Phonology of Lagwan
(Logone-Birni Kotoko)

Joy Naomi Ruff

2005

Contents

Abbreviations and transcriptions

Transcriptions: three levels of representation

Within the analysis that follows, three levels of structure will be distinguished: the underlying representation (UR), which is the input to the lexical phonology, presented between vertical lines; the intermediate form (IR), which is the input to the post-lexical phonology, presented between forward slashes; and phonetic representation, which is an allophonic transcription, presented between square brackets. Tone will be marked as part of the transcription in the IR and PR; in the UR, where tone association has not taken place, lexically specified tone will shown in parentheses following the transcription. This is exemplified in (i) below:

(i) |#bskʷan#| (L) → /bə̀skʷàn/ → [bùskwàn] – 'horse'

Where the supposed UR is given, it will always be supported by showing either the IR or the allophonic form. The UR is given wherever known; in some cases the UR cannot be determined from the surface form. Morpheme boundaries, where known, will always be shown in the UR.

Transcriptions use the symbols proposed by the International Phonetic Association (IPA) with a few exceptions. Following the conventions of Chadic linguistics, the following symbols are used in place of those suggested by the IPA:

IPA	Chadic
t͡ʃ	c
d͡ʒ	j
j	y
ɨ	ə
y	ü

Similarly, for convenience the following symbols are used:

UR	IR	PR
x	x	χ
	h	h
r	r	ɾ
		r

Abbreviations

C	Consonant	R	Rhyme
C$_n$	nth consonant	[son]	[sonorant]
[cons]	[consonantal]	[strid]	[strident]
[cont]	[continuant]	T	Tense
[distr]	[distributed]	TBU	Tone-bearing unit
DP	Determiner phrase	tr	Transitive
F.N	Feminine marker associating nouns	UR	Underlying representation
[glot]	[glottalic]	v	Verb
H	High tone	V	Vowel
IPA	International Phonetic Association	∅	Null
IR	Intermediate representation	σ	Syllable
L	Low tone	1sg	First person singular
+L	Low-tone-integrating	3f	Third person singular feminine
[lat]	[lateral]	3m	Third person singular masculine
M	Masculine associative marker	á	High tone
M.N	Masculine marker associating nouns	ā	Mid tone
n	Noun	à	Low tone
[n̠]	Retracted coronal nasal	a̋	Extra-high tone
|N|	Nasal consonant	ꜜ	Downstep
N	Nominalising suffix	꜒	Level 1 pitch (highest)
[ɴ]	Uvular nasal	꜓	Level 2 pitch
[nas]	[nasal]	.	Syllable boundary (in IR/ PR)
n.f.	Feminine noun	-	Morpheme boundary (in IR/ PR)
n.m.	Masculine noun	+	Morpheme boundary (in UR)
PAT	Person/ aspect/ tense marker	#	Phonological word boundary (in UR)
PERF	Perfective aspect	##	Pause group boundary
pl	Plural suffix	∗	Ungrammatical
PL	Plural associative marker	*	Proto-form
O	Onset	~	In free variation with
(opt)	Optionally	<	Source
prog	Progressive	[…]	Any features
PR	Phonetic representation	{…}	In any of the given environments

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1 Introduction

1.1 Population and location

Lagwan is one of the six[1] mutually unintelligible languages spoken by the Kotoko, a people group united by their ethnic heritage as descendants of the Sao, who may be found predominantly in the Logone-et-Chari department of the Far North province of Cameroon. Lagwan is the name of the language spoken by the Kotoko in Logone-Birni and the area north of Waza National Park, from the banks of the Logone River to the Nigerian border (Dieu *et al* 1983:93). Consequently, as well as being the language of a number of villages in Cameroon[2], the language area extends to a number of villages in Chad[3] and one in Nigeria[4].[5] The speakers of Lagwan are numbered at ten thousand (Tourneux 2005), forming a relatively small percentage of the inhabitants of their region due to the steady immigration of other ethnic groups into the area[6]. This has led to inevitable contact with a variety of other ethnic groups, and therefore with their languages.

The traditional occupation of the Lagwane is fishing, which remains the principal employment.

1.2 Language names, classification and genetic affiliation

Lagwan is the name given by the Kotoko to the language. The name of the village may also be used to refer to the language; Logone is used by Lukas (1936), and consequently tends to be the preferred choice within the literature, while Tourneux (2000a) uses Logone-Birni, though elsewhere (2000b) he uses Lagwan. Lagwane, or lagouané, is the administrative name serving as a generic term for the language, its speakers, the village and its people (Aboukar 2003:5). A. Lebeuf (1969:32) applies the same term purely to the language.

In this paper the name Lagwan is used for the language, while Lagwane refers to its speakers and the whole area in which it is spoken. Logone and Logone-Birni are reserved for the particular village(s) of that name. Kotoko is used only when it applies to the whole people group, or to the Kokoko languages as a whole.

Lagwan is a member of the Kotoko group of the Central Chadic branch of Afroasiatic. It is classed together in a sub-group of Kotoko with Msər (also Mser or Kousseri, after the town).

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[1] The Kotoko North languages of Mpadə (/ Mpade/ Makary), Malgbe (Goulfey), Afade and Maltam, and the Kotoko South languages Msər (/ Mser/ Kousseri) and Lagwan; Tourneux (2000a, b) also includes Buduma, Zina and Majera (totalling nine).

[2] Logone-Birni, Hinale, Mboudoufka, Kalkoussam, Goudjari, Zigue, Goulouadma, Ngame, Houzoume, Mdaga, Waza, Baram, Ngazi, Ble, Mbehche and Zigague

[3] Logone-Gana, Douvoul, Aouri, Gwafa, Mezil, Mandalia and Kraska

[4] Gazalfoul

[5] Information collected by my colleague Sean Allison, from Lagwan speakers participating in a course directed by him in 1999.

[6] Allison, p.c, citing p.c. from Tourneux, who states that in his opinion, the Kotoko represent 30-35% of the total population of the Logone and Chari department.

1.3 Dialects and variation

Bagley and Roberts (1991:33) identify two dialects of Lagwan: the variety spoken in Logone-Birni, Cameroon, and that spoken in Logone-Gana, Chad. They rate the lexical cognation between the two dialects at ninety-five percent (1991:8). A. Lebeuf (1969:32) describes the dialectal variation as minimal and chiefly a matter of intonation.

1.4 Previous research

Lagwan's earliest appearances in published literature are found in works giving word lists for the language (Barth 1862, Gaudefroy-Demombynes 1907 and Mouchet 1950). Published descriptive linguistic work is limited to Lukas' 1936 study, which gives what is largely a phonetic, rather than phonological, analysis of the language's sound system. In addition to this published linguistic study, the author is aware of one unpublished dissertation (Aboukar 2003), though there may be others. Outside the area of linguistics, A. Lebeuf published an anthropological article on the Lagwane in 1989.

During a course on orthography development led by my colleague Sean Allison in the village of Goulfey, a corpus of just over one thousand five hundred entries was transcribed by Marouf Brahim, Mamat Abama and Moumoune Mademe, native Lagwan speakers. It is this corpus that formed a basis for the present research. I would like to express my thanks to these people for this initial work, which has greatly facilitated further research.

1.5 Present research

This paper is the result of eighteen months' study of Lagwan as it is spoken in Cameroon. I spent six months working in Yaounde with a mother-tongue speaker of the language, Mme Sali Hadja Habi, originally from the village of Hinale. This was followed by a year in Maroua, where I worked principally with Mme Mahamat Aïcha Mavoua and her father M. Awalou Adam, originally from Logone-Birni, as well as other members of the family. During my time in Maroua I was also able to visit Logone-Birni and collect language data from a wider variety of speakers[7]. The expanded corpus of data used for this paper presently has just over two thousand two hundred entries.

1.6 Overview of phonology

Lagwan, like so many Chadic languages, has a rich consonantal system (see section 2, *Consonants*). It is the consonantal skeleton that largely bears the semantic load, supplemented by minimal underlying vowel-slots. These principally have the quality |a|, while other vowels, whose phonologisation appears to be an innovation, are marginal in their distribution (section 3, *Vowels*). The poverty of underlying vowel-slots necessitates the insertion of an epenthetic 'zero vowel', in order to preserve well-formed syllabification (sections 3.5, *The zero vowel*, and 4, *Syllabification and zero segment insertion*). It is this process of syllabification that licenses tone association and determines its realisation (see section 5, *Tone*).

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[7] I would like to thank my colleagues Aaron and Susan Shryock and their family for their hospitality during my time in Logone-Birni.

Due to considerable inter-language contact, Lagwan has a fairly large sub-lexicon of loan words[8]. This lexical sub-set allows exceptional phonological patterns, a thorough study of which is beyond the scope of this paper, which focuses on the more standard phonology of non-borrowed words.

2 Consonants

If known loan words are excluded, the set of contrastive consonantal units in the table below is found. The sub-lexicon of loan words has a further class of the pre-palatal obstruents /c/, /j/ and /ʃ/, as well as the glottal stop, in addition to the consonants given in the table below. These will be discussed in section 2.8, *Loan word consonants*, below.

Consonant phonemes				Labial	Coronal	Dorsal	Labialised dorsal
Obstruents	Pulmonic	Stops		p b	t d	k g	kʷ gʷ
		Fricatives	Central	f v	s z	χ ʁ	χʷ ʁʷ
			Lateral		ɬ ɮ		
	Glottalic	Stops		ɓ	ɗ	k'	kʷ'
		Fricatives	Central		s'		
			Lateral		ɬ'		
Sonorants		Nasals		m	n		
		Liquids	Lateral		l		
			Vibrant		ɾ		
		Glides			y		w

2.1 General characteristics of the consonant system

The inventory above distinguishes four major classes of place of articulation. The velar stops and uvular fricatives are categorised together as dorsal, as they behave phonologically as one class; this is manifested by their being the only class of consonants that can bear the feature of labialisation (see inventory above and 2.4.2.1, *Prosodic tendencies*). Similarly, the bilabial stops and the labiodental fricatives function together as a single class with regard to vowel assimilation (rule (229)). In terms of syllable structure and the related phenomenon of 'zero vowel' insertion, the implosives and the ejectives function as one phonological class and hence are grouped together as glottalic. Similarly, studying permitted surface syllable structures will highlight an important distinction observed between the obstruents and the sonorants (see 4.1, *Lexical syllabification*). It can be seen that the voicing contrast is productive only among the pulmonic obstruents (see also 2.3, *Distinctive consonantal features*); this contrast is again important in terms of syllable structure and 'zero vowel' insertion (rule (234)d) and (f)). For permitted syllable structures see section 4, *Syllabification and zero segment insertion*, and for rules governing 'zero vowel' insertion see 4.1.2, *Zero vowel insertion*, rule (234)).

The voiced lateral fricative, /ɮ/, has a marginal distribution; there is reason to believe it is on its way out of the language (see 2.6, *The voiced lateral fricative*).

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[8] Approximately 240 words in a lexicon of approximately 2200 entries. (The number of entries exceeds the number of different lexical items.) Loans are chiefly from Classical Arabic and Kanuri, as well as Hausa, French, Shoa Arabic, Ɓarma (also known as Bag(u)irmi), Sara, Ngambay, Fulfulde, English and possibly Musgu. I am indebted to my colleague Sean Allison for identifying the majority of the loan words from Classical Arabic, Kanuri, Hausa, French, Shoa Arabic, Fulfulde and English.

Excepting the absence of a dorsal nasal, the resulting inventory presents a very symmetrical system. It should be noted that [ŋ] and [N] appear phonetically as allophones of /n/, and in more restricted environments of /m/ (see 2.2 below, *Consonantal allophony*, rule (12))[9].

2.1.1 *Distributional restrictions*

Except in cases of reduplication, there is a restriction allowing a maximum of one glottalic consonant per phonological word.

The contrast between the two pulmonic lateral fricatives, /ɬ/ and /ɮ/, is neutralised in consonant clusters (see 2.6, *The voiced lateral fricative*).

For distributional restrictions within the syllable, see section 4, *Syllabification and zero segment insertion*.

2.2 Consonantal allophony

The consonant phoneme inventory above shows the contrastive underlying consonant segments; the phonetic realisation of these is determined by the phonological environment in which they appear. This information is summarised in allophonic rules given below, with the rules that take place earlier in the phonology given before the later rules.

(1) *Lenition of /x/*[10]

x → h/._V

'The voiceless dorsal fricative has a glottal realisation pre-vocalically when immediately following a syllable boundary.'

e.g: |#s + a + x + e#| (+L) → [sà.hè] – 'farms/ fields' (cf. |sxe| (L) → [sχè] – 'farm/ field')

|#k'lx#| → [k'ə́l.hə̀] – 'husk' (v) (corn)

This rule takes place following the initial process of lexical syllabification (see 4.1, *Lexical syllabification*) but before default syllabification of initial contigently extrasyllabic consonants by rule (257) below[11]. This is manifest in the example below, whereby the presence of the preceding unsyllabified consonant prevents lenition occurring:

(2) |#nxrna#| (L) → (234)d) (n)χə̀r.nà → (1) - → (257) [Ņ.χə̀r.nà]– 'palate' (oral)

(not→ (257) ņ̀.χə̀r.nà → (1) *[ņ̀.hə̀r.nà])

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[9] It does not seem that the gap in the synchronic Lagwan phoneme inventory at the dorsal place of articulation is indicative of a historical loss of consonant. This is supported by the phoneme inventory Newman (1977a) proposes for Proto-Chadic, where */m/ and */n/ are the only nasals.

[10] In other words, /x/ is only uvular in complex onsets and in the coda. Nevertheless, this consonant clearly patterns with the other dorsal ([+back]) obstruents (see 2.4.2.1).

[11] For some speakers, this rule reapplies in a slightly more restricted environment post-lexically, following rule (9):

(i) *Optional post-lexical lenition of /x/*

x → (opt) h/##_
          V_

'The voiceless uvular fricative optionally becomes a glottal fricative phrase-initially or intervocalically.'

e.g: |#axʷl + ni#| (L) → (234)b),(230) /ʔàxʷəlnì/ → (1) - → (9) [ʔàχùlnì ~ ʔàhùlnì] – 'poor man'

Where there is no initial extrasyllabic segment, the voiceless dorsal fricative |x| follows a syllable boundary and so rule (1) applies:

(3) |#xrga#| → (234)d) χər.ga → (1) [hə́ɾ.gà] – 'plunder' (a town)

(4) Palatal assimilation of /s/

   s → ʃ/_[-cons, -back, +high]
   'The voiceless coronal fricative becomes pre-palatal immediately preceding the high front vowel or glide.'
   e.g: |#v(y)si#| (L) → [vìʃì] – 'breath'   (cf. (5) below)

There seems to be some variation as to whether this rule applies before or after vowel deletion in rule (278). This variation can be seen in the possessive example below:

(5) |#v(y)si + a#ni| (L+H[12]#H) → (234) və̀(y)sìá ní → { (4) /və̀(y)ʃìá ní/ → (278) [vìʃá nî]   – 'his
                                                      { (278) [vìsá nî] → (4) -   breath'[13]

For the upper variant, rule (4) applies before vowel deletion; for the lower variant vowel deletion occurs before rule (4), so the [i] required by the latter rule is no longer available and the rule does not apply.

The upper variant is more common among younger speakers; it seems that the variant [ʃ] is becoming increasingly lexicalised (see 2.8.2, *Pre-palatal fricatives*, for a discussion of the phonological status of this consonant).

(6) Fricative devoicing

   [C, -son, +cont, +voice] → [-voice]/_[-voice]
   'A voiced fricative is devoiced immediately preceding a voiceless obstruent.'
   e.g: |#mzxʷi#| (LH) → [mùsχwí] – 'thief'   (cf. |#mz + a + xʷ + e#| (+L) → [m̀ᵊzàχwè] –
                                                                                                   'thieves')

(7) Labialisation realisation

   [C, +round, +back] → Cw/_V
   'The labialisation feature is realised as a labial-velar offglide pre-vocalically'
   e.g: |#ʁʷala#| (H) → [ʁwálá] – 'millet' (rainy season)

When this rule applies to /ʁ/, this voiced uvular fricative is very lightly articulated before the labial-velar glide and in one instance appears in free variation with the labial-velar glide alone[14]:

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[12] Here and elsewhere this clitic is marked as being underlyingly specified for high tone, which I suspect is the case. However, a more thorough study of Lagwan tone would be required to verify that the clitic is not underlyingly toneless.
[13] breath-ᴍ 3m
[14] This lenition process may explain the synchronic absence of a voiced back fricative in the Kotoko North languages. A brief comparative glance at the different Kotoko varieties reveals a tendency for the /ʁ/ of Lagwan to have in the Kotoko North languages the counterpart /w/ when labialised and /h/ elsewhere. An example is given below:

	Lagwan	Afade	Malgbe	Meaning
(i)	/ʁʷə̀lì/	wul	wulia	'child'

(8) |#ʁʷye#| (L) → [ʁùyè ~ ʁòyè ~ wⁱyè] – 'husband'

(9) Glide vocalisation

$\left.\begin{array}{l}\text{[-syl, -cons, α round, α back]ə}\\\text{ə[-syl, -cons, α round, α back]}\end{array}\right\}$ → [+syl, α round, α back]

   'An adjacent glide and /ə/ are contracted to a single vowel.'

    e.g: |#wsl#| → /wə̀sə̀l/ → [ùsə̀l] – 'deceive'   (cf. |#w + a + sl#| → /wásə̀l/ → [wásə̀l] –
                                           'deceive a lot' (distributive pluractional))

Note that this rule takes place after rule (7) above, as evidenced by the example below:

   (10) |#gʷxʷɓa#| (LH) → (234)d) /gʷə̀xʷɓá/ → (7) gwə̀χʷɓá → (9) [gùχʷɓá] – 'old person'

There is one counterexample to rule (9) above:

   (11) |#wl#| → /wə́l/ → [wúl] – 'melt' (tr)
                (not → *[úl])

This example seems simply to be exceptional. It is not possible that the initial |w| is in fact a geminate, since, as will be shown later (5.2, *Tone on verbs*), verbs with the skeletal structure CCəC always bear low tone. Neither is it possible to argue that this is actually an initial sequence of |wu̧|. See section 3.5, *The zero vowel*, for an explanation.

(12) Nasal assimilation

   a) n → [α back, β high]/_[-son, α back, β high]
      'A non-labial nasal assimilates in terms of place of articulation to a following non-labial obstruent.'
      e.g: |#dankyky#| (H) → [dáŋkíkí] – 'bubu'
   b) m → [α back, α high, α distr]/_[-son, +round, α back, α high, α distr]
      'A labial nasal assimilates in terms of place of articulation to a following labial or labialised obstruent.'
      e.g: |#mfwni/ (L) → [m̀fũnì] – 'coward'
      (see 2.4.1, *Prenasalised obstruents*, for potential examples preceding labialised dorsals.)

It is evident that the rules in (12) take place after rule (1) above, since, where /n/ precedes [h], unspecified for the features [back] and [high], it is realised as alveolar by default (see 2.3.2, *Default phonetic realisation*), rather than as uvular by assimilation in rule (12)a above. This is exemplified below:

(13) |#nknxi#| (L) → (234)d) (n)kə̀nxì → (1) (n)kə̀nhì → (12) [ŋ̀kə̀nhì]– 'hide' (n)

(not→ (12) ŋ̀kə̀ɴxì → (1) *[ŋ̀kə̀ɴhì])

c) n → (opt) [+round, α distr]/_[-son, +round, α distr]
'A non-labial nasal optionally assimilates in terms of place of articulation to a following labial obstruent.'
e.g: |#nbw#| (L) → [ǹ̩bù ~ m̩̀bù] – 'cork'

(14) Lateral ejective affrication
ɬ' → t͡ɬ'/##__
'The lateral ejective is affricated phrase-initially.'
e.g: |##ɬ'á#| → [t͡ɬ'á] – 'food'

(15) Vibrant trilling
r → r/##_
'The alveolar vibrant is trilled phrase-initially.'
e.g: |##rádà#| → [rádà] – 'tear' (v)

(16) Vibrant trilling and devoicing
r → [r̥]/C_##
'The alveolar vibrant is trilled and devoiced when syllabic (following rule (271)a) below) and phrase-final.'
e.g: |#gr##| → (234)b),(294) /gə́r##/ → (271)a) gŕ̩ → (16) [gr̩̊] – 'go'

2.3 Distinctive consonantal features[15]

The underlying consonants of the main lexicon of non-borrowed words in Lagwan can be distinguished by the feature set shown below. Redundant features are not marked (see *Redundancy*, below).

Distinctive features	cons	son	cont	strid	lat	round	back	high	nas	glot	voice
p			-			+	-				-
b		-	-			+	-				+
ɓ			-			+	-			+	
kʷ			-			+	+	+			-
gʷ		-	-			+	+	+			+
kʷ'			-			+	+	+		+	
t			-			-	-				-
d		-	-			-	-				+
ɗ			-			-	-			+	
k			-			-	+	+			-
g		-	-			-	+	+			+
k'			-			-	+	+		+	
f			+	+		+	-				-
v		-	+	+		+	-				+
xʷ			+	+		+	+	+			-
ʁʷ		-	+	+		+	+	+			+
s			+	+	-	-	-				-
z		-	+	+	-	-	-				+
s'			+	+	-	-	-			+	
x			+	+		-	+	+			-
ʁ		-	+	+		-	+	+			+
ɬ				+	+						-
ɮ		-		+	+						+
ɬ'				+	+					+	
m		+	-			+			+		
n		+	-			-			+		
r		+				-			-		
l		+			+						
w	-					+	+	+			
y	-					-		+			

13

2.3.1 Redundancy

In addition to the features underlying specified, shown above, the following rules apply:

(17) C → [-syl]
(18) [-cons] → [+son, +cont, -lat, -nas]
(19) [+nas] → [+son, -cont]
(20) [+son] → [-strid, -glot, +voice]
(21) [+strid] → [-son]
(22) [+glot] → [-son]
(23) [-voice] → [-son, -glot]
(24) [-son] → [+cons, -nas]
(25) [-cont] → [+cons, -strid, -lat]
(26) [+lat] → [+cons, +cont, -round, -back[16], -nas]
(27) [+cons] → [-syl, -low]
(28) [+round] → [-lat]
(29) [+back] → [-lat]
(30) [-cont, +back] → [+high]
(31) [-cont, +round, -back] → [-distr]

In terms of economy, [high] might seem to be a superfluous feature on consonants; it does not in itself distinguish any consonant from any other segment; it is marked as it is a relevant phonological feature in terms of vowel assimilation (see rule (229) below). For the same reason the labial-velar glide is marked as both [+round] and [+back], although in terms of distinguishing this segments only one of these features should be necessary.

2.3.2 Default phonetic realisation

In the case of underspecification - that is, the absence of feature specification by lexical marking or by redundancy, or of any allophonic conditioning (see rules in 2.2, *Consonantal allophony*) - phonetic realisation is given by default. The default realisation for the relevant consonant types is discussed below.

2.3.2.1 The glottalic obstruents

In the table given earlier, [voice] was not marked as a distinctive feature of the glottalic consonants. These obstruents do not seem to pattern phonologically either with the voiced or the voiceless obstruents. It will be shown in section 5.5, *Phonetic effects on pitch*, that the glottalic consonants and

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[16] Lukas (1936) classes all lateral fricatives as velar, while Aboukar (2003) classes the pulmonic laterals as velar and the lateral ejective as alveolar. It is possible that Lukas is giving as the place of articulation, not the point of oral closure, but the point where the friction is greatest. Though I have not conducted any instrumental study, there is clear evidence that all lateral fricatives are coronal. The evidence is seen in the output of rule (12) above:

  (i) |#nɬa#| (H) → [ǹ̩ɬá] – 'cow'

      (not → *[ŋ̩̀ɬá])

In this example the nasal assimilates to the coronal place of articulation of the following lateral fricative. That the place of articulation is coronal is further supported by comparative evidence; in Mpadə and Msər, the Kotoko languages where the lateral fricatives appear to have been lost, /ʃ/ seems to have replaced the /ɬ/ found in Lagwan, while Lagwan's /ɬ'/ is replaced by /c'/ in Mpadə and /s'/ in Msər.

the voiced obstruents have completely different effects. On the other hand, no glottalic consonant is as free as voiceless obstruents as regards syllabification and zero vowel insertion (see rule (234)c) below).

That voicing is not a distinctive feature of glottalic consonants is reflected in their phonetic realisation, whereby, for many speakers, except in careful pronunciation, /ɓ/ and /ɗ/ appear to have little or no voicing. Similarly, among many speakers the downward movement of the glottis is not prominent. Ladefoged (1964:6) notes that this is a general tendency in Chadic languages. Mme Sali Hadja Habi, the language assistant with whom I worked most extensively, consistently pronounced them as [ʔ͡b̥ˀ] and [ʔ͡d̥ˀ]. For articulatory ease the voiceless realisation is consistently preferred for the dorsal glottalic stop[17]; this segment and the glottalic fricatives are realised with an egressive airstream.

2.3.2.2   The nasals

The nasals are distinguished from each other only by the feature [±round]; in the absence of a following obstruent, the environment of rule (12) above, the [-round] nasal is realised by default as alveolar ([-round, -back, -high]).

2.3.2.3   The zero consonant

The zero consonant is not present underlyingly, but is a C-slot inserted by rule in respect of syllabic constraints (see 4.1.1, *Zero consonant insertion*). Rule (17) above automatically assigns to this C-slot the feature [-syl], but otherwise it is unmarked. It has the default phonetic realisation of [ʔ], a glottal stop.

2.4 Complex and contour consonants

Having presented the inventory of consonant phonemes and their distinctive features above, we now justify the interpretation of potentially ambiguous consonant clusters.

2.4.1   *Prenasalised obstruents*

It will be noted by Chadicists that the series of prenasalised stops common to Central Chadic languages is absent from my phoneme inventory. This is not to suggest that nasal-obstruent sequences are absent from the language. However, a thorough examination of the data shows that the only satisfactory account of their behaviour is given by a heterosegmental interpretation[18].

Firstly, prenasalisation is not limited to the voiced plosives: the nasal may be either homorganic or heterorganic; the obstruent either voiced or voiceless, stop or fricative, pulmonic or glottalic. The full range of nasal-obstruent sequences attested in my data is shown with examples in the table below. Notice here the application of the rules in (12) above; rule (b) is such that, for the labialised dorsal obstruents, it is impossible to determine the underlying specification of the feature [round] on preceding nasals, or if indeed this feature is marked in these cases. Known loan words and examples of reduplication are excluded.

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[17] The smaller distance between the glottis and the velum makes it more difficult to maintain voicing at this point of articulation. This is reflected cross-linguistically by the rarity of [ɠ] compared to [ɓ] and [ɗ].

[18] Neither Aboukar (2003) nor Lukas (1936) posits a series of prenasalised stops in Lagwan.

NCs	m [+nas, +round]	n [+nas, -round]
p	|#mpala#| (H) → [m̀pálá] – 'arm'	-
b	|#mba#| (L) → [m̀bà] – 'place' (n)	|#nbw#| (L) → [ǹbù ~ m̀bù] – 'cork'
ɓ	|#mɓi#| (L) → [m̀ɓì] – 'oil'	-
f	|#mfwni#| (L) → [m̀fùnì] – 'coward'	|#nfe#| (H) → [ǹfé ~ m̀fé] – 'fight' (v)
v	-	|#nvaɗe#| (L) → [ǹvàɗè ~ m̀vàɗè] – 'night'
t	|#mtakʷa#| (H) → [m̀tákwá ~ m̀ᵊtákwá] – 'nail'	|#ntas#| (H) → [ǹtásə́] – 'louse'
d	|#mdge#| (LH) → [m̀dᵊgé ~ m̀ᵊdᵊgé] – 'crocodile'	|#ndra#| (L) → [ǹdrà] – 'peanut'
ɗ	|#mɗankʷani#| (H) → [m̀ɗáŋkwání ~ m̀ᵊɗáŋkwání] – 'iguana'	|#nɗana#| → [ǹɗànà] – 'be not yet'
s	|#ms#| (H) → [m̀sə́ ~ m̀ᵊsə́] – 'story'	-
z	|#mzg#| (H) → [m̀zə́gə́ ~ m̀ᵊzə́gə́] – 'frontier'	|#nz + i#| (L) → [ǹzì] – 'knee'
s'	|#ms'a#| (L) → [m̀s'à ~ m̀ᵊs'à] – 'tamarind tree'	-
ɬ	|#mɬn + ni#| (L) → [m̀ɬə̀nnì ~ m̀ᵊɬə̀nnì] – 'axe'	|#nɬa#| (L) → [ǹɬà] – 'cow'
(ʒ)[19]	-	-
ɬ'	-	-
k	-	|nknx + i| (L) → [ŋ̀kə̀nhì] – 'hide' (n)
g	|#mgl#| (H) → [m̀ᵊgə́l] – 'scar'	|ngɗ| (LH) → [ŋ̀gə̀ɗə́] – 'rib'
k'	-	|#nk'a#| (L) → [ŋ̀k'à] – 'rice'
x	|#mx#| → [m̀χə̀ ~ m̀ᵊχə̀] – 'swear'	|#nxrna#| (L) → [Ǹχ̩rnà] – 'palate' (oral)
ʁ	|#mʁe#| (L) → [m̀ᵊʁè] – 'canton chief/ placenta'	|#nʁe#| (H) → [Ǹʁé] – 'move'
kʷ	|#Nkʷi#| (L) → [ŋ̀kwì] – 'charcoal'	
gʷ	|#Ngʷa#| (L) → [ŋ̀gwà] – 'look at/ see'	
kʷ'	|#Nkʷ'ə#| (H) → [ŋ̀k'ú] – 'pus'	
xʷ	|#Nxʷl + Ce#| (+L) → [Ǹχ̩ùllè] – 'gills'	
ʁʷ	-	

Secondly, the nasal and the obstruent are separated in the process of reduplication. This process is used to form the iterative pluractional (see 5.2, *Tone on verbs*, and rule (296) for a formal description of iterative pluractional formation and an explanation of tone changes). The examples in (32)-(43) show the iterative pluractional form of prenasalised verbs:

	verb	*pluractional*	*meaning*
(32)	/m̀bə̀r/	/m̀bə̀bə̀r/	'tire'
(33)	/m̀ɓí/	/m̀ɓìɓì/	'crawl'
(34)	/m̀tì/	/m̀tìtì/	'die'

---

[19] The contrast between /ɬ/ and /ʒ/ is neutralised in consonant clusters. See 2.6.

(35) /m̀xə̀/ /m̀xə̀xə̀/ 'swear'

(36) /ǹdə̀sə̀/ /ǹdə̀də̀sə̀/ 'groan/ grunt'

(37) /ǹfé/ /ǹfèfè/ 'fight'

(38) /ǹgàmà/ /ǹgə̀gàmà/ 'guard'

(39) /ǹgʷə̀l/ /ǹgʷə̀gʷə̀l/ 'greet'

(40) /ǹk'ə̀l/ /ǹk'ə̀k'ə̀l/ 'pass wind'

(41) /ǹɬí/ /ǹɬìɬì/ 'swim'

(42) /ǹʁé/ /ǹʁə̀ʁè/ 'move'

(43) /ǹtà/ /ǹtə̀tà/ 'alter' (with extension)

It is only the obstruent that is reduplicated, not the NC as a unit; it seems that the NC is being treated as a cluster.

Thirdly, there is additional evidence that these clusters are treated as two separate segments. As will be discussed in detail in section 5.2, *Tone on verbs*, the majority of verbs do not have lexical tone, but rather the tone melody can be predicted based on syllable structure. In these verbs, syllables of the type #CV#, #CəC and #C[V, -high] invariably bear high tone (see rule (294)), while all other syllables are realised with a default low tone (by rule (295)). Consider the verbs below:

	NCə̀	*CCə̀*	*Cə́*
(44)	/m̀xə̀/ – 'swear'	(cf. /ʂxə̀/ – 'shut'	/xə́/ – 'direct')
(45)	/ǹɬə̀/ – 'light'	(cf. /pɬə̀/ – 'chat/ count')	
(46)	/ǹgʷə̀/ – 'see'	(cf. /ʂkə̀/ – 'advise'	/kʷə́/ – 'hurt')

	NCə̀C		*Cə́C*
(47)	/m̀bə̀r/ – 'tire'		(cf. /bə́n/ – 'bathe')
(48)	/ǹgʷə̀l/ – 'greet'		(cf. /gə́m/ – 'like')
(49)	/ǹkʷə̀l/ – 'pass wind'		(cf. /kʷə́m/ – 'hesitate')
(50)	/ǹʁə̀r/ – 'bark'		(cf. /ʁə́n/ – 'make')

	NCV̀CV̀	*CCV̀CV̀*	*CV́CV̀*
(51)	/ǹɗànà/ – 'be not yet'	(cf. /ʂkʷàɗà/ – 'limp'	/dánà/ – 'transport')
(52)	/ǹgàmà/ – 'guard'		(cf. /gálà/ – 'drive away')

	NCV̀Cə̀	*CCV̀Cə̀*	*CV́Cə̀*
(53)	/ǹɗàsə̀/ – 'defecate'	(cf. /ɬxàtə̀/ – 'comb'	/vásə̀/ – 'fan')

The initial syllable of the verbs in the third column meet the criteria for high tone assignment. All these verbs begin with a single consonant segment. By contrast, the verbs in the second column have an initial di-consonantal cluster and therefore do not meet the criteria for high tone assignment. This means that the default low tone is assigned. Turning now to the nasal-obstruent-initial verbs, we can see that they have the same tonal realisation as the verbs with an initial di-consonantal cluster, not those with an initial single consonant. There are no exceptions to this pattern.

Finally, it will be seen that the word-initial nasal in these prenasalised clusters is a syllable in its own right (4.1.3.1, *Extrasyllabicity and syllabic consonants*), and as such a tone-bearing unit (TBU) (see 5.3.1, *Extrasyllabicity and default tone*).

2.4.2 *Labialised dorsal obstruents*

There is solid evidence from both the nominal and verbal systems that the series of labialised dorsal obstruents postulated above are phonological units and not sequences. Taking firstly the nominal morphology, a common means of forming the plural is to insert an –*a*- infix between each consonant, beginning from the right[20], to which the tone-integrating plural suffix –*è* may or may not be added, sometimes with gemination of the final consonant. Compare the behaviour of the dorsal obstruents in (54)-(56) and of the Cw sequence in (57) with that of the labialised consonants in (58)-(60). (–*i* is a masculine gender marker which is not required in the plural.)

> (54) a) |#kskr#| (H) → /kə́skə́r/ – 'basket'
>
> b) |#k+a+s+a+k+a+r+Ce#| (+L) → /kàsàkàrrè/ – 'baskets'
>
> (55) a) |#nknx+i#| (L) → /ǹkə̀nxì/ – 'skin' (of animal)
>
> b) |#nk+a+n+a+x+e#| (+L) → /ǹkànàxè/ - 'skins' (of animal)
>
> (56) a) |#lʁm+i#| (L) → /lə̀ʁə̀mì/ - 'river'
>
> b) |#l+a+ʁ+a+m#| (+L) → /làʁàm/ - 'rivers[21]'
>
> (57) a) |#ʁlw#| (LH) → /ʁə̀lə́w/ - '(inside of) mouth'
>
> b) |#ʁ+a+l+a+w+e#| (+L) → /ʁàlàwè/ - '(insides of) mouths'
>
> (58) a) |#bskʷan#| (L) → /bə̀skʷàn/ - 'horse'
>
> b) |#b+a+s+a+kʷ+a+n+e#| (+L) → /bàsàkʷànè/ - 'horses'
>
> (59) a) |#dʁʷm+i#| (L) → /də̀ʁʷə̀mì/ - 'bull/ ox'
>
> b) |#d+a+ʁʷ+a+m+e#| (+L) → /dàʁʷàmè/ - 'bulls/ oxen'
>
> (60) a) |#mzxʷ+i#| (L) → /mə̀zxʷì/ - 'thief' (male)
>
> b) |#mz+a+xʷ+e#| (+L) → /m̀zàxʷè/ - 'thieves'

If the labialised consonants in (58)-(60) were sequences underlyingly, they would be expected to pattern as the |lw| sequence in (57). Instead, they are treated as units.

Evidence from the verb structures also supports this conclusion. Firstly, the same test with regard to predictable tone that was applied to the nasal+obstruent sequences above can be applied here, but with the opposing result.

> (61) /gʷárà/ - 'fail'   (cf. /gálà/ - 'drive away')

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[20] Different numbers (0-3) of /-a-/ may be inserted in different nouns (see Aboukar (2003:24-27) for a more thorough description), but this has no effect on the point to be proved here, since, irrespective of the number inserted, the infix is always inserted right-to-left, between *each* consonant segment. There is no obvious rule determining the number to be inserted; I suspect that it is lexically specified.

[21] Strictly speaking, this should be translated 'river'. While the form in (56)b) is undeniably the morphosyntactic plural of the singular in (a), both may be used to designate a single river and appear to be used synonymously.

As mentioned above, and as discussed more thoroughly in section 5.2, *Tone on verbs*, a word-initial syllable #C[V, -high] always bears high tone, but #CC[V, -high] cannot; the labialised consonant in (61) (also, by the same test, those in (63)-(65) below) must therefore be a single segment.

Secondly, for verb roots there is a limited number of attested skeletal structures (see Appendix i, *Verb skeletal structures*). Consider the verbs in (62)-(65):

(62) |#laxʷ#| → /láxʷə̀/ - 'have diarrhoea'[22] = CVC/ **CVCC

(63) |#gʷlɗa#| → /gʷə́lɗà/ - 'make smooth' = CCCV/ *CCCCV

(64) |#ʁʷrɬˈa#| → /ʁʷə́rɬˈà/ - 'rub' = CCCV/ *CCCCV

(65) |#gʷraka#| → /gʷə̀ràkʷà ~ gʷə̀ràkà/ - 'annoy, disturb/ prevent' = CCVCV/ **CCCVCCV ~ ?CCCVCV

Interpreting the labialised consonants as units gives the already established root structures shown on the left; such an interpretation is not at all problematic. Meanwhile, the root structures resulting from a sequence interpretation are shown on the right, those in (62)-(64) and one of the variants in (65) being unattested elsewhere, while the structure accorded to the other variant has been found on only one other verb. The structures that must be presumed for (62) and the variant in (65) under this interpretation cause further problems in that they do not even resemble the types of structure found elsewhere in the verbal system, whereby consonants are clustered only at the beginning of the verb (see Appendix i). In addition, under the single segment interpretation the free variation in (65) is limited to the presence or absence of the feature of labialisation on a single consonant; the verb root structure is the same for both variants. This is far more satisfactory than the sequence interpretation, whereby different root structures must be presumed for each.

While it is safe to conclude that the labialised dorsal obstruents are phonological units, the question remains as to whether the feature of labialisation can be accounted for as a feature associated with a segment or if it is better explained as a prosody associated with the syllable or the word. This question is treated immediately below.

2.4.2.1 *Prosodic tendencies*

In the study of various Chadic languages it has frequently been found that secondary articulations such as labialisation, palatalisation and even nasalisation (most notably in Higi, described by Mohrlang 1972 and Barreteau 1983) should not be treated as inherent properties of the phoneme, but rather are prosodies affecting whole syllables or words.

Having established that labialised dorsal obstruents are phonological units, the question remains as to whether the labialisation on these is underlyingly specified on each one (i.e. there is a series of labialised dorsal consonants as shown in the inventory above) or if labialisation belongs to a separate prosodic tier. It has already been noted that nasal consonants are distinguished by the feature [±round]; the question remains as to whether the same distinction applies to the phonological word. The major points to be considered here are the domain of the putative prosody and whether or not its phonetic realisation within this domain is predictable.

Firstly, the distribution of labialised dorsal obstruents can be described as 'semi-prosodic' at word-level. For a word containing dorsal obstruents, either all of these are labialised, none is labialised, or only the left-most dorsal obstruent is labialised. Exceptions to this pattern are found only in the plural forms used

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[22] Derived from the noun |#laxʷ#| (L) → /làxʷə̀/ - 'diarrhoea'

by some younger speakers, whereby it is only the right-most dorsal obstruent (at a morpheme boundary) that is labialised. Examples of this semi-prosodic free variation are given below:

(66) [bə́lkí ~ búlkí ~ búlkwí] – 'cloud'

(67) [də̀gàyà ~ də̀gà ~ dùgwà] – 'try'

(68) a) [gúdᵊgé ~ gúdᵘgwé] – 'toad'

  b) [gàdàgwè ~ gwàdàgè ~ gwàdàgwè] – 'toads'

(69) a) [gùχʷɓà] – 'old person'

  b) [gwàhàɓè ~ gwàχwàɓè] – 'old people'

(70) [gʷràkà ~ gʷràkwà] – 'annoy'

(71) [kítə́ ~ kwítə́] – 'all/ whole'

(72) a) [kùskú] – 'hen'

  b) [kàsàkwè ~ kwàsàkè ~ kwàsàkwè] – 'hens'

(73) [m̩ᵊzᵊràk'èn ~ m̩ᵘzᵘràk'wèn] – 'wrinkles'

(74) [χʷdə̀gì²³ ~ χʷdùgwì] – 'forest'

(75) a) [χʷdə́gá ~ χʷdúgwá] – 'tree'

  b) [hàɗàggè ~ hàɗàgwè ~ χwàɗàgè ~ χwàɗàgwè] – 'trees'

There is considerable variation among speakers as to which of these distributional patterns surfaces, with a higher degree of labialisation among older speakers[24]. Splitting the speakers into three different age-groups, a survey of labialisation in the ten words given above gives the following distribution of labialisation patterns used:

Patterns of labialisation on dorsal obstruents				
Speaker age	no <lab>	only right-most <lab>	left-most <lab>	all <lab>
under 15	20%	20%	20%	40%
15-40	21%	-	43%	36%
over 40	13%	-	29%	58%

It seems that, for adult speakers, labialisation 'docks' onto the left-most dorsal obstruent; among those over forty it is more likely to spread over the whole word. However, there is no consistency as to the extent of labialisation either for individual speakers[25], either because they fully labialise certain words but not others, or, more rarely[26], because the same individual uses both the fully labialised and partially labialised forms in free variation. Furthermore, this prosodic-type distribution does not apply in the plural forms of some of the younger speakers; in these forms it is only the right-most dorsal obstruent that is labialised, although in the singular labialisation occurs only on the left-most dorsal.

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[23] Even though this word was unknown to the children, they still repeated my fully labialised pronunciation [χʷdùgwì] with only partial labialisation [χʷdùgì].

[24] M. Marouf Brahim was aware of this tendency, though most other native speakers only accept the form used in their idiolect.

[25] Mme Sali Hadja Habi, from Hinale, was the only speaker for whom labialisation was consistently a word-level feature. Whether this is typical of Hinale speakers I do not know, since she was the only speaker from this area I worked with.

[26] M. Awalou Adam was the only speaker I worked with who freely used different variants for the individual lexical item.

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There are three nouns that have the surface form [-son, +back]u as the right-most dorsal obstruent, but no labialisation on the left-most, shown in (76)-(78). It is clear in (76)-(77) that this sequence consists of separate segments, rather than a labialised unit; there is a contrast between the |kw| sequence here and the |kʷ| units in (66) and (71)-(73) above. The evidence for the heterosegmental interpretation is from the plural suffix -(C)e(n). Just the /w/ is being copied in the plural suffix, not the labialised dorsal as a unitary segment.

(76) a) |#klenkw#| (LH) → /kɘlénkɔ́w/ → [kˀlèŋkú] – 'eagle'

b) |#klenkw + Ce(n)#| (+L) → /kɘlènkɘwwè(n)/ → [kˀlèŋkùwè(n)] – 'eagles'

(77) a) |#gwgw#| (LH) → /gɘwgɔ́w/ → [gùgú] – 'pigeon'

b) |#gwgw + Ce#| (+L) → /gɘwgɘwwè/ → [gùgùwè] – 'pigeons'

(78) [hàkù] – 'thing' (abstract)

Although there is no evidence from a derived plural in (78), we postulate that this too is a sequence and not a single labialised segment; otherwise, in labialising only the right-most dorsal obstruent, it would not conform to the patterns of labialisation found elsewhere.

2.5 Gemination

In a small number of lexical items, geminate consonants are found. Excluding gemination at morpheme boundaries, which is obviously possible, these long consonants are found in the nouns in (79) -(82) and the verbs in (82)-(88) below, as well as a few functional morphemes, one adverb, one ideophone and six loan words.

(79) [ɔ́mːá][27] – 'mother'   (cf. [má] – 'lady')

(80) [màkɔ́mːí] – 'sesame seeds' (when prepared for marriage ceremony)

(81) a) [ʁɔ́lːá] – 'weight'

b) [ʁɔ́lːà] – 'be heavy'   (cf. [ʁˀlà] – 'hit')

(82) a) [vɔ́nːá] – 'praise' (n)

b) [vɔ́nːà] – 'praise' (v)

(83) [bːˀí] – 'be good'

(84) [gːà] – 'break'   (cf. [gá] – 'finish')

(85) [kːˀá] – 'be lost/ catch/ hold'   (cf. [ká] – 'say/ speak, talk')

(86) [mːà] – 'hide'

(87) [sːà] – 'fry'   (cf. [sá] – 'enter')

(88) [χːà] – 'crush'   (cf. [há] – 'steal')

In (81), (84), (85), (87) and (88), the geminate consonants appear to contrast with the 'short' consonants found elsewhere. However, the contrast can be regarded as belonging to the skeletal tier (also known as the CV tier or the timing tier) rather than what, following Goldsmith (1990:50), we shall term the 'phonemic tier' (also known as the segmental or melodic tier); in other words, the contrasting pairs are

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[27] This may be morphologically complex.

made up of exactly the same material on the phonemic tier, but have different skeletal structures. This is demonstrated in (89)-(90) below, autosegmental representations of (81) above.

(89) CVCCV
   | | ∨ |
   ʁ ə l a
   'be heavy/ weight'

(90) CVCV
   | | | |
   ʁ ə l a
   'hit'

We can posit the following rule associating floating C-slots to a neighbouring consonant segment:
(91) Geminate formation

     Ⓒ C
        |
       […]

       'The features of a consonant spread to an adjacent floating consonant, forming a geminate.'

Under this autosegmental approach, the lexical items in (79)-(88) are in no way exceptional, being made up of established phonemes and skeletal structures (see Appendix i, *Verb skeletal structures*).

2.6 The voiced lateral fricative

The previous two sections justified the interpretation of potentially ambiguous consonant types, whether complex (2.4, *Complex and contour consonants*) or geminates (2.5, *Gemination*). In this section we discuss and justify the phonemic status accorded to another potentially ambiguous segment, the voiced lateral fricative /ɮ/. This consonant merits discussion due to its very marginal distribution. Within the main lexicon of non-borrowed words, its appearance is limited within our corpus to the examples given in (92)-(97) below (see also (99)-(100) for examples of free variation). Note that it is equally represented in the different major word categories of noun ((92)-(96)), verb ((96)-(97)) and adjective ((100)).

(92) |#gaɮama#| (L) → [gàɮàmà] - 'balafon'

(93) |#ɮaba#| (L) → [ɮàbà] - straw fence around house

(94) |#ɮarw#| (LH) → [ɮàrú] - 'wound'

(95) |#ɮrm#| (H) → [ɮˀrə́m] - 'swindling'

(96) a) |#brbaɮa#| (H) → [bə́rbáɮá] - 'writing'

    b) |#brbaɮa#| → [bə́rbàɮà] - 'write'

(97) |#ɮm#| → [ɮə́m] - 'be able/ great, powerful'

In our corpus of known loan words it appears only in the example given below:

   Lagwan   *Arabic*
(98) [ɮə́má] – 'Friday'   *jmʕ*

There seem to be three possible interpretations, which will be discussed in turn: either [ɮ] is an allophone of another phoneme; it is the phonetic realisation of a sequence of two consonant phonemes; or it is a marginal phoneme.

There are a couple of cases, where word-initial before /r/, where the voiced lateral fricative appears in free variation with its voiceless counterpart, the voiced version being more common:

(99)   [ɮˤrèɗə ~ ɬˤrèɗə] – 'slip' (v)
(100)   [ɮˤrə́kə́ ~ ɬˤrə́kə́] – 'bright green'

[ɬˤr] is unattested elsewhere in the corpus.

Elsewhere, where word-initial before /a/, the two pulmonic lateral fricatives contrast:

(101) |#ɮaba#| (L) → [ɮàbà] - straw fence around house   (cf. |#ɬaba#| → [ɬábà] - 'play' (v))

However, unlike its voiceless counterpart, the voiced lateral fricative does not appear in obstruent clusters. It seems that the contrast between the two is neutralised in this environment.

The option of interpreting [ɮ] as an underlying sequence would account nicely for its absence in clusters, which, except where the first consonant is |s| or a nasal, are restricted to two consonants. It is likewise worth noting that the sequence |zl|, the most likely candidate for a sequence interpretation of [ɮ], appears in our corpus only in the loan word given in (131) above. In order to resolve this issue we apply the same test as that applied in section 2.4, *Complex and contour consonants*, above – that of the predictable tone realised on verbs (see 5.2, *Tone on verbs*). The reader is reminded that #CəC verbs have high tone, while #CCəC verbs receive a default low tone. Consider therefore the verb in (97) above. Its high tone is licensed only if [ɮ] constitutes a single segment; therefore it is not possible to interpret this consonant as a diconsonantal sequence.

Appealing now to comparative evidence, while nearly all the languages of Central Chadic have both voiced and voiceless lateral fricatives as phonemes, the voiced version, /ɮ/, appears to be absent from the other Kotoko varieties, suggesting it has been lost over time. The evidence suggests that the /ɮ/ of Lagwan is indeed phonemic[28], but its marginal distribution and neutralisation in certain environments with its voiceless counterpart, /ɬ/, indicate that the process of *ɮ-loss that is already complete in the other Kotoko languages is still in progress in Lagwan. Therefore, /ɮ/ has marginal phonemic status, but is on its way out of the language.

2.7 Free variation

Certain examples of free variation have already been discussed in the preceding sections (2.2, *Consonantal allophony*, 2.4.2.1, *Prosodic tendencies*, and 2.6, *The voiced lateral fricative*). Further examples will be discussed below in section 2.8, *Loan word consonants*. There remain a couple more examples of free variation.

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[28] Aboukar (2003) and Lukas (1936) also both accord it phonemic status.

In one instance the voiced bilabial plosive has its implosive counterpart as a variant. The only speaker I worked with who used the implosive variant was Mme Mahamat Aïcha Mavoua, a lady in her early twenties[29]:

(102)   /ǹdə́rbí ~ ǹdə́rɓí/ - 'mud'

The voiced and voiceless dorsal fricatives are in free variation in the example below[30]. The irregular tonal melody suggests that this example is either a loan word or a compound (see 5.1, *Lexical tone on nouns*).

(103)   /tàʁálʁásɛ̀ ~ tàxálxásɛ̀/ - 'crab'

2.8 Loan word consonants

As is the case in any living language, the phonology is not stable and changes take place over a period of time; this was demonstrated in section 2.6 above, *The voiced lateral fricative*, whereby a consonant appears to be on its way out of the language. The phonology of a language is especially subject to change where a language has borrowed extensively and over a significant time period from other languages. In Lagwan's sub-lexicon of loan words we find, as well as the consonant phonemes given in section 2 above, an additional class of pre-palatal strident consonants, the affricates [c] and [j] and the fricative [ʃ], either as consonants in their own right or by assimilation to their surrounding segments. In a more restricted environment – intervocalically - the glottal stop [ʔ] is also found. These loan word consonants have not infiltrated the verbal system, yet despite their limited distribution are for the most part not recognised as loans by native speakers. The extent of each's distribution is discussed in sections 2.8.1, *Pre-palatal affricates*, 2.8.2, *Pre-palatal fricatives*, and 2.8.3, *The glottal stop*, below.

2.8.1 *Pre-palatal affricates*

2.8.1.1 *The voiceless affricate [c]*

The voiceless affricate [c] occurs predominantly in loan words from Kanuri (Cyffer & Hutchison 1990 / Hutchison 1981) (in (104)-(108) below), mainly nouns (either <c, tc/cc, j) and one adjective (<s). It also appears in one noun from Classical Arabic (Jullien de Pommerel 1999) (in (109)) (<ʃ). There is one noun loaned from French for which by assimilation [c] is a variant of /t/ preceding [i] (in (110)). Where Classical Arabic is given as a source here and elsewhere, Shoa Arabic or Kanuri, as well as possibly Hausa or Ɓarma, has probably served as an intermediary.

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[29] M. Marouf Brahim informed me that younger speakers also use an implosive variant in the following example, though I personally have never heard it used:

(i)   /dɔ̀gʷà ~ ɗɔ̀gʷà/ - 'help' (v)

Tourneux (2003b) observes that the younger speakers of Malgbe have a tendency to replace voiced pulmonic plosives with their implosive counterparts. Further research is required to determine whether or not the same tendency is found among Lagwan speakers.

[30] The irregular tonal melody suggests this is either a loan word or a compound, though it has not to date been identified as such (see 5.1).

	Lagwan	*Source*
(104)	[àɾcàcà] – toad (sp.)[31]	Kanuri *arjaja / àrjàɟà* - 'toad'
(105)	[cáncáṇ] – 'good health'	Kanuri[32]
(106)	[cə́bə́ná ~ cíbə́ná] – 'namesake'	Kanuri *cuwúna*
(107)	[kócó] – snail (sp.)[33]	Kanuri *kótcó/kóccó* - snail (sp.)[34]
(108)	[càɾcàɾ] – 'stripy'	Kanuri *sársár* – 'slender, thin'
(109)	[cítːà] – 'hot pepper'	Arabic *ʃi̭.t.*
(110)	[tìyó ~ cìyó] – 'pipe'	French *tuyau* [tüyo]

Elsewhere in the corpus there are no other examples of [c] acting as a variant of /t/ in the above or any other environment. However, there is one case where by assimilation it appears as a variant realisation of |ky|:

(111) a) |#ky#xe#| (- #H) → [kí hé ~ cí hé] – 'remain, stay'

 b) |#ky + u + n#xe#| (- +H+H#H)→ [cún hé] – 'remaining, staying' (verbal noun)

I have only heard one speaker (Mme Sali Hadja Habi) use this variant and only with this item; elsewhere she joined with other speakers in consistently realising the sequence /ky/ as in the examples below:

(112) |#kyna#| (HL) → [kínà] – 'because'

(113) a) |#mpataky#| (H) → [m̀pátákí] – 'cotton'

 b) |#mpataky + a#ni#| (H+H#H)→ [m̀páták^iyá ní] – 'his cotton'[35]

There remains one unaccounted-for occurrence of [c], a word that is unknown to many speakers:

(114) [càl] – 'curiosity, inquisitiveness'

It is very probable that this is also a loan word[36]. Another possibility would be that this is the surface realisation of either |#tyal#| (L) or |#kyal#| (L). However, this realisation contrasts with the examples in (113)b) above and (115) below:

(115) |#gʷfty + a#ni#| → [gùft^iyá ní] – 'his ashes'[37]

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[31] Long in body and jumps long distances

[32] M. Awalou Adam identified this as a Kanuri word.

[33] Small and long

[34] Kind of snail with small conch-like white and red shell

[35] cotton-M 3m

[36] I am not sure if this word may be used independently; I have come across it only in associative constructions [bˀlè càl] – 'curious man' and [mál càl] – 'curious woman'. Comparing this with the Shoa Arabic *cala'* – 'open, rummage', from the Classical Arabic *ʃiʕ* - 'disperse' (Jullien de Pommerol 1999), I suspect we may have found the source.

[37] ashes-M 3m

In any case, given that this is the only potentially problematic appearance of this consonant, there does not seem to be any reason for regarding it as phonemic in the main lexicon of non-loaned words, at least at the present time.

2.8.1.2   The voiced affricate [j]

The voiced affricate [j] appears predominantly in nouns loaned from Classical Arabic (<j) (in (116)-(120)) and also in two from Ɓarma (Gaden 1909) (<j, y), shown in (121)-(122), one from Ngambay (Mianmbaymarde & Kali Mekongoto 1978) (<j), shown in (121),), and one from Fulfulde (Editions Annoora) (<y), shown in (124).

	Lagwan	*Source*
(116)	[jàfá] – 'affair, palaver'	Arabic *jfw* – 'revolt, revolution'
(117)	[jàmáʔà] – 'crowd'	Arabic *jmʔ*
(118)	[jàmbàlːàdáyà] – lamp (sp.)[38]	Arabic *jnb* – 'next to' + '*dw* – 'fireplace, kitchen'[39]
(119)	[járdàl] – 'bucket'	Arabic *jrdl*[40]
(120)	[jàzárī ~ jàzárì] – 'butcher'	Arabic *jzr*
(121)	[pˀránjàpé] – 'spinster'	Ɓarma *purajape*
(122)	[jó ~ jójó] – 'near/ quickly'	Ɓarma *yôyô -* 'quickly'[41]
(123)	[jáⁿʁáw] – toad (sp.)[42]	Ngambay *jángá -* aquatic creature?[43]
(124)	[ǹ̩jámːà] – cake (sp.)[44]	Fulfulde *nyaamugo* – 'consume, eat' / *nyaamdu* – 'food, meal'[45]

There are a couple of examples within the loan word phonology of [j] occurring by assimilation as an idiolectal variant of the voiced plosives /d/ (in (125)) and /g/ (in (126)) preceding [i]:

	Lagwan	*Source*
(125)	[díb(ú)nó ~ jíb(ú)nó[46]] – 'date (palm)'	Arabic *tmr*
(126)	[ǹ̩jíbá ~ ǹgíbá] – 'suffering, hardship/ funeral'	Kanuri *ngə́nə́wu / ngə́nə́vù; ngə́nə́fù -* 'hard work, effort, hard life, worry, trouble'

However, in the main lexicon of non-borrowed words such assimilation does not occur, though there is one other instance of [j] appearing in free variation with [g], also in the environment of a front vowel:

(127)	|#a#ge#| (L#H) → [à gé ~ à jé] – 'because'

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[38] cotton soaked in oil in a dish

[39] Alternatively <French *lampadaire* [lɑ̃padɛʁ] – 'lamp'

[40] Jullien de Pommerol (1999) suggests the Classical Arabic may itself be loaned from the Turkish *kardal*.

[41] My translation; the original reads 'vite'

[42] Long-legged toad that is prone to jumping long distances

[43] My translation; the original reads 'être aquatique ?'

[44] Made out of hard rice or millet left on the bottom of the cooking pot, mixed with groundnut paste and sugar, this can be eaten alone or with milk. It can be made quickly if an unexpected guest arrives and there is no meal prepared.

[45] My translations; the originals read 'consumer ; manger' and 'aliment ; nourriture ; repas'

[46] A small number of speakers use a LHH melody.

Still, elsewhere the sequence [ge] occurs without variants:

(128) |#mdge⁴⁷#| (LH) → [m̀ᵊdə̀gé] – 'crocodile'

                     (not → *[m̀ᵊdə̀jé])

In a few cases, the voiced pre-palatal affricate [j] appears as an idiolectal variant of /z/. Many speakers do not allow the [j] variant, or, in the case of (129) below, do not allow it in careful pronunciation. Some cases are nouns loaned from Classical Arabic:

	Lagwan	*Arabic*
(129)	[àzálá ~ àjálá] – 'speed'	ʄl – 'quickly'
(130)	[fázáɾ ~ fájáɾ ~ fáʒáɾ] – 'morning'	ft.r
(131)	[zᵊlí ~ jᵊlí] – 'clan'	's.l
(132)	[zàmán ~ jàmán] – 'time'	zmn – 'time period'

The remaining examples to date have not been identified as loan words:

(133)   [zə̀mí ~ jə̀mí]⁴⁸ – 'right' (direction)

(134)   [zún lɔ́ ká ~ jún lɔ́ ká] – 'hanging up' (verbal noun)

The evidence indicates that the underlying phoneme in (129)-(134) is /z/. However, there neither seems to be a phonetically plausible reason why the pre-palatal variant should occur, nor, comparing the examples in (129) and (135), where [j] is not allowed as a variant, does it apply as a systematic allophone:

(135)   [mázá] – 'antelope'

Turning instead to the [z] of loan words, certain examples from Arabic, Kanuri, Ɓarma and possibly Hausa (Abraham 1949) have /j/ as their source, as shown in (129) above and (136)-(142) below:

	Lagwan	*Source*
(136)	[dáɾázá] – 'reputation'	Arabic *drj*
(137)	[gàzázà] – 'bottle'	Arabic *zjj*
(138)	[ŋ̀gùmáʒí ~ ŋ̀gùmází] – 'bubu' (long)	Kanuri *gəmáje*

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⁴⁷ Given what appears to be emerging phonological status of /e/ (see 3.3.1.1) and rule (185), it is of course possible to account for the contrast in (127) and (128) by postulating that the underlying vowel in (127) is indeed the front vowel |e|, contrasting with the sequence |ay| in (128). However, the example below shows that synchronically the phonetic vowel in (128) must be regarded as a single vocalic segment:

   (i) |#mdge + a#ni#| (LH+H#H) → [m̀ᵊdə̀gá ní] – 'his crocodile'
Where two vowels meet, the first is deleted. This does not apply to glides (see rule (278)).

⁴⁸ I suspect that this is derived from /zɔ́m/ ('eat'), where |-i| is a nominalising suffix. Since it is correct form to eat with one's right hand, it is not unusual in African languages for the word for 'right' to be derived from the word for 'eat'.

(139)	[zˠɾé] – 'truth'	Kanuri *jíre / jírè*
(140)	[zúzù] – 'owl'	Kanuri *dúji*
(141)	[mágází] – 'elder sibling'	Hausa *mágàají* - 'heir' or Kanuri *mâjí* - 'first-born child' (in relation to one's own mother or father)
(142)	[zóɾⁱyó] – 'young man'	Barma *jorio* - 'bachelor'[49]

It seems that it is common to reanalyse the *j* of the source language as the /z/ native to Lagwan[50]: in (136)-(142) this reanalysis results in a stable [z]; in (129)-(131) the reanalysis is not common to all speakers; in (116)-(121) no reanalysis occurs and the [j] realisation is stable. It therefore is probable that the examples in (133)-(134) are likewise loan words with the source *j*, but are yet to be identified.

The remaining occurrences of the voiced pre-palatal affricate are given below:

(143)	[áɲjó] – 'bead'[51] (for a necklace)
(144)	[gə̀jàm] – 'mediocre'
(145)	[jàmtáwálè] – 'kingfisher'
(146)	[ǹjàpé] – 'blue'[52] (of synthetic objects)

Unlike the examples in (129)-(134), there is no indication that the above occurrences are variant realisations of /z/. Given that the data in (143)-(146) are the only examples where there is no apparent incentive for treating [j] as a surface variant of a well-established phoneme, and adding to this that in all these cases its appearance is restricted to a pre-vocalic environment, in the interests of economy it might appear preferable to interpret these instances as underlying sequences if possible. The potential candidates would be /dy/ and /gy/. However, contrasting the data below with that in (147)-(148), it is clear this is not an option:

| (147) | \|#mandgya#\| (H) → [mándˠgⁱyá] – 'cat' |
| (148) | \|#dyasn#\| (LH) → [dⁱyàsə́n] – 'tomorrow' |

It should be noted that the tonal melody in (145) is unattested on nouns elsewhere in the corpus, suggesting either this is a compound or a loan word (see 5.1, *Lexical tone on nouns*). The other examples in (143)-(144) and (122)-(146) have not to date been identified as loan words. However, given that [j] is completely absent from the verbal system, added to the fact that no other pre-palatal obstruent appears outside the sub-lexicon of loan words, it seems extremely probable that these, as all other, appearances of [j] belong to the sub-lexicon of loan words.

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[49] My translation; the original reads 'se dit d'un homme qui n'a pas de femme'

[50] (132), where the source is *z*, may be an example of hypercorrection, whereby the speakers who retain the source pronunciation [j] of loan words and who are aware this word is borrowed assume a source *j* in this case as well. Alternatively, since it is probable that another language has served as an intermediary, it is possible that this intermediary has itself reanalysed the source *z* with a *j*.

[51] Barma has a word *'anje* – 'clay'; if the Lagwan word refers to a bead made out of clay this may be the source. Alternatively, the Lagwan word may have the same origin as the Msər 'anzo' ('elbow')

[52] Barma has a homophone, *njape*, meaning 'white'.

2.8.2 Fricatives

In addition to the affricates discussed above, a pair of corresponding fricatives is also attested, [ʃ] and [ʒ]. Like the affricates, [ʃ] appears as a phonetic variant before [i], but, contrary to the case of the former, this variation is consistent and predictable throughout the whole corpus of loaned and non-loaned words and therefore is regarded as allophonic (see rule (4) above). Mme Sali Hadja Habi, who has more of a tendency to assimilate before [i][53] (see also above), also pronounced [ʒ] as a variant of /z/ in the following three words, of which (149)-(150) have been already identified as loan words:

(149) [kànàn̠ʒíɾ ~ kànànzíɾ] – 'pig'   (<Classical Arabic *xnzr* – 'domestic pig'[54])

(150) [ŋ̀gùmáʒí ~ ŋ̀gùmází] – 'bubu' (long)   (<Kanuri *gəmáje*)

(151) [m̀ʾʒíʒí ~ m̀ʾzízí] – 'porcupine'

The pre-palatal fricatives' appearance in the verbal system is limited to the examples in (152)-(153) below, where they appear to surface as an exceptional coalescence of [-son, +cont, -round, -back, α voice][-son, +back, α voice], or simply as irregular verb forms following the allophonic rule in (4):

(152) a) [ʃí] – 'grasp, take hold/ snatch'

b) [sχ̀ə̀-wùn ~ ʃì-wùn] – 'grasping, taking hold/ snatching' (intransitive verbal noun)

c) [sχ-è ~ ʃ-è] – 'grasping, taking hold of/ snatching' (transitive verbal noun)

d) [sχ-ú] (verbal noun with extension)

(153) a) [ʒí ~ zə̀gí] – 'take'

b) [zə̀gì-wùn] – 'taking' (intransitive verbal noun)

c) [zə̀g-è] – 'taking' (transitive verbal noun)

There are no other instances of [ʒ]; its status can therefore be regarded as purely phonetic.

Its voiceless counterpart, on the other hand, mirrors the affricates in having a considerable distribution within the sub-lexicon of loan words, appearing in nouns and numerals loaned from Classical Arabic (<ʃ, s), one Kanuri noun (<j) and one French noun (<ʃ):

	Lagwan	*Source*
(154)	[lìʃáʔì] – evening prayer time	Arabic *ʕyʃ*
(155)	[ʃáʔì] – 'tea'	Arabic *ʃyy*
(156)	[ʃáɾⁱyá] – '(Islamic) law'	Arabic *ʃrʕ*
(157)	[ʔàʃíɾ] – 'secret, danger'	Arabic *ʕʃr/ srr*
(158)	[ʔáʃkàɾ] – 'soldier'	Arabic *ʕskr*
(159)	[dìʃɗén] – 'nine'	Arabic *tsʕ*
(160)	[hàmʃín] – 'fifty'	Arabic *xms*

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[53] The only speaker I worked with from Hinale; this variation may or may not reflect the geographical difference between her and the other speakers.

[54] My translation; the original reads 'cochon domestique'

(161) [kàʃˈyá] – 'circumcision' Kanuri *kajâ*

(162) [ʃéz] – 'chair' French *chaise* [ʃɛz]

The following noun has also been identified as a loan word, though no source has as yet been found[55]; the HL melody, practically unattested on unambiguous nouns[56] (see 5.1, *Lexical tone on nouns*) is commonly found on nouns loaned from Classical Arabic:

(163) [ʃáwà] – 'semen'

Excluding occurrences directly preceding [i], which are presumed to be allophonic, and known loan words, the appearance of [ʃ] is limited to the examples below:

(164) [ʃàhə] - large ceramic plate or jar

(165) [ʃén] - 'non-existent'

(166) [ʃèʃí] - 'five'[57]

(167) [ʃᵘwá] - 'fishing line'[58]

(168) [χʷʃèʃí ~ χʷsèʃí][59] – 'shadow'

In the examples in (165)-(166) and (168), the pre-palatal realisation of the voiceless fricative could be attributed to assimilation to the immediately following front vowel. This seems very probable in (168), where the pre-palatal and alveolar fricatives appear in free variation. However, these three cases contrast with instances elsewhere in the lexicon of /se/ being realised as [se], as exemplified below:

(169) [sèʔén] – 'sand'

It is also worth noting that in (166) and (168) the succeding syllable has been regularly palatalised by the rule in (4), in which case the palatalisation may simply have spread further over the word.

Of course, it could be claimed that [ʃ] in (164)-(168) is the surface realisation of /sy/, the rule in (4) applying. However, the example below is an apparent counterexample:

(170) |#sysya#| (H) → [ʃíʃˈyá] – 'bird'

It seems most probable that the problematic words in (164) and (167) are loan words that have yet to be identified[60]. In any case, since there are only two problematic words in our corpus, and especially given its absence as a potentially phonemic consonant from the verbal system, there does not seem to be sufficient evidence to suggest that the voiceless pre-palatal fricative /ʃ/ has phonemic status outside the sub-lexicon of loan words.

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[55] Allison (2005:97) has convincing evidence that the Mpadə equivalent, *ʃàwà*, is a loan word.

[56] The one example, [ptálè] ('owner'), is surely likewise a loan word of which the source has yet to be identified.

[57] Allison (p.c.) suggests that 'maybe the southern Kotoko borrowed from their northern neighbours', citing the Mpadə cognate /ʃénsī/, a lexicalised compound whereby /ʃé/ is a masculine noun meaning 'hand', /sì/ means 'body' and /n/ 'is synchronically the masculine gender marker used before non-noun modifiers'.

[58] This also has the meaning 'Shoa Arab'; presumably this is borrowed.

[59] This could possibly be a lexicalised compound: | #xʷsi+e#zi#| (L+L#H) (bottom-M.N body')

[60] It is questionable as to whether the Kotoko, traditionally fishermen, would be likely to borrow the word for 'fishing line'.

2.8.3   The glottal stop

Within the main lexicon of non-borrowed words, the glottal stop is never present in the UR, but its insertion as a 'zero consonant' is triggered within the lexical phonology in order to preserve surface syllable constraints (see 4.1.1, *Zero consonant insertion*). Elsewhere, it may be the result of a loss of consonant between like vowels (see 3.4, *'Long' vowels*). Finally, in the verbs in (171)-(172) it surfaces as an idiolectal variant of /ɗ/:

(171) |#ɗs(n)#| → [ɗəsə̀ ~ ʔəsə̀n] – 'sneeze'

(172) |#ɗla#| → [ɗᵚlá ~ ʔə́lá] – 'scoop out'

This variant was consistently used by Mme Sali Hadja Habi, for whom the implosive is accompanied by little or no voicing (see 2.3.2.1, *The glottalic obstruents*), making the two sounds scarcely distinguishable perceptively. For these speakers, even in careful speech the pronunciation [ʔ] is preserved[61].

Turning now to the sub-lexicon of loan words, [ʔ] appears intervocalically in nouns loaned from Classical Arabic (173)-(178) (mostly <ʕ) and one from Ɓarma in (179):

	Lagwan	*Source*
(173)	[àɾbàʔín] – 'forty'	Arabic *rbʕ*
(174)	[jàmáʔà] – 'crowd'	Arabic *jmʕ*
(175)	[lìʃáʔì] – evening prayer time	Arabic *ʕyʃ*
(176)	[màʔáná] – 'explaining, preaching'	Arabic *ʕny*
(177)	[sáʔà] – 'time'	Arabic *swʕ*
(178)	[ʃáʔì] – 'tea'	Arabic *ʃyy*
(179)	[zùʔú] – 'abscess/ ulcer/ wound'	Ɓarma *dû* [duː]

It seems then that the glottal stop is a consonant restricted to the sub-lexicon of loan words; even here it is far more restricted than the pre-palatal obstruents, appearing only intervocalically.

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[61] Marouf Brahim, Mamat Abama and Moumoune Mademe, giving the verbal nouns as the citation form, transcribed these verbs *isɨnwun* and *ilawun* respectively.

3 Vowels

Having presented and analysed the rich consonantal system of Lagwan, we now turn to a study of the rarer vowel-slots, which supplement the consonantal skeleton.

3.1 General characteristics of the vowel system

As was noted in the introduction (1.6, *Overview of phonology*), in Lagwan underlying V-slots on the skeletal tier are relatively few and, as is so common in Chadic languages, are principally filled by the low central vowel[62] |a|; where there is no underlying V-slot, an epenthetic 'zero vowel' is inserted (see 3.5, *The zero vowel*, and 4.1.2, *Zero vowel insertion*). The comparative poverty of underlying vowels and predominance of |a| are manifest from the distribution of underlying vowels in verb roots, which is as follows[63]: |a| - 125 verbs; |e| - 16 verbs; |i| - 19 verbs; no vowel – 82 verbs. Despite the limited distribution of these other vowels, it will be shown (3.3, *Phonemic vowels with limited distribution*) that there is solid evidence for their phonemic status. However, as has been observed in other Chadic languages (Mohrlang (1972), Schuh (1971), Wolff (1983) and doubtless others), certain contrasts are productive only word-finally (see 3.3.1.2, *The back vowel /o/*, and 3.3.2, *The high vowels /i/ and /u/*). Excluding the exceptional sub-lexicon of loan words, the distribution is as follows:

Initial vowel phoneme[64]	a

Medial vowel phonemes[65]	
Front	Central
e	a

Final vowel phonemes	Front	Central	Back
High	i		u
Mid/ low	e	a	o

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[62] Following Chadic conventions and for typological convenience the symbol *a* is always used for this vowel, but it should be noted that both phonetically and phonologically it is, as its positioning in the vowel chart suggests, a low *central* vowel, and not the low *front* vowel of the IPA.

[63] Only one quality of vowel is found per verb root, so is is the number of verbs in which each vowel appears that is counted, rather than the number of appearances of each vowel. Under the latter approach the number of |a|s would have been much higher, since a verb may consist of up to three |a|s, whereas the other two vowels appear only in monovocalic verbs. (This is very similar to Newman's (1975:73) findings for Malgbe (which he calls Goulfei Kotoko), whereby polyconsonantal verbs have only the vowels /a/ and /ə/, monoconsonantal verbs having also /i/ and /e/.) Except where there is clear evidence to the contrary, every root-final occurrence of [i] is interpreted as underlyingly |i| rather than |y|. This may result in a slightly exaggerated distribution for this vowel, but nevertheless the point is still proved.

[64] Initial [e] appears in one noun in our corpus:

    (i)   [ènì] – 'milk'

Given rule (185) below, it is possible that underlyingly this is |#ayni#| (L), in which case |a| is the only vowel permitted word-initially.

[65] While [o] appears word-internally, it cannot be proven that it is not the surface realisation of |aw|, given the putative rule (200) below.

It seems that the front vowels are more productive than their back round counterparts, |u| and |o|. This bias is balanced by the effects of labialisation (more accurately described as 'labiovelarisation') in the consonantal system (2.4.2 above, *Labialised dorsal obstruents*). See also 3.3 below, *Phonemic vowels with limited distribution*.

3.2 Distinctive vowel features[66]

The five underlying vowel segments identified above are distinguished by the features given below. Redundant features are not marked (see *Redundancy*, below).

Distinctive features	round	high	low	tense
a			+	
e	-	-	-	+
i	-	+		
o	+	-	-	+
u	+	+		

It is important that at least the low vowels be specified as [+tense], as the presence or absence of this feature in the initial syllable of a toneless verb determines whether or not this syllable receives accent (see 5.2, *Tone on verbs*).

3.2.1 Redundancy

In addition to the features marked above, the following redundant features are given:

(180)   V → [+syl]
(181)   [+low] → [-round, -back, -high, +tense]
(182)   [+round] → [+back][67]

It is not possible to determine at this stage whether all underlying vowels should be marked as [+tense]; this feature is relevant only in the initial syllable (see 5.2, *Tone on verbs*), a position in which the high vowels do not appear.

The 'zero vowel' consists only of a V-slot inserted into the skeleton (see 4.1.2, *Zero vowel insertion*), so is not specified for any features except the redundant feature [+syl] given by rule (180) above.

3.3 Phonemic vowels with limited distribution

As was noted above in section 3.1, *General characteristics of the vowel system*, the vowels other than |a| have emerging phonological status. In this section the evidence for their phonemic status, as well as, in the case of the low vowels, their possible historical source will be discussed.

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[66] See footnote 15.
[67] This rule applies only to vowels.

3.3.1 The mid vowels |e| and |o|

In discussing the vowel system of the Kotoko group as a whole, Tourneux (2000b:5) accords the low vowels |e| and |o| phonological status, but postulates that they were not present in Proto-Kotoko, having the historical sources *ay and *aw/ *wa/ *aCʷ/ *Cʷa respectively. Both his synchronic description and historical explanation appear to be valid for Lagwan.

3.3.1.1 The front vowel |e|

Firstly, there is some evidence of a productive source |ay| for [e]. This is clear by comparing the singular and plural forms of the nouns below (refer to 2.4.2, *Labialised dorsal obstruents*, for a reminder of relevant Lagwan nominal morphology).

(183)   a) |#Nkʷayx + i#| (L) → [ŋ̀kwèhì] – 'deaf man'

b) |#Nkʷay + a + x + e#| (+L) → [ŋ̀kwàyàhè] – 'deaf people'

(184)   a) |#mlgay + ni#| (L) → [mə̀lgènì] – 'orphan boy'

b) |#m + a + l + a + g + a + y + e#| (+L)→ [màlàgàyè] – 'orphans'

It seems we can posit the following rule:

(185)   *'Diphthong' contraction*
|ay| → [e] /__C
'A rhyme made up of the low central vowel and the palatal glide are contracted to a low front monophthong pre-consonantally.'

Excepting loan words, there are no initially apparent counterexamples to this rule. However, this situation changes when we take into account the permitted verb root skeletal structures (see Appendix i, *Verb skeletal structures*). Consider the verbs below (where the final high vowel is the zero vowel):

(186) |#bref#| → [brèfù] – 'have mild diarrhoea'

(187) |#krex#| → [krèhə̀] – 'scrape'

(188) |#tef#| → [téfù] – 'bake' (in ashes)

(189) |#tel#| → [tél] – 'be bright/ shine'

(190) |#ɬ'ek#| → [ɬ'ékə̀] – 'throb' (with pain)

(191) |#zex#| → [zéhə̀] – 'sweep'

(192) |#ɟred#| → [ɟˀrèdə̀] – 'slip'

Under the 'diphthong' interpretation these verbs have the ungrammatical, or at best unattested, skeletal structure *(C)CVCC, suggesting that |e| has phonemic status, and the verbs in question the unproblematic structure (C)CVC. Therefore we can conclude that while rule (185) is valid, as the evidence in (183)-(184) shows, this does not mean that every pre-consonantal occurrence of [e] can or should be analysed as the surface realisation of |ay|. Rather, rule (185) leads to neutralisation of the contrast between underlying |ay| and |e| in a pre-consonantal position.

Word-finally, moreover, there is clear evidence that |e| and |ay| contrast:

(193)   a) |#maslankay#| (H) → [másˤláŋkáy] – 'hawk'

        b) |#maslankay + a#ni#| (H+H#H) → [másˤláŋkáyá ní] – 'his hawk'

(194)   a) |#manganzawe#| (H) → [máŋgánzáwé] – 'agama lizard' (red-headed)

        b) |#manganzawe + a#ni#| (H+H#H) → [máŋgánzáwá ní] – 'his agama lizard'

Where two vowels are adjacent, the first deletes (see rule (278)). True to form, the word-final vowel |e| in (194) deletes, whereas the 'diphthong' in (193) does not.

3.3.1.2 The back vowel |o|

Turning to the back vowel |o|, its phonologisation is less well established; as shown earlier (3.1, *General characteristics of the vowel system*), |o| does not appear as a lexical vowel in verbs. Within the nominal system [o] is restricted largely, but not exclusively, to loan words. Ignoring those cases where, for some speakers, [o] surfaces as a conditioned variant of /ə/ (rule (229)b)), its remaining apparently non-loan appearances are few and chiefly word-final. In these cases, we can apply the same test as applied to |e| in (193)-(194) above, in order to determine whether or not [o] is underlyingly a vowel. The chart below shows the behaviour of word-final [o] following, where applicable[68], cliticisation of the masculine possessive associative marker, and suffixation of the plural marker -*Cè(n)*. This latter, when suffixed to vowel-final nouns, takes the form –*yè*.

	citation form	*/ + a/*	*/ + Cè(n)/*	*meaning*
(195)	[áɲjó]	[áɲjá]	[àɲjòyè]	'bead'
(196)	[búdúgó ~ búdˤgó]	(n.f.)	[bùdùgòyè]	'rubbish heap'
(197)	[zə̀vˤlò]	[zə̀vˤlá]	-	'road'[69]
(198)	[bàŋgᵘló]	[bàŋgᵘlá ~ bàŋgᵘlwá]	[bàŋgᵘlòyèn]	'underground granary'
(199)	[m̀bìgò]	[m̀bìgwá]	[m̀bìgòwè]	'melon'

In (195)-(197), [o] behaves in the same way as an underlying vowel; like [e] in (194) above, it deletes according to the rule in (278). In addition, the form of the plural suffix is that of vowel-final nouns. In contrast, in (199) [w] surfaces before the suffixes, implying that it is present in the underlying form, either |ow|, |aw| or |w|, but not |o|. In (198) there is variation among different speakers. It is clear from this test that |o| has phonemic status word-finally.

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[68] Obviously the masculine associative marker can be suffixed only to masculine nouns. The same effect of vowel deletion occurs with the suffixation of any masculine associative marker or determiner, since they are all vowel-initial. Unfortunately for the purpose here, all feminine associative markers and determiners are consonant-initial, consequently never causing vowel elision in rule (278).

[69] This is the meaning given by Marouf Brahim, Mamat Abama and Moumoune Mademe. Mme Sali Hadja Habi, with whom I worked the most extensively, only knew this in the expression [zə̀və̀ʔá ʔú sá], meaning 'it's not my *business/ problem*'.

Turning to word-medial appearances of [o], it should be noted that, like |ay|, the back 'diphthong' |aw| never appears preceding a consonant; while there is no conclusive evidence of the kind given for |ay| in (183) and (184) above, nevertheless the distributional evidence offers a valid argument for positing the parallel rule below:

(200)   *'Diphthong' contraction*
         |aw| → [o]/ __C
         'A rhyme made up of the low central vowel and the labial-velar glide are contracted to a low front monophthong pre-consonantally.'

In addition, there is evidence supporting Tourneux's claim of a historically complex source. Below (3.5, *The zero vowel*) we give evidence of *–o* as a ventive suffix attached to verbs. Tourneux (2003a:294) suggests *(á)wá as a possible analysis of this suffix. Presumably he is referring to Newman's (1977b:115) Proto-Chadic *(a)wa, which may have indicated movement towards the speaker. Newman (p116) writes that this particle is synchronically realised *o* in many languages and further postulates (p129) that *o was probably non-existent in Proto-Chadic[70].

It seems that the phonologisation of |e| is somewhat more advanced than that of |o|. While the latter is clearly a phonemic vowel word-finally, it cannot be proved from my data whether or not it is present in the UR word-internally. Added to this is its complete absence as a lexical vowel in the verbal system, which is less susceptible to change than the nominal system. All this strongly supports Tourneux's claim that its phonologisation is an innovation, to which we can add that it is a more recent innovation than that of |e|.

3.3.2   The high vowels |i| and |u|

It was claimed above (3.1, *General characteristics of the vowel system*) that the high vowels |i| and |u| have phonemic status[71], but only in a word-final position. Elsewhere [i] and [u] are either the output of rule (9), *Glide vocalisation*, above, or a conditioned variant of the zero vowel (see rule (229) below). The evidence for their phonemic status word-finally is shown below.

3.3.2.1   The front vowel |i|

Applying the same test as applied to the low vowels above shows that word-final |i#| can be an underlying vowel:

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[70] It is possible that, while the ventive suffix *–o* in Lagwan is synchronically fully phonologised as a vowel, its original form has been maintained in the apparently irregular imperative form of the verb 'come':

(i)   a) |#l(w)+o#| → /ló/ - 'come' (cf. /lú/ - 'go')
         b) /àwà/ – 'come!'
More evidence is required.

[71] Here my findings for Lagwan differ from Tourneux's (2000b:5) for the Kotoko group as a whole, where the high vowels [i] and [u] are not distinctive segments underlyingly, but only conditioned variants of the high central vowel.

(201) a) |#nknx + i#| (L) → [ŋ̀kə̀nhì] - 'hide' (of animal)

b) |#nknx + i + a#ni#| (L+-+H#H) → [ŋ̀kə̀nhá ní] - 'its hide'[72]

c) |#nk + a + n + a + x + e#| (+L) → [ŋ̀kànàhè] - 'hides'

(202) a) |#tangi#| (L) → [tàŋgì] – 'arrow/ stinger'

b) |#tangi + a#ni#| (L+H#H) → [tàŋgá ní] – 'his arrow/ its stinger'[73]

c) |#tangi + Ce#| (+L) → [tàŋgìyè] – 'arrows/ stingers'

(203) a) |#maxʷsy#| (L) → [màχʷsì] – 'paddle' (n)

b) |#maxʷsy + a#ni#| (L+H#H) → [màχʷsⁱyá ní] - 'his paddle'[74]

c) |#maxʷsy + Ce#| (+L) → [màχʷsìyè] – 'paddles'

In (201)-(202), where two vowels meet, the first vowel, [i], is elided in accordance with the rule in (278) below. This happens both when the final vowel is functional, as in (201), and lexical, as in (202). It is clear that in the latter example the final |i#| is lexical, because, unlike the masculine gender marker, it surfaces in the plural form (refer to 2.4.2, *Labialised dorsal obstruents*, for a reminder of the relevant nominal morphology). By contrast, the word-final glide in (203), being consonantal, remains.

This evidence that |i#| can be phonemic word-finally is supported by further evidence from the verbs. In Lagwan there is a sub-class of verbs that exhibits the phenomenon observed elsewhere in Chadic languages of marking a pre-dative form (Newman's (1977b) D-form) - that is, where a verb has an overt dative complement. These verbs and their D-forms are given below:

	verb	*D-form*	*meaning*
(204)	/dí/	/dá/	'lead/ steer'
(205)	/ɬé/	/ɬá/	'draw'
(206)	/ví/	/vá/	'give'

It seems that the forms in the first column must be the underlying forms, with the D-forms being the product of the addition of a suffix, rather than vice versa, since the D-forms remain consistent while the proposed underlying form is unpredictable. The variant forms, therefore, must be lexically specified.

Further evidence that this surface [i] in (204) is underlyingly a vowel is found in the verbal noun when followed by a verbal extension, where |i|, as a vowel, is deleted by rule (278):

(207) |#di+u#| (+H) → [dú]

(not |#dy + u#| (+H)→ *[dⁱyú])

---

[72] hide-M 3m

[73] arrow-M 3m

[74] paddle-M 3m

While |i#| can be a phonemic vowel both in lexical words and functional morphemes, its back counterpart word-final |u#| only appears as an underlying vowel in functional morphemes. Indeed, there is only one morpheme for which there is clear evidence for an underlying |u|. This morpheme is the *-ú* suffix attached to the verbal noun of verbs with extensions. This suffix has the property of being 'root-vowel-integrating' – that is to say that any underlying vowel present in the verb root fully assimilates in quality to the suffix. Examples are given below:

	verb root	*/ + ú/*	*meaning*
(208)	|#kala#|	/kúlú/	'gather'
(209)	|#praka#|	/pə́rúkú/	'separate'
(210)	|#dgaya#|	/də́gúyú/	'try' (with extension)
(211)	|#dgʷala|	/də́gʷúlú/	'imitate' (with extension)

This assimilation applies to V-slots in the skeletal tier; the *-ú* suffix to which they assimilate must therefore also be associated with a V-slot.

3.4 'Long' vowels

Having accounted for the majority of appearances of surface vowels, there remain some slightly unusual appearances of vowels that are phonetically 'long'. These are found in a few words with like vowels separated by a glottal stop. These are given below (see also the loan word in (179)). Examples that are morphologically complex are excluded.

	noun	*possessive*	*plural*	*meaning*	
(212)	[kàʔà] (f)	[kànà]	[kàwèn]	'head'	
(213)	[ʁàʔà] (f)	[ʁànà]	[ʁèʔèn]	'house'	
(214)	[sèʔén] (f)	[sèʔénná]	-	'sand'	
(215)	[dùʔú] (f)	[dùʔúná]	[dùwè(n)]	'thorn'	
(216)	[kíʔí] (f)	[kíʔíná]	[kìʔìyè ~ kìʔìhè]	'fish'	(cf. Msər *kiti*)
(217)	[sóʔó]			(independent meaning unclear[75])	

These unexpected constructions may arise from the loss of a consonant; comparing the Msər word this certainly appears to be the case in (216). Remembering the free variation of [ɗ ~ ʔ] shown in section 2.8.3, *The glottal stop*, we might want to postulate that this consonant is [ɗ]. However, this would not be systematic conditioned variation, given counterexamples such as (218)-(219):

(218)	|#raɗa#xe#| (#H) → [ɾáɗà hé] – 'perch' (v)
(219)	|#skʷàɗa#| → [skwàɗà] – 'limp' (v)

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[75] This word appears in the associative constructions [bᵊlè sóʔó] – 'jealous man' and [mál ꞌsóʔó] – 'jealous woman'; it resembles the words for 'co-wife' used in Msər and Malgbe: /gərəm tə su/ and /grəm də yuu/ respectively.

An alternative explanation could be that these examples are morphologically complex, either by suffixation or reduplication of the final vowel, and the surface appearance of the glottal stop is allomorphic. It is certainly worth noting that all these words are feminine nouns, and as members of the same grammatical category share the same morphology.

A final possibility could be that, as we argued for the geminate consonants (2.5, *Gemination*), a single phoneme, here a vowel, is associated with two positions, here V-slots, on the skeletal tier. Rule (278) of vowel deletion does not apply, since this rule is dependent on two separate adjacent vowels in the phonemic tier. A glottal stop then surfaces purely as a phonetic phenomenon.

Given the very small number of nouns being dealt with here, it is not possible to come to a conclusion at this stage. Some possible interpretations were briefly above, but further research is needed to determine the best analysis.

3.5 The zero vowel

Having discussed the distribution of Lagwan's underlying vowels, let us now turn to a vowel that is not present in the UR; as is common in Chadic languages, Lagwan makes use of what, following Schuh (1971), we shall term a 'zero vowel'[76]. This zero vowel is not present in the input to the lexical phonology, but its insertion is rendered necessary for the purpose of syllabification.

There is clear evidence from the verbal morphology that /ə/ is not an underlying vowel. Among the verbal suffixes are three that are 'root-vowel-integrating': –*è*, forming the verbal noun of transitive verbs[77]; –*ú*, forming the verbal noun of verbs with extensions (already discussed in 3.3.2.2, *The high back vowel /u/*); and –*o*, the ventive suffix. Examples showing their 'root-vowel-integrating' nature are given below:

	root	/+è/	/+ú/	/+o/	*meaning*
(220)	/kálà/	/kèlè/	/kúlú/	/kólò/	'gather'
(221)	/dánà/	/dènè/	-	/dónò/	'transport'
(222)	/gálà/	/gèlè/	-	/gólò/	'hunt'
(223)	/pèràkà/	/pèrèkè/	/pə́rúkú/	-	'separate'
(224)	/də̀gàyà/	-	/də́gúyú/	-	'try' (with extension)
(225)	/də̀gʷàlà/	-	/də́gʷúlú/	-	'imitate' (with extension)
(226)	/ɬə́ná/	/ɬə̀nè/	/ɬə́nú/	-	'feel'
(227)	/ɬə́n/	/ɬə̀nè/	-	/ɬə́nó/	'lead, guide/ steer'
(228)	/wə́l/	/wə̀lè/	-	-	'melt' (tr)

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[76] Given its function and predictability, the word 'epenthetic' could equally well be employed to describe the behaviour of the high central vowel. Schuh prefers to avoid the term where (as in this case) the vowel bears contrastive tone.

[77] I suspect this is the same as the –*e* suffix used in the pseudo-passive. In both cases its suffixation prevents the verb from checking case on its complement, causing DP-raising in the pseudo-passive, in the case of the verbal noun necessitating the associative marker between verbal noun and complement.

In (220)-(226), the underlying vowel |a| takes on the quality of the 'root-vowel-integrating' suffix, in contrast to the zero vowel /ə/ in (223)-(228), which is unaffected[78]. This is especially clear in (223)-(226), where the verb contains both the underlying and the zero vowels. Given the integrating quality (for the verbal nouns in terms of tone as well as vowel quality) of these suffixes, it is safe to conclude that this suffixation is one of the earlier rules in the lexical phonology. Adding to this the evidence above, it is apparent that the zero vowel has no role in the phonology at this stage; its insertion must occur later in the derivation. This insertion will be discussed in section 4.1.2 below, *Zero vowel insertion*.

3.5.1 Phonetic realisation of the zero vowel

(229) *Zero vowel assimilation*
   a)   ə[79] → u/ ⎡ _(C)[+round, +back]⎤
                   ⎨ [+round, +back]_   ⎬
                   ⎣ [+round]_#   ⎦

   e.g: |#ɓgʷ#| → /ɓəgʷə/ → [ɓùgù] – 'beat'

   |#bref#| → /bərèfə/ → [brèfù] – 'have mild diarrhoea'

   b)   ə → (opt) [+round, +back, α high]/ ⎧ _[+round, +back, α high] ⎫
                                           ⎨ [+round, +back, α high]_ ⎬
                                           ⎩   ⎭

   e.g: |#txʷs#| → /tə́xʷsə̀/ → [tú χʷsə̀ ~ tó χʷsə̀] – 'remove grains with a pestle'

   |#ʁʷnan#| (L) → /ʁʷə̀nàn/ → [ʁùnàn ~ ʁònàn] – 'soup'

   c)   ə → i/_y[80]
        e.g: |#s'ya#| (HL) → /s'ə́yà/ → [s'íyà] – 'tear'

These rules apply both lexically and post-lexically; this must be the case since one part of rule (a) is dependent on the presence of a word-boundary, which is only accessible to the lexical phonology, but elsewhere the rules apply across word boundaries.

In the absence of the environments in (229) above, the zero vowel has the default realisation [ə].

Having discussed the behaviour of the zero vowel, we now turn to the process that necessitates its insertion: syllabification.

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[78] Returning to the problematic example in (11), repeated here in (228), the fact that the transitive verbal noun is not */wèlè/ proves that there is no underlying |u| vowel present.

[79] Strictly speaking the input here is not /ə/, but an empty V-slot.

[80] A similar rule optionally applies in the sub-lexicon of loan words, where there are pre-palatal consonants:
   (i)   ə → (opt) i/[-back, +high]_
            (see (106))

4 Syllabification and zero segment insertion

Syllabification and the accompanying phenomenon of zero vowel insertion are relatively early processes in the lexical phonology. At a post-lexical level, resyllabification occurs, permitting a wider range of syllable types. These separate processes at the different stages in the phonology are dealt with in two separate sections below: 4.1, *Lexical syllabification*, and 4.2, *Post-lexical resyllabification*.

4.1 Lexical syllabification

The initial process of syllabification permits two syllable types word-initially: CV and CV[C, -glot]. Word-medially V syllables are also permitted at morpheme boundaries. Word-finally only sonorants are permitted in the coda: (C)V([C, +son]). It is shown below that for many roots the underlying skeletal structure does not conform to these syllable types, hence zero segment insertion is required, either of the zero consonant (4.1.1 below) or of the zero vowel (see 4.1.2).

4.1.1 Zero consonant insertion

Certain words are vowel-initial and hence do not have the required onset. In order to preserve well-formed syllabification, a C-slot is inserted, triggered by rule (230) below:

(230)   *Zero consonant insertion*
         $\varnothing \rightarrow$ C/#_V
         'A C-slot is inserted immediately preceding a word-initial vowel.'

This C-slot is specified only for the feature [-syllabic]. While rule (91) would normally apply to floating consonants, forming a geminate, the zero consonant can only appear pre-vocalically and thus does not meet the criteria for this rule. Therefore it has the default phonetic realisation [ʔ] (see 2.3.2.3, *The zero consonant*). Examples are given below:

(231) |#alage#| (VCVCV) (L) $\rightarrow$ /ʔà.là.gè/ (CV.CV.CV) - 'south'

(232) |#amdi#| (VCCV) (L) $\rightarrow$ /ʔàm.dì/ (CVC.CV) - 'today'

4.1.2 Zero vowel insertion

For verbs, permissible underlying root skeletal structures are restricted in number and are formed in such a way that the vast majority of them are either vowelless, or have an initial consonant cluster (see Appendix i, *Verb skeletal structures*). Although the noun structures are less restricted, they are similar in that there is a comparative poverty of vowels. Structures such as these do not conform to the permitted syllable types outlined above, whereby a syllable must have a vocalic nucleus and cannot have a complex onset. Taking seven verbs with the five most common underlying skeletal structures, it can be seen the syllabification of the whole word is possible only in cases (f) and (g), and no syllabification can take place at all for the structures in (a)-(c):

(233)   a)   b)   c)   d) σ   e) σ   f) σ   g) σ σ

         C C   C C   C C C   C CV   C CV   CV   CVCV
         | | | | | | | | || | | | | | | | | |
         t kʷ   b n   g l k'   s ɗa   g m a   l a   ma g a
         'grill'   'bathe'   'wipe'   'roughcast' 'accept'   'lift'   'evade'

This problem is resolved by the insertion of the neutral zero vowel, a vowel slot inserted where required by the rules in (234) below. This vowel has the default realisation /ə/ (see 3.5.1, *Phonetic realisation of the zero vowel*). Where possible below, examples are given where the tone of the zero vowel differs from the rest of the word, thus proving that it is indeed present.

(234) *Zero vowel insertion*

   a) $\varnothing \rightarrow$ V/ $\left\{ \begin{array}{l} \#C^{81} \\ [-son]^{82} \end{array} \right\}$ _#

       e.g: |#bas'#| $\rightarrow$ /bá.s'ə̀/ - 'insult' (v)

   b) $\varnothing \rightarrow$ V/C_ $\left\{ \begin{array}{l} [+nas] \\ [C, +son]\# \end{array} \right\}$

       e.g: |#sn#| $\rightarrow$ /sə́n/ - 'know'

   c) $\varnothing \rightarrow$ V/ $\left\{ \begin{array}{l} [+glot] \\ \#[C, +son, -nas] \end{array} \right\}$ _C

       e.g: |#s'ya#| (HL) $\rightarrow$ /s'ə́.yà/ - 'tear' (v)

            |#lʁe#| (LH) $\rightarrow$ /lə̀.ʁé/ - 'lance'

   d) $\varnothing \rightarrow$ V/ $\left\{ \begin{array}{l} [C, -nas]\_CC \\ [+nas]\_[-voice][-son] \\ [+nas]\_[-son, +cont][-voice] \end{array} \right\}$ V

       e.g: |#drwa#| (L) $\rightarrow$ /də̀r.wà/ - 'clay jar'

            |#mzxʷ + i#| (L) $\rightarrow$ /mə̀z.xʷí/ - 'thief' (male)

---

[81] There is one morpheme where this rule does not seem to apply:

   (i) |n| $\rightarrow$ [ʔən] - 1sg object

This contrasts with the person/aspect/tense (PAT) marker below, where the rule in (a) does apply:

   (ii) |n| $\rightarrow$ [nə] - 2pl PAT

Note also that in (i), where the zero vowel precedes the consonant, a further 'zero' segment, the glottal stop, must be inserted to maintain well-formed syllabification, whereby the word-initial syllable must have an onset ((230) above).

I can think of two possible explanations for the apparent irregularity between (i) and (ii):

- The reason for the contrast is syntactic: in (ii), where the zero vowel follows the consonant, the morpheme is a head (T), preceding its complement; where the zero vowel precedes the consonant in (i), the morpheme is a complement (DP), following its head.
- In (i) [ə], instead of being the zero vowel, is actually the reduced form of |yn|. This reduction process occurs optionally with the feminine progressive PAT marker, where the unreduced form occurs rarely and only in careful speech, as below:

   (iii) |ynd| $\rightarrow$ [əndə ~ ində] – 3f prog PAT

[82] This rule has two exceptions:

   (i)   [sə́l:ák] – 'extremely'

   (ii)   [màtàbís ~ màtàbìs] – 'gift'

The first can be ignored, as it is an ideophone and as such is susceptible to exceptional syllable structure and tone. For the second, in continuous speech the zero vowel is inserted word-finally as predicted by rule (a), but not in isolation. Note that this noun also has an irregular tonal melody (see 5.1, *Lexical tone on nouns*), and as such may well turn out to be a loan word.

e) $\emptyset \rightarrow V/ \begin{Bmatrix} \# \\ C \end{Bmatrix} C\_[C, +son]$

   e.g: |#vle#| (LH) → /vɜ̀.lé/ - 'call'

         |#skle#| (H) → /ṣ.kə́lé/ - 'ostrich'

f) $\emptyset \rightarrow V/ \begin{Bmatrix} \# \\ C \end{Bmatrix} [+voice]\_[-cont]$

   e.g: |#zgi#| (LH) → /zɜ̀.gí/ - 'take'

g) $\emptyset \rightarrow V/ \begin{Bmatrix} \# \\ C \end{Bmatrix} [+voice, -cont]\_[-son]$

   e.g: |#dveɗ#| (LHL) → /dɜ̀.vé.ɗə/ - 'yesterday'

Returning then to the unsyllabified and partially syllabified examples in (233) and applying the rules in (234), zero vowel insertion and consequent syllabification take place as shown below[83]:

(235)   a) σ   b) σ   c) σ   σ   d) σ   e) σ σ

(235) diagram showing syllable structures:
a) σ over (C)CV over t kʷə 'grill'
b) σ over CVC over bə n 'bathe'
c) σ σ over CVCCV over g ə lk' ə 'wipe'
d) σ over (C)CV over s ɗa 'roughcast'
e) σ σ over CVCV over g əm a 'accept'

However, since complex onsets are not permitted in the lexical phonology, this still leaves floating initial consonants in (a) and (d). The rules in (234) are formulated such that this initial floating consonant may be a nasal, a voiceless obstruent or the initial C-slot of a geminate consonant; rule (c) ensures that non-nasal sonorants and glottalic consonants are always followed by the zero vowel where required, while rules (f)-(g) perform the same function for voiced obstruents. The initial C-slot of geminates does not appear to bear features other than [-syllabic], so is exempt from rules (c), (d), (f) and (g). We propose that at this stage in the derivation these floating consonants do not need to be syllabified; they are contingently extrasyllabic. The motivation for this proposal will be explained immediately below and still further evidence will be provided later in section 5.3.1, *Syllabic consonants and tone*.

4.1.3 *Extrasyllabicity and syllabic consonants*

We have just shown how certain word-initial consonants are left floating, that is they are contingently extrasyllabic, following the initial process of syllabification and zero vowel insertion. The reader may be wondering why it is considered necessary to postulate extrasyllabicity here, rather than simply permitting complex onsets. Evidence for the extrasyllabic nature of this initial consonant is found in the formation of the iterative pluractional. The pluractional form for unambiguous verbs – that is, verbs without the proposed extrasyllabic consonant – is shown below:

---

[83] It is not certain whether the rules in (234) insert a vowel segment in the phonemic tier as well as a V-slot in the skeletal tier. Here a /ə/ is inserted on the phonemic tier for ease of reading.

	verb	*iterative pluractional*	*meaning*
(236)	/gá.là/	/gə̀.gà.là/	'drive away'
(237)	/ʁʷə́r.ɬʼà/	/ʁʷə̀.ʁʷə̀r.ɬʼà/	'rub'
(238)	/ʁʷə̀.ví/	/ʁʷə̀.ʁʷə̀.vì/	'run (away)'
(239)	/sʼə̀.wà/	/sʼə̀.sʼə̀.wà/	'twist'
(240)	/sʼə́.yà/	/sʼə̀.sʼə̀.yà/	'tear'

The iterative pluractional appears to be formed by the rule in (241)[84]:

(241)   Iterative pluractional formation

$$\text{L} \atop {|\searrow}$$

$[C_1…]_V \rightarrow [C_1VC_1…]_V$

'The iterative pluractional is formed by reduplication of the initial consonant of the verb, followed by the insertion of a vowel slot[85]. The iterative pluractional has low tone.'

Consider now the pluractional of those verbs with the proposed extrasyllabic consonant, shown below, including the examples in (235)a) and (d), shown in (255) and (254) respectively[86]. The extrasyllabic consonant is placed between parentheses.

	verb	*iterative pluractional*	*meaning*
(242)	/(m̩)bə̀r/	/(m̩)bə̀.bə̀r/	'tire'
(243)	/(m̩)ɓí/	/(m̩)ɓì.ɓì/	'crawl'
(244)	/(m̩)tì/	/(m̩)tì.tì/	'die'
(245)	/(m̩)xə̀/	/(m̩)xə̀.xə̀/	'swear'
(246)	/(n̩)də̀.sə̀/	/(n̩)də̀.də̀.sə̀/	'groan/ grunt'
(247)	/(n̩)fé/	/(n̩)fè.fè/	'fight'
(248)	/(n̩)gà.mà/	/(n̩)gə̀.gà.mà/	'guard'
(249)	/(n̩)gʷə̀l/	/(n̩)gʷə̀.gʷə̀l/	'greet'
(250)	/(n̩)kʼə̀l/	/(n̩)kʼə̀.kʼə̀l/	'pass wind'
(251)	/(n̩)ɬí/	/(n̩)ɬì.ɬì/	'swim'
(252)	/(n̩)ʁé/	/(n̩)ʁə̀.ʁè/	'move'
(253)	/(n̩)tà/	/(n̩)tə̀.tà/	'alter' (with extension)
(254)	/(s̩)ɗà/	/(s̩)ɗà.ɗà/	'roughcast'
(255)	/(t̩)kʷə̀/	/(t̩)kʷə̀.kʷə̀/	'grill'
(256)	/(x̩)ɗà/	/(x̩)ɗà.ɗà/	'draw water/ ripen'

It seems that, for the application of rule (241), the initial consonant is completely invisible; in other words, it is extrasyllabic.

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[84] This rule will later be slightly revised in (296).

[85] The vowel-slot inserted usually has the default phonetic realisation /ə/, but in some cases assimilates to the quality of the following vowel. See examples.

[86] I am grateful to my colleague Aaron Shryock for collecting the important data in (254)-(256), with Marouf Brahim in Logone-Birni, for me.

Further proof of the extrasyllabic nature of these consonants will be given in section 5.2, *Tone on verbs*, where it is the syllable structure that determines the predictable tone realised on underlyingly toneless verbs.

4.1.3.1 Syllabic consonants

It was shown above that certain word-initial consonants are extrasyllabic to the initial process of syllabification; at this stage in the derivation they are floating. However, before the post-lexical rules of the language can be applied, everything must be syllabified; floating consonants are no longer permitted. The following late rule of default syllabification syllabifies all remaining floating consonants:

(257)   *Default syllabification*

               σ

     Ⓒ→ [+syl]
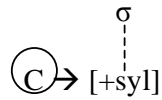
     'Any remaining floating consonant becomes syllabic.'

There is clear evidence for this in the behaviour of the masculine possessive associative marker, *-a*, when cliticised to low tone nouns. The tone of this clitic appears to be influenced by the number of post-lexical syllables in the noun it modifies. Consider first the post-lexically (following resyllabification; see rule (271)) monosyllabic nouns below:

	noun	*+ -a*	*meaning*
(258)	|##bly#| (L) → [bᵊlì]	[bᵊlì.yà]	'okra'
(259)	|##dar#| (L) → [dàɾ]	[dà.ɾà]	'gun'
(260)	|##fly#| (L) → [fᵊlì]	[fᵊlì.yà]	'well'
(261)	|##kle#| (L) → [kᵊlè]	[kᵊlà]	'dog'

Here the possessive associative marker is realised with a low tone. This contrasts with the polysyllabic examples below, where this clitic has a high tone:

	noun	*+ -a*	*meaning*
(262)	|##bzg + i#| (L) → [bə̀z.gì]	[bə̀z.gá]	'hip-chain'
(263)	|##ʁʷbe#| (L) → [ʁʷù.bè]	[ʁʷù.bá]	'trousers'
(264)	|##tangi#| (L) → [tàŋ.gì]	[tàŋ.gá]	'arrow/ stinger'
(265)	|##aɬ#| (L) → [ʔà.ɬə̀]	[ʔà.ɬá]	'bone'
(266)	|##as#| (L) → [ʔà.sə̀]	[ʔà.sá]	'foot'
(267)	|##ayni#| (L) → [ʔè.nì]	[ʔè.ná]	'milk'

Let us turn now to those masculine nouns consisting of the proposed extrasyllabic segment followed by a single syllable, shown below. Assuming the application of rule (257), these consist of two separate syllables[87] and consequently we would predict that such nouns should pattern with the polysyllabic nouns in (262)-(267), and not the monosyllabic nouns in (258)-(261); in other words, the clitic should bear high, rather than low, tone.

	noun	*+ -a*	*meaning*
(268)	|##mbay#| (L) → [m̩.bày]	[m̩.bà.yá]	'cassava'
(269)	|##mby#| (L) → [m̩.bì]	[m̩.bⁱyá]	'belongings/ clothes'
(270)	|##ms'al#| (L) → [m̩.s'àl]	[m̩.s'à.lá]	'hair'

This is indeed the case, proving that the initial consonant is a syllable in its own right. Still further evidence will be given below in section 5.3.1, *Syllabic consonants and tone*, where it is shown that this initial consonant can be a TBU.

All segments having been syllabified, the process of lexical syllabification is complete and the post-lexical phonological rules are applied. It is the post-lexical rules of resyllabification that will be studied below.

4.2 Post-lexical resyllabification

To summarise the rules studied above, following lexical syllabification, the input to the post-lexical component of the phonology consists of the following syllable types: C and CV(C) in word-initial position; (C)V(C) in word-medial position; (C)V([C, +son]) in word-final position. Post-lexically, the alterations described below take place to permit syllable types (C)C and (C)CV(CC); complex onsets and codas are permitted (by rules (271) and (277)b)) and all syllables must have an onset (by rule (278)).

(271)   Zero vowel deletion

a)   /ə/ → ∅/.[C, -glot]_ $\begin{Bmatrix} \text{[+son, -nas][-cons]} \\ \text{r##} \end{Bmatrix}$

e.g: \|#bla#\| (L) → /bə̀.là/ → (271)a) [bˀlà] – 'man'

\|#tr##\| → /tə́r/ → (271)a) tɽ́ → (16) [tɽ̥] – 'peel' (v)

b)   /ə/ → ∅/V[+son]_
'The zero vowel is deleted following a post-vocalic sonorant. This sonorant becomes the coda of the preceding syllable and the zero vowel is deleted.'
e.g: \|#lʁʷaɗ + e#lkʷ'yo#\| (L+L#LH) → /lə̀.ʁʷà.də̀.è. lə̀.kʷ'ə́.yó/ → [lə̀.ʁwà.dè

l.k'wí.yó] – 'clay'[88]

c)   /ə/ → ∅/[α round, α back, +nas][-cont, α round, α back, +voice]_C
'The zero vowel is deleted pre-consonantally following a homorganic voiced nasal-obstruent cluster. The nasal-obstruent cluster becomes a complex coda.'
e.g: \|#sambɗe#\| (H) → /sám.bə́.ɗé/ → [sámb.ɗé] – 'ladle'

---

[87] It is only the word-initial nasals and voiced geminates that maintain syllabic status post-lexically; post-lexical resyllabification in (277)b) desyllabifies the lexically syllabic voiceless obstruents to form complex onsets. Since the assignment of tone to the masculine possessive clitic is a post-lexical rule, it does not therefore count the initial voiceless obstruent as a separate syllable.
[88] ground-M clay

Following the rule given in (a), rule (272) below applies:

(272)   *Rhyme insertion*
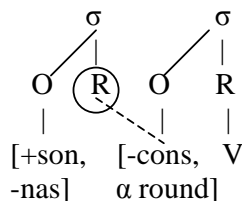
'A rhyme is inserted between a non-nasal sonorant onset and a glide. The glide features spread to this preceding rhyme.'

e.g: |#wa#mbr#ya#| (H#H#H) → /wá. m̀.bə́r. yá/ → [wá m.ˈbrí. yá] – 'I'm tired'[89]

In the rule given in (271)a, although the zero vowel has been deleted phonologically, except where the consequent onset consists of a plosive followed by the vibrant, phonetically a transition vowel is pronounced between the two consonants. However, it is clear that a syllable has been deleted from the data in (258)-(261); if the examples (258) and (260)-(261) were post-lexically two syllables, they would not pattern with the other monosyllabic nouns.

Furthermore, given the phonetic properties of the sequences and the phonemic contrasts in the language, there is strong perceptual motivation for pronouncing Cl clusters with open transition. Firstly, the contrast between labialised dorsal consonants and simple dorsal obstruents must be maintained. This is difficult when the consonant is immediately followed by another consonant; a short transition vowel, particularly for the labialised consonants, facilitates this. The examples below demonstrate this:

(273) |#kle#| (L) → [kᵊlè] – 'dog'

(274) |#kʷla#| (L) → [kᵘlà] – 'pool'

Secondly, it is natural phonetically to devoice a lateral immediately following a voiceless obstruent. This means that without open transition, the clusters |pl| in (275) and |pł| in (276) would be barely distinguishable, whereas the open transition in (275) enables the speaker to fully voice the lateral approximant:

(275) |#plam#| (L) → [pᵊlàm] – 'bench'

(276) |#pł#| → [płə̀] – 'chat/ count'

(277)   *Syllabic consonant desyllabification*
   a)
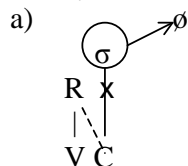
'A syllabic consonant is resyllabified as the coda of the preceding syllable.'

e.g: |#x + i#mɓlkny#| (+H#H) → /hí. m̀.ɓə́l.kə́.nə́y/ → [hí m.ˈɓə́l.kə́.ní] – 'geckos'[90]

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b)

```
        ∅
         \
         (σ)
          |χ O
         /‖ |
      ##C  C
          |
      [-voice]
```
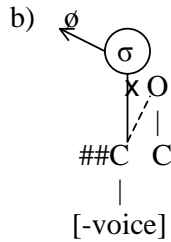
'When phrase initial, a syllabic voiceless obstruent is resyllabified to form a complex onset in the following syllable.'

e.g: |##sxe#| (L) → /##ṣ.xè/ → [##sχè] – 'farm/ field'

(278)   *Vowel deletion*
V → ∅/_V
'Where two vowels meet, the first is deleted.'
e.g: /gɘ̀.gɘ̀w.wè.í. má.sár/ → [gù.gù.wí. má.sár] – 'domestic pigeons'[91]

The rule in (278) above takes place following zero vowel deletion in (271). The evidence for this can be seen in the data in section 4.1.3.1 above, *Syllabic consonants*. In these examples the tone of the masculine possessive clitic is determined by the number of syllables preceding it; as was noted above, zero vowel deletion in (271) has already taken place. However, the vowel-final examples in (262)-(267) pattern with other poly-syllabic masculine nouns, even though their second syllable will later be deleted by rule (278) above.

The tonal effects of these post-lexical resyllabification rules will be discussed below in section 5.4, *Post-lexical realisation of tone*.

5 Tone

Lagwan has two contrastive phonological tones, low and high. On intensifiers the phonological high tone has a phonetic extra-high realisation:

(279) |#kɗam#|_INTENSIFIER (H) → [kɗǎm] – 'too much'

(280) |#pya#|_INTENSIFIER (H) (CCCV) → [pǐyːá] – 'very much'

(281) |#slak#|_INTENSIFIER (H) (CCCVC) → [sɔ̌lːák] – 'extremely'

Mid tone is found on a couple of nouns loaned from Classical Arabic, for one of which it appears in free variation with a low tone:

	Lagwan	*Classical Arabic*
(282)	[sɘ́msɘ̄m] – 'sesame seeds'	smm
(283)	[jàzárì ~ jàzárī] – 'butcher'	jzr

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[91] pigeon-pl-PL Egypt

Mid tone also appears in free variation with a low tone in (284). This noun is phonologically exceptional in other ways and so may also be a loan word.[92]

(284)   [də́b.də́.bə̀ ~ də̀b.də́.bə̄ ~ dúb.dú.bù] – 'shoulder blade'

Tone may be either lexical, derivational, grammatical, or may mark a boundary at the end of a phonological phrase. This paper focuses primarily on lexical tone.

5.1 Lexical tone on nouns

Lagwan is a typical Chadic language in that, excepting the lexical sub-set of loan words and compounds, only a restricted number of lexical tone melodies are found. In the noun system three major melodies are attested; L, H and LH:

Lexical tone melodies on nouns[93]					
1σ: 59	2σ: 250	3σ: 80	4σ: 7	5σ: 1	*Total:* 397
L: 34 (58%)	**LL**: 106 (42%)	**LLL**: 32 (40%)	**LLLL**: 4 (57%)		**L**: 176 (44%)
H: 25 (42%)	**HH**: 92 (37%)	**HHH**: 27 (34%)	**HHHH**: 2 (29%)		**H**: 146 (37%)
	LH: 51 (20%)	**LH**H: 17 (21%)			**LH**: 68 (17%)
	HL: 1	HHL: 4 (5%)	LHHL: 1 (14%)	LLLHH:1	Other: 2 (2%)

The surface realisation of the LH melody as LHH on tri-syllabic nouns shows that tone is associated left-to-right, with spreading. It is strongly suspected that the nouns with marginal tone melodies are actually loan words for which the source has not yet been identified. Certainly this would appear to be the case for melodies such as HHL, LHHL and LLLHH, where the surface melody does not appear to be the outcome of the usual left-to-right association.

The semantic load of tone on nouns is small, minimal tone pairs[94] being limited to the few examples below. In examples (286)-(291) the meaning of the two nouns is clearly related; we can note that the low tone forms, which are masculine, are used for the more generic meaning, while the (L)H forms, which are feminine, have a more specific meaning. Since there is also a gender difference between the two sets, it is questionable as to whether the change in tone is lexical or derivational. Similarly, in (292) the low melody is a grammatical feature of the plural noun; with, to my knowledge, only one exception[95], plural nouns are always low throughout.

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[92] Even where the variant is low, the melody HHL is unusual for non-borrowed words and does not fit the left-to-right tone association rule (see 5.1 below). Also, rule (229)a) does not apply for most speakers here. This rule is obligatory except in loan words, as exemplified below:

(i)   [kópə̀ ~ kópù] – 'cup' (< Classical Arabic *kwb*)

[93] Extrasyllabic nasals are invisible for the process of lexical tone association; at this stage in the derivation they have neither received tone, nor been syllabified. For this reason their default low tone is not taken into account here, nor are they counted as separate syllables. See 4.1.3 above and 5.3.1 below.

[94] The term 'minimal tone pairs' is used here to apply to pairs where it is only the information on the tonal tier that distinguishes the lexemes. This does not necessarily mean that the two are distinguished by a single tone, but rather by a single tone melody.

[95] /máwé/ - 'men'; sg. - /méní/

(285) L: [ʁùzùm] (n.f.) – 'hunger'   LH: [ʁùzúm] (n.f.) – 'leg'[96]

(286) L: [bùskwàn] (n.m.) – 'horse'   LH: [bùskwán] (n.f.) – 'mare'

(287) L: [ləʁwàɗə] (n.m.) – 'ground, land' LH: [ləʁwáɗə́] (n.f.) – 'country, ethnic area'

(288) L: [kˀlè] (n.m.) – 'dog'   H: [kˀlé] (n.f.) – 'bitch'

(289) L: [ɬìvì] (n.m.) – 'grass'   H: [ɬíví] (n.f.) – 'blade of grass'

(290) L: [ŋ̀kə̀nhì] (n.m.) – 'hide'   H[97]:[ŋ̀kə́nhí] (n.f.) – 'skin' (of human)

(291) L: [vìʃì] (n.m.) – 'breath'   H: [víʃí] (n.f.) – 'heart'

(292) L: [sè?èn] (n.pl) – grass (sp.)   LH: [sè?én] (n.f..) – 'sand'

There is also one contrast with a loan word:

(293) L: [màkàsə̀] – 'young girl's breast' HHL: [mákásə̀] – 'scissors' (loan[98])

5.2 Tone on verbs

Turning to the verb system, tone melodies are even more restricted; indeed, tone is lexically specified only on certain verbs containing underlying vowels. These verbs have the syllable structures and distribution shown below, where, following syllable constraints (see 4.1, *Lexical syllabification*), all word-final consonants are sonorants. Examples are given following each verb type. Throughout this section *V* is used to mean an underlying vowel, as opposed to the zero vowel.

Verbs with contrastive tone[99]		L	H	LH	HL
Di-C	Mono-V	CCV̀ = 16: /f̣ɗà/[100] Cə̀CV̀ = 16: /gə̀mà/[101]	CCV́ = 8: /ṣkí/[102] Cə́CV́ = 4: /ɬə́ná/[103]	Cə̀CV́ = 3: /sə̀mé/[104]	Cə́CV̀ = 5: /wə́ɬà/[105]
Tri-C	Mono-V	Cə̀CV̀C = 5: /kʷə̀làm/[106]		Cə̀CV́C = 2: /ɗə̀vál/[107]	
	Di-V		CV́CV́C = 1: /ɗákál/[108]		CV́CV̀C = 1: /ɬábàl/[109]

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[96] It is not certain here that it is the tonal melody alone that distinguishes these two, since it is impossible to tell from the surface form whether the underlying phonemes are |#ʁʷzm#|, |#ʁwzm#|, |#ʁzwm#|, |#ʁʷzwm#| or |#ʁwzwm#|. The latter three are not possibilities for [ʁùzúm], as is evidenced by the plural, [ʁùzàmmè] – 'legs'.

[97] The low tone on the initial nasal is not lexically specified. See 5.3.2.

[98] Source Classical Arabic *qs.s.*

[99] As with the nouns, in this table and in the table below the default low tone realised on extrasyllabic segments is not taken into account (see 5.3.1). However, in both tables we do take into account the C-slot on the skeletal tier with which the extrasyllabic segment is associated.

[100] 'inflate'

[101] 'accept, receive/ admit/ agree'

[102] 'be ruined, spoiled'

[103] 'feel'

[104] 'touch'

[105] 'cough'

[106] 'boil'

[107] 'be afraid'

[108] 'wait (for)'

Tone on other verbs (see exceptions in (302)-(304)), including all verbs with no underlying vowels, is entirely predictable. Tone is therefore predictable on a hundred and seventy-six out of two hundred and forty-two verbs in our corpus. The entire set of predictable patterns is shown below:

Verbs with predictable tone		L	H(L)
Mono-consonantal	Vowelless	(impossible)	Cá: /ɗə́/ - 'put'
	Mono-vocalic	(impossible)	CV́: /bá/ - 'pierce/ sow'
Di-consonantal	Vowelless	CCə̀: /psə̀/ - 'pay' Cə̀Cə̀: /ləbə̀/ - 'wash'	Cə́C: /ɓə́n/ – 'tether'
	Mono-vocalic	(impossible)	CV́C: /tél/ – 'shine' CV́Cə̀: /láxʷə̀/ - 'have diarrhoea'
	Di-vocalic	(impossible)	CV́CV̀: /dánà/ - 'transport'
Tri-consonantal	Vowelless	CCə̀C: /ʈkə̀m/ - 'measure' Cə̀Cə̀C: /wə̀sə̀l/ - 'deceive'	Cə́CCə̀: /ʁə́dgə̀/ - 'throb'
	Mono-vocalic	CCV̀C: /ʂkʷàl/ - 'look for' CCV̀Cə̀: /ɬxàtə̀/ - 'comb'	Cə́CCV̀: /vénnà/ - 'praise'
	Di-vocalic	CCV̀CV̀: /ʂkʷàɗà/ - 'limp' Cə̀CV̀CV̀: /s'əwàrà/ - 'squat'	(not attested)
	Tri-vocalic	(impossible)	CV́CV̀CV̀: /málàkà/ - 'rule over'
Quadro-consonantal	Vowelless	CCə̀Cə̀C: /ǹdə̀bə̀r/ – 'stagger'	(not attested)
	Di-vocalic	(not attested)	Cə́CCV̀CV̀: /bə́rbàʤà/ - 'write'

While it is not unusual in Chadic languages for certain verb types not to have lexical tone, commonly it is the initial consonant-type that determines the predictable tone of the verb. However, no evidence of interaction between consonant type and phonological tone has been found here or elsewhere in Lagwan. It seems rather to be syllable structure that is the determining factor; the same syllabic output does not appear in both L and H(L) columns in the preceding table. Firstly, rule (294) below assigns a default high tone to certain underlyingly toneless word-initial syllables:

(294)   *Default high tone assignment*
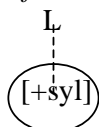
$$[C \left\{ \begin{matrix} ə \\ ə \ C(\ldots) \\ V \ (\ldots) \end{matrix} \right\}]_V$$

with H tone (dashed) linked above.
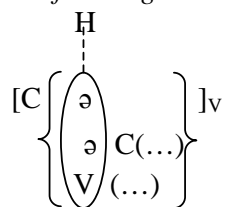
'In verbs, toneless syllables of the type #Cə#, #CəC and #CV receive a default high tone.'

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[109] 'destroy'

Following the application of rule (294), rule (295) assigns low tone to any remaining toneless TBUs.

(295)   *Default low tone assignment*

L

([+syl])

'Any toneless TBU receives a default low tone.'

These same rules apply when the skeletal and syllable structures are altered for morphological reasons. We have already noted that the iterative pluractional is always accompanied by low tone (see 4.1.3, *Extrasyllabicity and syllabic consonants*, rule (241), examples (236)-(256)). However, rather than regarding this as a morphological property, we can simply note that the iterative pluractional never has an initial syllable of the type #Cə#, #CəC or #CV, and so receives low tone by default based on syllable structure. The rule given in (241) can therefore be simplified as in (296) below:

(296)   *Iterative pluractional formation*
$[C_1…]_V \rightarrow [C_1VC_1…]_V$

Similarly, tone on the distributive pluractional is predicted by rules (294)-(295). The rule for formation of the distributive pluractional can be formulated as follows:

(297)   *Distributive pluractional formation*
$[C_1C_2…]_V \rightarrow [C_1aC_2…]_V$

'The distributive pluractional is formed by inserting an –*a*- infix between the initial two consonants of a verb.'

Examples are given below:

	verb	*distributive pluractional*	*meaning*
(298)	|#sɗa#| (L) → /ṣɗà/	/sáɗà/	'roughcast'
(299)	|#tf#| → /t̩fə̀/	/táfə̀/	'spit'
(300)	|#tkʷ#| → /t̩kʷə̀/	/tákʷə̀/	'grill'
(301)	|#wsl#| → /wə̀sə̀l/	/wásə̀l/	'deceive'

The formula in (297) is such that the criteria in (294) will always be met on the initial syllable, with low tone being assigned by (295) elsewhere.

So far we have given a description of the tonal behaviour on the set of underlyingly toneless verbs; the next stage is to attempt to provide an explanation. The following observations can be made: underlyingly toneless verbs do not have to have a high tone; no more than one high tone per verb is allowed; high tone is allowed only on the initial syllable; high tone appears on monosyllabic verbs, heavy syllables and (if we call the underlying vowel 'tense' and the zero vowel 'lax') tense vowels; high tone cannot be assigned where there is an initial consonant cluster. In many respects the realisation of tone on underlyingly toneless verbs resembles a predictable quantity sensitive stress system: there is no more than one 'peak' (high tone) per word; this 'peak' is realised at the periphery of the word (in word-initial position) and is attracted to prominent (heavy and tense) syllables. However, in a typical quantity-sensitive stress system, in the absence of the required prominent syllable, a default syllable receives the 'peak' instead. This is not the case with this set of verbs in Lagwan, whereby, in the

absence of the required word-initial prominent syllable, no 'peak' (high tone) is assigned; low tone is assigned by default. Therefore, while the set of underlyingly toneless verbs does not exhibit all the characteristics of a stress system, on a continuum between tone and stress the behaviour of these verbs would certainly be nearer the stress end.

However, there is one characteristic of this set of underlyingly toneless verbs that resembles neither a stress nor a tone system – the fact that a high cannot appear where there is an initial consonant cluster; all verbs in this set with initial consonant clusters must have low tone throughout. It is in considering this question of the initial consonant cluster that it is again clear why we are postulating the notion of contingent extrasyllabicity and syllabic consonants.

Let us consider first the implications of the alternative explanation, which has been rejected, whereby initial consonant clusters are tautosyllabic. Under this interpretation, syllable weight is important for tone or stress assignment not only in terms of the structure of the syllable rhyme, but also, totally unexpectedly, in that the make-up of the onset is taken into account. In stress systems the content of the onset is universally irrelevant for stress assignment, while for tone systems the material in the onset is significant only where there is consonant-tone interaction. As mentioned above, such interaction is absent from the Lagwan verb system.

On the other hand, if the initial consonant of a consonant cluster is, as suggested by rule (257), a syllable in its own right, it in itself is the initial syllable. This initial syllabic consonant, as a simple C syllable, is neither heavy nor does it contain a tense vowel; hence it does not meet the criteria for high assignment. The structure of consequent syllables is irrelevant, because a high can be assigned only to the initial syllable.

There are three verbs in our corpus whose tone melodies do not conform to the patterns above. One of these has the structure CVCə, which elsewhere always has a HL melody; here, however, the tone is high throughout:

(302)   [ɬˈáhə́] – 'laugh'

The other two exceptional verbs both have the structure CəCVCə:

(303)   [və̀nàhə́ ~ və̀náhə́] – 'vomit'
(304)   a) [ʤˀrèɗə] – 'slip'
         b) [ʤˀréɗə] – 'be slippery'

No other verb in our corpus has this syllable structure, while other verbs with the underlying structure CCV[+obs] all conform to the predictable patterns above. We do not attempt to analyse these forms at this stage, since they cannot be compared with other verbs of the same syllable structure, the tone in (303) is variable, and it is uncertain as to which of the forms in (304) is the unmarked form, and which is the derived form. It is certainly worth noting, however, that the verbs in (302)-(304) are all onomatopoeic and consequently may well be subject to exceptional tone.

Turning back to those verbs with lexically specified tone, it seems at first glance that these are those with the skeletal structures CCV([-syl, +son]) and CVCV[-syl, +son]. However, for the tri-consonantal structure, CCV[-syl, +son], where disyllabic, only two tone melodies are attested, rather than the expected four. Comparing these with the predictable patterns above, it can be seen that it is only the heavy CV[-syl, +son] syllable that contrasts; the Cə syllable bears low tone as elsewhere. While there are not sufficient examples of CVCV[-syl, +son] verbs to draw conclusions (our corpus provides only

two), here also it is only the heavy CV[-syl, +son] syllable on which the contrastive tone is realised; the light #CV syllable bears high tone as elsewhere. Further research on a larger corpus of verbs should shed further light on this matter.

Where tone on verbs is lexical, its semantic load is small. Within our corpus, of two hundred and forty-two verbs, only one minimal tone pair has been found:

(305) |#wɫa#| (HL) → /wə́ɫà/ – 'cough' |#wɫa#| (L) → /wə̀ɫà/ – 'fill'

5.3 The tone-bearing unit

The TBU is any [+syllabic] segment, in other words the syllable nucleus. This unit is associated in the initial syllabification process with the underlying vowels and the zero vowel. It was shown above (4.1.3.1, *Syllabic consonants*) that before the rules of post-lexical phonology apply, contingently extrasyllabic consonants are made syllabic by default. Therefore these syllabic consonants meet the criteria for the TBU. It is shown below that for the process of lexical tone association, the contingently extrasyllabic consonants are ignored; it is not until they are made syllabic that, if voiced, they become TBUs and as such are assigned default tones.

5.3.1 Syllabic consonants and tone

There is ample evidence that certain word-initial consonants bear low tone. The word-initial consonants in question are nasals in nasal+obstruent clusters and the initial C-slot of geminates. The evidence can be seen in the verbal morphology; the verbs below are preceded by the first person marker, *u*[110]. This morpheme has polar tone.

(306) |#ka#| (H) (CCV) → /ꞯká/:[ú k.ꞌká] – 'I hold' (c.f. |#ka#| → /ká/:   [ù ká] – 'I speak')
(307) |#mɓi#| (H) → /m̀ɓí/:   [ú m.ꞌɓí] – 'I crawl'
(308) |#nfe#| (H) → /ǹfé/:   [ú ɱ.ꞌfe ~ ú n.ꞌfé] – 'I fight'
(309) |#nɫi#| (H) → /ǹɫí/:   [ú n.ꞌɫí] – 'I swim'
(310) |#nʁe#| (H) → /ǹʁé/:   [ú N.ꞌʁé] – 'I move'

Firstly, the initial low tone causes the preceding polar tone to be realised as a high. Secondly, although, because of post-lexical resyllabification in rule (271) above, the low tone is not realised phonetically, its presence is shown by the following high being downstepped. This downstep can also be seen in the nominal morphology, where the low-tone-bearing initial nasal follows the high-toned plural associative marker, -*í*:

(311)   a) |#mparga#| (H) → /m̀.pár.gá/ → [m̀.pár.gá]- 'lamb'
         b) |#ʁli + i#mparga#| (L+H#H) → /ʁə̀.lì.í. m̀.pár.gá/ → [ʁˀlǐ mꞌ.pár.gá] – 'lambs'[111]

Comparison with a high-toned noun in this construction, where there is no downstep, proves that it is the low tone on the nasal that is causing downstep in (143), rather than a floating low being a property of the associative construction:

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[110] This is probably |#w#| → /wə/ → [u] (cf. |#w + a#| (H) → [wá] – 1sg perfective)
[111] children-PL lamb

(312) a) |#mawe#| (H) → /má.wé/ → [má.wé] - 'men'

  b) |#ʁli + i#mawe#| (L+H#H)→ /ʁə̀.lì.í. má.wé/ → [ʁˤlǐ. má.wé] - 'boys'[112]

Similarly, downstep is the result of post-lexical resyllabification in rule (271) above:

(313) /##k̬.ká/ → [kːꜜá] – 'hold!' (imperative)

Although here, unlike the examples in (306)-(311), there is no high tone preceding the downstepped high, the latter is realised at a lower pitch than an ordinary – where there is no floating low - phrase-initial high.

However, although it is evident that word-initial nasals and geminates bear tone, it seems that this tone is not lexical. To begin with, this tone is always low, never high; although TBUs, these segments do not bear contrastive tone. This is supported by comparing the tone melodies realised on nasal- and geminate-initial words with other nouns and verbs. A table of the tone of nasal+obstruent-initial nouns is given below; the low tone on the initial nasal is shown between parentheses):

Tone melodies on nasal+obstruent-initial nouns			Total:
syllables: N+**1**: 29	N+**2**: 63	N+**3**: 12	104
melodies: (L)**L**: 16 (55%)	(L)**LL**: 23 (37%)	(L)**LLL**: 4 (33%)	(L)**L**: 43 (41%)
(L)**H**: 13 (45%)	(L)**HH**: 28 (44%)	(L)**HHH**: 5 (42%)	(L)**H**: 46 (44%)
	(L)**LH**: 12 (19%)	(L)**LHH**: 3 (25%)	(L)**LH**: 15 (14%)

Comparing this table with that shown above in section 5.1, *Lexical tone on nouns*, it is clear that the low tone on the initial nasal is extra to the lexical tone melody; the previous table shows that tone association is a left-to-right process and hence melodies such as *LLH(H) are impossible, but if the first low is excluded LH(H) is perfectly acceptable. Likewise, comparing the distribution, similar patterns are found only if the initial low is ignored; for instance, forty-four per cent of the nasal+obstruent-initial nouns have the melody LH(HH), which is nearer the thirty-seven per cent of nouns in the earlier table with H(HHH) than the seventeen per cent with LH(HH), this latter being similar to the fourteen per cent of nasal+obstruent-initial nouns with the melody LLH(H).

The same conclusions can be drawn from a comparison between the tone realised on nasal+obstruent- and geminate-initial verbs with lexically specified tone – that is, those with the skeletal structure CCV – and the tone of those verbs with the same skeletal structure, tabulated in the previous section:

Tone of nasal+obstruent- and geminate-initial verbs of the structure CCV	
(L)**L** = 8: /(ŋ̀)gʷà/ - 'look at/ see'	(L)**H** = 6: /(ŋ̀)fé/ - 'fight'

If, ignoring the initial extrasyllabic consonant, these are considered to be monosyllabic, we would expect the two registers of high and low to surface, which, only if the initial low is excluded, is the case. Were we to hypothesise that the initial segment belonged to a separate syllable, we would expect the four possible melodies found on disyllabic verbs of this structure.

It seems then that for the process of lexical tone association, the word-initial nasal or geminate is contingently extrasyllabic. Prior to the post-lexical phonology, this floating consonant is firstly made syllabic by rule (257), and then, with other toneless syllables, assigned a default low tone by rule (295). Post-lexically, this low tone is fully functional, triggering downstep and polar tone.

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[112] children-PL men

In addition to nasals and geminates, it was shown that voiceless consonants may also be contingently extrasyllabic and therefore later become syllabic consonants by default (4.1.3.1, *Syllabic consonants*). However, these voiceless syllabic consonants do not bear low tone. This is evident from the absence of downstep in the example below (cf. (311)b)):

(314) |#ʁli + i#xtw#man#| (L#H#H) → /ʁə̀.lì.í. x̩.tə́w. mán/ → [ʁᵊlǐ. χtú. mán] – 'my nephews'
   (sister's children)

We propose that it is the feature [-voice] that blocks low tone assignment. Voiceless geminates, such as that in (313), are excluded from this blocking, since, at this stage in the derivation, the initial C-slot is marked only for the feature [syllabic]. This means that rule (295), assigning low tone, must occur before rule (91), whereby the initial C-slot of geminates is associated to the features of its neighbouring consonant.

5.4 Post-lexical realisation of tone

In section 4.2 above, *Post-lexical resyllabification*, it was shown that the number of lexical syllables may be reduced post-lexically. This loss of TBUs results in floating tones; in this section we examine the effects of these floating tones.

Firstly, following deletion of the zero vowel by rule (271), certain rules of reassociation are applied. As is shown by the association of the lexical tone melody in sections 5.1, *Lexical tone on nouns*, and 5.2, *Tone on verbs*, the lexical phonology does not allow contour tones; however, in the post-lexical phonology, in order to preserve the lexical tone melody, contour tones are employed as a last resort, by rule (315) below:
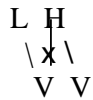
(315)   *Floating tone reassociation*

Ⓛ H
  ˎ |
    V
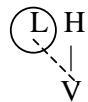
'A floating low[113] is reassociated to the succeeding TBU to form a rising tone.'
e.g: /và.lé/ → [vᵊlě] – 'call'

Following this rule, since the language prefers not to have contour tones, where the lexical tone melody may still be preserved rule (316) below delinks the high of the contour:

(316)   *Contour tone delinking*

L H
 \ x̶ \
   V V

'A multiply associated high forming the second tone of a rising contour tone is delinked from the contour.'
e.g: /kʷə̀.lé.sə́/ → [kᵘlè.sə́] – 'dry season'

It seems that these two rules in (315) and (316) apply before syllabic nasals are resyllabified by rule (277); this is clear from the examples in (306)-(311) above, whereby the low does not reassociate but is left floating, causing downstep. This downstep is due to the phenomenon of downdrift in the language,

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[113] No examples of floating lexical high tones have been found.

whereby the floating low, although not pronounced in itself, nevertheless behaves like any other low in lowering the pitch of the following high.

5.5 Phonetic effects on pitch

We examined above the surface realisation of phonological information, as a result of reassociation or floating tones and downdrift resulting in downstep. The surface realisation of pitch may also be affected by phonetic information.

Firstly, consider the rule of reassociation in (315) above, resulting in a phonological rising contour sequence. Where this rule is necessitated by zero vowel deletion in rule (271)a, it was shown in section 4.2, *Post-lexical resyllabification*, that there is phonetic open transition. The rising contour on the syllable with this open transition tends to be realised with a low-pitched short transition vowel and a high-pitched vowel nucleus.

In addition, certain segments act as pitch-raisers or depressors. The high vowels [i] and [u], as well as the two implosives, [ɓ] and [ɗ], tend to raise the pitch slightly. This is especially prominent phrase-finally. Consequently, in (307), although phonologically a floating low is followed by a high tone – the environment for downstep - , phonetically, especially if phrase-final, the combined effects of the pitch-raisers [ɓ] and [i] minimise the lowering effects of downstep.

Voiced obstruents may act as pitch-lowerers on a following tone, but only in the specific environment of [-son, +voice].[C, +voice]. This environment occurs in the nouns below:

	noun	*phonetic pitch* [˥ ˦]	*meaning*
(317)	|#gʷdg + e#| (H) → /gʷə́d.g⁽ʷ⁾é/	[gudᵘ.g(w)e]	'toad'
(318)	|#magʷr + e#| (H) → /mágʷ.ré/	[magʷ.re]	'bean'
(319)	|#maʁʷda#| (H) → /máʁʷ.dá/	[maʁʷ.da]	'army ant, soldier ant'
(320)	|#mandgya#| (H) → /mán.də́.gə́.yá/	[mandᵊ.gⁱya]	'cat'

Here the verbs have a high tone melody spreading across the word; however, the [-son, +voice].[C, +voice] environment slightly lowers the pitch of the following high. The phonetic realisation here resembles the downstep examples seen in (306)-(311). However, in the nouns in (317)-(320) there is no floating low tone. Supposing there were a low tone here, the resulting tone melody would be HLH, which, as we saw in section 5.1, *Lexical tone on nouns*, is unattested on any other noun. Even more convincing is the evidence of syllable structure: the language inserts the zero vowel only where necessary; also it does not allow contour tones lexically. Were we to hypothesise that there were a suppressed lexical low tone here we would have to postulate the presence of a suppressed syllable; however, the rules of lexical syllabification, which permit a CVC(C) syllable word-internally, do not trigger the insertion of a zero vowel between the [-son, +voice] and [C, +voice, -nas] segments[114], so there is no suppressed syllable here.

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[114] This is especially clear from the example below:

    (i)   /ʁə́d.gə̀/ - 'throb'

Remembering the default rule of high tone assignment on verbs in (294), high tone can only be assigned if the initial syllable is #CəC, not if the verb as a whole is #Cə.Cə.Cə.

Finally, there is evidence of idiolect-specific post-lexical maximisation of the onset. One of the speakers I worked with, M. Awalou Adam, would resyllabify post-lexically so that, where a word-initial onset is possible post-lexically, this same onset would be formed word-internally. Consequently he would syllabify (318) above as follows:

$$[\overline{} \quad \overline{}]$$

(321) |#magʷr + e#| (H) → /mágʷ.ré/   [ma.gʷɾe]   'bean'

When thus syllabified there is no syllable break between the [-son, +voice] and [+voice] segments; the environment for pitch-lowering identified above is not present. As predicted, under this maximisation of the onset the high pitch remains level throughout.

6 Conclusion

This paper has shown how Lagwan has a rich consonantal system, with consonants belonging to four major points of articulation: labial, coronal, dorsal and labialised dorsal. The evidence suggests that this latter series, while synchronically a phonological class in its own right, has its historical source in a labialisation prosody. The effects of this remain manifest in the 'semi-prosodic' distribution of the labialised dorsal obstruents. The sub-lexicon of loan words has a fifth class of palatal obstruents. Further research into loan word phonology as well as a larger corpus of data are required to shed further light on the extent of the phonologisation of these palatal consonants.

The rich consonantal skeleton is supplemented by a poverty of vowel-slots. Underlying vowels principally have the quality |a|, while four other vowels have emerging phonological status, with a greater number of vowel contrasts observed word-finally. The front vowels are more productive than their round counterparts; this apparent bias is balanced by the series of labialised obstruents in the consonant system. The poverty of underlying vowels is balanced by the insertion of 'zero vowels' to preserve well-formed syllabification. The zero vowel is characterised by its absence in the UR, its early insertion and predictability in the lexical phonology and its ability to bear contrastive tone, this being associated within the lexical phonology.

While Lagwan is typical of a Chadic language in its diversity of consonants, poverty of vowels and consequent zero vowel insertion, its syllabification rules have resulted in the exceptional post-lexical phenomenon of syllabic consonants. Similarly, Lagwan is typical in that lexical tone carries far greater weight on nouns than verbs, only a small sub-set of this latter category being underlyingly specified with lexical tone. However, Lagwan is exceptional in that, for verbs underlyingly unspecified for tone, it is the syllable structure that determines the realisation of default tone; in this respect the set of underlyingly toneless verbs resembles a predictable quantity-sensitive stress system. While other Chadic languages allow consonant types to have a major impact on tone, Lagwan limits this to a minor effect at the level of phonetic realisation. Post-lexically, Lagwan also exhibits the phenomena of downdrift and downstep.

Appendix

i. Verb skeletal structures

In the majority of cases, verb roots are made up of one, two, or three consonants, with up to three vowels (though cases with three vowels are few). The structure of verb roots is such that vowels must always be broken up by consonants, and consonant clusters always appear at the beginning of the word.[115]

Statistically this gives the following distribution of structures (excluding cases of reduplication). Surface [-son, +back][-cons, +round] sequences are always treated as a single labialised dorsal obstruents. Word-final [i] is always treated as underlying |i|.

Verbs	Mono-consonantal	Di-consonantal		Tri-consonantal		Quadro-consonantal	*Totals*
Vowelless	C=4	CC=53		CCC=24		CCCC=1	82
Mono-vocalic	CV=27	CCV=63	CVC=11	CCCa=6	CCVC=14	CCCaC=1	122
Di-vocalic	(impossible)	CaCa=21		CCaCa=10	CaCaI=2	CCCaCa=1	34
Tri-vocalic	(impossible)	(impossible)		CaCaCa=4		(not attested)	4
Totals	31	148		60		3	242

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[115] The same pattern occurs as a result of –a- infixation in the plural form of nouns.

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