

THE GREAT NGAMO TONE SHIFT

Russell G. Schuh
UCLA, July 2005

In the Gudi dialect of Ngamo, a Chadic language of northeastern Nigeria, a process that this paper refers to as the Great Ngamo Tone Shift (GNTS) has shifted the entire tone patterns of words to the right and has associated low tone to the initial tonal domain. The GNTS respects the Obligatory Contour Principle (OCP) in that tones may have domains ranging from a single mora to several syllables, and the effect of the tone shift is to move tones to take over the entire original domains of their right-hand neighbors. Effects of the GNTS seem to remain as part of the consciousness of Ngamo speakers, inasmuch as it has applied to most relatively recent loanwords, though there are word categories that have systematically resisted the GNTS, most notably proper names. The GNTS has applied to morphemically complex constructions as well as to monomorphemic words, resulting in tonal alternations, but the GNTS, as such, should probably be viewed as a historical sound change rather than an active process of the modern language. The phonetic outcomes of the GNTS are governed by various phonological constraints, particularly a strong dispreference for rising tones (= L+H on a single syllable) and the reassociation of floating tones to the final syllable of a word where this would not violate more highly ranked constraints. All the constraints governing the outcomes of the GNTS correspond to attested phenomena in other African tone languages.

1. Introduction

Clements and Ford (1979) describe a tone shift in Kikuyu whereby each original tone of a fairly recent ancestor of Kikuyu has moved one syllable to the right across the word.¹ Of the Kikuyu tone shift, they say, “We are dealing, clearly, with an unusual type of historical change... . To the best of our knowledge, no other language is known to possess such a rule” (201). Though Clements and Ford could not have known about it in 1979, a tone shift of exactly this type has taken place in the Chadic language, Ngamo. The Ngamo tone shift differs from the Kikuyu shift, however. Whereas the Kikuyu shift displaces each tone one SYLLABLE to the right, Ngamo displaces each tone such that it occupies the DOMAIN of its right-hand neighbor, a domain that may range from a single mora to multiple syllables.

Ngamo is a West Chadic language spoken in Yobe State in northeastern Nigeria.² Ngamo belongs to the Bole-Tangale group of the A branch of West Chadic (Newman 1977), along with Karekare and Bole, both also spoken in Yobe State, and a number of languages spoken to the south of Yobe State, most notably Tangale and Kanakuru, which have been fairly well described (Kidida 1985, Jungrathmayr 1991, Newman 1974). Ngamo has two major dialects: the Gudi dialect, spoken in the eastern portion of the Ngamo area, and the Yaya dialect, spoken in the western portion.

¹ Clements and Ford cite Harries (1952) as the first published description of the Kikuyu tone shift.

² Research on Ngamo and Bole has been supported by a grant from the US National Science Foundation, award #BCS-0111289, Russell G. Schuh, Principal Investigator. I owe special thanks to Jibir Audu Janga Dole and Umaru Mamu Goge, who provided data on the Gudi dialect of Ngamo, and to Isa Adamu Gashinge, who provided data on the Yaya dialect of Ngamo. The entire research project would have been impossible without the collaboration of the In-Country Director, Dr. Alhaji Maina Gimba. Gimba and Madu Bah supplied Bole data. Finally, thanks to Kie Zuraw for discussing the paper and steering me away from pitfalls in the original OT account and to Larry Hyman for forcing me to rethink much of what I originally had to say.

2. Great Ngamo Tone Shift (GNTS) Basics

By and large, the tones of lexical items are quite stable in the Bole-Tangale languages. For example, most cognate native nouns in Karekare, Bole, and Yaya Ngamo have the same tone patterns, verbal conjugations of cognate verb classes have the same patterns (or patterns transparently relatable to the original patterns), and verbal nouns fall into the same tone classes. The striking exception is the Gudi dialect of Ngamo. In this dialect, the entire original tone patterns of words shift to the right (assuming a left-to-right transcription) and the initial domain takes L tone. The original final tone of the pattern is left to float or reassociates with another syllable depending on context. T = tone, D = domain of a single tone.

(1) The Great Ngamo Tone Shift (GNTS)

T1	...	Tn	>	L	T1	...	Tn-1	Tn
								\ ()
D1	...	Dn		D1	D2	...	Dn	

The the form of the GTNS is easiest to see on trisyllabic words, as illustrated in (2). Empty cells indicate that a cognate item is not available in current data. Items in parentheses are cognates that do not show the expected tonal correspondence to the other languages or otherwise do not correspond in a straightforward way. The tone pattern in the left-hand column is the historically original pattern, still hear in Karekare, Bole, and Yaya Ngamo.³

(2) The GNTS with trisyllabic words

	Karekare	Bole	Yaya Ngamo	Gudi Ngamo	
LLL	kànkàrcàl	kànkirsà	kànkàrshà	kànkàrshà	‘puff adder’
			dàmàtò	dàmàtò	‘broom’
LHL			kètèmbì	kètèmbî	‘stirring stick’
	àlbásà	àlbàsàr	àlbàsàr	àlbàsàr kî ngô	‘onion’
LLH	gàlǎfí	gàlǎpí	gàlǎfí	gàlǎhì	‘small axe’
	màtácí	mòccí	mè’èshí	mè’èshì	‘locust bean tree’
LHH	Nàsárá	Nàsárá	Nàsárá	Nàsàrà	‘European’
	(kàgilmó)	kàgilmó		kàgilmò	‘garlic’
HHH			mándírá	màndìrà	‘sesame’
			Lágídé	Làgìdè	a man’s name
HLH	ánkàlí	ánkàlí	hánkàlí	hànkàlì	‘intelligence’
		(kùltí)	kùlèttí	kùlèti	‘hare’

³ Citations are in the standard orthography developed for Ngamo and based on that of Hausa, plus diacritics marking tone and vowel length: **c** = [tʃ], **sh** = [ʃ]; grave accent = low tone (à); acute accent = high tone (á); circumflex accent = falling tone, equivalent to H+L on one syllable (â); hachek = rising tone, equivalent to L+H on one syllable (ǎ); macron = long vowel (ā). Where it is necessary to show association of a tone with a mora of length, long vowels are marked with a colon (a:) rather than a macron.

HHL	(kúrmèsí)	kúrméshì	kúrmásò	kùrùmsô	‘biting ant’
	láfíyà	lápíyà	láfíyà	làfíyâ	‘health’
HLL	(mà-fé)	(pètìlà)	fètìrè	hétrè	‘white’

In nouns with a LLL pattern, there is no overt evidence for any tonal change having taken place. LHL nouns show the GTNS most clearly. The initial H has been replaced by L, the L originally associated with the first syllable is now on the second syllable. The H-L sequence originally associated with the second and third syllables is associated with the final syllable as a falling contour in phrase final position (**kètèmbî**), but in phrase medial position, the final L associates with the next domain, leaving only H on the final syllable of the original LHL word (**àlbàsár kî ngô**, literally ‘onion of person’, as distinct from various wild onion-like plants). As a parallel to the ...HL of the LHL pattern, one might expect, the ...LH of the LLH pattern to show up as a R(ise) on the final syllable, i.e. original ***gàlàhí** after the shift should become “**gàlàhĩ**”. However, the Gudi dialect of Ngamo does not allow phonetic rising contours. The original final H is therefore not heard in phrase final position, but evidence in section 3 will show that it is still present as a floating tone.

It is the tonal outcome of words with original H tone sequences, such as LHH, HHH, and HHL, that differentiate the GNTS from the Kikuyu tone shift mentioned in the opening paragraph of this paper. Ngamo adheres to the Obligatory Contour Principle (OCP), which disallows geminate tones. That is, contiguous Tone Bearing Units (TBU) in a tonal phrase that bear the same tone are associated with a single tone on the tonal tier. Thus, in the word for ‘European’ in (2), with original LHH tones, the final two syllables, both of which bear H tone, form a domain with a single tonal association.⁴ The GNTS shifts the original L to this disyllabic domain, and the original H becomes a floating H, not heard when the word is pronounced in isolation since it cannot reassociate with the final syllable to become R. In the derivation in (3), the OCP requires that the L that is associated with the original initial domain (= the first syllable) be linked to the shifted L, resulting in a single L with the entire segmental word as its domain.⁵

(3) Application of the GNTS to original **Nàsárá** ‘European’

L H		L H		L H
/ \	GNTS >	/ \	default L on initial domain >	/ \
Nasāra		Nasāra		Nasāra

A similar account applies to the original HHH and HHL words in (2). The HHH word for ‘sesame’ forms a trisyllabic domain associated with a single H, which, after the

⁴ Though a single tone may have a multisyllabic domain, I will continue to represent tone patterns as if they applied to syllables for purposes of describing surface tone patterns. Thus, LLL = a trisyllabic word with L associated with all syllables, HHL = a trisyllabic word with H associated to the first two syllables and L to the third syllable, etc.

⁵ I am assuming that a L is ADDED as a default tone to the initial domain. This is another difference between the GNTS and the Kikuyu tone shift. In Kikuyu, Clements and Ford (1979) provide the initial syllable with a tone by reassociating the shifted initial tone to the initial syllable. This would work for an Ngamo word like ‘European’, where the initial tone was L, but it could not account for why the initial tone is L after the GNTS when the original initial tone was H.

GNTS, becomes a floating H and a default L associates with the original trisyllabic domain of the shifted H. Similarly, in the word for ‘biting ant’, the initial disyllabic domain is associated with a single H, which shifts to the monosyllabic domain of the final L, which in turn is shifted as a floating tone, which reassociates with the final syllable to produce a F. The original initial disyllabic tonal domain is associated with default L.

In (4) are derivations of ‘stirring stick’, ‘biting ant’, and ‘sesame’. The first two have original LHL and HHL original tone patterns respectively, but as a result of the GNTS, both come out with an identical LLF pattern. The latter has original all H tones, but comes out with all L, differentiated from original all L by the presence of final floating H.

(4) Derivations for **kètèmbî** ‘stirring stick’ and **kùrùmsô** ‘biting ant’

Original tones	L H L	H L	H
		/ \	/ \
	ketembi	kurumso	mandira
GNTS	L HL	HL	H
		/ \	/ \
	ketembi	kurumso	mandira
Default L on initial domain (and application of OCP)	L HL	L HL	L H
	/ \	/ \	/ \
	ketembi	kurumso	mandira
Reassociation of floating L	L HL	L HL	L H
	/ \ /	/ \ /	/ \
	ketembi	kurumso	mandira

The data in (2) represent all the possible combinations of H and L over three syllables (see below for discussion of contour tones, i.e. multiple tones associated with one syllable). Of those, the one that has so far not clearly been accounted for is HLL. The predicted outcome of the GNTS for this pattern would be LHF, i.e. the initial H would associate with the disyllabic domain of the L, the resultant floating L would reassociate with the last syllable to give F, and the original initial monosyllabic domain would take default L. This correspondence is not attested. There are two apparent reasons for this. First, for unknown reasons, monomorphemic words with an original HLL pattern apparently are rare to non-existent in this language group. In current data for the Yaya dialect of Ngamo, there are only three: **fètìrè** ‘white’, cited in (2) and to which I return immediately below; **ádèndè** ‘kidney’, a somewhat reformed reduplicant of **édè** ‘bean’ (referring the bean-like shape of the kidney) with the Gudi counterpart **è’èdè**; and the Hausa loanword **móngòrò** ‘mango’ with Gudi counterpart **móngìròn**, also with a HLL pattern—see section 4.1 for discussion of tones on loanwords. Likewise, in more distantly related Bole, virtually all words with a HLL pattern are reduplicants without Ngamo counterparts (**kúdàmdàm** a type of bed), loanwords (**púrsìnà** ‘prisoner’), or proper names (**Bámàdò**), which also have special properties in Ngamo—see section 4.2.

Second, alongside the current (near) absence of HLL words in Yaya Ngamo and Bole with which Gudi Ngamo might have cognate items, there are no words at all in Gudi Ngamo with a LHF tone pattern. Note that this pattern has a tonal configuration that none of the other outcome patterns of the GNTS in (2) have, viz. given the OCP, the H straddles two syllables as follows: L HL

$$\begin{array}{c} | \quad | \quad | \\ \sigma \quad \sigma \quad \sigma \end{array}$$

That is, the H on the penultimate syllable forms the initial part of the F contour of the last syllable. Many languages, including Gudi Ngamo, do not tolerate a situation where an edge of a contour tone has the same pitch as the tone of a contiguous syllable (“The Law of the Like Neighbor”, Hyman 2004). The typical response is for the offending edge of the contour to be “absorbed” by the neighboring syllable, leaving the syllable originally bearing the contour associated with a single tone. In the Ngamo case, the penultimate H would absorb the H portion of the final syllable, leaving just L, i.e. instead of LHF, the ultimate outcome of the GNTS on original HLL would be LHL.

With this background, we can understand how the HLL pattern of Yaya Ngamo *fétirè* ‘white’ in (2) could result in Gudi *hétrè*.

(5) Derivation of Gudi **hétirè* ‘white’ > *hétrè*

H L	L HL	L HL	L HL	H L
/ \	/ \ /		/	
GNTS, etc. >	ABSORPTION >	SYNCOPE >	R SIMP.	
hetire	hetire	hetire	hetre	hetre

In the first stage, the GNTS shifts tones rightward, the resultant floating L is reassociated, and default L is added to the initial domain. In the second stage, the H part of the HL contour on the last syllable is absorbed, as proposed just above. In the third stage, the medial vowel is syncopated, causing its tone to be reassociated to the initial (now bimoraic) syllable, resulting in a LH (= R) contour. We saw in the case of words like ‘small axe’ in (2) that Ngamo disallows word final R and hence does not reassociate a floating H to a final L syllable. Ngamo also does not allow word internal R, but unlike final tones, which may be left to float unpronounced, something else must happen word internal. The Ngamo response is to simplify the R to H, or, stated autosegmentally, to dissociate the L portion of the R (see Leben (1971), who first presented evidence for a parallel R → H rule in Hausa). The account in (5) presupposes that SYNCOPE took place after the GNTS. We will justify this chronology below.

The outcomes of the GNTS with monosyllabic and disyllabic nouns, illustrated in (6), have the same explanations as for trisyllabic nouns, though three patterns—original F, FH and FL—need additional discussion.

(6) The GNTS with monosyllabic and disyllabic nouns

	Karekare	Bole	Yaya Ngamo	Gudi Ngamo	
L	bò	bò	bò	bò	‘mouth’
H	ló	ló	lú	lù	‘meat’
R	bàká	mbǎ	mbǎ	mà	‘upper arm, wing’
F		zôu	zôu	zâu	‘next year; life’
	bayàku	bâi	bâi	bêi	‘perhaps’

LL	bìdò	bìdò	bìdò	bìdò	‘monkey’
	àyàkù	àikì	hàikò	hàikò	‘squirrel’
LH	jàmbé	jèmbér	jèmbér	jèmbèr	‘hemp’
		tìlò	tìlì	tìlì	‘heart’
	tàmčí	tèmshí	tèmshí	tèmshì	‘sheep’
	bèlu	bòlòu	bòlò	bòlò	‘two’
	nzànó	nzònó	nzònó	nzònò	‘yesterday’
HH	(càràfù)	kérwó	kérhó	kèrwò	‘fish’
	kòró	kòró	kòró	kòrò	‘donkey’
HL	(kàrà̀m)⁶	kádàm	kádàm	kàdàm	‘crocodile’
	sírìm	shòrìn	shòrì	shòrî	‘root’
	lúsìn	líshìm	línsà	lìnsò	‘tongue’
	kúnù	kúnùm	kúnù	kùnû	‘three’
	ďáçì	ďóshì	ďóshì	ďòshî	‘tomorrow’
FH/L			shûlí	shúlì	‘black kite’
	(fílílà)	(pémpéli)	híblá	híplà	‘wind’
	fífèdú	(pórdó)	hórhìdó	hórdò	‘eight’
	támçai	(támká)	têmkà	tèmkâ	‘sheep (pl)’

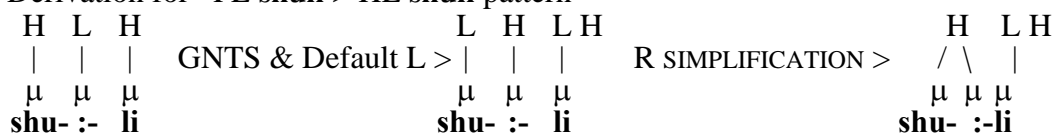
The effects of the GNTS that parallel those with trisyllabic nouns are the following: (1) absence of overt evidence for the GNTS on words with all L tones; (2) reassociation of an original word final HL sequence over two syllables to create a prepausal F on a final syllable; (3) absence of a parallel reassociation of an original LH pattern to create a final R because of a general Ngamo constraint against R tones; (4) application of the OCP, i.e. shift of an initial tone associated with a multisyllabic domain from that domain and replacement of the tone of that entire domain with L. The F monosyllabic pattern and the FH/L patterns on disyllabic nouns do not have exact counterparts in trisyllabic nouns. I consider first the FH/L patterns and return to monosyllabic patterns below.

I have not been able to establish consistent tonal correspondences between the FH/L patterns in Ngamo and tones of cognate words in Ngamo’s sister languages, but the tonal correspondences between Ngamo dialects are consistent: the correspondence to Yaya FH is Gudi HL. Assuming that Yaya represents the tone pattern that was the input to the GNTS in Gudi, the resulting FH > HL correspondence is surprising, since we would expect all outputs of the GNTS to begin with L tone. The explanation arises from the fact that minimal Tone Bearing Unit (TBU) in Ngamo is the mora, meaning that the domain of a tone may range from a single mora to a multi-syllabic domain.⁷ All the words with a Yaya FH/L pattern have a heavy (bimoraic) first syllable. The GNTS applied to the pattern represented by Yaya **shûlí** ‘black kite’ is thus as follows (μ = mora):

⁶ The Karekare word ‘crocodile’ **kàrà̀m** is cognate with the other languages, but in a round about way. The Karekare word is borrowed from Ngizim, which borrowed it from Kanuri (a Saharan, not a Chadic language), which borrowed it in ancient times from a Chadic language of the Biu-Mandara branch!

⁷ Strictly speaking, all the autosegmental representations should thus have two association lines for every heavy (bimoraic) syllable. To make representations easier to read, I have used one association line per syllable, regardless of weight, except where two tones are associated with a single syllable.

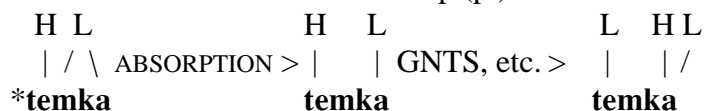
(7) Derivation for *FL **shûlí** > HL **shúli** pattern



The initial HL pattern is associated with the two moras of the first syllable. The GNTS shifts the initial H to the next domain to the right, which is a single mora and default L is added to the initial monomoraic domain. The initial syllable now bears LH, i.e. R, but Ngamo does not allow R. This R simplifies to H, a rule which has already been presented in (5). A similar derivation applies to **hórdò** ‘eight’, assuming syncope of the vowel prior to the GNTS, giving a FH pattern.⁸

FL does not exist as a surface pattern in Gudi. In current data there are fewer than five root words in Yaya with this pattern, but it does exist as a productive derived pattern, as in genitives such as **tìli háikò** ‘tongue of a squirrel’ (see section 5.3). Notice that this is a parallel situation to what we saw in the derivation in (5) for ***hétirè** ‘white’ > **hétrè**, viz. a tone is shared by one edge of a contour and a contiguous syllable. In the present case, the final L of original **tèmkà** is shared by the second mora of the first syllable and the final syllable. The derivation for the Gudi form is given in (8).

(8) Derivation of Gudi ***tèmkà** ‘sheep (pl)’ > **tèmkâ**



Comparing the derivation in (8) with that in (5), we see that the relative ordering of ABSORPTION and the GNTS is opposite, i.e. in (5) the GNTS feeds ABSORPTION. It seems that in Gudi Ngamo, ABSORPTION is an “everywhere” rule—in effect, it is a condition on outputs of any derivation or, in Optimality Theoretic terms, a constraint requiring that a tone align with a syllable edge would be highly ranked. The facts of Gudi Ngamo support this, i.e. there are no words where the edge of a contour in one syllable is the same as the tone of a contiguous syllable.⁹

Let us return briefly to the Gudi word for ‘white’, where we proposed in (5) that the original pattern was trisyllabic HLL ***hétirè** to which the GNTS first applied, followed by ABSORPTION, then SYNCOPE to give the disyllabic outcome **hétrè**, with a HL pattern. The outcome of the pattern ***tèmkà** ‘sheep (pl)’ > **tèmkâ** (FL > LF) confirms that the

⁸ The word for ‘eight’ is perhaps the only word of Gudi Ngamo to have an extra-heavy syllable (a closed syllable with a long vowel). The contraction resulting in the unusual extra-heavy syllable has parallels in other languages, where numbers have counting forms that violate otherwise general phonological constraints.

⁹ It would be possible to have a derivation with the GNTS applying first. After the GNTS, the original initial H would be shared on the first syllable with the default L and on the second syllable with the reassociated original final L. This configuration would have the H straddling two syllables but not exhaustively associated with either one, violating the suggested constraint that a tone must align with a syllable edge. The H could then be dissociated from the first syllable, leaving just the L, in order to avoid the unacceptable R contour on the first syllable and giving the attested LF result. Section 6, Tableau 4 provides an Optimality Theoretic account that is essentially in the spirit of this rule-based account.

GNTS had to have preceded SYNCOPE. Had SYNCOPE applied first, the input to the GNTS would have been FH ***hêtrè**, i.e. the same as the input for ‘sheep (pl)’, and the result would have been LF ***hètrê**. We can thus fairly confidently conclude that the source for modern Gudi Ngamo **hêtrè** ‘white’ had a trisyllabic HLL pattern, and moreover, we can predict that should we find more words with the HLL pattern in Yaya Ngamo or Bole with cognates in Gudi, they should have a LHL pattern in Gudi.

Turning to the monosyllables in (6), words with original L, H, and R have expected outcomes: the GNTS applies vacuously or not at all to L, and it shifts H and the H portion of R (= LH) off the right edge of the word as a floating tone, leaving the word pronounced with L. Words with original F have F in Gudi as well, e.g. Yaya **zôu**, Gudi **zâu** ‘next year; life’,¹⁰ making it appear that they have not been affected by the GNTS. Bearing in mind, however, that the TBU is the mora, that R tones simplify to H, and that shifted floating tones reassociate if possible, this tonal correspondence can also be accounted for in the context of the GNTS. The original form must have had a HL pattern with the two moras of the word being associated with the two tones (**záù**). The GNTS moves the H to the second mora, shifts the L as a floating tone, and adds L to the first mora (**zàú** `). The two moras now have the pattern LH = R, but R simplifies to H, and the floating L reassociates, to give the word a surface HL pattern (**záù**)—identical to the original pattern!

It may be worthwhile to insert a sidebar here on the pronunciation of syllables associated with more than one tone. In non-final position in words, Ngamo, regardless of dialect, allows F (= HL) only on bimoraic syllables.¹¹ Both Yaya and Gudi Ngamo allow F on bimoraic word final syllables, whether monosyllables or longer words, e.g. Yaya **zôu**, Gudi **zâu** ‘next year’, Yaya **shîndâl** ‘naughty person’, Gudi **kàdâm** ‘crocodile’. Gudi Ngamo is unusual among Chadic languages in allowing a contour tone such as F on monomoraic syllables, e.g. **lînsô** ‘tongue’, where the original ...HL final tone pattern over two syllables now associates with the final syllable. Yip (2002:141-145) notes that although in general only one tone may be associated with a TBU, it is relatively common in African languages for “excess tones [to] stack at the end” of a word (page 141) and to produce a multiple association with a single TBU on a final syllable. This is what has happened in Gudi Ngamo when the final syllable is associated with H followed by floating L to yield a F contour. However, R is disallowed in Gudi Ngamo regardless of environment, and hence a floating H is always left unassociated.

To conclude this section on the basics of the GNTS, I raise the question of exactly what kind of process the GNTS is/was. As described, the GNTS is a statement of tonal correspondences between words of Gudi Ngamo and cognate items in closely related dialects or languages. In other words, it is a historical sound change whose existence can be discovered only through comparative linguistic evidence. In sections 4-5, I address the question of whether or not the GNTS is somehow reflected as an active process in modern Gudi Ngamo, but for words such as those in (2) and (6), language learners would

¹⁰ It is not clear whether this is a polysemic word or two homophonous words. Bole has the same word/word pair, but other languages seem to lack cognates in either meaning.

¹¹ In current data, the only two words in Gudi with medial F are loanwords, viz. **bâmmí** ‘palm wine’ and **yôwwá** ‘right!’ < Hausa. Presumably, most words with an original non-final F would have been tonally altered by the GNTS in Gudi.

have no evidence that the underlying tones were any different from the surface tones in the absence of alternations suggesting otherwise (the “alternation condition”, Kiparsky (1968)). It is equally implausible, however, that Gudi Ngamo speakers went to bed one night and woke up the next morning, as a community, pronouncing the tones of all their words shifted one domain to the right. Clements and Ford (1979:189) essentially make just such a claim with respect to the Kikuyu tone shift, saying,

“...it is difficult to conceive of any plausible chain of events that would have [the cumulative effect of dislodging tones one after another in succession across the word]. Rather, tone shift must be conceived of as a process which affected all the tones of a word in a unitary manner.”

Being “difficult to conceive” does not mean that such a chain of events did not, in fact, take place. The chain of events that derived modern English vowel systems from that of Middle English is difficult to conceive, and trying to conceive of what that chain of events must have been has resulted in decades of arguing among Anglicists with no definitive answers, but we do know the beginning and end points with considerable certainty. This is almost always the nature of sound change—the only certainty is the correspondences between the beginning and end points with everything else being speculative. Both the Kikuyu and Ngamo shifts must have had their origin in the well-known tendency for tones to spread beyond their original domain (Hyman and Schuh 1974). What is remarkable in this (and virtually all sound change) is that what must have been a rather messy transitional period culminates with such clean results. I have no idea of how the GNTS took place, but what is clear is that the correspondences between the original tone patterns, well-attested in several Bole-Tangale languages, and the innovative tone patterns seen in Gudi Ngamo can be captured by a few well-known principles of tonal phonology with wide application, viz. the OCP (which links a single tone to a domain of multiple TBUs), the existence of floating tones, and simplification of contour tones through absorption of part of the contour into a neighboring tone or replacement of the contour by a simple tone.

3. Final Floating Tones

At several points above, I have mentioned that the GNTS has shifted the final tone of a word the right to become a floating tone, though if the original final tone pattern was ...HL, the floating L reassociates to the final syllable to produce final F (= HL). That these floating tones are still present is most easily demonstrated by adding something to the right to which the floating tone can associate and hence be realized in pronunciation. One such addition is the general negative marker **bù**, which has base L tone in both the Yaya and Gudi dialects and acts as a clitic to the preceding word. Compare the tone patterns in the following phrases, where Yaya retains the original tone patterns on each member of the phrase.

(9) Association of floating tones to a following domain

Original tones	Yaya Ngamo	Gudi citation	Gudi + bù	
LL	bìdò bù	bìdò	bìdò bù	‘not a monkey’
HL	shòrí bù	shòrí	shòrí bù	‘not a root’
LH	tèmshí bù	tèmshì	tèmshì bù	‘not a sheep’
HH	kòró bù	kòrò	kòrò bù	‘not a donkey’

In terms of pronunciation in isolation, the GNTS has applied vacuously to words with original all L, such as ‘monkey’, and there is no way to tell whether the original L has been shifted to become a floating L. Because the GNTS has caused the vast majority of words to begin with L, it is essentially impossible to construct environments where a floating L would show up associated with a following domain.¹² The original final L of ‘root’ is pronounced as the second component of a F in the citation form, **shòrî**, but when the L **bù** follows, the final L of **shòrî** is absorbed into it, leaving just the H on the final syllable of **shòrî**... . Viewed autosegmentally, with the OCP in effect, the geminate LL of ***shòrî bù** becomes a single L. Since the TBU is the mora and since multiple tonal associations with a single mora takes place only phrase final, the mora of **bù** is the only available TBU for the L.

The words for ‘sheep’ and ‘donkey’ both have original H as the final tone. This H does not reassociate with the final syllable of the noun in isolation because of the prohibition against R tones, but when **bù** follows, there is a site for association of the floating H, and **bù** is pronounced with a Falling tone, i.e. the floating H of the noun plus the base L of **bù**. Another way to view this would be to say that the GNTS has applied to the entire clitic phrase, e.g. the original LH-L pattern of **tèmshí bù** ‘not a sheep’ has undergone the GNTS to give LL-H (L), with the floating L reassociated to give the LL-F pattern of **tèmshî bù**. This is implausible. It would imply that at the time the GNTS was taking place, Ngamo speakers not only knew the tone patterns of lexical roots, but also the tone patterns of phrases, i.e. they knew that the phrase **bìdò bù** ‘not a monkey’ had all L tones but the phrase **tèmshí bù** ‘not a sheep’ had LHL tones. Far more likely is that Gudi Ngamo speakers, in the post-GNTS era, keep mental track of the words that have floating H and those that do not, in the same way that English speakers keep track of verbs that have irregular past tenses and those that do not, such as *teach* vs. *reach*. Note that in isolation, original LL, LH, and HH (and their counterparts in longer words) all neutralize to an all-L pattern. I checked a sizable number of Gudi Ngamo reflexes of words with all the original patterns in the frame /___**bù**. Speakers were remarkably consistent in applying the floating H in words that had original final H and pronouncing **bù** with L in words that had original final L. One of the few lapses (from a historical point of view) that I attested was in a video recording documenting these tone patterns, where a speaker did pronounce **kèrwò bù** ‘not a fish’ rather than (historically) expected “**kèrwò bù**”. Significantly, the word ‘fish’ had an original all H pattern. All H nouns are rare in Bole and Ngamo in general, whereas the all L pattern is one of the most common for nouns. It is therefore not surprising that these patterns would occasionally fall together in favor of the original all-L pattern.

The GNTS has affected clitics as well as lexical substantives. The prepositions **kí** (original H) ‘from’ and **kì** (original L) ‘with, and (conjoining nouns)’ present a case where the GNTS and resultant floating tones transfer an original tonal distinction to a new position.

¹² There are words in Ngamo that begin with H tone, categories of which are discussed in section 4. Constraints on time in the field prevented me from seeking answers to all the questions that the GNTS raises, including the question of what constitutes a tonal phrase above the level of a clitic phrase and how the GNTS would apply in such phrases.

(10)	Yaya Ngamo	Gudi Ngamo	
	kí riyá	kì riyà	‘from the bush’
	kòrì kì riyá	kòrì kì riyà	‘farm and bush’

Yaya shows the original tones. The GNTS has created homophonous prepositions in Gudi, both with L tone. However the original tones of the prepositions associate with their complements, preserving the tonal distinction. Since prepositions in Ngamo can never be stranded and since nearly all nouns in Gudi begin in L tone because of the GNTS, the tonal distinction between the prepositions is rarely neutralized.

4. Application and Non-application of the GNTS

4.1. Loanwords. At the end of section 2, I suggested that the GNTS is a historical sound change for which the only evidence is comparative. Tones of loanwords suggest that this may be too strong a claim. The table in (11) lists loanwords from Hausa,¹³ directly borrowed into Ngamo or possibly acquired via Bole.

(11) Tones of Hausa loanwords in Gudi

	Source word	GNTS applied	GNTS not applied	
a.	bábá	bàbà		‘indigo’
	kùrá	’ùrà ¹⁴		‘dust’
	kàlàngù	kàlàngù		‘pressure drum’
	hánkàlì	hànkàlì		‘intelligence’
	tábà	tàbà		‘tobacco’
	rìbà	rìbà		‘profit’
	láfíyà	lǎfíyà		‘good health’
b.	dànkálì		dànkàlì	‘sweet potato’
	kàtántánwà		gàtántàwà	‘snail shell’
	górò		górò	‘kola’
	tébùr		tépùr	‘table’
	mángwàrò		móngìròŋ	‘mango’
c.	bàré/bàllé		bàré/bàllé	‘all the more that...’
	tún		tín	‘since’
	dâ má		dâmá(n)	‘it is known that...’
	yâwwá		yôwwá	‘right!’
	hùhù		hùhú	‘lungs’
	kílákì		kílákì	‘prostitute’

¹³ Most of the words are originally loanwords into Hausa from Arabic, English, or other languages, but they are all fully nativized in Hausa, and for Ngamo borrowing purposes, they are purely Hausa words.

¹⁴ The forms listed in the “Source word” column are in Standard Hausa. In part of the eastern Hausa-speaking area, the ejective **k** is rendered as a glottal stop. These loanwords would, for the most part, have entered Ngamo through this variety of Hausa.

There are certain tone patterns that the GNTS would make impossible in Gudi Ngamo. (1) H on the last syllable of a word, including a monosyllable, would not be possible: if the word had HL as its last two tones, the H would be shifted to the last syllable but the L would reassociate with it to give F; if the word had (L)H as its last tone(s), the H would be shifted to the right as a floating tone and would not be able to reassociate because it would create R. (2) HH or FH on the first two syllables of a word would not be possible: the only source for H on the first syllable of a word is an original HL on the two moras of the first syllable; the GNTS moves the L to the second syllable, assuring that it will bear L, and the first syllable ends up H because the GNTS creates LH = R, which simplifies to H—see the derivation in (7).

The words in (11c) do have one or other of the “impossible” patterns listed in the previous paragraph. The words **bàré/bàllé**, **tín**, **dâmá(n)**, **yôwwá** (and a few similar items not listed) fall into the categories of “grammatical complementizer” or “affective expression”, which, as we will see in section 4.3, have generally resisted the GNTS. The words **hùhù** and **kílákì** are the only two common nouns identified as Hausa loanwords in currently available data that are pronounced in Gudi Ngamo with “impossible” tone patterns. **Hùhù** is clearly an onomatopoeic form that may not even be a loanword and might be included among the categories discussed in section 4.3.

Among the remainder of the words in (11), the distribution of tone patterns between words that have undergone the GNTS (11a) and those that have resisted it (11b) is not random. In current data, I have identified 26 loanwords of Hausa origin that are candidates for the GNTS.¹⁵

(12) Tone correspondences of Hausa loanwords

<u>GNTS applied</u>		<u>GNTS not applied</u>	
HH → LL	3	HH	0
(L)LH → (L)LL	5	LH	0
LHL → LLF	0	LH(H)L	4
HLH → LHL	1	HLH	0
(H)HL → (L)LF	8	HL(L)	5

With one class of exceptions, the GNTS has applied to these loanwords only where the words with their original tone patterns would be impossible under the GNTS. The exceptional class comprises words with an original HL(L) tone pattern, where roughly half the words have been adapted by applying the GNTS and the other half have been left with the original tones. (Only one word in current data, **láfíyà** → **làfíyâ**, has impossible HHL as its original pattern, and, as expected, it has undergone the GNTS.) Recall that the source for the HL pattern in Gudi is words with an original FH pattern. This is an uncommon source pattern for lexical roots within Ngamo (8 nouns in current Yaya data), whereas HL is very common (about 170 nouns in current Yaya data). Ngamo speakers,

¹⁵ In addition to grammatical and affective words of the types mentioned in the previous paragraph, this number excludes borrowed verbs, whose tones are morphologically determined in Ngamo, and a handful—fewer than five—of words that have tone patterns that are not one of the “impossible” types but which do not correspond to those of Hausa, either with or without the GNTS, e.g. **lòkòshì** ‘time’ (Hausa **lòkàcǐ**). These words may have come into Ngamo via some other language where the tone pattern differed from that of Hausa.

who are nearly all fluent Hausa speakers as well, seem to be ambivalent about leaving recognizable Hausa loanwords with the original HL, which is a legitimate Gudi surface pattern, or applying the GNTS to give LF, which is far more common. This ambivalence became evident when I was videotaping a narrative designed for eliciting syntactic structures. The narrative involved pushing a car that had broken down and hence the word for ‘car’ came up several times in the narrative. The source word for ‘car’ is Hausa **mótà**, with HL tones. In giving the title of the narrative, the speaker first applied the GNTS, saying **mòtâ**, with LF tones, then self-corrected to **mótà**, with the source tones. Throughout the narrative he used both tone patterns, apparently randomly. One would expect this ambivalence to arise only for words with a heavy first syllable. An original FL pattern would require a bimoraic initial syllable to carry the two tones of the F = HL. There are two Hausa loans in current data with a HL pattern and initial light syllables, and both undergo the GNTS, e.g. **dàbô** ‘trick, scheme’ (Hausa **dábò**).

Apparent loanwords from Bole, which is a major source of loans in Ngamo, show a pattern similar to that observed for Hausa, e.g. Bole **górzó**, Gudi **gòrzò** ‘man, male’ and Bole **wàriyá**, Gudi **wàriyâ** ‘rheumatism’ both have final H in Bole, impossible in Gudi Ngamo, and they have undergone the GNTS. Because Bole and Ngamo are closely related, we cannot always know whether a similar word is native to Ngamo and has undergone the GNTS as part of a historical sound change or has been borrowed and adapted, but as with Hausa loanwords, Bole loanwords with impossible tone patterns, such as Bole = Gudi **gálágò** ‘enclosure for storing harvested grain’, are very few in number aside from grammatical and affective words such as **ǎ** ‘or; yes/no question marker’ or **shím** ‘a little’ (an ideophone-like adverb), and since many speaker of Ngamo are also fluent speakers of Bole, it may be that an Ngamo speaker using a non-adapted Bole word is doing something similar to an English speaker who pronounces *par excellence* with nasalized [ã] in the last syllable.

4.2. Proper names. Proper names comprise a systematic exception to the GNTS. Ngamo has a large repertoire of pre-Islamic/pre-Christian proper names, as well a fair number of nativized names with Islamic sources. As illustrated in (13), many of these names in Gudi have tone patterns that would not be possible under the GNTS. There are names with all H and with LH that have no counterparts among common nouns—nouns with all H have become L and LH nouns have become LL. There are HL proper names that could have a FH source, but the F (= H+L) would require a two mora syllable whereas a number of HL proper names have initial light syllables. Finally, many Gudi proper names have counterparts in Yaya, but unlike common nouns, the tone patterns are usually the same in the two dialects or differ for reasons other than the GNTS.¹⁶ For example, the names **Bābà**, **Māmà** in (13) have HL tones in Gudi rather than RL as in Yaya because the constraint against R apparently applies more comprehensively in Gudi than in Yaya, and the name **Mādi** in (13) has HL in Gudi rather than FL as in Yaya because Gudi requires that the edge of a contour tone be absorbed into a contiguous syllable bearing the same tone—see the derivations in (5) and (8) and discussion there..

¹⁶ A couple of names with all H in Yaya have all L in Gudi, such as **Lāgife/Lāgìdè** (man’s name) listed in (2). As noted in section 3, in discussion of the neutralization of original all H words with original all L words, all H is an uncommon pattern in general in Ngamo. This tonal correspondence between names may thus be a shift to an unmarked tone pattern rather than a result of the GNTS.

(13) Tones on proper names

Gudi names	Yaya cognate names	
Tóngáyá		man's name
Tídá		man's name
Zàkú		man's name
Bálè		man's name
Húsàm		woman's name
Gírbà	Gírbà	man's name
Màd'èrà	Màd'èrà	man's name
Àngítò	Àngítò	woman's name
Bábà, Mámà	Bǎbà, Mǎmà	names derived from 'father', 'mother'
Mádi	Mádi	man's name

I have no principled explanation for why proper names as a group would have resisted the GNTS other than to point out that proper names have other exceptional phonological properties. Virtually no common nouns in Ngamo have root internal geminate consonants, yet geminates are fairly common in proper names, e.g. **Lúccù** (man's name), **Úbbà** (woman's name). In closely related Bole, proper names fail to undergo or to condition tonal alternations that hold for all common nouns (Gimba 1998).

4.3. Affective words and grammatical function words. The GNTS has applied to most lexical categories. The data in (2) and (6) include nouns, adjectives, numerals, and adverbs, and in section 5.1 we will see that the GNTS has applied to verbs. There are, however, words in two general lexical categories that have resisted the GNTS. *Affective words* include ideophones, ideophonic adjectives, and interjections. Except for a few F monosyllables, ideophones and ideophonic adjectives are all monotonal in Gudi Ngamo—about half all H and half all L. The H pattern would have become all L had the GNTS applied to these words. *Interjections* and *grammatical function* words seem unrestricted in their tone patterns, several of which would not be possible patterns under the GNTS. Quite a few of these words are borrowed and have already been mentioned in section 4.1. I include only words that have patterns that would be impossible under the GNTS. If the “Source” column is empty, the assumption is that the word is native to Ngamo.

(14) Ideophones Source

nûsh		sound of compressing
ríp		closing tightly
líkáɓ		completely burned
túmpúlúm		small and hunched up
Interjections		
yôwwá	Hausa yâwwá	'right'
ìyé		“yes!” (reponse to a call)

Function words		
ḍḍ	Bole ḍḍ	‘or’; yes/no question marker
hár	Hausa hár	‘even; until’
báyà		‘because (of)’
bàré	Hausa bàṛé	‘how much less that...’
bòló	Bole bòló	‘then; and moreover’

5. The GNTS and Morphologically Complex Constructions

The discussion to this point has dealt with the GNTS as it applies to monomorphemic words. Gudi Ngamo and its sister dialects and languages have shared inheritance of not only root words, but also of patterns of inflectional morphology and phrasal syntax. The GNTS has applied to the overall tone patterns of these constructions. A comprehensive discussion of the morphology and phrasal syntax of Ngamo is beyond the scope of this paper. I will thus limit the discussion to selected examples from several phrasal realms.

5.1. Verbs. Consider the tones of the subject clitics and verb roots of the following paradigms of verbs in the completive in Bole and Gudi Ngamo. The verb root in both languages means ‘jump, hop’. The expressions can be translated ‘I jumped’, etc.

(15) Completive verbs with pronominal subject clitics

	Bole	Gudi Ngamo		Bole	Gudi Ngamo
1 sg.	ḥ dūr-wò	nè dūr-kò	1 pl.	mú dūr-án-gò	mù dūr-àn-kò
2 m.sg.	ká dūr-wò	kò dūr-kò	2 pl.	mǎ dūr-án-gò	ṅù dūr-àn-kò
2 f.sg.	shí dūr-ák-kò¹⁷	shì dūr-kò			
3 sg.	dūr-wò	dūr-kò	3 pl.	dūr-án-gò	dūr-àn-kò

We can be sure that Bole represents the original morphological and tonal configuration inasmuch as it is shared with Karekare, a more distantly related language in the same group. The generalized configuration for verbs in the completive is as follows. “Verb” = verb root + gender/number agreement affixes (**-aG** for feminine singular subjects, **-an** for plural subjects); **ko** is the completive suffix, which has allomorphs **wo/ko/go** in Bole, conditioned by the preceding environment.

(16) Schematic representation of Bole and Ngamo completive

$$\begin{array}{c}
 \text{L H L} \\
 / \quad | \quad | \\
 \text{(Subject clitic) } [\sigma_0 \sigma]_{\text{Verb}} \text{ ko}
 \end{array}$$

First and second persons have obligatory subject clitics; third persons have no subject clitics, though 3rd person pronominal subjects may have optional overt expression using

¹⁷ With verbs in the completive, Bole adds a feminine singular agreement suffix **-aG** (G = a geminate copy of the following consonant) to 2nd and 3rd person if the subject is feminine. Ngamo does not have this agreement pattern. When the Bole feminine agreement suffix is added, the verb takes the same tone pattern as verbs with plural subjects, to be discussed below

independent pronouns. In Bole, the first person singular subject clitic bears L tone, and all the rest bear H, a pattern shared with the more distantly related Karekare. Bole 2nd plural **mã** is of uncertain origin—the canonical West Chadic form is “**ku**”, of which Gudi **ngù** is a reflex, but crucially, the R = L+H tone on the Bole pronoun ends in H.. In Gudi Ngamo, all the subject clitics bear L because of the GNTS, and the original tone of the pronoun appears on the root syllable of the verb.¹⁸ The original tones on the verb, in turn, shift to the right. Thus, the H of the root on the 3rd singular ***dúr-kò** > **dùr-kô** shifts to the completive suffix, which is reassociated to its original L, resulting in a F. In the 3rd plural, ***dùr-án-kò** > **dùr-àn-kô**, the original L of the verb root shifts to the plural agreement suffix **-an**, and the original H of that suffix shifts to the completive suffix.

I have used Bole rather than Yaya Ngamo to demonstrate the GNTS in subject + verb paradigms because Yaya Ngamo has, itself, undergone certain changes. In particular, the subject clitics all bear L tone perhaps on analogy with the first person singular. The verbs themselves are tonally like Bole, however, and Yaya Ngamo does provide a way to see how the GNTS has operated in Gudi in extended verbs. In (17) I illustrate two extensions, one usually called the “totality” extension in the Chadic literature, the other called the “additive” extension by Gimba (2000), referring to the Bole counterpart. The totality extension can be reliably elicited using a Hausa form meaning “do all of, do to completion”, e.g. ‘buy up’, ‘shoot dead’, etc.¹⁹ The additive extension, depending on context, can mean “do again, do like that, do there”. Compare the Yaya and Gudi unextended verbs with the same verbs bearing the totality extension: The verbs are in the completive with 3rd person subjects.

(17) Tones of extended verbs in Ngamo

	Yaya Ngamo	Gudi Ngamo	
Unextended	ngár-kò	ngàr-kô	‘he tied’
	ngàr-án-kò	ngàr-àn-kô	‘they tied’
Totality extension	ngár-tù-kó	ngàr-kò	‘he tied up’
	ngàr-án-tù-kó	ngàr-án-kò	‘they tied up’
Additive extension	ngár-dù-gó	ngàr-gò	‘he tied again’
	ngàr-án-dù-gó	ngàr-án-gò	‘they tied again’

In discussion following (15), we have already seen the explanation for the tonal correspondences in the unextended forms between Ngamo dialects—they are the same as that between Bole and Gudi Ngamo. Comparing the Yaya and Gudi unextended and totality forms with singular subjects, we note (1) that the unextended forms in the two dialects differ only in tone, (2) that the Gudi unextended and totality forms differ only in tone, and (3) the Yaya unextended forms have the same tones as the Gudi totality forms.

¹⁸ In Schuh (1980), long before I had any notion of the GNTS, I singled out the tonal relationship between subject clitics and verb root tone compared to other Bole-Tangale languages as an example of “paradigmatic displacement”, i.e. shifting of a set of distinctions from one point in an inflectional paradigm to another. Although the facts as I stated them were correct, they exemplified only a tiny corner of the much more general GNTS.

¹⁹ This description of the *totality extension* is satisfactory for the purposes of this paper. In Schuh (2005b), I argue that in the Yobe State Bole-Tangale languages, this extension actually has the function of *auxiliary focus*.

The GNTS allows us to account for all these facts. The Yaya totality forms have a suffix **-tù-** that is absent in Gudi forms. This suffix bears L tone, and the completive suffix **-kò** following it bears H, probably because of tonal polar relation to the preceding syllable. I propose the following historical derivation for Gudi totality extended **ngàr-kò** ‘he tied up’:

(18) Derivation of Gudi completive + totality extension

$$\begin{array}{cccccccccccccccc} \text{H} & \text{L} & \text{H} & & & \text{L} & \text{H} & \text{L} & \text{H} & & & \text{L} & \text{H} & \text{L} & \text{H} & & & \text{H} & \text{L} \\ | & | & | & & & | & | & | & & & & | & / & | & & & & | & | \\ *ngar-tu-ko & \text{GNTS} & > & ngar-tu-ko & \text{HAPLOLOGY} & > & ngar-kò & \text{R SIMPLIFICATION} & > & ngar-kò \end{array}$$

A similar derivation would apply to the plural subject form, simply adding a L syllable at the beginning. The unexplained step is HAPLOLOGY. It is hard to say why the entire ***tu** syllable was lost, leaving only a tone as a trace, but we can be sure that it was there. The **t** does appear in Gudi with verb roots ending in vowels (**bàsá-t-kò** ‘he shot dead’—cf. Yaya **bàsá-t-kò**).²⁰ I have included the additive forms as additional evidence that an extension suffix was present. The additive suffix is formally identical to the totality suffix except for the consonant **d** additive vs. **t** totality. Like the totality suffix, the additive suffix has been haplogized, but its effect is evident in the voicing of the completive suffix, which becomes **-go** just in cases where the additive is present. It is strange that Yaya also voiced the completive suffix, apparently as voicing assimilation between suffixes. This change probably took place before the dialects split

I present one further verb paradigm to show that the effects of the GNTS are not restricted to particular forms illustrated above:

(19) Subjunctive unextended with indirect object and totality with indirect object

	Yaya Ngamo	Gudi Ngamo ²¹	
Unextended	ngàrî	à-ngàrî	‘that he tie’
Unextended + IO	ngàr-tó	à-ngàr-tò	‘that he tie for her’
Totality	ngàr-tí	à-ngàr-tì	‘that he tie up’
Totality + IO	ngàr-tó-tì	à-ngàr-tò-tî	‘that he tie up for her’

The unextended Gudi subjunctive with no object has LF tones, suggesting a HL source, but the Yaya form also has LF tones. I have no really satisfactory explanation for this, but one possibility is that since the final syllable is monomoraic, i.e. a single TBU, the GNTS would have shifted the F (= HL) off the right edge. This floating sequence was then reassociated with the final syllable, giving a tritonal LHL association with one syllable. The LH portion simplified to H, leaving HL, identical to the original.

The remaining forms follow straightforwardly from the GNTS. In the Bole-Tangale languages, indirect object pronouns are suffixed directly to verb roots to create indirect

²⁰ The Gudi and Yaya forms are identical. The Gudi form can be explained from original ***bàsá-tù-kò** GNTS > **bàsá-tù-kò** SYNCOPE > **bàsá-t-kò** R SIMPLIFICATION > **bàsá -t-kò**. In the Yaya form the L from the totality suffix ***tù** seems to have transferred to the completive suffix when the vowel was syncopated.

²¹ Gudi Ngamo subjunctives have a prefix **a-**. The source of this prefix is unclear, since no other nearby Bole-Tangale languages have any kind of prefix in the subjunctive. It may be on analogy with the incomplete, which has such a prefix.

object stems (see Gimba (2000:102-105) for Bole and Newman (1974:21) for Kanakuru), and in Yaya Ngamo, the verb root+pronoun has the canonical LH verb stem tone pattern seen in the schema in (16). The Ngamo (and also Bole) totality extension has the shape **-ti** when it is the final morpheme of a verb form. In the Yaya form **ngàr-tí**, the verb root+totality morpheme also has the canonical LH verb stem tone pattern. However, since verb root+indirect object pronoun forms a verb stem, this stem bears the LH verb stem tones and the totality suffix bears base L, as in Yaya **ngàr-tó-tì**. We can be sure that these tone patterns are original inasmuch as they are shared by Bole. In Gudi, the GNTS applies in expected ways, shifting final H tones off the right edge, leaving the verbs pronounced with all L, and shifting the H of the IO pronoun to a following **ti** totality suffix to give a F (= H from the pronoun + the original L of the totality). By a regular rule of Gudi Ngamo, the vowel of the pronoun lengthens when it precedes a suffix, but viewing the process as a set of ordered rules, the mora of length is added before the GNTS and the original tone is associated with both moras.

5.2. Determiners and pronouns. Ngamo has grammatical gender. Most determiners have at least two components: a base morpheme and an agreement morpheme. Akin to determiners are the independent genitive pronouns ('mine, yours, etc. '), which have a formative agreeing in gender with the possessed item plus a pronominal component agreeing with possessor. Finally, the plural independent pronouns are bimorphemic, at least historically and show regular effects of the GNTS. I include the singular independent pronouns as well, though they seem to be monomorphemic. The 1st singular, originally LH, has the normal GNTS correspondence LL. The 2nd masculine singular usually has a disyllabic HL pronunciation in Yaya but a monosyllabic F pronunciation in Gudi. Assuming that the contraction to one syllable preceded the GNTS, this is a regular correspondence (see section 2 for discussion of F monosyllables). The remaining singular independent pronouns are also bimoraic with a F in Gudi but are monomoraic with H in Yaya. Unlike Gudi, Yaya does not allow contour tones on monomoraic syllables. The Yaya forms thus look to be contracted from forms phonetically identical to the modern Gudi forms. The table in (20) lists demonstratives, independent genitive pronouns, and independent pronouns, most of which are multi-morphemic and all of which have undergone the GNTS.²²

(20) Ngamo demonstratives and personal pronouns

Yaya Ngamo	Gudi Ngamo	
wóyò	wòyé'è	'this one (m)'
wónsò	wònsé'è	'this one (f)'
má'yò	màyé'è	'these'
wòmbí < *wóm̀bì'í	wòm̀mí'ì	'that one (m)'
wónsì'í	wònsí'ì	'that one (f)'
mám̀ì'í	màm̀ì'ì	'those'

²² All the demonstratives in Gudi and the distal demonstratives in Yaya are extended with **-e** or **-i**, which is the general definite determiner. This determiner in Gudi bears the tone that would have been shifted to the right as a floating tone from the base demonstrative by the GNTS.

yónò, yókò, etc.	yònô, yòkô, etc.	'mine, yours, etc. (m)'
sónò, sókò, etc.	sònô, sòkô, etc.	'mine, yours, etc. (f)'
mánò, mákò, etc.	mànô, màkô, etc.	'mine, yours, etc. (pl)'
múnì ḡúnì, nzúnì	mùnî, ḡùnî, nzùnî	'us, you (pl), them'
ně, kó'ì, shí, sí, té	nè'è, kôî, shî, sî, tê	'me, you (m), you (f), him, her'

There are, however, related forms that have not undergone the GNTS. The indefinite determiners appear not to have undergone the GNTS, though the way the Gudi forms relate tonally to the Yaya forms is not entirely clear.²³ The 3rd masculine singular independent genitives have identical forms in the two dialects. Third masculine singular pronouns have other idiosyncracies in this group of languages, as well.

(21) Determiners and pronouns that have resisted the GNTS

Yaya Ngamo	Gudi Ngamo	
yò'òtò	yò'ótò	'a certain one (m)'
sò'òtò	sò'ótò	'a certain one (f)'
yòbí'ì, sòbí'ì, màbí'ì	yòbî, sòbî, màbî	'his (m, f, pl)'

I have no comprehensive explanation for this mixed picture. The resistance of certain determiners and pronouns to the GNTS is probably related to the same property that affects proper names, which are inherently determined, but this provides no account of the mixed picture in determiners and pronouns, nor does inherent determination relate in any obvious way to tonal properties.

5.3. Genitive phrases. Genitive phrases are good candidates for examining how the GNTS may apply within constructions larger than a lexical root. In Gudi Ngamo, genitive phrases with pronoun possessors have the form NOUN+Linker+Pronoun, where "Linker" is a formative agreeing in gender/number with NOUN. Once certain adjustments are made so as to relate the Yaya and Gudi forms to a single proto-Ngamo input structure, we find that the GNTS has applied regularly to these phrases. The table shows nouns of each tone pattern (except original HH, for which I did not elicit any examples) for each gender with 1st singular and 2nd masculine singular possessors. These persons are representative of the morphology for all persons.

(22) Ngamo pronominal genitives

Yaya	Gudi		Yaya	Gudi	
Masc LL	> LL		Fem LL	> LL	
zùgò-nó	zùgò-nò	'my body'	bàn-nó	bànò-n-nò	'my house'
zùgò-kó	zùgò-n-kò	'your body'	bàn-tò-wó	bànò-t-kò	'your house'
Masc LH	> LL (H)		Fem LH	> LL (H)	
tílì-nó	tílì-nò	'my heart'	sàrà-n-nó	sàrà-n-nò	'my hand'
tílì-kó	tílì-n-kò	'your heart'	sàrà-tò-wó	sàrà-t-kò	'your hand'

²³ The table shows only the masculine and feminine singular indefinite determiners. Gudi Ngamo has borrowed the plural, **màd'fì** 'some, certain ones', from Bole. The Yaya form is native **mà'atò**.

Masc HL	> LF		Fem HL	> LF	
sórkò-nó	sòrkò-nò	‘my in-law’	(no forms elicited in either dialect)		
sórkò-kó	sòrkò-n-kò	‘your in-law’			
Masc L	> L		Fem L	> L	
bò-nó	bò-nò	‘my mouth’	kà-n-nó	kà-n-nò	‘my head’
bò-n-kó	bò-n-kò	‘your mouth’	kà-tò-wó	kà-t-kò	‘your head’
Masc H	> L (H)		Fem H (non-existent)		
lû-nó	lû-nò	‘my meat’			
lû-n-kó	lû-n-kò	‘your meat’			

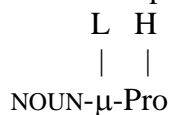
Remarks on segmental phonology: (1) In both dialects, when identical consonants come together to form a geminate, the geminate is simplified with compensatory lengthening of the preceding vowel. The Gudi LL masculine form for ‘my body’ is thus /zùgò-n-nò/ → [zùgò-nò]. (2) /t/ assimilates completely to a following /n/, resulting in a geminate [nn]. The Gudi LL feminine form for ‘my house’ is thus /bànò-t-nò/ → [bànò-n-nò]. Schuh (2005a) spells out these and related alternations in detail.

Remarks on Yaya morphology: Masculine CV nouns are joined to a pronominal possessor with a linker ñ. Other masculine nouns juxtapose the noun and pronoun. All feminine nouns join the noun to the pronoun with a linker reconstructable as *ṭ (see Schuh (2005a) for modern Ngamo allomorphs). The pronoun is always H, except for 3rd masculine singular nì, which is L in all contexts in both dialects.

Remarks on Gudi morphology: Constructions where a masculine noun is the head have the form /NOUN+n+Pronoun/. Constructions where a feminine noun is head have the form /NOUN+t+Pronoun/.

The Yaya masculine constructions with no linking morpheme seem not to fit the general picture. Let us assume that these constructions originally had a Linker ñ like that seen with CV masculine nouns and all Gudi genitives.²⁴ We can then reconstruct a proto-Ngamo schematic representation for genitive constructions with pronouns as follows. The symbol “μ” represents the mora contributed by the linker.

(23) Schematic pronominal genitive structure for proto-Ngamo



With this configuration as the starting point, the GNTS accounts for all the Gudi forms:

²⁴ One can only speculate as to why Yaya has dropped the linker in genitives with masculine nouns. One possible pivot is degemination and compensatory lengthening mentioned in the remarks on segmental phonology. Probably the two most frequently occurring possessive pronouns are -no ‘my’ and -nì ‘his’, both of which would condition degemination of the masculine linker n, leaving only the lengthened vowel as a mark of the genitive relation. It may be that the vowel was shortened, leaving no genitive marker at all, and this linkerless configuration then spread to other persons.

Original L(L) nouns: The GNTS floats the H of the pronoun, leaving all L.

Original LH nouns: *sàrà-t`-kò GNTS > sàrà-t`-kò´ R SIMPLIFICATION > sàrà-t-kò

Original HL nouns: *sòrkò-n`-kò GNTS > sòrkò-n`-kò´ ABSORPTION > sòrkò-n-kò

Original H nouns: *lù-n`-kò GNTS > lù-n`-kò´ R SIMPLIFICATION > lù-n-kò

To this point, we have seen ABSORPTION of the edge of a contour tone into a contiguous syllable of the same tone only in monomorphemic words, as in (5) and (8). The derivation for *sòrkò-n`-kò ‘your in-law’ shows that it also applies across morpheme boundaries. The GNTS shifts the original H of the initial syllable to the first mora of the syllable – kò-n`, which comprises the second syllable of the root plus the linking *n*. This produces a HL sequence on one syllable preceding the L on the possessive pronoun –kò. The L on the second mora of – kò-n` is then absorbed into that syllable.

Although genitive constructions with pronoun possessor conform regularly to the GNTS, this is not the case for N+N genitive constructions. Below is a table showing N+N genitives for all configurations of all original tone patterns of disyllabic nouns. The starred tone patterns, such as *LL are the original tone patterns, which are those heard in the citation of Yaya nouns.

(24) Ngamo N+N genitives

N2 = *LL	Yaya	Gudi	
N1 = *LL	zùgò hâikò	zùk háikò	‘body of a squirrel’
N1 = *LH	tìlì hâikò	tìlì háikò	‘heart of a squirrel’
N1 = *HL	línsá hâikò	línsò háikò	‘tongue of a squirrel’
N1 = *HH	kérfó hâikò	kèrwò-k háikò	‘fish of a squirrel’
N2 = *LH			
N1 = *LL	zùgò tèmshí	zùk tèmshì	‘body of a sheep’
N1 = *LH	tìlì tèmshí	tìlì tèmshì	‘heart of a sheep’
N1 = *HL	línsá tèmshí	línsò tèmshì	‘tongue of a sheep’
N1 = *HH	kérfó tèmshí	kèrwò-k tèmshì	‘fish of a sheep’
N2 = *HL			
N1 = *LL	zùgò kádàm	zùk kàdâm	‘body of a crocodile’
N1 = *LH	tìlì kádàm	tìlì kàdâm	‘heart of a crocodile’
N1 = *HL	línsá kádàm	línsò kàdâm	‘tongue of a crocodile’
N1 = *HH	kérfó kádàm	kèrwò-k kàdâm	‘fish of a crocodile’
N2 = *HH			
N1 = *LL	zùgò kóró	zùk kórò	‘body of a donkey’
N1 = *LH	tìlì kóró	tìlì kórò	‘heart of a donkey’
N1 = *HL	línsá kóró	línsò kórò	‘tongue of a donkey’
N1 = *HH	kérfó kóró	kèrwò-k kórò	‘fish of a donkey’

N+N genitive constructions have no segmental linker when N1 is masculine in either dialect. When N1 is feminine, both dialects have a linker –k. In the table above, the only feminine N1 is Gudi kèrwò ‘fish’, but note Yaya sàrà-k lâmbá, Gudi sàrà-k ngô ‘hand

of a boy/a person’, where the word for ‘hand’ is feminine in both dialects. For N+N constructions it seems necessary to propose a genitive H tone whose effects are apparent in both dialects. In Yaya, N2 begins in H regardless of the original tones of N1 or N2, and in Gudi, where both N1 and N2 had *LL, N2 begins in H, which could have no source from the nouns alone. In Yaya, two further adjustments account for the remainder of the tonal configurations: (1) LH → LL in N1 position, and (2) HL → HH in N1 position.²⁵

For Gudi configurations other than original LL + LL, it is not possible to take either the original input or the input after the GNTS, make small adjustments such as those for Yaya, and account for the current situation. Looking at the paradigm as a whole, what we see is that N1 is always LL, regardless of input tones, pre- or post-GNTS. N2 is HL for all pre- and post-GNTS patterns *except* *HL > LF (*kádàm > kàdâm ‘crocodile’), which retains the post-GNTS pattern. My suggestion is that the GNTS made such a mess of the surface tone patterns of N+N genitive constructions, with floating tones both from the tone shift as well as the original genitive tone, that Gudi Ngamo speakers just gave up and decided to mark all N+N genitives as tonal phrases with a single tone pattern. The pattern is LHL with H associated with the first syllable of N2 and L associated with all other syllables left and right, probably based on the model of genitives comprising two LL nouns. LL is perhaps the commonest original nominal tone pattern, and in Gudi after the GNTS, it was the citation tone pattern for all nouns except original *HL and a miniscule number of disyllabic nouns that had original *FL. The one exception to the modern Gudi LHL genitive pattern with H on the first syllable of N2 is construction with *HL > LF (= LH+L) on N2. This is the one construction that is guaranteed to always have an internal ...HL pattern regardless of the tone of N1. In just this case, then, the ...HL of N2 itself fills out the desired LHL genitive phrase pattern.

5.4. Reprise: is the GNTS a historical sound correspondence or a phonological process? At the end of section 2, I raised the question of whether the tonal correspondences between Gudi Ngamo and closely related dialects and languages represent the frozen end result of a historical sound shift or have some dynamic repercussions in the phonology of modern Gudi Ngamo. In section 4.1, I showed that the GNTS appears to have applied to relatively recent loanwords, and I presented anecdotal evidence that speakers may even appear to apply it on the fly. This does not necessarily show, however, that speakers are applying an active *rule* of tone shifting. The GNTS has resulted in certain canonical tone patterns, and in particular, it has removed certain tonal configurations from the inventory of native Ngamo words (aside from specific word categories, like proper names, that have systematically resisted the GNTS). In loanword adaptation, Ngamo speakers may simply be replacing tone patterns that do not fit the Ngamo canon, a suggestion that has support from the fact that loanwords that do fit the tonal canon usually retain their source language tones.

At various points I have likened the GNTS to the Kikiyu tone shift described in Clements and Ford (1979) and Clements (1984). Working in an autosegmental rule-based framework, Clements and Ford do, in fact, come to the conclusion that TONE SHIFT

²⁵ The facts are slightly more complicated than this, but not in ways relevant to the discussion here. A more comprehensive description of Ngamo genitives, including comparison of the two dialects, can be downloaded in pdf formant from www.humnet.ucla.edu/humnet/aflang/Ngamo/ngamo.html.

is one of the rules of modern Kikuyu phonology. They have several reasons for suggesting this. One is the fact that the tone shift predicts that the original final tone of a word will be shifted right to become a floating tone. This prediction is born out by the fact that just those words where the proto-Bantu form of the word ended in an extra-low tone have downstep on a following word—see esp. Clements and Ford (1979:204ff.). The GNTS likewise has yielded floating tones, some of whose effects are illustrated in section 3, and some of which cause a F on monomoraic word final syllables that otherwise do not exist in closely related languages, as in words like **línsò* > *línsô* ‘tongue’.²⁶ The presence of floating tones whose origin is in tone shift does not, however, necessarily demonstrate that the shift itself has synchronic reality. The psychological reality of floating tones has been amply demonstrated for many African languages, and there is thus no reason to think that Gudi Ngamo speakers are dynamically creating floating tones rather than simply learning that certain words have a final floating tone as part of their lexical make-up.

A more compelling argument for the synchronic reality of TONE SHIFT in Kikuyu, presented in detail in Clements (1984:291ff.), comes from the extensive agglutinative system of verbal morphology. Clements (1984:293) notes that, “...formatives show a pattern of tone alternation which correlates with the identity of the formative to their immediate left. Thus, all formatives are H after the formatives *-tom-*, *ma-*, and *-ir-*, and all formatives are L after the formatives *to-*, *mo-*, and *-ir-*.” Clements argues that by assigning underlying H or L to the respective formatives, then shifting the tone to the next formative with the single rule of TONE SHIFT, we can explain this situation in a single statement. Equating surface tones with underlying tones, on the other hand, would yield a system that, in principle, would probably be unlearnable because of the potentially infinite number of tonal configurations it would predict.

The verbal morphology of Ngamo is not nearly as extensive as that of Kikuyu, and though there is much yet to be learned about Ngamo verbal morphology, as far as I can determine, although Gudi Ngamo verbal tones are different from those of Yaya Ngamo or Bole, the resulting configurations themselves are largely static, and hence learnable, for any configuration of verb class, tense, verbal extension, and pronominal affix. The major exception is tones on verbs roots with different subject pronouns as in (15), e.g. *nè ngàr-kô* ‘I tied’ vs. *kò ngár-kô* ‘you (m.s.) tied’, where the pronoun subjects are both L but the verb root tone is L in 1st singular but H in 2nd singular. This difference is a result of the GNTS inasmuch as the tone of *ne* ‘I’ was originally L but *ko* ‘you (m.s.)’ was originally H. Rather than this historical configuration being the underlying pattern of the modern Gudi Ngamo system, it is more likely that either speakers learn formatives /*nò*/ ‘I’ and /*kò*/ H/ ‘you (m.s.)’, the latter with a floating H tone, or they learn the paradigmatic configuration L-L... for verbs with first person singular subjects and L-H... for second singular.

In short, the GNTS has left its mark in the form of floating tones and resultant tonal alternations, and, compared to closely related languages, the canonical set of lexical tone patterns is rather skewed, but there is little, if any evidence that the GNTS, as such, has synchronic reality in modern Gudi Ngamo.

²⁶ The Yaya dialect also has F on apparently monomoraic final syllables, but this always is a result of contraction of two syllables, not of tone shift, Yaya *bàsâ* = *bàsá’â* < **bàsá-kò* ‘he shot’—cf. Karekare *bàsá-kàu*.

6. Analysis

In this section, I propose an Optimality Theoretic (OT) account of the GNTS. This exercise has several purposes. First, it will consider what it might mean for OT constraints to apply to an output whose input is a temporally earlier stage of a language rather than a base form in a synchronic grammar. Second, it will show that regardless of what the path of a historical sound change was, constraints that have been applied to tonal phenomena in synchronic grammars can regulate the outcomes of historical sound change. Third, whereas constraints proposed elsewhere have focused on faithfulness and markedness of the tones themselves, the analysis here will suggest that constraints should also apply to the associations that link tones to segmental material.

In section 5.4, I concluded that the GNTS is a historical sound change, and although its effects comprise part of the phonology of modern Gudi Ngamo, for example, in alternations conditioned by floating tones, evidence points against there being an active rule of TONE SHIFT. Consequently, if one is to propose an OT account of the GNTS, it will be relating an earlier historical stage to modern lexical forms (which, themselves, would, of course, be the base forms whose outputs would be subject to constraints that are now active—I will not consider this issue in the present paper). It is fair to ask whether it makes sense to propose a (set of) constraint(s) that would relate sound correspondences between items at one historical stage and their reflexes at a later stage.²⁷ In the typical case, such correspondences conflate a series of intermediate stages for which we have no record. Though we might propose constraints, for example, that would relate the long vowels of Middle English as input to their reflexes in a particular dialect of modern English as output, a relationship stated in terms of such constraints would almost surely be fiction. The relevant constraints should relate the modern output to the immediately preceding ancestor, which is unlikely to have been Middle English. With this discussion as a caveat, we might nonetheless see what an OT account that relates correspondences between remote stages of a language might look like,

At the end of section 2, I argued that the GNTS must be the conflation of a series of events for which we have only the historical input, reflected in Yaya Ngamo, Bole, and other more distantly related languages, and the Gudi Ngamo output. I also suggested that, from what we know cross-linguistically about natural tone processes, the GNTS probably had its origin in *tone spreading*, the tendency of tones to extend beyond their original domains. Such spreading is virtually always perserverative, probably resulting from the voicing frequency generated in the larynx getting out of synch with the segmental hosts

²⁷ Yip (2002:82) says, “OT is committed to the view that the difference between grammars is a difference in [rankings of universal constraints]. ... Along the same lines, the grammars of a single language at two points in time must also differ only in constraint rankings, so the process of historical change also results in the re-ranking of constraints.” This concept has its clearest significance in cases where a set of two or more constraints would rank high enough in both stages of the language to be playing some clear role in output evaluation. For example, one could argue that the constraints ONSET and NOCODA (Kager 1999:93-94) both rank relatively high in regulating syllable structure in Bade and Ngizim but that Ngizim **də̀gàgà̀rú** ‘harden floor by pounding’ (representing the historically more conservative form) and Bade **ə̀dgàgà̀rú** differ in that Ngizim has the ranking ONSET >> NOCODA whereas Bade has innovated by reversing this ranking (Schuh 1978). In the case of the GNTS, however, it is difficult to see how reordering a few highly ranked constraints could account for the tonal differences between Yaya Ngamo and Gudi Ngamo.

by which pitch frequencies are realized. Since such pitch spreading is natural and widespread, I suggest it be translated directly into a constraint, SPREAD-R, that evaluates an output in which tones are associated with domains to the right of the input domains. Schematically, we could thus imagine each tone of a word in Ngamo spreading rightward, taking over the domain of its right-hand neighbor with the end result being that each tone ends up where its right-hand neighbor used to be. Using this idea I propose the following constraints to account for the outputs of the GNTS. Some of these constraints are listed in Yip (2002:83-84). For those constraints, I give Yip's formulation without comment. For those that differ from Yip's, I explain the motivation.

Markedness constraints

- SPREAD-R: A tone is associated with segmental material to its right—see discussion immediately above.
- OCP: Adjacent identical elements are prohibited.
- SPECIFY T: A TBU must be associated with a tone.
- *FLOAT: A tone must be associated with a TBU.
- *R: Rising tones are prohibited. This is a specific case of Yip's NOCONTOUR, "A TBU may be associated with at most one tone." NOCONTOUR can be viewed as a family of constraints, with languages differing as to which members of the family, if any, they tolerate. Ngamo allows F contours but not R. Kikuyu, on the other hand, allows R but not F (Clements and Ford 1979:191-192).
- ALIGN (Tone, Syllable): A tonal association should align with a syllable edge. This constraint corresponds to the rule of ABSORPTION in (5) and (8) and expresses a widespread cross-linguistic restriction ("The Law of the Like Neighbor", Hyman 2004) disallowing a syllable bearing a contour tone from having an endpoint of the contour that is the same as the tone of a contiguous following syllable or, less commonly, from having a beginning point that is the same as a contiguous preceding syllable. For example, Bole, which does allow phonetic rising tones, has words with the sequence RL (*kǎngò* 'gum Arabic') but none with a sequence RH. Newman (2000:Chapter 71) discusses a number of active processes of this type in Hausa. For example, in the Maradi dialect, a F monosyllable becomes L after H but remains F after L (*gíshírí dà mǎi* 'salt and oil' vs. *gíshírí kó mǎi* 'salt or oil'—cf. citation form *mǎi* 'oil').

Faithfulness constraints

- MAX-T, DEP-T: Do not insert or delete tones.
- MAX-ASSOC, DEP-ASSOC: Yip lists *DISSOCIATE "No removal of association lines" and *ASSOCIATE "No new association lines". The apparent reason for not formulating these as MAX and DEP constraints, parallel to MAX-T and DEP-T, is that the lines associating TBUs to tones are not, themselves taken to be phonological units. In a case like Kikuyu, for example, where, at least in the analyses of Clements and Ford (1979) and Clements (1984), the TBU is the syllable and there is an invariable one-to-one relationship of tone to TBU, there is no reason to take the association lines to be anything other a link between tone and TBU. However, in a language like Ngamo, where the domain of a tone is lexically specified and can vary from a single mora to multiple syllables, the GNTS shows that those domains are respected, i.e. the GNTS moves each tone rightward without affecting the

original tonal domains. Since OT expresses I-O invariance of this type in terms of faithfulness constraints, it seems that such constraints should be formulated in a consistent way for all elements in the phonology.

- I-CONTIG-ASSOC, O-CONTIG-ASSOC: Do not remove or insert association lines internal to a string. Contiguity (CONTIG) constraints were proposed by McCarthy and Prince (1995). These are a sub-case of MAX and DEP respectively. In tonal phonology, ranking CONTIG-ASSOC constraints separately from and higher than MAX/DEP-ASSOC constraints corresponds to a least two widely attested facts. First, floating tones, which often arise through dissociation of a tone from a segmental host, are far more common at word edges than word medial, i.e. violating an I-CONTIG constraint by allowing a medial floating tone is less common than violating a MAX-ASSOC constraint by allowing a word-edge floating tone. Second, as noted above, toward the end of section 2, and in Yip (2002:141-145), it is common for “excess” tones to pile up at the end of a word and result in multiple associations with a single TBU, as in the case of Ngamo words like **lìnsô** ‘tongue’ with HL (= F) associated with the final (monomoraic) syllable. The reassociation of the floating L with the last syllable is a violation of DEP-ASSOC but not of O-CONTIG-ASSOC, and in fact Ngamo, and most other languages would not allow such multiple associations with a single TBU word internally.

Tableau 1 shows the application of most of these constraints to ***kúrúmsò** > **kùrùmsò** ‘biting ant’. *R and ALIGN (Tone, Syllable) do not play a role here, but they do in tableaux below.

Tableau 1. ***kúrúmsò** > **kùrùmsò** ‘biting ant’

Base and output candidates	SPECIFY T	OC P	SPREAD-R	I-CONTIG-ASSOC	O-CONTIG-ASSOC	*FLOAT	MAX-ASSOC	DEP-ASSOC	MAX/DEP-T
H L / \ kurumso ‘biting ant’			*!*						
H L / \ kurumso				*!		*	*		
H L / \ kurumso	*!			**			*	**	*
H HL / \ / kurumso		*!						*	*
L HL / \ / ☞ kurumso								*	*

Line 1, representing the historical input, is shown as violating SPREAD-R twice, once for each tone. Though the final tone may end up as floating, one can think of this as spread since the floating tone can reappear associated with what follows in a larger phrase. SPECIFY-T, OCP, and SPREAD-R as a group are probably unranked, but I have

placed SPECIFY-T and OCP higher because any violation of these constraints would be fatal regardless of whether or not an output violated SPREAD-R. Line 2 spreads the H by extending its association to the last syllable. This fatally violates I-CONTIG-ASSOC by adding a new association line to the H and also violates MAX-ASSOC by deleting the last association line and *FLOAT by leaving the final L to float. In the remaining lines of the tableau, I have associated the final L with the last syllable, which avoids violating *FLOAT by adding an association line at a word edge, violating only low-ranked DEP-ASSOC. Line 3 spreads the H by moving the entire disyllabic domain of the H one syllable to the right. The fatal violation is SPECIFY-T, since the initial domain has been left toneless, though even had a tone been supplied, the I-CONTIG-ASSOC violation would have been fatal, as in the previous line. Any violation of SPECIFY-T is fatal, so the remaining lines show all domains associated with a tone. Line 4 spreads the tone by copying the H to the last syllable. This, however, fatally violates the OCP. Line 5, the winning candidate, like line 4, spreads the H by moving it to the tonal domain of the last syllable, but it avoids violating SPECIFY-T and the OCP by supplying L to the initial domain, violating only low-ranked DEP-T.²⁸ The result of these constraint interactions is that there is no evidence in the output for a “spread”, i.e. as far as the output goes, there is just a “shift”, which is exactly what we see when comparing Yaya and Gudi Ngamo.

Tableaux 2-4 demonstrate application of the constraints to words with other tonal configurations. The constraints SPECIFY T, OCP, and SPREAD-R are included in tableaux only where needed for discussion of particular candidates. Otherwise, it is assumed that a violation of any of these constraints would be fatal. These tableaux will show the crucial role of *R and ALIGN (Tone, Syllable), which did not play a role in Tableau 1.

Tableau 2. *tèmshí > tèmshì (H) 'sheep'

Base and output candidates	OCP	*R	I-CONTIG-ASSOC	O-CONTIG-ASSOC	*FLOAT	MAX-ASSOC	DEP-ASSOC	MAX/DEP-T
$\begin{array}{c} L \quad H \\ \quad \\ \text{temshi} \\ \text{'sheep'} \end{array}$								
$\begin{array}{c} L \quad L \quad H \\ \quad \\ \text{temshi} \end{array}$	*!				*			*
$\begin{array}{c} L \quad H \\ / \quad \backslash / \\ \text{temshi} \end{array}$		*!				*	**	
$\begin{array}{c} L \quad H \\ / \quad \backslash \\ \text{temshi} \end{array}$					*	*	*	

Line 2 has a configuration similar to the winning candidate in Tableau 1, where each original tone is displaced one domain to the right and L is associated with the initial

²⁸ Ngamo probably needs a markedness constraint *H “No high tones” (Yip 2002:80), which would account for why a domain that would otherwise have no tone is preferably associated with L rather than H. However, in the case of the GNTS, an inserted H would always be ruled out by violation of the highly ranked OCP.

domain. However, the resultant sequence of L tones fatally violates the OCP. This is avoided in the other two candidates by associating a single L to the first two syllables, creating violations of relatively low-ranked MAX-ASSOC and DEP-ASSOC. Under this interpretation, the double association of the L involves deletion of the original initial association line and adding a new association line to the L, which has spread to the second domain, originally occupied by H. Line 3, where the floating H has been reassociated with the final syllable to avoid a violation of *FLOAT, as in the last three lines of Tableau 1, creates a LH sequence on the last syllable, creating a fatal violation of highly ranked *R. Line 4 is thus the winning candidate, where the floating H is left unassociated.

Tableau 3. *shûlí > shùlí (H) 'black kite'

Base and output candidates	OCP	*R	I-CONTIG-ASSOC	O-CONTIG-ASSOC	*FLOAT	MAX-ASSOC	DEP-ASSOC	MAX/DEP-T
H L H shu:li 'black kite'								
L H L H shu:li		*!			*			*
H L H ^ ☞ shu:li					*	*	*	

Line 2 has a configuration like the winning candidate in Tableau 1, where each original tone is displaced to the domain to its right and the initial domain is associated with L. However, in this case, the first two domains constitute a single mora each, with the effect that the initial L+H are associated with one syllable, resulting in a fatal violation of *R. Line 3, the winning candidate, deletes the initial association and creates a new association with the shifted H, violating only the relatively low-ranked MAX-ASSOC and DEP-ASSOC constraints. As in Tableau 2, the final H must be left to float, since reassociation to the final syllable would result in a violation of high-ranked *R. It is interesting to compare the autosegmental, rule-based account in (7) with the constraint-based account in Tableau 3. The rule-based account first creates a R, then “simplifies” this contour tone to a level H. The constraint-based account does not involve a R at any stage.

Tableau 4. *têmkà > tèmka 'sheep (pl)'

Base and output candidates	SPREAD	*R	ALIGN (T, σ)	I-CONTIG-ASSOC	O-CONTIG-ASSOC	*FLOAT	MAX-ASSOC	DEP-ASSOC	MAX/DEP-T
H L / \ temka 'sheep (pl)'									
L H L / \ temka		*!	*			*			*
H L / \ temka			*!			*	*	*	
H L /\ temka	*!			*			*	*	
L H L /\ temka				*		*!	*	*	*
L H L /\ / temka				*			*	**	*

Line 2 shows the tones displaced one domain to the right with L supplied on the initial domain. As in Tableau 3, the first two domains are monomoraic, and when L is added to the initial syllable, the result is a fatal violation of *R on the first syllable. The candidate in line 2 also violates ALIGN (Tone, Syllable). As far as I can tell at present, *R and ALIGN (Tone, Syllable) are unranked with respect to each other, either one resulting in fatal output violations in Gudi Ngamo. Line 2 avoids R on the first syllable in the same way the winning in Tableau 3 does, that is, by reassociating the initial domain with the shifted H, but like the candidate in line 2, it violates ALIGN (Tone, Syllable). Line 4 avoids the violations of lines 2 and 3 by deleting the internal association line that connected the H to the second domain. Simply deleting this line (a candidate not shown in the tableau) would leave the final syllable unassociated, a violation of highly ranked SPECIFY T. However, avoiding this violation by leaving the original final L associated with the second syllable violates SPREAD. Line 5 deletes the line linking the H to the first syllable, thus avoiding a violation of ALIGN (Tone, Syllable) and leaving the initial domain free to be associated with L. This candidate violates the rather low-ranked *FLOAT, a violation that can be avoided by associating the floating L to the final syllable, violating the lower ranked DEP-ASSOC.

7. Conclusion

This paper has described the Great Ngamo Tone Shift (GNTS), a phenomenon whereby the Gudi dialect of Ngamo, a Chadic language of northeastern Nigeria, has systematically shifted the entire original tone pattern of a word to the right and has associated a L tone with the original initial tonal domain. The GNTS has left remnants in Gudi Ngamo in the form of tones that have shifted off the right edge of words to become

floating tones and certain tonal alternations, particularly in verb inflection. Loanwords have been, and may continue to be adapted to fit the canonical tonal patterns created by the GNTS. However, current evidence suggests that the GNTS is best viewed as a historical sound shift that accounts for tonal correspondences between items in Gudi Ngamo and their cognates in closely related languages rather than an active rule in Gudi Ngamo. Given the systematicity of the GNTS, its non-application in some cases is nearly as interesting as its application. In particular, proper names have resisted the GNTS, showing that Ngamo speakers are sensitive to names as a special lexical category.

The domains of tones in Ngamo are lexically specified and can range from a single mora to multiple syllables. The fact that the original patterns of tonal domains in a word remain stable even as the pitches associated with each domain shift shows that a tone and its associations comprise different aspects of phonological structure. A constraint-based analysis of the GNTS thus includes constraints that refer to the associations and the tones separately. The constraints proposed to account for input-output correspondences brought about by the GNTS have independent cross-linguistic support. For example, ranking contiguity constraints involving tone above more general faithfulness constraints corresponds to the fact that floating tones are nearly always at the peripheries of tonal phrases.

In short, the GNTS, while an interesting phenomenon in its own right, also provides insights into the nature of phonological representations.

References

- Clements, George N. 1984. "Principles of tone assignment in Kikuyu." In G.N. Clements and J. Goldsmith (eds.), *Autosegmental Studies in Bantu Tone*, pp. 281-339. Publications in African Languages and Linguistics, 3. Dordrecht: Foris Publications.
- Clements, George N. and Kevin C. Ford. 1979. "Kikuyu tone shift and its synchronic consequences." *Linguistic Inquiry* 10:179-210.
- Gimba, Alhaji Maina. 1998. "Low Tone Raising in Bole." MA thesis, UCLA Department of Linguistics.
- Gimba, Alhaji Maina. 2000. "Bole verb morphology." PhD dissertation, UCLA Department of Linguistics.
- Harries, Lyndon. 1952. "Some tonal principles of the Kikuyu language." *Word* 8:140-144.
- Hyman, Larry M. 2004. "Universals of tone rules: 30 years later." Paper presented at the International Conference on Tone and Intonation, Santorini, September 9-11, 2004.
- Hyman, Larry M. and Russell G. Schuh. 1974. "Universals of tone rules: evidence from West Africa." *Linguistic Inquiry* 5_81-115.
- Jungraithmayr, Herrmann. 1991. *A Dictionary of the Tangale Language (Kaltungo, Northern Nigeria)*. Franfurter Studien zur Afrikanistik, 12. Berlin: Dietrich Reimer.
- Kager, René. 1999. *Optimality Theory*. Cambridge: Cambridge University Press.
- Kidda, Mairo Elinor. 1985. "Tangale phonology: a descriptive analysis." Ph.D. dissertation, University of Illinois at Urbana-Champaign.
- Kiparsky, Paul. 1968. "How abstract is phonology?" Bloomington: Indiana University Linguistics Club.

- Leben, William R. 1971. "The morphophonemics of tone in Hausa." In *Papers in African Linguistics*, ed. by C.-W. Kim and Herbert Stahlke, pp. 201-218. Edmonton: Linguistic Research, Inc.
- McCarthy, John J. and Alan S. Prince. 1995. "Faithfulness and reduplicative identity." In Jill Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk (eds.), *Papers in Optimality Theory*, pp. 249-384. University of Massachusetts Occasional Papers in Linguistics 18. Amherst MA: Graduate Linguistic Student Association.
- Newman, Paul. 1974. *The Kanakuru Language*. West African Language Monographs, 9. Leeds: Institute of Modern English Language Studies, University of Leeds and West African Linguistic Society.
- Newman, Paul. 1977. "Chadic classification and reconstructions." *Afroasiatic Linguistics* 5(1):1-42.
- Schuh, Russell G. 1978. "Bade/Ngizim vowels and syllable structure." *Studies in African Linguistics* 9:247-283.
- Schuh, Russell G. 1980. "Paradigmatic displacement." In J. Fisiak (ed.), *Historical Morphology*, pp. 349-358. Trends in Linguistics, Studies and Monographs, 17. The Hague: Mouton.
- Schuh, Russell G. 2005a. "Degemination, compensatory lengthening, and gemination in Gudi Ngamo." In Jeffrey Heinz, Andrew Martin, and Katya Pertsova (eds.), *Papers in Phonology* 6, pp. 1-11. UCLA Working Papers in Linguistics 11. Los Angeles: UCLA Department of Linguistics.
- Schuh, Russell G. 2005b. "The totality extension and focus in West Chadic." Paper presented at the International Berlin Focus Conference, 6-8 October, 2005.
- Yip, Moira. 2002. *Tone*. Cambridge: Cambridge University Press.