focus or more general foregrounding pervades Buli phonology: the definite of nouns is marked by a high; the focus marker *ká* has a high tone; and the emphatic form of a pronoun has a high tone. For the stative, recall that the emphatic high tone does not appear when the verb is third person: cf. *fì nǎlà* 'you *are nice'* emphatic but *wà nālā* (**wà nǎlà*) 'he *is nice'*. The HL of the stative thus has a distribution comparable to the H(L) in the perfect, which is also absent in the third person. The parallel is further strengthened by the fact that in the negative the verb is HL in the perfect regardless of the person of the subject. And the same is true for the emphatic form of the stative. This suggests that the emphatic HL of the stative is really the agreement H(L) morpheme found in the perfect. In the affirmative form of both the perfect and the stative the agreement H(L) is absent in the third person. Cross-linguistically third person often has unmarked inflection, as opposed to first and second. Also, first and second person stand out from the background as participants in the speech act and so the agreement morpheme shares a family resemblance with the definite and focus forms.

Let us formalize these observations by postulating an agreement morpheme Agr consisting of a H+L tonal sequence. It appears in the preverbal INFL position. We postulate a rule deleting this morpheme when it immediately follows a third person [-participant] subject. The rule fails to apply in the negative because the negative morpheme intervenes between Agr and the subject. In the stative the Agr morpheme is normally absent but can be inserted when the verb is emphatic (focused).

The tense markers *à* and *lì* have a low tone. And in the perfect a low tone appears on the verb in the third person: *wà là* 'he laughed' (cf. *ǹ lǎ* < /ǹ lá/ 'I laughed'). It seems reasonable to identify this low tone as an exponent of the tense morpheme. Any following suffix is mid—presumably a default tone.

Collecting all these ingredients together, we postulate the underlying structure of (43a) for the verb in Buli. The rule of (43b) deletes the Agr following a [-participant] (i.e., third person) morpheme. Rule (43c) assigns a default mid tone when the verb fails to receive a tone from the Infl node.

(43) a. Neg [Agr Tns]$_{INFL}$ Verb
L H+L L

b. Agr → Ø / [-participant] ____

c. default: Ø → M

Let us sketch some derivations utilizing the transitive verb /ŋma/'blame'. In the perfect there is no segmental spell out of the Tns node. If the subject is third person, the Agr morpheme deletes leaving just the Tns L. It associates to the verb. Any object suffix gets the default mid.

(44) morphosyntax:

wà [H+L]$_{Agr}$ [L]$_{Tns}$	*ŋma-wa*	underlying
wà [L]$_{Tns}$	*ŋma-wa*	Agr Deletion
wà	*ŋma-wa*	Tone Association
	[L]$_{Tns}$	

phonology:

wà	*ŋma-wa*	Default Mid
	[L]$_{Tns}$ M	
wà ŋmà-wā		output
'he blamed him'		

In the first or second person of the perfect, the Agr morpheme is not deleted. Under left-to-right association the Agr H associates to the verb and any object suffix receives a L.

(45) morphosyntax:

fì [H+L]$_{Agr}$ [L]$_{Tns}$	*ŋma-wa*	underlying
fì	*ŋma-wa*	Tone Association
	[H+L]$_{Agr}$ [L]$_{Tns}$	

phonology:

fì	*ŋma wa*	Floating Tone Deletion
	H L	
fì ŋmă wà		Low Tone Spread
'you blamed him'		

In the negative of the perfect, the negator *án* intervenes between the subject and the verb blocking deletion of the Agr H+L. This morpheme persists in the representation and maps to the verb to produce a H(L) contour.

(46) morphosyntax:

wà àn	$[H+L]_{Agr}$ $[L]_{Tns}$	*ŋma-wa*	underlying
inappl.			Agr Deletion
wà àn		*ŋma-wa*	Tone Association
		$[H+L]_{Agr}$ $[L]_{Tns}$	

phonology:

wà àn	*ŋma-wa*	Floating Tone Deletion
	H L	
wà àn ŋmă-wà		Low Tone Spread
'he did not blame him'		

In the stative the INFL node normally deletes (or is not spelled out). The verb thus receives a default mid tone, as in (47). But under emphasis the INFL node is retained (cf. English emphatic *do*). We then derive the familiar H(L) contour (48).

(47) morphosyntax:

fɪ	$[H+L]_{Agr}$ $[L]_{Tns}$	*nal-a*	underlying
fì		*nal-a*	Infl Deletion

phonology:

fì nāl-ā	Default Mid
'you are nice'	

(48) morphosyntax:

fɪ	$[H+L]_{Agr}$	*nal-a*	underlying
fì		*nal-a*	Tone Association
		$[H+L]_{Agr}$	

phonology:

fì năl-à	Low Tone Spread
'you *are nice'*	

In the future the tense node is lexicalized with *lì* that takes the low tone. We assume that lexicalization of the Tns node blocks association of the Agr and its H+L tones to the following verb. As a result, the verb gets default mid tone.

(49) morphosyntax:

fì [H+L]$_{Agr}$	*lì ŋma-wa*	underlying
	inappl.	Agr Deletion
	inappl.	Tone Association

phonology:

fì	*lì ŋma-wa*	Floating Tone Deletion
fì	*lì ŋma-wa*	Default Mid
	M M	
fì lì ŋmā-wā		output
'you will blame him'		

As in many other languages the imperative form of the verb consists of the bare stem without any Infl. Thus, only a default mid is inserted: *nāgī-wā* 'hit him'. In the negative imperative, we find *kán* and low tone on the following verb: *kán nàgì-wā* 'don't hit him'. According to the first author, this form of the imperative has an emphatic sense (cf. English *do nót open the door*) and is thus comparable to the emphatic stative. The emphatic sense calls for insertion of the Agr mor-pheme. But the H of Agr H+L associates to the negative [kan] and the L to the verb. Any object suffix receives the default mid.[6]

(50) morphosyntax:

kan	*ŋma-wa*	underlying
[H+L]$_{Ag}$	*kan ŋma-wa*	Emphatic Agr Insertion
kan	*ŋma-wa*	Tone Association
H	L	

phonology:

kan ŋma-wa	Default Mid
H L M	
kán ŋmà-wā	output
'do not blame him'	

6 It is also conceivable that the emphatic negative particle *kán* is some amalgamation of the focus marker *ká* plus the negative *àn*.

The most puzzling tonal contrast is found in the present tense. Recall that it is marked by the tense-aspect morpheme *à*. This morpheme will block association of the Agr tones to the verb, which then receives default mid, just as in the future (49): *mí à nāgī náːb* 'I emphatic hit a cow'. But if the verb is encliticized with an object pronoun suffix then the verb appears as HL. This suggests that the Agr node lowers onto the verb when it contains an "agreeing" object suffix. The verb will then acquire the H+L tonal contour. Agr lowering must precede Agr deletion since it applies even when the subject is third person.

(51) morphosyntax:

wà	$[H+L]_{Agr}$ $[à]_{Tns}$	*ŋma-wa*	underlying
wà	$[à]_{Tns}$ $[H+L]_{Agr}$	*ŋma-wa*	Agr Lowering
	inappl.		Agr Deletion
wà	*à*	*ŋma-wa*	Tone Association
		H L	

phonology:

wà à ŋmă-wà	Low Tone Spread
'he hits him'	

We are unable to explain why Agr Lowering does not occur in the future (or the third person of the perfect). Clearly more study of the complex morphosyntax of the Buli verb is required before this discrepancy can be explained.

8. Other Constructions

In this section we review the tonal patterns of the verbal inflection in several additional constructions.

8.1 Serial Verbs. The serial verb construction consists of two verbs that share an object. (See Lee [2002] for analysis of serial verbs in Buli). The shared object must appear between the two verbs. In what follows, we are interested primarily in how the serial verb inflects for tone. Our paradigms use the canonical serial verb composed of *tūsī* 'push' and *lʷānsī* 'drop'. When combined into a serial verb, the meaning changes to 'push down'.

The paradigm in (52) shows some serial verb constructions in the perfect tense.

(52)

ǹ tùsì bí:k lʷànsì	'I pushed down a child'
ǹ tùsí bāŋ lʷànsì	'I pushed down a bangle'
àtì:m tùsì bāŋ lʷànsì	'Atim pushed down a bangle'
àtì:m àn tùsí bāŋ lʷàsī yà	'Atim did not push down a bangle'[7]
wà tùsì bǐk lʷànsì	'he pushed down a child'
ǹ tùsì wá lʷànsì	'I pushed him down'
mí túsí wá lʷànsì	'I (emph) pushed him down'
wà tùsì mī lʷànsì	'he pushed me emph. down'
fì tùsí mí lʷànsì	'you pushed me down'
mí àn tùsì wá lʷànsì	'I (emph) did not push him down'

We observe that V_1 shows the agreement alternation. It takes an underlying H when the subject is first or second person and L when it is third person. Low Tone Spread and Rising Tone Absorption apply to derive the *tùsì* and *tùsí* alternants. In the perfect tense V_2 is consistently low in tone. This suggests that the underlying structure of the IP in the serial construction is [Subj-Agr-Tns-V_1-Obj-Tns-V_2] with both verbs inflected for tense. The L Tns morpheme appears on V_1 in the third person when the Agr morpheme is deleted. But it is pushed aside in the first and second person by Agr H<L>.

(53) morphosyntax:

mí Agr Tns *tus* Tns *lʷans* HL L L	*wà* Agr Tns *tus* Tns *lʷans* HL L L	underlying
inappl.	*wà* Tns *tus* Tns *lʷans* L L	Agr Deletion
mí tus lʷans H L	*wà tus lʷans* L L	Tone Association

phonology:

mí túsí lʷànsì 'I (emph.) pushed down'	*wà tùsì lʷànsì* 'he pushed down'	Epenthesis

There is one unexplained gap in the paradigm. When the verb is first or second person (and hence has the HL Agr morpheme) it cannot take a cliticized object. Instead the full form of the object must be used.

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7 The negative perfect of the serial must take the sentence final completive particle *yà* that imposes a mid tone on the preceding syllable.

(54) *wà tùsì-mə̄ lʷànsì* 'he pushed me down'
wà tùsì mǐ lʷànsì 'he pushed me (emph) down'
fì tùsí mí lʷànsì 'you pushed me (emph) down'
**fì tùsí-mə̀ lʷànsì* 'you pushed me down'

àtù:m àn tùsì-kú lʷànsī yà 'Atim did not push it [ku] down

In the present each verb takes a segmentally lexicalized tense morpheme: Tns-V_1 Tns-V_2.

(55) a. *àtù:m à tūsī mí á lʷānsī* 'Atim is pushing me down'
b. *mí à tūsī bí:k á lʷānsī* 'I (emph.) am pushing down a child'
c. *mí túsí bí:ká á lʷānsī* 'I (emph.) push down the child'
d. *àtù:m tùsì mì á lʷānsī* 'Atim pushes me (emph.) down'

V_2 consistently has the high toned *á* particle that is found in the imperative (38).[8] The verb itself carries a default mid. When the serial verb has the progressive sense, then V_1 is preceded by the low tone tense-aspect particle *à*. The following verb V_1 has default mid. This is what we expect since the *à* particle blocks the docking of the AGR morpheme on V_1. When the serial verb has a habitual sense then V_1 has no segmental preverbal particle. In this case, the H(L) agreement morpheme can appear on V_1 when the subject is not third person (55c). In the third person, the AGR is deleted and so only the Tense L survives; it docks to the verb (55d).

In the imperative and future forms of the serial verb, V_1 is inflected in the manner of the nonserial construction while V_2 has a Tns low tone, just as in the perfect. The only complication is that in the negative future V_2 must be preceded by the *á* particle that appears in the present tense. Since it occupies the Tns slot, the L tone that might otherwise be expected does not occur. As a result, the verb receives a default mid tone.

(56) *tūsī bàŋ lʷànsì* 'push down a lizard!'
kán tùsì bàŋ lʷànsì 'don't push down a lizard!'
wà ǹ tūsī bàŋ lʷànsì 'he will push down a lizard!'
wà kàn tūsī bí:k á lʷānsī 'he will not push down a child!'

[8] The *á* particle that precedes V_2 appears with a low tone after an object that has a low tone: *mí à tūsī bàŋ à lwānsī* 'I (emph.) am pushing down a lizard'. We do not understand this alternation.

In sum, in the serial verb construction both verbs are inflected for tense-aspect. The Tns node on V_2 is only lexicalized in the present as *á*. Otherwise, the Tns is reflected in the L that appears on the following verb. The Agr HL appears on V_1 (so long as the subject is not third person and the V_1 Tns node is not lexicalized). But for some unknown reason cliticization is blocked when the verb is first or second person. The L portion of the Agr HL is then pruned away.

8.2 Subordinate Clauses. As in some other languages, the relative clause in Buli has more restricted inflection than the main clause. [See Hiraiwa 2002 for analysis of the syntax of Buli relative constructions]. In particular the agreement morpheme is banned from the relative. Hence, as shown in the paradigm of (57), the verb *nàgǐ* of the relative clause does not change its tone as the person of the subject is changed (in contrast to the main clause verb). Instead, the verb of the relative clause receives the L tense marker in all forms. It triggers Low Tone Spread to create a rising tone on the particle *lá* that terminates the relative clause. Subject relatives are introduced by the particle *lī* and nonsubject ones by the particle *tì*.

(57)	*àtù:m nyà bì:ká tì mǐ nàgì lǎ*	'Atim saw the child that I (emph.) hit'
	àtù:m nyà bì:ká tì ǹ nàgì lǎ	'Atim saw the child that I hit'
	ǹ nyà bí:ká tì àtù:m nàgì lǎ	'I saw the child that Atim hit'

Since the agreement morpheme is banned from the relative clause, there can be no Agr Lowering that we find in the main clause of present tense verbs. We can ask what tone an object pronoun will receive in the absence of the Agr morpheme. Other things being equal, we expect a default mid to appear. This is a correct prediction, as shown by the paradigm in (58).

(58)	a.	*ǹ nyà bí:ká lī nàgì-mō lá*	'I saw the child that hit me'
	b.	*ǹ nyà bí:ká lī à nāgī-bā lá*	'I saw the child that hits them'
	c.	*àtù:m à nàgí-bà*	'Atim hits them'

In (58a) the verb of the relative clause is in the perfect tense. Thus, the verb takes the Tns L tone and the enclitic object suffix takes default mid tone. But in (58b) the tense node is lexicalized as *à*. The Infl node thus has no tone to contribute to the verb, which consequently surfaces with default mid. Compare the present tense of the main clause verb in (58c). Here the Agr HL is lured onto the verb by the clitic object.

Finally, Buli has constructions in which the verb of the subordinate clause appears in a nonfinite form. (See Norris [2002] for discussion). One of these is as

complement to the main clause verb *yāːlī* 'want'. If a clause lacks inflection and if inflection is the source of the tone for the verb, then we expect the verb to appear in the default mid tone in this context. The paradigm in (59) shows that this expectation is confirmed.

(59)	*mà: yāːlī (àyĭn) àtùːm nāgī-mə̄*	'I want (that) Atim to hit me'
	àtùːm à: yāːlī (àyĭn) ǹ nāgī-wā	'Atim wants (that) me to hit him'
	mà: yāːlī (àyĭn) àtùːm pā-kū tē-mə̄	'I want (that) Atim to hand it [ku] over to me'

8.3 Reduplication. In Buli the verb can reduplicate to denote repeated action. [See Hsiao 2002 for discussion of reduplication in Buli]. In (60) we show some reduplicated verbs along with their non-reduplicated counterparts.

(60)	*àtùːm nàgì-mə̄*	'Atim hit me'
	àtùːm nàgì-nàgì-mə̄	'Atim kept on hitting me'
	fì nàgí-wà	'you hit him'
	fì nàgí-nàgì-wā	'you kept on hitting him'

One possible analysis goes as follows. In third person, the Agr morpheme deletes; the verb gets the L tense morpheme while the object gets default mid. The verb is then reduplicated, as in (61). But, if reduplication follows Tone Association, then the HL Agr morpheme (when not deleted) should associate to the verb +

(61) morphosyntax:

àtùːm	Agr H+L	Tns L	[*nag-mə*]	underlying
àtùːm		Tns L	[*nag-mə*]	Agr Deletion
			nag-mə L	Tone Association

phonology:

nag-mə L M	Default
nag-nag-mə L L M	Reduplication of verb

obj first to give /nág-wà/ and then reduplicate to /nág-nág-wà/ (and eventually *nágí-nágí-wà*). But this is doubly wrong: the second half of the reduplicant has a low tone and the object has a mid tone: *fì nàgí-nàgì-wā* 'you kept on hitting him'.

The other possible analysis is that the L appearing on the second half of the reduplicated verb is neither copied from the first half nor a reflex of Agr. Instead it is the L that we saw in the serial verb construction where V_2 consistently had the L tense morpheme except in the present where the *á* particle occurs forcing V_2 to get default mid tone unless an object enclitic occurs. In fact, this is the correct analysis as shown by the data in (62). Here the verb is reduplicated and takes two occurrences of the Tns particle. The second one licenses the HL Agr morpheme which can lower onto the verb with the encliticized object suffix.

(62) *àtù:m à nàgí-mə̀* 'Atim hits me (habitually)'
àtù:m à nāg á nágí-mə̀ 'Atim keeps on hitting me (habitually)'
àtù:m à nāg á nāgī mí 'Atim keeps on hitting me (emph.) (habitually)'

Thus, verbal reduplication in Buli takes place at the V' level of the morphology (V' = Tns+V) [cf. Inkelas & Zoll 2002] rather than copying in the phonology or filling out an underspecified CV skeletal slot [cf. Marantz 1982] or RED morpheme [cf. McCarthy & Prince 1995].

9. Phonetics

In this section we report several findings from a study of the phonetic implementation of the tonal data discussed in this paper. This study is based on the speech of a single speaker, the first author.

Buli is unusual among Gur languages in having a three-way distinction in tonal height. The minimal triple in (63) illustrates this difference. In citation forms the low and mid tones are quite regularly implemented at c. 100 Hz and 130 Hz, respectively, while the high tone fluctuates between 150–200 Hz. This might indicate that the high tone belongs to an upper register while the low and mid tones belong to a lower register. There is a modicum of phonological evidence to support this conjecture. Diachronically, there is our hypothesis that the Buli H originates from the raising (enhancement) of a H before L. Synchronically, we have seen two rules that relate low and mid tones in Buli: mid is changed to low in the noun-adjective construction and the low of the plural suffix *–à* is changed to mid after a mid tone. It is true that a low tone changes to high between high tones (31a) but this could arguably reflect phonologization of an undershoot phenomenon.

(63)

sʸúk
'path'

sʸūk
'navel'

sʸùk
'fish sp.'

As we have seen, the syllable is the tone-bearing unit in Buli. There is no underlying phonemic contrast between level and contour tones. Furthermore, the language contrasts CV, CVV, CVC, and CVVC syllable shapes. One might wonder how a tone such as a H is realized on the syllable. Can the peak be located anywhere in the syllable? Or is it achieved at some designated point such as the onset of the vowel or the right edge of the syllable? In fact, the following generalization underlies Buli tonal implementation: the tone stretches over the entire syllable rime producing a plateau. This point is evident in the pitch tracings in (64) showing the realization of a high tone on syllables of various canonical shapes. There is a rapid Fo rise in the onset and then the high tonal level is maintained with a slow decline reflecting prepausal lowering. This plateau structure may aid in the discrimination of three tonal levels by increasing the duration over which the stimulus can be perceived.

(64)

mí
'I (emph.)'

náŋ
'leg'

mí:
'helped'

dá:m
'drink'

The spectrograms in (65) show the transition from H to M and L. In general there is minimal anticipation in the achievement of the tonal targets on syllable rimes. The vast majority of the transition occurs in the syllable onset located between the two rimes.

(65)

náŋ bāŋ
'leg-bangle'

mí dá:m ɲʷè:
'my drink is gone'

Confining the F0 transitions to syllable onsets makes sense. Onsets may contain obstruent consonants, which are not optimal tone-bearing units. Making the F0 transition there allows the more hospitable (i.e. sonorant) syllable rime to host the tone. Also, Xu [1999] argues that it takes time for the relatively sluggish laryngeal articulators to implement a tone. If tonal implementation is aligned with the beginning of the syllable then the onset portion coincides with the inertia that must be overcome to approach the tonal target.

In (66) we illustrate the H≈R≈L alternation on *bí:k* 'child' produced by Low Tone Spread and Rising Tone Absorption. It is clear that in *m̀ bǐ:ká* the low of the pronoun spreads to first part of the rime of *bí:k*. This is followed by a rapid rise on the second mora. It is equally clear from *m̀ bì:ká* that this rise has been suppressed when a H follows. There is instead a rapid transition from the L on [bì:] to the H on [ká] that takes place primarily in the onset.

(66)

bí:k	*m̀ bǐ:k*	*m̀ bì:ká*
'child'	'my child'	'my child' def.

It is well known from the phonetics literature that rising tones take longer to implement than falling tones [Sundberg 1979]. Since Buli has syllables of various sizes we can ask if they behave differently under rising tone creation. In (67) we report the syllable rime durations for underlying high tone syllables in two prepausal contexts: (1) preceded by the high-toned emphatic pronoun *mí* 'my' and (2) preceded by the low-toned nonemphatic counterpart *n̂*. In the former context the H is unchanged while in the latter it turns to rising by Low Tone Spread. The durations of the CVVC, CVV, and CVC syllables remain relatively stable across the two contexts. But the monomoraic CV is significantly longer. It thus appears that in the prepausal context there is an opportunity for phrase-final lengthening. The Buli speaker takes advantage of this opportunity to realize his rise more comfortably. Comparable examples in the durational disparity between rising and falling tones have been reported in the literature. For example, Lehiste and Ivic [1986] found that short vowels with a rising tone are longer in duration than short vowels with a falling tone. Myers (to appear) reports that in Kinyarwanda the bimoraic long vowel under rising tone (H on the second mora) is significantly longer than a comparable bimoraic long vowel under a falling tone (H on the first mora). And Gandour [1977] finds diachronic changes in vowel length in Thai

(67) CVX

	H	R
Mean	306	301
St. dev.	51	48
N	11	11
Min.	210	236
Max.	400	400

t-test: mean diff. 5.2, DF 10, t = 1.05, p = .3183

CV

	H	R
Mean	109	159
St. dev.	26	20
N	15	15
Min.	76	129
Max.	129	203

t-test: mean diff. 49, DF 14, t = 7.63 p = < .0001

(68) CV́X

	Post-L	Post-H
Mean	349	340
St. dev.	39	50
N	13	13
Min.	300	276

t-test: mean diff. 8.4, DF 12, t = .640, p = .534

CV̀

	Post-L	Post-H
Mean	113	130
St. dev.	11	22
N	5	5
Min.	129	155

t-test: mean diff. 16.2, DF 4, t = 1.36, p = .243

dialects that track the direction of contour change: short > long in syllables with rising tones and long > short in syllables with level or falling tones.

Buli has no falling tones and so we cannot test the durational requirements of a rising vs. falling contrast. However, we did measure the duration of prepausal low tone syllables after a high vs. a low tone, shown in (68). The former sequence requires a transition from H to L while the latter does not. In this case neither the CV:, CVC, and CV:C syllables nor the CV syllables showed a significant durational difference in the two contexts.

9. Summary and Conclusion

The principal findings of this study of Buli tone can be summarized as follows. The language contrasts three levels of tone: high, mid, and low. Although Buli combines a vowel length contrast with an open vs. closed syllable contrast, there are no underlying complex tones. A general process spreads a low tone to a following syllable with a high tone to produce a rising tone. The rising tone simplifies to low when followed by a high-tone syllable. These processes apply at the level of the syllable, which is the tone-bearing unit of the language. Buli differs from other Gur languages in lacking a downstep and more generally in banning floating tones. We demonstrated a systematic correspondence between high, low, and toneless roots in Dagaare and high, low, and mid roots in Buli. We suggested that the mid tone in Buli arose from phonologization of the phonetic raising of a high tone before a low. We then surveyed the tonal changes associated with the nominal and verbal inflection. The latter was shown to be unusually complex. We suggested an analysis that made crucial use of an Inflection node that comprises a H+L agreement morpheme and a L tense morpheme that lower onto the verb in various contexts. Certain loose ends of the analysis were left as tasks for future research. The paper closed with a summary of the phonetic implementations of the tonal patterns. The syllable rime is the domain of realization of tones while the onset of the syllable is a zone of F0 transition. Rising tones are consistently distinguished from highs by delay of the peak until the end of the syllable. In the case of a monomoraic CV syllable, a rising tone occasions a significant lengthening before pause.

We hope that this paper will stimulate further study of the tone of Gur languages from both descriptive as well as comparative, typological perspectives.

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