The Masa tonal system

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Abstract

Masa language, *vùn màsànà*, is classified in the family of Chadic languages, one of the four families of the Afroasiatic phylum.
P. Newman (1977) proposes that Masa group is considered as an independent branch.
This classification was resumed by D. Barreteau with the collaboration of P. Newman (1978), using the inventory by C. Hoffman (1971) and by Caprile-Jungraithmayr (1973). Then the following languages relate to Masa branch:
Masa (= Banana = Masana), Musey, Zimé (Lamé, Pévé, Dari), Mesme (Bero, Zmré), Marba (= Kulong = Azumeina), Monogoy.

After this classification, H. Jungraithmayr (1981) proposed a division all over again in three groups, the Centre-East group being constituted by: a Kotoko subgroup (two languages) and a Masa-Musgu subgroup (7 languages: Musgu, Masa, Musey, Marba, Monogoy, Mesme, Zime).
In 1987 D. Barreteau adopted the classification proposed by H. Jungraithmayr, Masa branch being reattached to the B sub-branch of the Biu-Mandara branch. In this classification the Masa groups is composed by a South subgroup (Masa, Musey, Lame) and a North subgroup (Zumaya).
By H. Tourneux, it would be acceptable to keep the Masa group inside of the Biu-Mandara branch, while dividing it in a North set including Masa, Musey, Azumeyna, Zumaya and a South set including Zime and Mesme.

Here we will base on a spoken corpus recorded in December 1999 in Bongor (Chad).
We want to analyse the phonetic and phonology of tones in Masa. They have lexical and grammatical functions. But if you analyse their syntagmatic distribution in monosyllables and polysyllables, then you find that tones are somewhat conditioned by the nature of the preceding consonant or by the application of a fixed tonal pattern. We argue that Masa shows only two tonal registers and we demonstrate that by means of three rules these registers are reduced to one. Thus we could conclude that from a phonological standpoint Masa could be classified as a tonal or pitch accent language.

1. The Masa distinctive units

Tables 1-2 give the list of distinctive units.

SHORT		Opening	LONG	
front	back		front	back
i	u	1st degree	ii	uu
e	o	2nd degree	ee	oo
a		3rd degree	aa	

Table 1: *Masa vowels.*

		Bilabial			Labiodental			Dental			Alveolar			Palato-alveolar			Palatal			Velar			Glottal		
		B	I	E	B	I	E	B	I	E	B	I	E	B	I	E	B	I	E	B	I	E	B	I	E
Stop	Unvoiced	p		p				t		t										k		k	ʔ		ʔ
	Voiced	b	b					d	d											g	g				
	Implosive	ɓ	ɓ					ɗ	ɗ																
Affricate	Unvoiced													tʃ											
	Voiced													dʒ	dʒ										
Fricative	Unvoiced				f		f	ɬ		ɬ	s		s										h		h
	Voiced				v	v		ɮ	ɮ		z	z											ɦ	ɦ	
Sonorant	Nasal	m	m	m				n	n	n										ŋ	ŋ	ŋ			
	Lateral							l	l	l															
	Trill							r	r	r															
Approximant					w	w	w										j	j	j						

Table 2: *Masa consonants in initial (B), intervocalic (I) and final (E) position.*

1.1 The tones

In Masa the tones have a double function:

- a lexical distinctive function;
- a grammatical function in the verb, where the aspect is expressed by tone.

Out of context and in the connected speech, previous studies attested the existence of three phonetic registers, as showed by C. Caitucoli (1983: 3), D. Barreteau-M. Dieu (1986: 7) and Melis (1999). But we analysed a spoken corpus where the tonetic data did not show more than two levels.

Even if the phonetics does not corroborate the identification of three tones, let us suppose to deal with three. Well, we will demonstrate that from a phonological standpoint Masa is a two tones language. Let us follow the lexical filing by Melis (1999).

1.1.1 Nouns: monosyllables of CV, CVV and CVC type

1.1.1.1 The high register

It is opposable to the two other registers independently of the nature of the initial consonant of word:

(1) H ≠ M

tʃér	"*Ptilostomus afer*"
tʃēr	"coasts"
ɗám	"*Feretia apodantera*"
ɗām	"joke"
sá	"masa game"
sā	"human"
páá	"tobacco"
pāā	"turtle sp."

(2) H ≠ L

bák	"*Gyps bengalensis*"
bàk	"animal skin"
ŋál	"calms"
ŋàl	"pottery"
líŋ	"fishing basket"

lìŋ "salty"
dò "a few"
dó "who already gave birth"

1.1.1.2 The mid register
It is opposable to the two other registers, but the opposition to the low tone is possible only on a reduced number of initial consonants: we will see their inventory in section 3, treating tonological problems:

(3) M ≠ L
māl "rafter in the granary"
màl "straw, *Hyparrhenia rufa*"
nàk "2nd pers. fem. sing."
nāk "bird sp."

(4) M ≠ H
fūl "genius, spirit"
fúl "bush"
hōt "*Acorypha glaucopsis*"
hót "fast"

1.1.1.3 The low register
It is opposable to the two other registers, with restrictions view before:

(5) L ≠ H
dél "vagina"
dèl "neck"
gám "*Kaya senegalensis*"
gàm "*Auchenoglanis occidentalis*"

(6) L ≠ M
mìl "wound"
mīl "genet"

1.2 Nouns: the polysyllables
Given the weak percentage of trisyllables, it is practically impossible to find some minimal pair oppositions in this category. We will limit ourselves therefore to disyllables, to demonstrate the relevance of the three registers realized.

1.2.1 Isotonic words
(7) HH ≠ MM
tʃígál "fish sp."
tʃīgāl "wisdom tooth"

(8) HH ≠ LL
dúwéj "cold"
dùwèj "pot"

(9) MM ≠ LL: not attested opposition

1.2.2 Heterotonic words
One will notice that a certain number of oppositions is impossible on the second syllable; here we simply signal them and we will explain the reason of it in the section 3, treating tonological problems.

a) The high register:

(10) HH ≠ HM
tʃégé "francolin"
tʃégē "involuntarily"

(11) HH ≠ HL: impossible (HL not attested)
(12) HH ≠ MH
kílér "*Ficus sp.*"
kīlér "not thick"

(13) HH ≠ LH
dúwéj "cold"
dùwéj "dream"

(14) MH ≠ MM
kōléj "pipe"
kōlēj "speed"

(15) MH ≠ ML: (ML impossible)

(16) LH ≠ LL: (LH = LM)

(17) LH ≠ LM: (impossible opposition)

b) The mid register:

(18) MM ≠ MH
kōlēj "speed"
kōléj "pipe"

(19) MM ≠ ML: (ML impossible)

(20) MM ≠ HM
kúlūr "*Flaucurtia flavescens*"
kūlūr "race of the hedgehog"

(21) MM ≠ LM (not attested)

(22) HM ≠ HH: cf. *supra*

(23) HM ≠ HL (HL impossible)

(24) LM ≠ LH (LM = LH)

(25) LM ≠ LL

	bòbō	"disease of the low stomach"
	bòbò	"locust sp."

c) The low register:

cf. previous oppositions concerning the high and mid registers.

1.3 Summing up

Whereas in monosyllables the three registers can oppose each others, even if with some difficulties concerning the L/M opposition (cf. 3, 5, 6), in polysyllables one could have noted that a certain number of oppositions were either impossible or not attested in the minimal pairs permitting to show their relevance (9, 15, 17, 19, 21, 24, 25). Below we give the list of attested diagrams.

1.3.1. Monosyllables

(26) H	**fúl**	"bush"
(27) M	**sā**	"human"
(28) L	**bàk**	"animal skin"

1.3.2 Disyllables

(29) L L	**bìrìm**	"tobacco bag"
(30) L M = L H	**bìrī**	"dry tornado"
(31) M M	**kōlēj**	"speed"
(32) M H	**kīlér**	"not thick"
(33) H H	**kílér**	"*Ficus sp*."
(34) H M	**bírēm**	"Acacia ataxacantha"

1.3.3 Trisyllables

(35) H H H	**tʃígídém**	"with small mouthfuls"
(36) H H M	**tʃólógō**	"tisserin bird"
(37) H M M	**tábārā**	"belt of pearls"
(38) H M H	**máɲālāŋ**	"crab"
(39) M M M	**kūtūrū**	"leprosy"
(40) M M H	**tɪŋɪrɪk**	"basket"
(41) M H H	**kōkúló**	"scavenger"
(42) L L L	**bàɣàrà**	"palm leaf "
(43) L L H	**bàgàsí**	"pearls set"
(44) L M H	**gùɣūbí**	"fish trap"
(45) L M M	**ŋìlārā**	"crevasse"

The diagrams L H H and L H M are not attested.

2. Tonological problems

2.1 In the tonal system: 2 or 3 tones ?

In Masa nominal paradigm the possible tonal oppositions H/M/L are entirely determined by the nature of the initial consonant.

Indeed, on the first syllable if the high register can mark terms having for initial any consonants of the system, it can not oppose to the mid register except that in words having as initial either unvoiced stops and fricatives, the implosives /ɓ, ɗ/ or the glottal /ʔ/, or the nasals and the sonorants, or approximants /j/ and /w/, and to the low register except that with words having for initial, either the voiced stops and fricatives, or some nasals and the sonorants, or the glottal /ʔ/.

Moreover, the mid register can oppose to the low register on the first syllable only in words having for initial, either nasals, or sonorants, or the glottal /ʔ/.

Thus, this behaviour divides the inventory of the initial consonants (syllabic onset) of nominal terms in three sets that we will call first, second and third set:

1. First set (non depressor or tone-raising consonants): unvoiced obstruents (stops and fricatives) or the implosives /ɓ, ɗ/ or the glottal /ʔ/.
2. Second set (depressor or tone-lowering consonants): voiced obstruents (stops and fricatives).
3. Third set (neutral consonants): nasals, or sonorants, or the glottal /ʔ/ or approximants.

In the second syllable it also exists, as one saw explaining the relevance of each of the three registers, a certain number of incompatibilities, but they are independent of the nature of the initial consonant of the internal or final syllable, this one being inevitably a voiced consonant in internal position and an unvoiced one in final position.

If now we examine the different registers that can mark verbs, we are going to see that one finds also a set of constraints triggered by the

nature of the initial consonant. The interference between the tone and the nature of preceding consonant is a trait that Masa shares with Musey (Shryock, 1995), and Zime (Jungraithmayr, 1978). So far, the most well-known cases of consonant-tone interaction are found in Ewe (a Kwa language spoken in Togo and Ghana), in the Coastal Bantu languages, Digo and the Mijikeda languages (spoken in Kenya) and the Shona and Nguni subgroups of Bantu (spoken in southern Africa). Consonant-tone interaction has quite recently also been reported for several Adamawa-Ubangi languages spoken in the Central-African Republic: Suma, Gbaya. Moreover, Wolff (1983, 1986) develops his theory of tonogenesis in Chadic languages based on the influence of depressor consonants. The effects of depressor consonants has been described in some more detail for one of these: Kera (Pearce, 1998/99).

2.2 The tonal behaviour in the verbal paradigm
At first, the nature of the initial consonant will determine two classes of verbs:
- the first one regrouping verbs with consonantal initial belonging to the first set, as well as a certain number of verbs having as initial some consonants belonging to the third set;
- the other one regrouping verbs with consonantal initial belonging to the second set, as well as a certain number of verbs having as initial some consonants belonging to the third set.
Then, on these bases, aspectual distinctions will be marked. Indeed Masa involves three aspects: neutral (Ø), unaccomplished (unac.) and accomplished aspect (ac.).
When the verb is followed by a pause, a vowel marked by a tone is added inevitably to the root.

2.2.1 The tone of the neutral aspect
Two registers are attested in the verbal paradigm of the neutral aspect: mid for the first class, low for the second class:

1 **t-āŋū** //eat(Ø)-you// "eat"
f-ān pūtū //find(Ø)-you /bovine// "find a bovine"

2 **d-àŋù** //speak(Ø)-you// "speak"
v-àŋ pūtū //take(Ø)-you/bovine// "take a bovine"

2.2.2 The tone of the accomplished aspect
One finds again in the accomplished the two classes of verbs, one marked by a mid register, the other by a high register:

1 **ʔàn tīʔé** // I / eat(ac.)// "I ate"
ʔàn fī pūtū // I / find(ac.)/ bovine.// "I found a bovine"

2 **ʔàn díʔī** // I / say(ac.) // "I say"
ʔàn ví pūtū // I / take(ac.) / bovine // "I took a bovine"

2.2.3 The tone of the unaccomplished aspect
The opposition between the two classes of verbs is shown by a high register for the first class and by a low register for the second class.

1 **ʔàn tíʔē** // I / eat(unac.)// "I eat"
ʔàn fí pūtū // I / find(unac.)/ bovine // "I find a bovine"

2 **ʔàn dìʔē** // I / say(unac.)// "I say"
ʔàn vì pūtū // I / take(unac.)/ bovine // "I take a bovine"

In summary, we have the following diagram, where the register in brackets means the tonal register of the final vowel before pause:

	class 1	class 2
neutral	M (M)	L (L)
accomplished	M (H)	H (M)
unaccomplished	H (M)	L (M)

Table 3. Masa verbs: aspects & tones

As we will see thereafter, these diagrams apply to all Masa verbs, whatever the syllabic structure of their root is: CV, CVC, CVCV, CVCVC. The trisyllabic verbs CVCVCVC always undergo a reduction in CVCCVC entailed by the fall of the second vowel so that the tonal diagram becomes the same of the disyllabic verbs.

2.3 Interpretation
How to interpret these constraints and these incompatibilities that one finds both in nouns and in the verbal paradigm, where they influence not only the type of the tonal register

in the neutral aspect, but also the way trough which distinctions are expressed among the three aspects: neutral, accomplished, unaccomplished ?

2.3.1 For terms with initial consonants of the first and second sets

If, on the basis of the three registers attested, one establishes the sum of all theoretically possible realizations in the disyllables one gets:

uniform succession	HH	MM	LL
raising succession	MH	LM	LH
falling succession	HL	HM	ML

However if we compare this inventory of possibilities with the attested realizations, we note that:

- the successions M L and H L are not attested; and that
- the succession L H is a free variant of L M.

To explain these gaps, Melis (1999) postulated that the tonal realizations obey to two rules:

1 - the existence of two tones, the marked one, with high register (H) independent of the nature of the initial consonant, the unmarked one, whose register depends on the nature of the initial consonant and that is realized, as we saw, mid (M) with consonants of the first set, and some terms of the third set, low (L) with consonants of the second set and some terms of the third set;

2 - the impossibility in a tonal succession inside the same word, to show a difference bigger than one register.

Applying these two rules to the diagram of possibilities, one gets:

uniform successions:	marked	**HH**
	unmarked	**MM**
		LL
raising successions:	unmar./mar.	**MH**
		LH that realizes as LM in application of the 2nd rule
falling successions:	mar./unmar.	**HL** that realizes as HM in application of the 2nd rule

The impossibility, that we signalled, of the ML combination corroborates this analysis in two tones, the marked one of high register, the unmarked one of mid or low register according to the initial consonant, since both these two registers correspond to unmarked tones.

2.3.2 For terms with initial consonants of the third set

If all initial consonants divide exclusively between the first and the second set, our analysis would permit to keep phonologically only two tones, since the mid and low register corresponding to the unmarked tone are conditioned by the nature of the initial consonant of words.

But the behaviour of terms of the third set, regrouping the nasals, the trill, the lateral, the approximants and the glottal, is a problem because, in this case, the three registers are opposable (cf. section 5).

3. The tonal system

The phonetic issues gave no evidences of the existence of three tonal registers in Masa. So, according to the interpretation of the tonal realizations in minimal pair oppositions, we will keep the following system:

a marked tone: realized as high (H, v́), that doesn't undergo the influence of the nature of the initial consonant;

an unmarked tone: realized, on the first syllable, according to the nature of the initial consonant, either as mid (M, v̄), or as low (L, v), and on the second syllable according to the admitted combinations.

From this standpoint, it is easy and useful to support this system by comparing it to Mbara, that shows two registers as Masa (Tourneux, Seignobos & Lafarge 1986) and to Musey that presents the same consonant-tone interference (Shryock, 1995).

To explain the syntagmatic distribution of phonetic tones in Masa, we propose 3 new tonal rules:

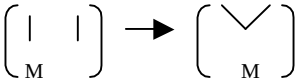
1. Two superficial tones exist (Melis, 1999): the marked one (H register), independent from the nature of the consonant in syllabic onset; the unmarked one, whose register depends on the consonant-tone interference: M

register after non depressor consonant (1st set, part of the 3rd set); L register after depressor consonant (2nd set, part of the 3rd set).

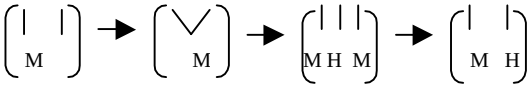
2. Rule of non adjacency of two marked tones (H): their adjacency triggers a tonal dissimilation to the right (with variation of only one degree of tonal register).
3. Rule of the propagation to the right of a tone.

Reformulation of tonal syntagmatic distribution in verbal paradigm:

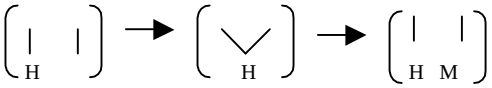
class 1
NEUTRAL ASPECT MM: [M] → [M] (unmarked tone + rule 3)



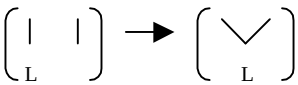
AC. ASPECT MH: [M] → [M] → [MHM] → [MH] (unmarked tone + rule 3 + floating H + upstep)



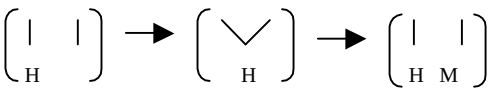
UNAC. ASPECT HM: [H] → [H] → [HM] (marked tone + rule 3 + rule 2 & dissimilation to the right of one degree)



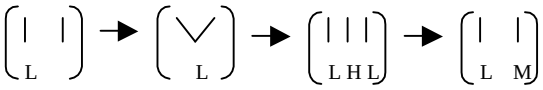
class 2
NEUTRAL ASPECT LL: [L] → [L] (unmarked tone + rule 3)



AC. ASPECT HM: [H] → [H] → [HM] (marked tone + rule 3 + rule 2 & dissimilation to the right of one degree)



UNAC. ASPECT LM: [L] → [L] → [LHL] → [LM] (unmarked tone + rule 3 + floating H + upstep)



As one can see, we postulate the existence of a marked tone (H), of an unmarked tone (L or M) and of an unmarked tone + floating H (upstep).

The results of the investigation allow us to conclude that Masa language shows only one marked tone. The other tones derive as a consequence of the application of three tonal rules and of some restrictions relative to the phonetic nature of the initial consonant of the word. Therefore Masa should be classified as a tonal or pitch accent language.

4. Problem: the minimal pairs L/M

We discussed some occurrences of nominal roots where the initial consonant belonged to the "neutral set". They may give rise both to M or L registers. So that you can not predict the tone (Mid or Low): e.g. the minimal pairs in (3) and (6).

Thus, one could tend to conclude that M and L tones have an underlining status and that Masa has three tones (H, M, L). In order to experimentally verify whether the consonant before M tone is the same consonant that one finds before L tone, we examined their spectrograms. So, if we look at the segmental features of the sonorants in the onset of the minimal pairs, then we find that, according to their different amplitude, we distinguish two subsets of nasals, laterals, trills, approximants and also two /ʔ/. So that, as the laryngeal contrast in Musey (Shryock, 1995), in Masa the intensity contrast triggers the splitting of the so-called neutral consonantal set:
Subset 1 (+): more intense with non depressor or raising effects on the tone of the following vowel (H and M registers);
Subset 2 (-): less intense with depressor effects on the following vowel (H and L registers).
Figures 1-4 show some examples and Table 4 presents the final diagram.

From a comparative standpoint, all the Masa sonorants of subset 1 (+) seem to correspond to Musey prenasalized stops, as for example Masa **māllà** – Musey **mballa** "rafter" vs. Masa **màllà** – Musey **malla** "straw".

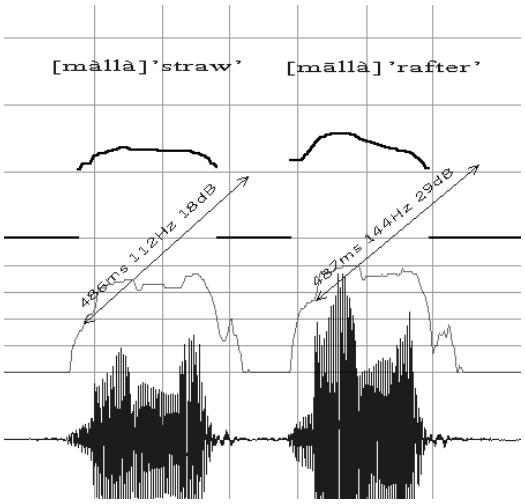


Figure 1. *Minimal pair L/M: màllà (18 dB)/ māllà (29 dB)*

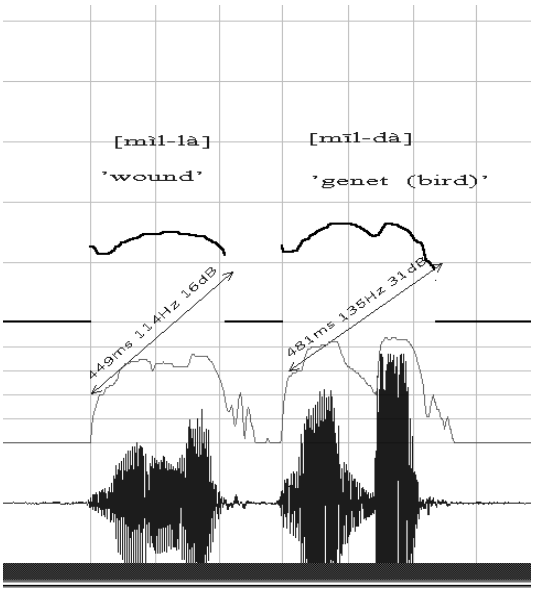


Figure 2. *Minimal pair L/M: mìllà (16 dB)/ mīldà (31 dB)*

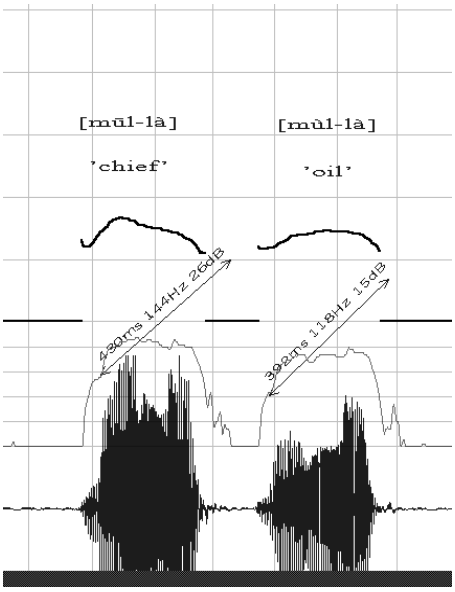


Figure 3. *Minimal pair M/L: mūllà (26 dB) /mùllà (15 dB)*

Finally, we can demonstrate that the minimal pairs listed before are not tonal pairs, but only segmental pairs. Summing up, Masa shows only one tonal register: the high one.

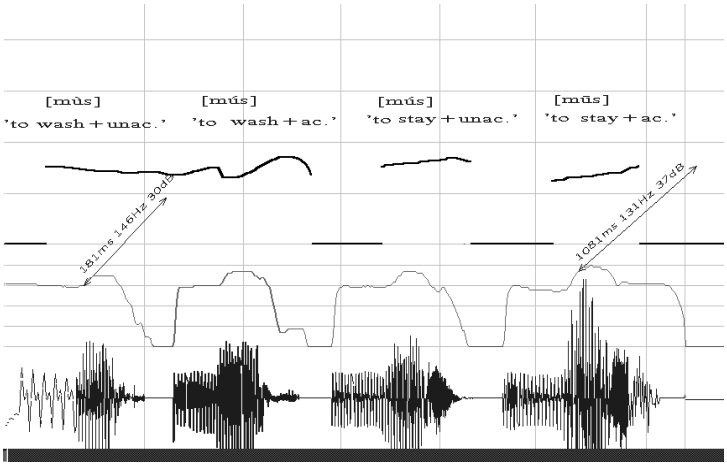


Figure 4. *Minimal pairs H/M/L: verbal class 2: mùs (30 dB) /mús; verbal class 1: mús / mūs (37 dB)*

		Bilabial			Labiodental			Dental			Alveolar			Palato-alveolar			Palatal			Velar			Glottal		
		B	I	E	B	I	E	B	I	E	B	I	E	B	I	E	B	I	E	B	I	E	B	I	E
Stop	Unvoiced +	p		p				t		t										k		k	ʔ		ʔ
	Unvoiced -																						ʔ		ʔ
	Voiced -	b	b					ɗ	ɗ											g	g				
	Implosive +	ɓ	ɓ					ƈ	ƈ																
Affricate	Unvoiced +													tʃ											
	Voiced -													dʒ	dʒ										
Fricative	Unvoiced +				f		f	ɬ		ɬ	s		s										h		h
	Voiced -				v	v		ɮ	ɮ		z	z											ɦ	ɦ	
Sonorant	Nasal +	m	m	m				n	n	n										ŋ	ŋ	ŋ			
	Nasal -	m	m	m				n	n	n										ŋ	ŋ	ŋ			
	Lateral +							l	l	l															
	Lateral -							l	l	l															
	Trill +							r	r	r															
	Trill -							r	r	r															
Approximant	+				w	w	w										j	j	j						
	-				w	w	w										j	j	j						

Table 4. *Masa consonants: depressor (-) and non depressor (+) in initial (B), intervocalic (I) and final (E) position.*

5. References

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