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LABIALISATION AND PALATALISATION IN MOLOKO

Catherine Bow

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Key to Symbolisation of the Data

[....]	phonetic data	
/..../	phonemic data	
'....'	specific English gloss	
('...')	generic English gloss	e.g. ('bird') = 'type of bird'
V	vowel	
C	consonant	
v	epenthetic vowel slot	
L	liquid	
/^{w}.../	labialised word	
/^{y}.../	palatalised word	
C^{w}	labialised consonant	
~	alternates with (free variation)	
->	realised as	
#	morpheme/word boundary	

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INTRODUCTION

Moloko is a Chadic language spoken by around 12,000 people on and around Moloko Mountain, in the arrondissement of Tokombéré, department of Mayo-Sava, in the Far North Province of Cameroon. It belongs to the sub-group South of the Mafa group, of the Biu-Mandara A (or Central Chadic) sub-branch of the Chadic language family (Bow 1997), classified in the ALCAM (Dieu & Renaud 1983) as 'melokwo' [154].

As in many other Chadic languages, particularly in the Central Chadic sub-branch, the processes of labialisation and palatalisation form a significant part of the phonology and morphology of the Moloko language.

Labialisation is a secondary articulation, characterised phonetically by lip-rounding and raising the back of the tongue towards a velar position (ie. labiovelarisation). Palatalisation refers to any articulation involving a movement of the tongue towards the hard palate. In Moloko these both function as word-level prosodies.

Wolff (1981:144) refers to "the notion of 'prosodies' as abstractions apart from the consonant and vowel systems, i.e. 'unplaced' sources of palatalisation and labiovelarisation rather than segmental phonemes within linear structures are assumed to account for vocalic surface realisations other than [ə] and [a]."

1. VOWELS

1.1 Phonemic and Phonetic Vowels

The vowel system of Moloko can be analysed as having one underlying vowel /a/. This gives us a two-way system, relying on the presence or absence of this vowel in any position within the word. The absence of a vowel requires an epenthetic vowel to break up consonant clusters, however this epenthetic [ə] is not a phoneme in itself. These two central vowels, in turn, can undergo processes of labialisation and palatalisation, as well as certain allophonic rules, to create a system of nine surface vowels.

1.1.1 Labialisation and Palatalisation

Labialisation and palatalisation are word-level prosodies. They spread leftward from the end of the word, affecting all vowels, and certain consonants. On the central vowel phoneme /a/, the backing and rounding movements of labialisation cause it to be realised as [ɔ]. The raising and fronting of palatalisation cause /a/ to be realised as [ɛ]. Both prosodies can simultaneously affect /a/ and create the front rounded vowel [œ].

Epenthetic schwa can also be palatalised to become [ɪ] and labialised to become [ʊ]. There is however a phonetic gap left by the absence of a high vowel with both palatalisation and labialisation *[ü].[1] Adjacent to semi-vowels, [ə] realises the allophones [i] and [u] (ref: §2.1).

1.1.2 Features of vowels

From a single underlying vowel phoneme, with the effects of labialisation and palatalisation, and with the addition of an epenthetic vowel and its allophonic realisations, there is a system consisting of nine surface

[1] In this paper I will follow the conventions of Chadic literature by using [y] to represent the palatal approximant. See §2.1) for discussion of the high front rounded vowel represented by [ü].

vowels: [i, ɪ, ɛ, œ, ə, a, ɔ, ʊ, u].[2] These can be distinguished using four features: the feature of height distinguishes between [a] and [ə]and their realisations (with [+/-Low] the marked feature since epenthetic [ə] functions as the unmarked vowel), while the feature ATR distinguishes between [i, ɪ] and [u, ʊ]. Palatalisation and labialisation cause the fronting and backing effects already mentioned. This gives us the following feature chart:

	i	ɪ	ɛ	œ	ə	a	ɔ	ʊ	u
LOW	-	-	+	+	-	+	+	-	-
ATR	+	-	-	-	-	-	-	-	+
PAL	+	+	+	+	-	-	-	-	-
LAB	-	-	-	+	-	-	+	+	+

Table 1: Vowel feature chart

At the underlying level, we will represent the prosodies using superscript symbols: /ʷ/ to represent labialisation and /ʲ/ to represent palatalisation.

1.1.3 Vowel harmony

Throughout the data, there is a clear pattern of vowel harmony. All vowels in any mono-morphemic word will carry the same prosody (either zero, labialisation or palatalisation). It is the final syllable which bears the prosody underlyingly, which then spreads leftwards throughout the word. This includes both underlying and epenthesised vowels.[3] The following examples illustrate the three possible underlying prosody patterns (rules governing the final vowel will be discussed in §1.2.2):

1)

∅:	/ft/	[fat]	'day/sun'	/harts/	[harats]	'scorpion'	/matabɬ/	[matabaɬ]	'cloud'
LAB:	/ʷhd/	[hɔd]	'stomach'	/ʷbaɮm/	[bɔɮɔm]	'cheek'	/ʷtalaln/	[tɔlɔlɔŋ]	'chest'
PAL:	/ʲdzn/	[dʒɛŋ]	'chance'	/ʲmahr/	[mɛhɛr]	'forehead'	/ʲmababk/	[mɛbɛbɛk]	'bat'

1.2 Vowel slots

1.2.1 Distribution of vowels

At surface level, Moloko has three basic syllable types:

V - word-initial only

CV - the most common syllable type, appearing in any position within the word

CVC - word-final only [4]

CV syllables have no segmental restrictions, allowing any consonant and vowel combination. V syllables are restricted to /a/ (which may be an old prefix, see §1.2.5). Restrictions on vowels in word-final syllables, whether CV or CVC, will be considered in the following section.[5] The influence of the liquids /r/ and /l/ on syllable types will be discussed under §3.4.1.

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[2] Some speakers also distinguish between [a] and [æ] in certain environments (§1.2.5), but this will not be treated here as a distinct allophone because it is not in general use.

[3] Exceptions to this general rule will be examined in §1.2.5 and §3.2.2.

[4] Fast speech phenomena, where CC clusters occur more commonly with reduction or absence of epenthesised vowels, will not be discussed in this paper. In §3.4 we will observe another source of CC clusters.

[5] Restrictions on word-final consonants also exist, but will not be discussed here

The basic structure of any Moloko word is a consonantal skeleton, and between each consonantal segment[6] is the possibility of a vowel slot. We will call a [+Low] vowel slot any which is filled by /a/, which on the surface will be realised as [a], [ɛ] or [ɔ], depending on the prosody of the word. Potential vowel slots, not marked in the underlying representation, will normally be filled by a [-Low] epenthetic vowel [ə], [ɪ] or [ʊ], as in the following examples:

2)	Ø:	/kra/	[kəra]	'dog'	/mdga/	[mədəga]	'older sibling'
	LAB:	/ʷgza/	[gʊzɔ]	'kidney'	/ʷ bmbala/	[bʊmbɔlɔ]	'greed'
	PAL:	/ʸ gva/	[gɪvɛ]	'game'	/ʸ vmata/	[vɪmɛtɛ]	'neighbour'

1.2.2 Word-final vowels

As in the examples in (2) above, the final vowel of a word is always [+Low]. In closed syllables, the [+Low] vowel is only realised in a pre-pausal context. Therefore in citation form, or at the end of a phrase or sentence, the final vowel of any word must be [+Low]. However, in other contexts, i.e. non-pre-pausally, the final vowel may be either [+/-Low] (see §1.2.4 for discussion).

3)	CITATION FORM:	[ɗaf]	'food'	
	CONTEXT FORM:	[ɗəf-ʊla]	'my food'	(morpheme boundary)
	CONTEXT FORM:	[ɗəf atsar]	'(the) food is good'	(word boundary)
	PRE-PAUSAL:	[na zʊm ɗaf]	'I eat food'	

Therefore it is necessary to posit the underlying form of this word as /ɗf/, which requires the epenthesis of [ə], and write a rule which states that pre-pausally, the final vowel in a word must become [+Low].

4) V -> [+Low] / _ C #

Since the vowels of word-final open syllables are always [+Low], we will continue to write the final vowel in the underlying form for those words. Final vowels in closed syllables will not be marked underlyingly, however we will use the citation form for the surface representation, as in the following examples:

5)	Ø:	/hmɗ/	[həmaɗ]	'wind'	/ggmj/	[gəgəmay]	'cotton'
	LAB:	/ʷgzm/	[gʊzɔm]	'alcohol'	/ʷ bmbala/	[bʊmbɔlɔ]	'greed
	PAL:	/ʸ hndr/	[hɪndɛr]	'nose'	/ʸ mdgr/	[mɪdɪgɛr]	'hoe'

The following sets of words have mostly the same segments and prosodies, but differ in whether the final syllable is open or closed. Compare their underlying representations:

6)	**Ø:**	/hara/	[hara]	'metal'	/harf/	[haraf]	'medicine'
	LAB:	/ʷ hamba/	[hɔmbɔ]	'flour'	/ʷ hambh/	[hɔmbɔx]	'pardon'
	PAL:	/ʸ dada/	[dɛdɛ]	'beetle'	/ʸ dadw/	[dɛdɛw]	'morning'

1.2.3 Non-final position

In non-final position, it is not predictable as to whether a vowel slot is [-Low] or [+Low].

Consider the following sets of minimal pairs:

7)	/bly/	[bəlay]	'sea'	/baly/	[balay]	'wash'
	/dry/	[dəray]	'head'	/dary/	[daray]	'plant'
	/mbɗy/	[mbəɗay]	'change'	/mbaɗy/	[mbaɗay]	'choose'

[6] Some consonantal segments are written with two graphemes, eg. pre-nasalised consonants /mb, nd, ng, nz/ and affricates /ts, dz/. For consonant phoneme inventory, see §3.1.

In these cases, the same consonantal skeleton can have two realisations, depending on whether the vowel slot in non-final position is filled with a [+Low] or [-Low] vowel.

The following three-syllable words (all using vowels unaffected by prosodies) indicate the complete range of possible structures. [+Low] vowel slots are marked with V, epenthesis slots with v in the first column.

8) V-final	/CvCvCV/	/mdga/	[mədəga]	'older sibling'
	/CvCVCV/	/mndava/	[məndava]	'scar'
	/CVCvCV/	/dagla/	[dagəla]	'calabash'
	/CVCVCV/	/manzara/	[manzara]	'termite'
9) C-final	/CvCvCC/	/ggmy/	[gəgəmay]	'cotton'
	/CvCVCC/	/ttark/	[tətarak]	'shoe'
	/CVCvCC/	/madrs/	[madəras]	'pig'
	/CVCVCC/	/matabɬ/	[matabaɬ]	'cloud'

1.2.4 Presence vs absence of vowel

Two words can have the same surface representation, while differing in their underlying form. The following verbs have identical surface forms in the second person singular imperative:

10a) [tsar] 'climb!'

[tsar] 'taste good!'

However, when we consider the second person plural conjugations (formed by adding the suffix /ʷ-am/ which has a labialisation prosody, see also §3.2.1), we can see the differences in the underlying form:

10b) [tsʊrɔm] 'climb' (pl)

[tsɔrɔm] 'taste good' (pl)

The contrast here is between the [-Low] [ʊ] and the [+Low] [ɔ], which tells us that the underlying form of the verbs differ in their vowel slots:

10c) /tsr/ 'climb'

/tsar/ 'taste good'

To identify whether the final vowel slot is unfilled at the underlying level, in certain cases we have access to the external evidence of reduplication.

11) [ɮəkəɮak] 'winged termite'

The reduplicated syllable is underlyingly /ɮk/ with [-Low] vowel slot, which is indicated by the presence of [ə]in the first syllable. In the final syllable, pre-pausally, this slot must be filled by the [+Low] vowel [a]. If the surface form was *[ɮakəɮak], this would indicate the presence of a [-Low] vowel slot in the reduplicated syllable, as in the following example:

12) [tʃɛtʃɛ] /ʸ tsatsa/ 'louse'

where it is clear that the reduplicated syllable is /tsa/ because it has a [-Low] vowel in the first syllable, rather than *[tʃitʃɛ] which would come from */ʸ ts tsa/. Other examples of this contrast include:

13)	/ʸ tsm/	[tʃɪmtʃɛm]	('tree')
	/ʸ kakɓ/	[kɛkɪɓkɛkɛɓ]	'sharp' (ideophone)
	/ʷhvat/	[hʊvɔthʊvɔt]	'softness' (ideophone)

Without this type of external evidence, there is no way of knowing whether the final vowel slot is underlyingly present or not.

1.2.5 Exceptions to vowel harmony

One of the exceptions to the rule of vowel harmony is a sub-class of vowel-initial nouns.

14)	**PAL:**	[alɛ]	'eye'	[atɛmɛ]	'onion'	[aɬɛɬɛd][7]	'egg'
	LAB:	[amɔm]	'bee'	[azʊŋg^{w}ɔ]	'donkey'	[ambɔdɔts]	'sugar cane'

In each of these cases, the initial vowel always remains [a] despite whatever prosody spreads over the remainder of the word.

There are a number of possible ways to interpret this phenomenon:

a) since V-syllables are restricted to [a], then the presence of a word-initial /a/ blocks any prosodic spreading to this syllable.

b) since V-syllables are restricted to /a/, then a rule must be applied which changes any other V-syllable vowel to /a/ at a surface level. However, this seems counter-intuitive, if an underlying /a/ goes through one process of, say, palatalisation, then this process is undone before reaching the surface phonetic level.

c) the prosody may spread rightwards from the left, in these cases beginning at the second syllable, however this would be exceptional in the language, where prosodies consistently spread leftwards from the end.

d) that /a/ was once a separate morpheme whose function has now been lost.

This last option seems the most tenable. Most of the words which carry this initial [a] are very common, everyday words in the language, (eg. [ahar] 'arm/hand', [asak] 'leg, foot', [aɗijɛŋ] 'bird') which would therefore be less susceptible to change. Other external evidence comes from comparing words in the neighbouring language Mbuko (Mbuagbaw: 1995)

15)	**Moloko**	**Mbuko**
'onion'	[atɛmɛ]	[teme]
'donkey'	[azʊŋg^{w}ɔ]	[zuŋgo]

Since this process does not adhere to the rules of vowel harmony, it must be concluded that word-level prosodies do not spread to a word-initial prefix. Further investigation is required on the spread of prosodies across morpheme boundaries.

Other exceptions to the vowel harmony rule will be considered under §3.2.2.

2. SEMI-VOWELS

2.1 Semi-vowels and vowels

Moloko has two semi-vowel phonemes: a labiovelar approximant /w/ and a palatal approximant /y/. They function as consonants in the language, their vocalic counterparts being [i] and [u], which are allophones of schwa. The close relationship between the semi-vowels and their vocalic counterparts is maintained through the rules governing the following allophonic processes:

16a)	[ə] -> [i] / _ y	eg. /kya/	[kiya]	'moon'	/^{y}myk/	[miyɛk]	'deer'
16b)	[ə] -> [u] / _ w	eg. /ɗwa/	[ɗuwa]	'milk/breast'	/^{y}ɗwr/	[ɗuwɛr]	'sleep'
	/ w _	eg. /wɗaky/	[wuɗakay]	'separate/share'			

According to these rules, schwa assimilates to the palatal and labial features of the adjacent semi-vowel.

The vowel phoneme /a/ is not affected by semi-vowels, as in the following examples:

[7] As mentioned above, some speakers have an allophone [æ] in this environment: /a/ -> [æ] / # _ Cɛ

17) /layw/ [layaw] 'squash' /yaʤy/ [yaʤay] 'tire' (vb) not *[yɛʤɛy]
/mawr/ [mawar] 'tamarind' /gnw/ [gənaw] 'animal' not *[gʊnɔw]

It should be noted that the semi-vowels themselves do not cause the processes of palatalisation or labialisation to occur. For example, the presence of the labiovelar semi-vowel /w/ in any position within a word (including word-finally) does not imply that there will be a labialisation prosody across the word. In fact, in my data, I have no examples of words containing /w/ which have a word-level labialisation prosody, though several cases with either zero or palatalisation prosody.

Similarly with the palatal semi-vowel, the above examples (from 16) indicate that the presence of [y] is independent of any palatalisation prosody, although it may occur within a palatalised word.

18) /ʷsky/ [sukʷɔy] 'clan' /ʸhayw/ [hɛyɛw] 'cricket' cf. /byw/ [biyaw] 'next year'
/ʸtanzw/ [tɛnʒɛw] 'mosquito' /ʸdadawa/ [dɛdɛwɛ] ('bird')

As noted above (§1.1.1) there is a phonetic gap, in the absence of a high front rounded vowel *[ü]. It seems that while the full vowel [a] can carry both palatalisation and labialisation (in the realisation [œ]), the epenthetic vowel [ə] cannot, and the vowel [u] fills the slot.

19) /ʸmtwz/ 'sorrel fruit' -> [mɪtuwɛʒ] *[mɪtüwɛʒ]
/ʸnzwalk/ 'sorrel plant' -> [nʒuwɛlɛk] *[nʒüwɛlɛk][8]

There is therefore no [-Low] variant of the front rounded allophone of /a/.

2.2 Semi-vowels and consonants

Word-final semi-vowels are realised as vowels in non-utterance-final position before consonants. This requires the assimilation rule mentioned above (§2.1) and a rule of semi-vowel deletion. The following examples show how such a result is derived:

20a)	COMPONENT WORDS:	/zy/ [zay] 'peace'	/ʤw/ [ʤaw]	('question marker')
	UNDERLYING FORM:	/zy ʤw/		
	VOWEL EPENTHESIS:	zəy ʤəw		
	UTTERANCE-FINAL LOWERING:	zəy ʤaw		
	ASSIMILATION TO SEMI-VOWEL:	ziy ʤaw		
	SEMI-VOWEL DELETION:	zi ʤaw		
	SURFACE FORM:	[zi ʤaw][9]	('greeting')	(lit. 'do you have peace?')
20b)	COMPONENT WORDS:	/mahw/	[mahaw]	('snake')
		/na/	[na]	(DEM?) (meaning uncertain)
	UNDERLYING FORM:	/mahw na/		
	VOWEL EPENTHESIS:	mahəw na		
	UTTERANCE-FINAL LOWERING:	N/A		
	ASSIMILATION TO SEMI-VOWEL:	mahuw na		
	SEMI-VOWEL DELETION:	mahu na		
	SURFACE FORM:	[mahu na]	'that snake there'	

[8] I have found no mono-morphemic examples of labialised words with either [yə] or [əy] to see whether the vowel would become [i].

[9] See §3.3 for discussion of why [z] is not realised as [ʒ] in this context.

Without the semi-vowel rule, a second epenthetic vowel would be required between the semi-vowel and the following consonant. If the semi-vowel precedes a vowel, then it functions as a regular consonant, with the assimilation rules of 16) above applying to [-Low] vowels. Compare the following examples:

21) /hahr/ 'bean' + /na/ (DEM?) [haharəna] 'that bean there'

compare 20b) [mahu na] 'that snake there'

22) semi-vowel preceding a vowel: /mahw-ahn/ 'snake' + ('3rd person sg possessive marker')

[mahuw-ahaŋ] 'his snake'

compare /hahr-ahn/ [hahar-ahaŋ] 'his bean'

3. CONSONANTS

3.1 Consonant phonemes

Moloko has the following consonant phonemes:

		FRONT	CENTRAL	BACK	LAB-VEL
STOPS	-voice	p	t	k	k^w
	+voice	b	d	g	g^w
	pre-nas	mb	nd	ng	(ng^w)
	implos	ɓ	ɗ		
AFFRICATES	-voice		ts		
	+voice		dz		
	pre-nas		nz		
FRICATIVES	-voice	f	s	h	h^w
	+voice	v	z		
LATERAL FRICATIVES	-voice		ɬ		
	+voice		ɮ		
LAT APPROX			l		
SEMI-VOWELS			y		w
VIBRANT			r		
NASALS		m	n		

Table 3: Consonant phonemes

Front refers to bilabial and labio-velar sounds, central to alveolar and palatal sounds, and back to velar and glottal sounds. For discussion of labio-velars, see §3.2.2.

Besides the effects of labialisation (ref: §3.2) and palatalisation (ref: §3.3), the following allophonic rules apply:

23a) /h/ -> [x] / _ # eg. /gvh/ [gəvax] 'field'

compare: /gvh-hy/ [gəvahay] 'fields' ([hay] - plural marker)

23b) /n/ -> [ŋ] / _ # eg. /hadzn/ [hadzaŋ] 'tomorrow'

/ _ C [+velar] eg. /gangn/ [gaŋgaŋ] 'drum'

3.2 Labialisation

Labialisation as a word-level prosody has already been discussed in relation to its effect on vowels (ref: §1.1.1). In regard to consonants, its effect is restricted to the velar consonants. There is however a second possible source of labialisation within a word, which is the case of underlyingly labialised consonants (§3.2.2).

3.2.1 Word-level labialisation

The effect of labialisation is only fully realised on the velar consonants, causing /k/ to be realised as [kʷ], /g/ -> [gʷ] and /ng/ -> [ŋgʷ][10] adjacent to low back vowels.[11]

24) [gʷɔrɔ] 'kola' [mɔzɔŋgʷɔ] 'chameleon' [mɔgʷɔdɔkʷ] 'large hawk'

Although a back consonant, /h/ does not manifest the effects of labialisation in the same way as the velars.[12]

25) [tɔhɔr] 'cheek' [hɔmbɔx] 'pardon'

Certain grammatical distinctions are indicated with the feature labial, for example in the first and second person plural conjugations of verbs (see also 1.2.4 Presence vs absence of vowel)

26) 'to see' [mɛmɪnʒɛrɛ] root: /mnzar/

	singular	**plural**
1st person inclusive	-	mɔ-mʊnzɔr-ɔkʷ
1st person exclusive	nə-mənzar	nɔ-mʊnzɔr-ɔm
2nd person	kə-mənzar	kʷɔ-mʊnzɔr-ɔm
3rd person	a-mənzar	tə-mənzar

The plural suffix carries the labialisation prosody, which then spreads leftwards through the verb root to the pronominal prefix, causing each vowel to become rounded.

3.2.2 Underlyingly labialised consonants

There are several examples of words with labialised segments which do not have a labialisation prosody across the word. The following examples do not fit neatly into the system of vowel harmony in Moloko (ref: §1.1.3):

27a) [gʊdɛdɛ̄k] 'frog' [tʊkʊrak] 'partridge' [agʷɔɣ̄ak] 'rooster'

[kʊtʃɛɬ] 'viper' [mɛtʃœkʷɛd] 'maggot' [pɛdœkʷ] 'blade'

If the prosody (or absence of prosody) applied across the whole word, one would expect the following results:

27b) [gʊdɛdɛk] 'frog' -> *[gɪdɛdɛ̄k] or *[gʊdɔdɔkʷ]

[tʊkʊrak] 'partridge' -> *[təkərak] or *[tʊkʊrɔkʷ]

[agʷɔɣ̄ak] 'rooster' -> *[agaɣ̄ak] or *[agʷɔɣ̄ɔkʷ]

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[10] As in rule 4) above, there is no phoneme */ŋ/. Therefore the final consonant of words such as [kʷondoŋ] is not *[ŋʷ] but rather /ʷkandn/.

[11] With high back vowels it is more difficult to identify any explicit lip-rounding on the preceding velar consonant, as phonetically there is little difference between [kʷɔ] and [kʊ]. For this reason I will not mark *[Cʷʊ] in this data.

[12] In collecting data I transcribed the word for 'back' at different times as [hʊlɛŋ] [həlɛŋ] [hɔlɛŋ] and [hœlɛŋ]. This could be free variation or possibly dialectal.

In each case, the focus of the problem is the labialisation feature which seems to attach itself to certain velar consonants. In the case of 'partridge' the first and second syllables are labialised but not the third, therefore it cannot be a case of a word-level labialisation prosody spreading leftwards from the end of the word.

To account for these cases, it seems to be necessary to posit the existence of distinct 'underlyingly labialised' consonants.

In the following pair of words, the first example does not manifest consistent vowel harmony across the whole word, while the second does. Therefore only the second example carries a labialisation prosody across the whole word. Their underlying forms must differ in the following way:

28) /dgʷaly/ [dʊgʷɔlay] 'thigh' /ᵂggara/ [gʊgʷɔrɔ] 'ram'

Consider also the following minimal pair, which is distinguished only by the contrast between /k/ and /kʷ/ in word-final position.

29) /ʸslk/ [ʃɪlɛk] 'jealousy' /ʸslkʷ/ [ʃɪlœkʷ] 'broom'

Having established the existence of four distinct consonant phonemes (ie.[g, gʷ, k, kʷ]) among the velar stops, we should also consider the other back consonants.

In the case of /ng/, the only example I have which would indicate the presence of a separate labialised consonant is the following:

30) /ʸmadalangʷaz/ [mɛdɛlɛŋgʷɛʒ]~ [mɛdɛlœngʷɛʒ] 'leopard/panther'

but its length (the majority of Moloko mono-morphemic words are 3 syllables or less) suggests it could be a compound, therefore the morpheme that includes [ŋgʷ] could carry a labialisation prosody.

Although /h/ does not manifest the lip-rounding of the other back consonants as mentioned previously, the following examples suggest that there are also two consonants /h/ and /hʷ/.

31) /hʷaɗa/ [hɔɗa] 'dregs' /ʷhaɗa/ [hɔɗɔ] 'wall' (compare: /haɗa/ [haɗa] 'much')

Without an underlyingly labialised /hʷ/, the word for 'dregs' would be homophonous with either 'wall' (with a word-level labialisation prosody) or 'much' (with no prosody). The final [a] of [hɔɗa] indicates that there must be a different source of the rounding of the first vowel. This can only be explained by positing two separate phonemes.

Underlyingly labialised consonants cause any adjacent vowel to become rounded, whether [+/-Low], with one exception. In words with a palatalisation prosody, the labialised consonant only affects the preceding vowel.[13] The domain of influence therefore is asymmetrical, as the following chart shows.

		V Cʷ		**Cʷ V**	
PROSODY	**VOWEL**	**input**	**result**	**input**	**result**
Ø	[-Low]	əCʷ	ʊCʷ	Cʷə	C ʊ
	[+Low]	aCʷ	-	Cʷa	Cʷɔ
PAL	[+Low][14]	ʸ aCʷ	œCʷ	ʸ Cʷa	Cʷɛ

Table 4: Domain of labialised consonants

The following example demonstrates the domain of the labialised consonants' influence.

32) [gʷœgʷɛʒ] 'red'

[13] In fast speech however, both adjacent vowels may become labialised, resulting in free variation, as in (34) above, which may be pronounced [dʒœgʷer] or [dʒœgʷœr]

[14] There are no examples in the data of [-Low] vowels with labialised consonants in palatalised words.

Since both vowels are palatalised, there must be a palatalisation prosody across the whole word. If both velars were /g/, the surface form would be *[gɐgɐʒ]. If the surface form was *[g^{w}œg^{w}œʒ], this would suggest that two prosodies were affecting the whole word. The domain chart (Table 4) indicates that the second velar consonant is underlyingly labialised, since the preceding vowel is round. The first velar could be either /g/ or /g^{w}/. The former option is more likely, since this would be the only example in the data of two labialised consonants appearing in the same word without a labialisation prosody, and secondly if C_1 was /g^{w}/ then the rounding of the following vowel is redundant. Therefore the underlying form of this word is most likely to be /^{y} gag^{w}z/.

At a surface phonetic level, therefore, a C^{w} can have two possible sources, either a labialisation prosody across the whole word, or the presence of an underlyingly labialised consonant.

33) labialisation across whole word: /^{w} dzgr/ [dzʊg^{w}ɔr] 'stake'

34) labialised velar consonant: /^{y} dzag^{w}r/ [dʒœg^{w}ɛr] 'limp'

The way to identify whether labialisation is consistent across the whole word, or merely attached to one velar consonant is to examine other vowels in the same word at surface level. If they do not follow the vowel harmony patterns, (not counting poly-morphemic cases) then a separate labialised consonant is the source of the labialisation.

There are several cases in the data where it is impossible to tell whether the consonant is underlyingly labialised or there is a labialisation prosody across the word, such as the following examples:

35) /sk^{w}m/ ~ /^{w}skm/ [sʊk^{w}ɔm] 'buy/sell' /mag^{w}m/ ~ /^{w}magm/ [mɔg^{w}ɔm] 'home'

To decide on the underlying form of these types of word would require certain grammatical contexts or phonological environments which would produce alternations. Further research is required to determine such contexts.

3.3 Palatalisation

Palatalisation on consonants causes a backing movement on alveolar sibilants - causing /s/ -> [ʃ], /z/ -> [ʒ], /ts/ -> [tʃ], and /dz/ -> [dʒ], including the prenasalised /nz/ -> [nʒ].

36)

/dzn/	[dzaŋ]	'prick'	/^{y} dzn/	[dʒɛŋ]	'chance'
/mtsapr/	[mətsapar]	'multiple'	/^{y} mtsapa/	[mɪtʃɛpɛ]	'to drape'
/nzavr/	[nzavar]	'young man'	/^{y} nzamr/	[nʒɛmɛr]	'artery'

The palatal feature is used to indicate certain grammatical distinctions. One example is the formation of verbal nouns, which function as a type of infinitive form of the verb in Moloko. This process has three steps: affixation of a nominaliser prefix /m-/, a suffix /-a/,[15] and palatalisation spread throughout the word. This can be demonstrated using the minimal pair from §1.2.4 (ex. 10):

37)

VERB ROOT:	/tsr/	'climb'	/tsar/	'taste good'
PREFIXATION:	/mtsr/		/mtsar/	
SUFFIXATION:	/mtsra/		/mtsara/	(insertion of epenthetic vowels)
PALATALISATION:	[mɪtʃɪrɛ]		[mɪtʃɛrɛ]	

Palatalisation of a consonant is not determined by an adjacent palatal vowel. In example 20) above, whose derivation produced the surface form [zi ɗaw], it should be noted that the alveolar sibilant does not become palatalised even though it is now adjacent to a high front vowel *[ʒi ɗaw]. Compare this to example (12), where /^{y}tsatsa/ is realised as [tʃɛtʃɛ]. In example 20) there is no palatalisation spreading throughout the word, as there is in 12), which supports the notion that the palatalisation of consonants is not purely segmental, where any alveolar sibilant will palatalise in this environment.

[15] The function of this suffix is uncertain at this stage.

3.4 Liquids

3.4.1 Liquids and epenthetic vowels

The liquids (/r/ and /l/) function differently to other consonants with respect to epenthetic vowels. Schwa insertion is not compulsory adjacent to a liquid. This affects syllable structure in the following ways:

a) The insertion of schwa is optional in the case of an underlying /CC/ structure if C_2 is a liquid. This results in free variation, as in the following examples:

38) /kra/ [kra] ~ [kəra] 'dog'
/madrs/ [madras] ~ [madəras] 'pig'

If the C_2 liquid is followed by another consonant, the liquid can function as the nucleus of a syllable, or schwa(s) can optionally be inserted on either side:

39) /blgadn/ [blgadaŋ] ~ [bəlgadaŋ] ~ [bləgadaŋ] ~ [bələgadaŋ] 'harmattan'

b) Word-initially, a liquid can form its own syllable, or optionally take [ə]

40) /lvn/ [lvaŋ] ~ [ləvaŋ] 'night'
/rɓj/ [rɓay] ~ [rəɓay] 'be beautiful'

c) Liquids can form the coda of a syllable

41) /malgamy/ [malgamay] ~ [maləgamay] 'jawbone'

The basic syllable types established in §1.2.1 have now been expanded to allow the following syllable structures:

V, L, CV, CL, CVL, CVC

3.4.2 Liquids and prosodies

In the case of words with either a labialisation or palatalisation prosody, the prosodic effects on [ə] are optional when adjacent to a liquid:

42) **LAB:** /ʷdlv/ [dlɔv] ~ [dəlɔv] ~ [dʊlɔv] 'lake'
/ʷhrgv/ [hrgʷɔv] ~ [hərgʷɔv] ~ [hʊrgʷɔv] ~ [hrʊgʷɔv] 'monkey'
PAL: /ʲklf/ [klɛf] ~ [kəlɛf] ~ [kɪlɛf] 'fish'
/ʲhrddm/ [hrdɪdɛm] ~ [hərdɪdɛm] ~ [hɪrdɪdɛm] etc. 'knee'

However, among the verbs there are minimal pairs which are distinguished solely by the labialisation prosody on schwa, as in the following minimal pairs (/-ay/ is the 2nd person singular imperative ending):

43) /ɓrts -ay/ [ɓərts-ay] 'grind/crush' (2^{nd} person sg imperative)
/ʷɓrts -ay/ [ɓʊrts-ay] 'unravel' (2^{nd} person sg imperative)

In these cases, usually involving either a labial or velar consonant, the application of the word-level prosody to the vowel is compulsory.

4. CONCLUSION

The present work examines the influences of the word-level prosodies of labialisation and palatalisation on the phonology of Moloko.

Like its distant Afroasiatic relations, the Semitic languages, the phonology of Moloko is built on a consonantal skeleton. This is then broken up with certain vowel slots, which may contain either a phonemic or

an epenthetic vowel. We have analysed the vowel system of Moloko as having only one phonemic vowel /a/, which then contrasts with the [-Low] central vowel [ə], a non-phonemic epenthetic vowel. If a word carries either a labialisation or a palatalisation prosody, all vowels in that word, and certain consonantal segments, will be affected.

There is much more work to be done on this aspect of Moloko phonology, particularly an examination of the spread of prosodies across morphological and word boundaries.

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6. APPENDIX - WORD LIST

The following 200 Moloko words have been selected from my data to allow the reader to examine additional examples. I have included words with zero, labialisation and palatalisation prosodies, and a mix of nouns and verbs, all in citation form (verbs in 2nd person sg imperative). All examples from this paper are included.

/a-gʷaɮk/	[agʷɔɮak]	'rooster' N
/a-hr/	[ahar]	'arm/hand' N
/a-ʸla/	[alɛ]	'eye' N
/a-ʸɬaɬd/	[aɬɛɬɛd]	'egg' N
/a-ʷmm/	[amɔm]	'bee' N
/a-ʷmbadts/	[ambɔdɔts]	'sugar cane' N
/a-sk/	[asak]	'leg/foot' N
/a-ʸtama/	[atɛmɛ]	'onion' N
/a-wk/	[awak]	'goat' N
/a-ʷzanga/	[azʊŋgʷɔ]	'donkey' N
/baly/	[balay]	'wash' V
/ʷbaɮm/	[bɔɮɔm]	'cheek' N
/blgadn/	[blgadaŋ] ~ ~ ~	'harmattan' N
/bly/	[bəlay] ~ [blay]	'sea' N
/ʷbmbala/	[bʊmbɔlɔ]	'greed' N
/byw/	[biyaw]	'next year' ADVERB

/ɓah/[16]	[ɓax]	'sew' V
/ɓra/	[ɓəra] ~ [ɓra]	'granary' N
/ɓrtsy/	[ɓərtsay]	'grind/crush' V
/ʷɓrtsy/	[ɓurtsay]	'unravel' V
/ʸ dada/	[dɛdɛ]	'beetle' N
/ʸ dadawa/	[dɛdɛwɛ]	('bird') N
/ʸ dadw/	[dɛdɛw]	'morning' N
/dagla/	[dagəla] ~ [dagla]	'calabash' N
/dary/	[daray]	'plant' V
/dbny/	[dəbənay]	'learn' V
/dd/	[dad]	'fall' V
/dgʷaly/	[dʊgʷɔlay]	'thigh' N
/ʷdlv/	[dəlɔv] ~ [dlɔv]	'lake' N
/ʷdnga/	[dʊŋgʷɔ]	'neck' N
/ʸ drlanga/	[drlɛŋgɛ] ~ ~ ~	'hyena' N
/dry/	[dəray] ~ [dray]	'head' N
/ʷdzaga/	[dzɔgʷɔ]	'hat' N
/ʷdzagm/	[dzɔgʷɔm]	'shoulder' N
/ʸ dzagʷr/	[dʒœgʷɛr]	'limp' N
/ʸ dzara/	[dʒɛrɛ]	'truth' N
/ʷdzgr/	[dzʊgʷɔr]	'stake' N
/dzn/	[dzaŋ]	'prick' V
/ʸ dzn/	[dʒɛŋ]	'chance/luck' N
/dzy/	[dzay]	'speak' V
/ɗf/	[ɗaf]	'food' N
/ɗw/	[ɗaw]	('question marker')
/ɗwa/	[ɗuwa]	'milk/breast' N
/ʸ ɗwr/	[duwɛr]	'sleep' N
/ft/	[fat]	'day' N
/faty/	[fatay]	'grow/sprout' V
/ʸ gagʷz/	[gʷœgʷɛʒ]	'red' ADJECTIVE
/gangn/	[gaŋgaŋ]	'drum' N
/ʷgara/	[gʷɔrɔ]	'kola' N
/gɓr/	[gəɓar]	'strength' N
/ʷggara/	[gʊgʷɔrɔ]	'ram' N
/ggmj/	[gəgəmay]	'cotton' N
/ʷglm/	[gəlɔm]~ [gʊlɔm] ~ [glɔm]	'quiver' N
/gnw/	[gənaw]	'animal' N
/gs/	[gas]	'take' V
/ʸ gva/	[gɪvɛ]	'game' N
/gvh/	[gəvax]	'field' N
/ʸ gvr/	[gɪvɛr]	'liver' N
/ʷgza/	[gʊzɔ]	'kidney' N
/ʷgzm/	[gʊzɔm]	'alcohol' N

[16] 2nd person plural conjugation [kʷɔ-ɓɔh-ɔm] (ref: exs 26) and 37) indicates that there is a [+Low] vowel in the underlying form. See also /har/ -> [kʷɔ-hɔr-ɔm], /ngah/ -> [kʷɔ-ŋgɔh-ɔm], compared to /kɗ/ -> [kʷɔ-kʊɗ-ɔm] /rh/ -> [kʷɔ-rʊh-ɔm]

/ʸ gʷdaɗk/	[gʊdɛɗek]	'frog' N
/gʷla/	[gʊla]	'son' N
/ʸ gʷlk/	[gʊlɛk]	'small axe' N
/hadzn/	[hadzaŋ]	'tomorrow' ADVERB
/haɗa/	[haɗa]	'much' ADVERB
/ʷhaɗa/	[hɔɗɔ]	'wall' N
/hahr/	[hahar]	'bean' N
/ʷhamba/	[hɔmbɔ]	'flour' N
/ʷhambh/	[hɔmbɔx]	'pardon' N
/har/	[har]	'make/build' V
/hara/	[hara]	'metal' N
/harf/	[haraf]	'medicine' N
/harts/	[harats]	'scorpion' N
/ʸ hayw/	[hɛyɛw]	'cricket' N
/ʷhɗ/	[hɔɗ]	'stomach' N
/hmɗ/	[həmaɗ]	'wind' N
/hmy/	[həmay]	'run' V
/ʸ hndr/	[hɪndɛr]	'nose' N
/ʷhr/	[hɔr]	'woman' N
/hrɗ/	[hərad] ~ [hrad]	'jump' V
/ʸ hrddm/	[hrdɪdɛm] ~ ~ ~	'knee' N
/ʷhrgv/	[hrgʷɔv] ~ ~ ~	'monkey' N
/ʸ hrngƛ/	[hrŋgɛƛ] ~ ~ ~	'knot/joint' N
/ʷhvat hvat/	[hʊvɔthʊvɔt]	'softness' IDEOPHONE
/hy/	[hay]	('plural suffix') INFLECTION
/hy/	[hay]	'millet' N
/hʷaɗa/	[hɔɗa]	'dregs' N
/hʷɗy/	[hʊɗay]	'day off' N
/ʸ hʷƛn/	[hʊƛɛŋ]	'cave' N
/ʷkaka/	[kʷɔkʷɔ]	'baobab' N
/ʸ kakɓ kakɓ/	[kɛkɪɓkɛkɛɓ]	'sharp' Ideophone
/kɗ/	[kaɗ]	'beat/kill' V
/klakɬ/	[kəlakaɬ] ~ [klakaɬ]	'bone' N
/ʸ klf/	[kəlɛf] ~ [klɛf]	'fish' N
/ʸ kmadza/	[kɪmɛdʒɛ]	'clothes' N
/ʸ kmts/	[kɪmɛtʃ]	'knife' N
/kra/	[kəra] ~ [kra]	'dog' N
/ʸ kra/	[kərɛ] ~ [kɪrɛ] ~ [krɛ]	'stake' N
/kya/	[kiya]	'moon' N
/kʷrɗk/	[kʊrəɗak] ~ [kʊrɗak]	'blister' N
/kʷsy/	[kʊsay]	'fog' N
/ʸ kʷtsɬ/	[kʊtʃɛɬ]	'viper' N
/ʷla/	[lɔ]	'go' V
/ʸ laha/	[lɛhɛ]	'bush' N
/lala/	[lala]	'come' V
/layw/	[layaw]	'large squash' N
/ʸ lms/	[ləmɛʃ] ~ [lɪmɛʃ] ~ [lmɛʃ]	'song' N
/lvn/	[ləvaŋ] ~ [lvaŋ]	'night' N
/ʷɬaka/	[ɬɔkʷɔ]	'earring' N

/ɬɓaty/	[ɬəɓatay]	'repair' V
/ɬm/	[ɬam]	'place' N
/ɬmy/	[ɬəmay]	'ear/name' N
/ᵞ ʁavk/	[ʁɛvɛk]	'rabbit' N
/ʁk ʁk/	[ʁəkəʁak]	'winged termite' N
/ᵞ ʁwʁw/	[ʁuʁɛw]	'stream' N
/ma/	[ma]	'mouth/word/language' N
/ᵞ mababk/	[mɛbɛbɛk]	'bat' N
/ᵞ madalangʷz/	[mɛdɛlɛŋgʷɛʒ]	'leopard/panther' N
/madra/	[madəra] ~ [madra]	'harvest season' N
/madrs/	[madəras] ~ [madras]	'pig' N
/ʷmaga/	[mɔgʷɔ]	'anger' N
/ʷmagadk/	[mɔgʷɔdɔkʷ]	'large hawk' N
/ʷmagm/ ~ /magʷm/	[mɔgʷɔm]	'home' N
/ᵞ mahr/	[mɛhɛr]	'forehead' N
/mahw/	[mahaw]	('snake') N
/ᵞ makts/	[mɛkɛtʃ]	'knife' N
/maky/	[makay]	'leave/stop' V
/malgamy/	[maləgamay] ~ [malgamay]	'jawbone' N
/manzara/	[manzara]	'termite' N
/ᵞ mapatpata/	[mɛpɛtɪpɛtɛ]	'butterfly' N
/matabɬ/	[matabaɬ]	'cloud' N
/ᵞ matsakʷɗ/	[mɛtʃœkʷɛɗ]	'maggot' N
/mawr/	[mawar]	'tamarind' N
/ʷmazanga/	[mɔzɔŋgʷɔ]	'chameleon' N
/ᵞ mdagn/	[mɪdɛgɛŋ]	'cold/flu' N
/mdara/	[mədara]	'bicep' N
/mdga/	[mədəga]	'older sibling' N
/ᵞ mdgr/	[mɪdɪgɛr]	'hoe' N
/mndava/	[məndava]	'scar' N
/mnzar/	[mənzar]	'see' V
/ᵞ mtwz/	[mɪtuwɛʒ]	'sorrel fruit' N
/ᵞ mtsapa/	[mɪtʃɛpɛ]	'to drape' V
/mtsapr/	[mətsapar]	'multiple' N
/ᵞ myk/	[miyɛk]	'deer' N
/mbaɗy/	[mbaɗay]	'swear' V
/ᵞ mbasn/	[mbɛʃɛŋ]	'breathe/live' V
/mbasy/	[mbasay]	'smile/laugh' V
/ʷmbalm/	[mbɔlɔm]	'horizon' N
/mbɗ/	[mbaɗ]	'turn/change' V
/mbɗy/	[mbəɗay]	'exchange' V
/ʷmbrlm/	[mbrlɔm] ~ ~ ~	'throat' N
/ngah/	[ŋgax]	'hide' V
/ᵞ nza/	[nʒɛ]	'stay/live/sit' V
/ᵞ nzamr/	[nzɛmɛr]	'artery' N
/nzavr/	[nzavar]	'young man' N
/ᵞ nzwalk/	[nʒuwɛlɛk]	'sorrel plant' N

/ʸ padkʷ/	[pɛɗœkʷ]	'blade' N
/paɗy/	[paɗay]	'bite' V
/ʷplangɗ/	[plɔŋgʷɔɗ]	'bark/skin' N
/ʸ pls/	[plɛʃ]	'horse' N
/rɓy/	[rɓay]	'be beautiful' V
/rh/	[rax]	'pluck' V
/ʸ sa/	[ʃɛ]	'drink' V
/ʸ sasa/	[ʃɛʃɛ]	'meat' N
/ʷskm/	[sʊkʷɔm]	'buy/sell' V
/ʷsky/	[sʊkʷɔy]	'clan' N
/ʸ slk/	[ʃəlɛk] ~[ʃɪlɛk] ~ [ʃlɛk]	'jealousy' N
/ʸ slkʷ/	[ʃɪlœkʷ] ~ ~	'broom' N
/ʸ smbatkʷ/	[ʃɪmbɛtœkʷ]	'hair' N
/swh/	[suwax]	'well' N
/ʷtahr/	[tɔhɔr]	'cheek' N
/ʷtalaln/	[tɔlɔlɔŋ]	'chest' N
/ʸ tanzw/	[tɛnʒɛw]	'mosquito' N
/tkʷrk/	[tʊkʊrak]	'partridge' N
/tmk/	[təmak]	'sheep' N
/ttark/	[tətarak]	'shoe' N
/tsar/	[tsar]	'taste good' V
/tsary/	[tsaray]	'tear/rip' V
/ʸ tsatsa/	[tʃɛtʃɛ]	'louse' N
/ʸ tstsawa/	[tʃɪtʃɛwɛ]	'branch/twig' N
/ʸ tsatskʷ/	[tʃɛtʃœkʷ]	'flute'
/ʸ tsatsw/	[tʃɛtʃɛw]	'friend' N
/ʸ tsɗzn/	[tʃɪdʒɛŋ]	'lose' V
/ʸ tska/	[tʃɪkɛ]	'stand' V
/ʸ tsm tsm/	[tʃɪmtʃɛm]	('tree') N
/tsr/	[tsar]	'climb' V
/vahy/	[vahay]	'fly' V
/ʸ vmata/	[vɪmɛtɛ]	'neighbour' N
/vya/	[viya]	'rainy season' N
/wɗaky/	[wuɗakay]	'separate/share' V
/wr/	[war]	'child' N
/wrɮa/	[wurɮa]	'star' N
/ws/	[was]	'cultivate/weed' V
/yaɗy/	[yaɗay]	'tire' V
/ʸ zazakʷa/	[ʒɛʒœkʷɛ]	'frightening thing' N
/ʷzm/	[zɔm]	'eat' V
/zr/	[zar]	'man' N
/zy/	[zay]	'peace' N

****