

**Tone on Lagwan Verbs:
The Conflict between Perceptual Prominence and Lexical Contrast¹**

Joy Naomi PHILIP
UCL

1. Introduction

This paper is concerned with the realisation of tone in Lagwan², a Central Chadic language of the Kotoko group, spoken in Northern Cameroon, focusing on the verbal system. It will be shown that the verbal system is interesting for such study, since, like many Chadic languages (cf. Schuh 1971), tone is lexically contrastive only for a minority of verbs. This paper aims firstly to establish what factors determine the realisation of tone in Lagwan verbs; secondly, to consider why Lagwan allows two apparently different tonal systems to operate within the same lexical category. In fulfilling these objectives, my paper has the wider aim of placing the results within the broader context of natural phonological processes.

2. Overview of vowel system

Before turning to the tonal systems found on Lagwan verbs, it will first be useful to give a brief overview of the vowel system.³ Like many Chadic languages (Schuh 1971, Wolff 1983), Lagwan has a greater number of vowel contrasts word-finally than initially or medially, with the high vowels appearing as underlying vowels only in final position.⁴ Verbs display fewer lexical vowel contrasts than other categories, with the back vowels being absent from the system.⁵ In verbs, therefore, the underlying vowels /i/, /e/

¹ I would like to thank Sean Allison, Steve Anderson, Mary Pearce, Aaron Shryock and Moira Yip for helpful discussion and suggestions at various stages concerning the data and ideas in this paper, as well as fellow participants of the fourth BICCL. An earlier version of some of the material in this paper was presented at the University of York (1st June 2006). My thanks are also due to the Lagwan speakers I worked with in Cameroon from 2004-2005, especially Awalou Adam, Marouf Ibrahim, Aïcha Mahamat and Hadja Habi Sali. Any errors are of course my own.

² Alternative names: Lagouané, Lagwane, Logone, Logone-Birmi (Kotoko)

³ See Tourneux (2003) for an analysis of the vowel system in Kotoko in general. See Ruff (2005:§3) for an analysis of vowels in Lagwan.

⁴ High vowels may appear on the surface in initial or medial position, but only as realisations either of glides or of the epenthetic vowel, discussed below.

⁵ That is to say that back vowels are absent as *lexical* vowels. The suffix *-o* may be attached to give the verb a ventive reading, while *-ú* derives verbal nouns from particle verbs. Both suffixes trigger vowel harmony on any underlying vowels in the root. (See Ruff 2005:39.)

and /a/ appear in final position, with only /e/ and /a/ in medial position. In verbs vowels never appear in initial position.

Throughout Lagwan, as is common in Chadic, the underlying vowels are supplemented by a short epenthetic high vowel (Schuh's 1971 'zero vowel'), present only when required for well-formed syllabification (for rules, see Ruff 2005:§§4.1.2 and 4.2). This vowel assimilates to its environment, such that it may be realised [i], [ə]⁶ or [u] (see Ruff 2005:§3.5.1 for rules), with a default realisation of [ə], the high central vowel.

3. *Tone on verbs*

Bearing this overview of vowels in mind, we now turn to the issue of interest, the realisation of tone on verbs.

3.1 Subset of verbs with lexical tone

As for certain other Chadic languages (Dera, Schuh 1971:36-37; Hausa, Newman 1973; Migaama, Roberts 2005), in Lagwan tone is lexically contrastive for only a subset of verbs. The verb structures permitting lexical tone are given in table 1 overleaf, with their distribution and examples. Known loan words are excluded, here and in subsequent tables. Throughout this paper 'V' represents any underlying vowel, 'ə' any epenthetic vowel, which is always a high vowel (see section 2 above). Given that 'ə' is epenthetic, we can make the generalisation that only verbs with the structure CCV(C) allow lexical tone to surface. This is in fact the most common underlying structure for verbs (cf. Ruff 2005:59), the potential significance of which will be discussed later, in subsection 3.3.

Where a word has an initial CC cluster, there is good evidence for treating the initial consonant as a syllable and tone-bearing unit in its own right. This has already been shown for initial geminates and nasal-obstruent sequences (Tourneux 2006, Ruff 2007). Here I show that the same analysis extends to CC sequences of any sonorant followed by an obstruent, or any voiceless obstruent followed by either another voiceless, or a glottalic, obstruent.

Evidence for the tone-bearing status of the initial consonant in these clusters is found where the verb is preceded by a polar tone. This is exemplified by (1)-(4) overleaf, where the tone of the first person singular morpheme, *wu*, is invariably polar with respect to the initial tone of the following verb.

⁶ Following Chadic conventions, [ə] represents a high central vowel (IPA [ɨ]), [r] represents a flap (IPA [ɾ]) and [y] a glide (IPA [j]).

<i>Structure/Tone</i>	L	LH	H ⁷	HL
C.CV = 24	16: ñ.k'à <i>create</i>	8: m̃.bí <i>crawl</i>	-	-
C.CVC = 2	1: š.k ^w ál <i>seek</i>	1: š.χél <i>suit</i>	-	-
Cə.CV = 26	16: wù.ɬà <i>fill</i>	3: sè.mé <i>touch</i>	2: ɬə.ná <i>feel</i>	5: s'í.yà <i>tear</i>
Cə.CVC = 7	5: k ^w ù.lám <i>boil</i>	2: d̃ə.vál <i>fear</i>	-	-
Cə.CV.Cə = 3	2: k ^w ù.rè.hè <i>scratch</i>	1: vè.ná.hè <i>vomit</i> ⁸	-	-
Total = 62	40	15	2	5

Table 1. Verb structures with lexical tone (to be revised in table 4)

- (1) wú. wù.ɬà *I fill*
(2) wú. sè.mé *I touch*
(3) wù. ɬə.ná *I feel*
(4) wù. s'í.yà *I tear*

The same effects are found whenever the verb starts with a consonant bearing low tone. This is shown in examples (5)-(8), where the verb has an initial low-toned consonant followed by a high syllable:

- (5) wú m.!bí ~ wù m.bí *I crawl*
(6) wú n.!í ~ wù n.í *I swim*
(7) wú k.!ká *I hold*
(8) wú χ^w.!bí *I get old*

⁷ A couple of verbs with syllable structures other than those shown have high tone throughout, but these can essentially be ignored: *ʔáhə* ('laugh') is onomatopoeic (thanks to Steve Anderson for pointing this out); *dákál* ~ *dálkál* ('wait (for)') may very well be a loan, indicated by the medial consonant cluster, never found in native Lagwan verbs (cf. Ruff 2005:59). The fact that it has a variant with a deleted consonant suggests that some speakers have reanalysed it to conform to native Lagwan verb structures.

⁸ There is some free variation here: [v³nàhə] ~ [vənəhə] ~ [vənāhə] ~ [vənáhə]. I suspect the optional and variable spreading of the low tone is due to the shortness of the first vowel, particularly when, as is usually the case (except in the imperative, the tone of which I do not yet fully understand), the verb follows an open syllable. I am treating this spreading as a purely phonetic phenomenon here, a result of the fact that it requires some time to produce, and to change, tone. Notice however that the low tone does not spread on disyllabic CəCV(C) verbs with a LH melody; presumably each lexical tone must be realised on at least one whole syllable.

In such cases resyllabification occurs, such that the initial consonant of the verb becomes the coda of the preceding syllable. However, the evidence from polar tone and downstep clearly shows that there is a phonological low tone associated to the initial consonant of the verb prior to resyllabification.

Firstly, the polar tone on *wu* is realised as high, proving that the low of the initial consonant is a genuine phonological tone. If, conversely, this initial low were simply phonetic low pitch, the initial tone of the verb would be the high tone, and accordingly we would expect the polar tone to be realised as low. Moreover, where low of the consonant is not realised phonetically, due to resyllabification or voicelessness, the following high tone is downstepped, providing further evidence that the low is phonologically present. Furthermore, this low must be associated at some point in the derivation to a syllable, rather than a mora, since in Lagwan only syllable nuclei are tone-bearing units. This is shown by the contrast between (5)-(8) and (9)-(12), where the same kinds of consonant cluster appear word-internally. In such examples the word-internal consonant is the coda, rather than the nucleus, of the syllable. The coda cannot bear tone and therefore there is no downstep.

- | | |
|---------------------------|-------------------------|
| (9) tán.dá | <i>flirtatious lady</i> |
| (10) ɛ́l.lá | <i>weight</i> |
| (11) lák ^w .dé | <i>younger sibling</i> |

While examples (5)-(8) constitute evidence that the verbs with an initial consonant cluster have an initial low-toned syllable, the reader might wonder whether there in fact might be a short epenthetic vowel between the two initial consonants, in which case it would not actually be the initial consonant itself that were syllabic. However, evidence from the pluractional in (12)-(16) shows a clear difference between verbs with an initial consonant cluster⁹ and verbs with an epenthetic vowel between the first two consonants. In the former case, as in (12)-(16), the initial syllable with the epenthetic vowel is reduplicated. However, if the initial syllable is a syllabic consonant, as in (14)-(16), it is the second syllable that is reduplicated instead. This reduplication of the second, unmarked, syllable, where the initial syllable is marked, is not an uncommon strategy cross-linguistically (cf. McCarthy and Prince 2001:132 and references cited there).

⁹ The reader may wonder why epenthesis is not permitted in these cases. Epenthesis is obviously not possible in geminates. Syllabic sonorant consonants are permitted, but there is a requirement for a decrease in sonority across a syllable boundary. Therefore syllabic sonorant consonants precede obstruents, but epenthesis is required between two nasals. Ease of articulation motivates the prohibition on epenthesis between non-voiced obstruents, by avoiding the need to initiate voicing for a very short vowel between two non-voiced consonants.

	<i>Structure</i>	<i>Verb</i>	<i>Pluractional</i>	
(12)	Cə.CV	ɛ̀ù.ví	ɛ̀ù.ɛ̀ù.vì	<i>run</i>
(13)	Cə.CV	s'ù.wà	s'ù.s'ù.wà	<i>twist</i>
(14)	C.CV	m̀.ɓí	m̀.ɓì.ɓì	<i>crawl</i>
(15)	C.CV	h̀.ṭì	h̀.ṭì.ṭì	<i>die</i>
(16)	C.CV	š̀.ḍà	š̀.ḍà.ḍà	<i>roughcast</i>

The data presented above provide evidence for both the syllabic and the tone-bearing status of the initial consonant in CC-initial verbs. Further evidence that the initial consonant is indeed a syllable in its own right will be provided by the verbs with predictable tone in subsection 3.2 below (see footnote 13). However, a curious property of this tone-bearing unit, consistent throughout the language, is that it only ever bears low tone (cf. table 1). A brief glance at lexical tone as it is realised on nouns sheds some light on why this might be.

Firstly, table 2 below gives the distribution of surface tonal melodies on unambiguous nouns – that is, nouns without an initial syllabic consonant. We see that there are three major underlying tonal melodies – L, H and LH – with left-to-right association and spreading.¹⁰

1σ:	2σ:	3σ:	4σ:	Total:
L: 15 (71%)	LL: 77 (44%)	LLL: 26 (39%)	LLLL: 4 (57%)	L: 122 (46%)
H: 6 (29%)	HH: 59 (34%)	HHH: 22 (33%)	HHHH: 2 (29%)	H: 89 (33%)
	LH: 37 (21%)	LHH: 14 (21%)		LH: 51 (19%)
	HL: 1	HHL: 4 (5%)	LHHL: 1 (14%)	Other: 6 (2%)

Table 2. Lexical tone on unambiguous nouns

Table 3 overleaf shows tone on nouns with an initial syllabic consonant, with the tone on this initial consonant given in parentheses. We see that as for the verbs in table 1, the tone of the syllabic consonant is always low. However, this low tone does not seem to be part of the noun's lexical melody; if the initial low is ignored, the same L, H, and LH melodies are found. In particular, under left-to-right association, surface melodies such as LLH(H) should not be possible, but if the initial low is ignored, we have the same LH(H) melody as in table 2.

¹⁰ It is probable that the exceptions are either loans whose source is yet to be identified or compounds.

C+1σ: 41	C+2σ: 76	C+3σ: 11	<i>Total:</i> 128
(L)L: 21 (51%)	(L)LL: 29 (38%)	(L)LLL: 4 (36%)	(L)L: 54 (42%)
(L)H: 20 (49%)	(L)HH: 34 (45%)	(L)HHH: 5 (45%)	(L)H: 59 (46%)
	(L)LH: 13 (17%)	(L)LHH: 2 (18%)	(L)LH: 15 (12%)

Table 3. Tone on syllabic-consonant-initial nouns

It seems then that, where a noun has an initial syllabic consonant, the first tone of the lexical melody is associated to the second syllable, with subsequent left-to-right association and spreading. There is therefore some kind of prohibition on realising lexical tone on a consonantal syllable nucleus. I propose that the reason for this prohibition lies in the need to preserve lexical contrasts. Lexically contrastive tone is best preserved when it is associated to syllables with greater perceptual prominence. The sonority hierarchy in (17) shows that consonants are less sonorous than vowels, and as such phonetically and perceptually less prominent:¹¹

(17) *Sonority hierarchy*

low vowels > mid vowels > high vowels > liquids > nasal consonants > fricatives > plosives

Therefore lexical tone is associated to the leftmost syllable with a vocalic nucleus. If there is an initial syllabic consonant, it is assigned a default low, in order to satisfy the requirement that all syllables bear tone. We will see in the next subsection why low is chosen as the default tone in these cases.

Given the evidence that the low tone realised on initial syllabic consonants is not lexical, we need to revise the table showing the realisation of lexical tone on verbs. The revised table is given in table 4 overleaf.

The verbs in this table with an initial syllabic consonant, in the first two rows, have only a single syllable capable of bearing lexical tone, and so there

¹¹ There is an additional (and more serious) problem with voiceless consonants, in that only tone associated to voiced syllables can be realised phonetically and therefore the quality of this tone is only detectable via the presence or absence of downstep between two highs (as in (7)-(8)). However, since all the voiceless consonants are obstruents, and more sonorous syllabic consonants such as nasals also prohibit the association of lexically contrastive tone (cf. Ruff 2007:§4.2.1), we can safely conclude that low sonority alone is sufficient to prevent association of lexically contrastive tone to voiceless syllabic consonants.

are only two logically possible lexical melodies¹² – low and high – both of which are attested. In the third row, where the verbs have two syllables capable of bearing lexical tone, all four logically possible melodies are attested. I would hypothesise that the reason all four melodies are not attested on the remaining verbs is purely due to the poverty of data.

<i>Structure/Tone</i>	L	LH	H	HL
C.CV = 24	16: ñ.k'à <i>create</i>	-	8: m̄.bí <i>crawl</i>	-
C.CVC = 2	1: š.k ^w ál <i>seek</i>	-	1: š.χél <i>suit</i>	-
Cə.CV = 26	16: wù.ɬà <i>fill</i>	3: sə.mé <i>touch</i>	2: ɬə.ná <i>feel</i>	5: s'í.yà <i>tear</i>
Cə.CVC = 7	5: k ^w ù.làm <i>boil</i>	2: dɛ.vál <i>fear</i>	-	-
Cə.CV.Cə = 3	2: k ^w ù.rè.hè <i>scratch</i>	1: vè.ná.hé <i>vomit</i>	-	-
Total = 62	40	6	11	5

Table 4. Verb structures with lexical tone

3.2 Verbs with predictable tone

Having looked at the subset of verbs that permit lexical tone, we now turn to the majority of verbs, where tone is predictable. It is not unusual for Chadic languages to have at least a class of verbs with predictable tone (Ngizim, Schuh 1971:34; Karekare, p36; Dera, p37; Bole, Newman 1972:§4.1; Hausa, Newman 1973; Mbuko, Gravina 1999:81; Zina, Odden 2002). We will see that for the majority of verbs in Lagwan tone can be predicted according to the verb's syllable structure.

The predictable patterns are shown in tables 5 and 6 overleaf, which give the distribution for each structure with an example. The verbs in table 5 have low tone throughout, while those in table 6 have high tone on the first syllable and low on any remaining syllables.

That low should be chosen as the default tone for the verbs in table 5 is unsurprising: we have already seen it function as a default tone in Lagwan; moreover the choice reflects a cross-linguistic preference for low as the default in two-tone systems, a result of the fact that producing a low requires less articulatory effort than producing a high.

¹² Lagwan does not allow contour tones, except as a phonetic phenomenon resulting from resyllabification, as in (5)-(6) above.

<i>Structure/Tone</i>	L	=	51
C.σ(.σ) = 29:	Ċ.Cà	=	17: Ì.bù wash
	Ċ.CàC	=	5: Ñ.ɛ̀ər bark
	Ċ.Cà.Cà	=	1: ñ.də.sə groan
	Ċ.Cà.CàC	=	1: ñ.də.bər stagger
	Ċ.CV̇.Cà	=	1: ɛ̃.χà.tə comb
	Ċ.CV̇.CV̇	=	4: ɲ.gà.mà guard
Cə.σ(.σ) = 22:	Cà.Cà	=	12: ɛ̀ə.gə close
	Cà.CàC	=	3: zə.gəl crow
	Cà.CV̇.CV̇	=	7: pə.rà.kà separate

Table 5. Verbs with predictable L tone

<i>Structure/Tone</i>	H	=	112
Cə = 4:	Cá	=	4: dǎ put
CəC(.σ.σ) = 45:	CáC	=	24: bǎn tether
	CáC.Cà	=	14: ɛ̀əd.gə throb
	CáC.CV̇	=	6: vǎn.nà praise
	CáC.CV̇.CV̇	=	1: bər.bà.ɣà write
CV(C.σ.σ) = 63:	CV̇	=	27: bá pierce
	CV̇C	=	1: tɛ́l shine
	CV̇.Cà	=	9: bá.s'ə insult
	CV̇.CV̇	=	21: dá.nà transport
	CV̇.CV̇C	=	1: ɬá.bəl destroy
	CV̇.CV̇.CV̇	=	4: má.là.kà rule over

Table 6. Verbs with predictable H(L) melody

The data in table 6, on the other hand, require further explanation, but we will see that this explanation is no less well motivated. For these verbs, high tone is assigned to the initial syllable, and low to any remaining syllables. However, comparing tables 5 and 6, we see that high tone is associated to a syllable if and only if it meets certain criteria; besides being initial, it must also be either monosyllabic, heavy, or contain an underlying vowel.¹³

¹³ Note that, in light of these criteria, the data in table 5 provide further evidence that the initial consonant of word-initial clusters constitutes a syllable in its own right. In verbs like *ìbù*, *Ñɛ̀ər* and *ɲgàmà*, the initial syllabic consonant is followed respectively by a monosyllable, a heavy syllable, and a syllable with a lexical vowel. If the initial consonant were not syllabic, but part of a complex onset, we would therefore expect these verbs to have a (H)L melody. However, on these and on all verbs with an initial syllabic consonant (excepting of course the CCV(C) verbs in table 4), the tone is low throughout, indicating the initial syllable is the syllabic consonant.

Some of these properties are found elsewhere in Chadic. For example, the initial syllable of Hausa grade III verbs is high if heavy, low if light (Newman 1973:§2.1).¹⁴ Similarly, in Migaama the first heavy syllable of a verb is predictably high (Roberts 2005). In Bade and Ngizim, if the initial vowel of a verb is [a], the verb is high (Hombert 1978:96), while in Ngizim if it is a high, epenthetic, vowel, the verb is low (Schuh 1971:34).

What is it about these syllable types that attracts high tone? In the case of Lagwan verbs, it can be shown that the types of syllable bearing default high tone are united by being perceptually prominent in some way. This is significant since it is known that prominent positions prefer high tone, itself more perceptually prominent, avoiding low tone, and that non-prominent positions prefer low tone and avoid high (de Lacy 1999, 2002; Smith 2003).

In Lagwan the high is attracted to the initial syllable – a psycholinguistically strong position. However, high is only assigned to this initial syllable if it is also strong in some other way, either phonetically or psycholinguistically.

The initial syllable may be phonetically strong in one of two ways – either by weight or by sonority. Weight accounts for why initial heavy syllables bear high tone.

Where the initial syllable of a verb is light, relative sonority explains the difference in tone realised on underlying and epenthetic vowels. Recall from section 2 that, underlyingly, only the mid vowel /e/ and the low vowel /a/ appear verb-medially. Therefore, where the verb is polysyllabic, an underlying vowel in the initial syllable – being verb-medial – must either be mid or low. On the other hand, recall that the epenthetic vowel is always high. Therefore, given the sonority hierarchy in (17) above, an underlying vowel in the initial syllable of a polysyllabic verb will always be more sonorous – and hence more prominent – than an epenthetic vowel. Accordingly, if the initial syllable of a verb has an underlying vowel as its nucleus, it will bear high tone, while initial syllables with relatively low sonority – syllabic consonants or light Cə syllables – bear low tone.

The one exception to this rule – that an initial light syllable with a high vowel must bear low tone – occurs where the verb is monosyllabic. In this case the monosyllable is psycholinguistically prominent, since it contains all the verb's lexical meaning.¹⁵ This explains why all monosyllabic verbs also receive high tone, irrespective of weight or sonority.

¹⁴ Thanks to Philip Jaggard for bringing this to my attention

¹⁵ Thanks to Mary Pearce for pointing this out to me

Having examined the criteria determining high-assignment on verbs, it seems that the attested quantity- and sonority-sensitivity are properties more characteristic of stress than of tone systems. Despite high pitch being one way in which stress can be realised, evidence from polar tone shows that the predictable high on Lagwan verbs is a genuine phonological tone. In (18)-(20), where the initial tone of the verb is predictably high, the polar tone on *wu* is realised as low, contrasting with (21)-(22), where it is realised as high before the default low tone:

- | | |
|----------------|----------------|
| (18) wù. dǎ | <i>I put</i> |
| (19) wù. bǎn | <i>I bathe</i> |
| (20) wù. fá | <i>I bury</i> |
| (21) wú l.bù | <i>I wash</i> |
| (22) wú. dǎ.gè | <i>I push</i> |

Tonal behaviour in Lagwan verbs therefore supports ideas that tone and stress are not distinct systems, but extremes of a continuum.

3.3 The conflict between perceptual prominence and lexical contrast¹⁶

We have now determined both the criteria governing realisation of tone on the subset of verbs permitting lexical tone to surface and those determining predictable tone on the majority of verbs. We have seen that in both cases the relative perceptual prominence of the syllable has a role to play. If the verb is of the form CCV(C), lexical tone is preserved, but must not be realised on syllabic consonants, which are insufficiently prominent. Elsewhere, high is assigned to any prominent initial syllable. Low is assigned as a default to all remaining syllables, prior to any resyllabification.

However, the fundamental question remains as to why verbs of a particular phonological shape, here CCV(C), should permit lexical tone to surface, while elsewhere tone is predictable. The distinction appears arbitrary; however, as linguists, we want, as far as possible, to do away with arbitrariness and instead understand data in terms of a set of well-motivated principles.

In Lagwan I propose that the data can be accounted for by the conflict that exists naturally in phonology: the need to preserve lexical contrasts while avoiding what is phonologically marked. In Lagwan verbs, as with any phonological system, there is a requirement that a certain number of lexical

¹⁶ Thanks to Moira Yip for suggesting the main idea in this section. Any shortcomings in its implementation are naturally my own.

contrasts be maintained. In addition, there are two markedness constraints, to be obeyed where possible: firstly, verbs should be of the structure CCV(C); secondly, high tone in verbs should be realised on initial prominent syllables and nowhere else.

However, if both these constraints are satisfied, (taking into account inventory, phonotactic and skeletal structure constraints¹⁷) the number of potential contrasts among verbs will be relatively small, thus directly conflicting with the requirement that a sufficient number of lexical contrasts be maintained. The only verbs we have seen that obey both of these are the CCV(C) verbs with low tone, in the second column of table 4.

Therefore it is permitted that one or other of the markedness constraints be violated, but not both. A verb is permitted to violate the first constraint by having a structure other than CCV(C), but in this case must obey the second by realising high on its initial syllable if prominent, and low elsewhere. This applies to all the verbs in tables 5 and 6. Alternatively, the second constraint may be violated by high tone appearing on syllables that are not initial and prominent (excepting syllabic consonants¹⁸), but only if the verb obeys the first constraint in having the structure CCV(C). This accounts for the remaining verbs, those in the final three columns of table 4.

4. Summary

To summarise, we have seen that Lagwan has two sets of verbs: one with lexical, and the other with predictable, tone. In both sets the relative perceptual prominence of a syllable is significant in some way. We have seen that the difference between the two sets need not be arbitrary, but can be understood according to the competition between lexical contrast and markedness that is inherent to phonology.

References

- de Lacy, Paul. 1999. 'Tone and Prominence.' *Rutgers Optimality Archive* 333-0799. [<http://roa.rutgers.edu/files/333-0799/333-0799-LACY-0-0.pdf>].
- de Lacy, Paul. 2002. 'The Interaction of Tone and Stress in Optimality Theory.' *Phonology* 19, 1–32.

¹⁷ See Ruff 2005, 2007:§2 for inventory constraints. Only fifteen different underlying skeletal (CV) structures are attested in Lagwan verbs (see Ruff 2005:59).

¹⁸ That is to say that the markedness constraint prohibiting the association of lexical tone to syllabic consonants cannot be violated.

- Gravina, Richard. 1999. 'The Phonology of Mbuko.' *SIL*.
[http://www.sil.org/africa/cameroun/bydomain/linguistics/phonology/mbuko_gravina1999_2353_o.pdf].
- Hombert, Jean-Marie. 1978. 'Consonant Types, Vowel Quality and Tone.' In Victoria A. Fromkin (ed.), *Tone: A Linguistic Survey*. New York: Academic Press, 77-112.
- McCarthy, John J. & Alan Prince. 2001. 'Prosodic Morphology: Constraint Interaction and Satisfaction.' *Rutgers Optimality Archive* 482-1201. [<http://roa.rutgers.edu/files/482-1201/482-1201-MCCARTHY-0-1.PDF>].
- Newman, Paul. 1972. 'Syllable Weight as a Phonological Variable: The Nature and Function of the Contrast between "Heavy" and "Light" Syllables.' *Studies in African Linguistics* 3, 301-323.
- Newman, Paul. 1973. 'Grades, Vowel-Tone Classes and Extensions in the Hausa Verbal System.' *Studies in African Linguistics* 4, 297-346.
- Odden, David. 2002. 'The Verbal Tone System of Zina Kotoko.' In Bodil Kappel Schmidt, David Odden & Anders Holmberg (eds.), *Some Aspects of the Grammar of Zina Kotoko*. Munich: Lincom Europa, 15-34.
- Roberts, James. 2005. 'Is Migaama a Tonal or an Accentual Language?' Poster given at Between Stress and Tone, Leiden, June 2005.
- Ruff, Joy Naomi. 2005. 'Phonology of Lagwan (Logone-Birni Kotoko).' *SIL*. [<http://www.sil.org/africa/cameroun/bydomain/linguistics/phonologies/Lagwan%20Phonology%202005%20Ruff.pdf>].
- Ruff, Joy Naomi. 2007. 'Nasal + Obstruent Sequences in Lagwan.' In Henry Tourneux (ed.), *Topics in Chadic Linguistics IV: Comparative and Descriptive Studies*. Cologne: Rüdiger Köppe Verlag, 103-119.
- Schuh, Russell G. 1971. 'Toward a Typology of Chadic Vowel and Tone Systems.' Doctoral qualifying paper, University of California, Los Angeles.
- Smith, Jennifer L. 2003. 'Prominence, Augmentation, and Neutralization in Phonology.' In *University of North Carolina at Chapel Hill*. [<http://www.unc.edu/~jlsmith/home/pdf/bls26.pdf>]. (Correction of that in Lisa Conathan *et al* (eds.), 2000, *Proceedings of BLS 26*, Berkeley, California: Berkeley Linguistic Society, 247-257.)
- Tourneux, Henry. 2003. 'Le système vocalique dans le groupe « kotoko ».' In Kézié K. Lébiakaza (ed.), *Actes du 3e Congrès mondial de linguistique africaine : Lomé 2000*. Cologne: Rüdiger Köppe Verlag, 69-77.
- Tourneux, Henry. 2006. 'Origines des consonnes doubles et de la nasale syllabique à l'initiale dans les parlers « kotoko » du Cameroun.' In Dmitry Ibrizimow (ed.), *Topics in Chadic Linguistics II*. Cologne: Rüdiger Köppe Verlag, 133-140.
- Wolff, Ekkehard. 1983. 'Reconstructing Vowels in Central Chadic.' In Ekkehard Wolff & Hilke Meyer-Bahlburg (eds.), *Studies in Chadic and Afroasiatic Linguistics*. Hamburg: Helmut Buske Verlag, 211-232.