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Form and meaning in Fulfulde: a morphophonological study of Maasinankoore

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Chapter four
The syllable

4.0 INTRODUCTION

The syllable in Fulfulde has the structure CV(V)(C). A number of authors on Fulfulde do not give a description of the syllable, although they make use of the term syllable and related terms like monosyllabic or polysyllabic (Arnott 1970a:62-64, Noye 1974:11). Some authors give a separate statement on the syllable structure, for others the syllable structure is perhaps too obvious to be described. McIntosh (1984:20) indicates that the syllable is a unit that is necessary for describing stress assignment. Klingenheben (1953) makes use of the syllable in the description of certain phonological changes which are restricted to the syllable final position.

The notion of syllable is needed in even more areas than the ones suggested by these authors. It is shown below that constraints on possible syllable structures limit the possible sequential combinations of vowels and consonants. The syllable also plays an important role in the formulation of rules involving the deletion of vowels and consonants or the reduction of their length. The syllable structure is also invoked as a conditioning factor for the so called "anaptyctic vowels" (Arnott 1970a:55, McIntosh 1984:157) or "Sproβvokal" (Klingenheben 1927:152). The vowels which are claimed to be epenthetic can be [**u**], [**i**] or a vowel identical to the vowel of the following syllable. The actual epenthetic status of these vowels is questionable.

This chapter gives a short sketch of the syllable structure found in Fulfulde, focusing on the Maasina dialect. The possible syllable templates and their syllable weight are described. This includes a discussion of the marginal status of the CVVC syllable and its implications for vowel length and the alternation between CVCC and CVVC that has sometimes been labelled "compensatory lengthening". Then the influence of the sonority hierarchy in a number of phonological rules related to the syllable is discussed. Sometimes changes in the CV-structure can occur to prevent the occurrence of ill-formed syllable structures. In this context, the alleged epenthetic status of a number of vowels in Fulfulde is challenged. Finally, it is demonstrated that stress in Fulfulde is largely predictable from the syllabic structure of words, and a few intonation patterns that make use of the possible stressed syllables in words are described.

4.1 SYLLABIFICATION RULES

The model used in this study to derive the syllable structure is the XMS-model (Schadeberg 1987) which derives the syllable structure of words from the sequence of its consonants and vowels. The name of this model follows from the abbreviations of the three levels used in the derivation of the syllable: the X from the x-tier (also called skeletal, segmental, root or time tier) the M for the moraic level where weight is represented, and the S for the syllabic level. The Greek letters μ and σ represent the mora and the syllable respectively. The

syllables are derived from the sequence of elements on the x-tier or time-tier which is made up of the time slots occuring in an utterance. The number of time slots attached to each morpheme is given in the lexicon. Time slots are linked to segmental matrices that combine the information of the different feature tiers.

In this study a CV-tier replaces the x-tier in the XMS-model. The CV-tier represents an explicit derivation of the consonantal or vocalic status of the time slots. This CV-tier is not formally present in Schadeberg's model, although he has to interprete the time slots on the x-tier as a consonant or a vowel in order to derive the correct moraic and syllabic structure. The consonantal or vocalic status of the time slots on the x-tier must be known to derive the correct syllabic and moraic structure of the words. This consonantal or vocalic status is made explicit on the CV-tier where the time slots are identified as consonantal (C) or as vocalic (V). The terms "consonantal" and "vocalic" are not taken as features in this study; they do not appear in the list of phonological binary features in the matrices that give the phonological content of the speech sounds. Instead, a consonant is considered to be a time slot with a consonantal status on the CV-tier and a vowel is a time slot with a vocalic status on the CV-tier. The consonantal or vocalic status of a given time slot can be derived from the content of the autosegments associated to that time slot. The rules for interpreting time slots as consonantal or vocalic are discussed in section 2.4. The CV-tier is derived from the segmental structure of time slots and the moraic and syllabic structure of a word is derived from the sequence of consonantal and vocalic time slots. The following procedure using the XMS-model produces the syllabic division of a given utterance in Fulfulde.

MORAIC LEVEL

(M1) Build a mora with any CV sequence.

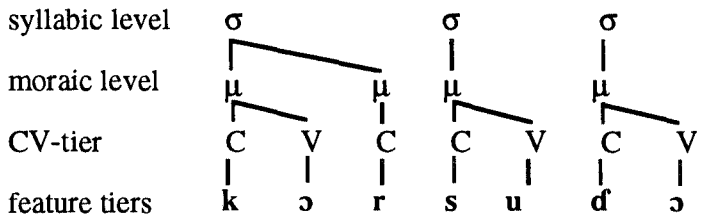
(M2) Build a mora with all V and C that are not in a CV sequence.

SYLLABIC LEVEL

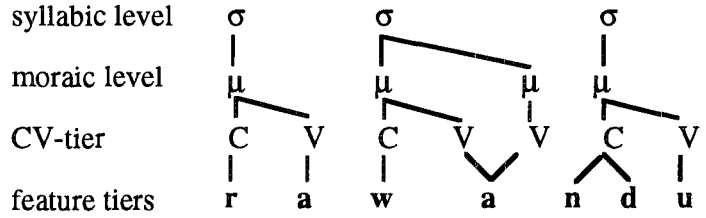
(S1) Build a syllable on each branching mora (constituting a CV sequence)

(S2) Attach all the non-branching morae to the preceding syllable.

The following figures represent the application of these syllabification rules which occur at the word level.



The application of these rules produces the correct syllable structure of the word **kor·su·ɗɔ** 'cherished one' .



The word **ra·waa·ⁿdu** 'dog' is an example of the derivation of the syllabic structure of words in which long vowels and prenasalized consonants occur. The syllable structure shows that the prenasalized sequence [ⁿd] functions as one consonant in the onset of the last syllable.

4.2 WELL-FORMED SYLLABLE STRUCTURES

4.2.1 SYLLABLE TEMPLATES

The following description of the syllable structure is given by Stennes (1967:13) for the Fulfulde dialect of Aadamaawa.

> The phonological shape of all syllables is CV(C) or consonant, vowel (where the vowel can be either short or long) with an optional final consonant.
>
> Stennes (1967:13)

This description is valid for all Fulfulde dialects although it seems to contradict Paradis' analysis of some syllables in Pulaar as having an empty onset in the underlying structure (Paradis 1986:172-177). However, she postulates an additional automatic phonological rule that fills the onset with a glottal stop. The following CV-templates occur as possible syllable structures in Maasina.

CV	CVC
CV_iV_i	CV_iV_iC

Sub-parts of the syllable are the onset, the nucleus, and an optional coda. The CV-core is considered to be the unit which forms the basis of any syllable, rather than the rhyme. The CV-core consists of the onset and the nucleus. The rhyme is formed by the nucleus and the coda. A rule attaching the onset to the rhyme is needed when the rhyme is considered to be the basic unit of the syllable (Clements & Keyser 1983:11-16, Hyman 1985:7, Goldsmith 1990:108). Goldsmith (1990:137) calls this the Maximum Onset Principle. Clements & Keyser (1983:37) call it the Onset First Principle. Hyman (1985:15-17) describes the linking of the onset to the nucleus in the equivalent Onset Creation Rule. An argument for the unity of this CV-core is the fact that the CV-core forms a constant structure that does not undergo any change, neither feature changes nor structural changes. The onset and nucleus are never separated by epenthesis. The assumption that the onset together with the nucleus form the basic unit of the syllable makes it no longer necessary to state the Maximum Onset Principle. Any vowel is linked to a preceding consonant in the same syllable by the syllable assignment rule that assigns a mora to the syllable core CV first.

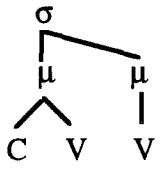
A rule that groups the onset-nucleus unit first has an advantage over the "all nuclei first" approach which is an assignment rule that wants to assign the nucleus first (Goldsmith 1990:117). For this latter approach, a separate rule or a lexical indication is needed to establish which segments (mostly which vowels) form the nucleus. Hyman's Onset Creation Rule proposes to parse all CV sequences first. When I take this CV sequence as the core of the syllable, this makes it unnecessary to give a separate statement about which vowels constitute a nucleus. This follows from the CV-core assignment rule itself: each vowel that is preceded by a consonant constitutes the nucleus of a syllable.

This CV-core assignment rule leaves the coda as a secondary unit in the syllable which basically consists of consonantal or vocalic time slots that cannot form a syllable by themselves. These segments are therefore always attached to the preceding CV-core, thus forming with it a heavy syllable. This coincides with the fact that the presence of a coda in a syllable means that this syllable counts as two morae, i.e. as two units of weight. The four possible syllable types in Fulfulde have the following internal structure:

CV syllable:

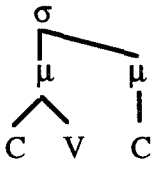
The light CV syllable represents the most simple syllable structure. It consists only of a CV-core which forms one mora.

CVV syllable:



The heavy CVV syllable consists of a CV-core to which a vocalic time slot is added. The CVV syllable consists of two morae: one is formed by the CV-core, one mora is added by the additional vocalic time slot.

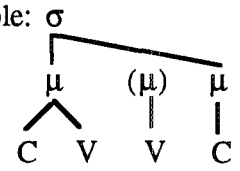
CVC syllable:



The internal structure of the CVC heavy syllable shows a lot of similarity with the CVV syllable. The weights are identical and the division of morae over the CV-core and the coda is also identical in both structures.

The weight structure of the marginally acceptable CVVC syllable is difficult to represent. At the moraic level there are only two morae allowed per syllable, it is not clear which mora (attached to the final V or the final C) is deleted. At the segmental level the CVVC sequence is sometimes allowed. Often reduction occurs at the segmental level.

CVVC syllable:



The heavy CVVC syllable consists of the CV-core to which an additional vocalic and a consonantal time slot are added. A rule must be formulated to delete one mora because Fulfulde does not allow a syllable to contain more than two morae. That the deletion of one mora sometimes has consequences for the phonetic length of the vowel is described in section 4.3.

The CV-core can contain any consonant and any vowel. A further restriction on the segmental structure of the syllable is that all segments that occur in non-branching morae are licensed by their position in the syllable. All vowels occurring in a non-branching mora are identical to the vowel in the preceding CV-core. All consonants that occur in a non-branching mora are either identical to the core consonant of the following syllable (thus forming a geminate) or they are sonorant and they follow the sonority hierarchy pattern, a few exceptions are discussed in section 4.4.2. The definition of CV-core reduces the importance of the rhyme (nucleus and coda) considerably, there are no generalizations about the rhyme that are missed out in the present proposal. The second vocalic time slot in a CVVC syllable probably belongs neither to the CV-core, nor to the coda. Its status is marginal, as is shown by the marginal status of the CVVC syllable itself.

4.2.2 SYLLABLE WEIGHT

Syllables are divided into light and heavy syllables (see Newman 1972). A heavy syllable equals two morae, a light syllable equals one mora.

CV	one mora	light
CVV	two morae	heavy
CVC	two morae	heavy
CVVC	two morae	heavy

The division that Gaden (Gaden & Tyam 1935:xi) makes between short and long syllables coincides with the division between light and heavy syllables. What he calls the metric value of the different syllable structures in Pulaar (Fuuta Tooro) could be interpreted as their syllable weight.

> La syllabe *brève* est formée d'une consonne suivie d'une voyelle brève. La syllabe *longue* est formée d'une consonne suivie d'une voyelle longue ou de deux consonnes encadrant une voyelle, que celle-ci soit brève ou longue, accentuée ou non: **ɗum** et **ɗúum** sont deux syllabes longues de même valeur métrique
>
> (Gaden & Tyam 1935:xi).*

* A short syllable is formed by a consonant followed by a short vowel. A long syllable is formed by a consonant followed by a long vowel, or it is formed by two consonants surrounding a vowel, either long or short, with or without accent. So **ɗum** and **ɗúum** are two long syllables with the same metric value

The equation of one heavy syllable with two light syllables in poetry confirms the syllable weight of CV as one mora and the double weight of two morae for the CVV, CVC, and CVVC syllables. This equation can be demonstrated when the syllables have to follow a prescribed metre, as is often the case in poems. The following two lines come from the epic poem on the life of El Hadj Omar transcribed by Henri Gaden (1935). In this poem, the words are organized according to a metre called **kaamil**.

kaamil metre: — — ◡ ˋ — | ◡ ◡ — ◡ ˋ — | ◡ ◡ — ◡ ˋ —

The sentences following the **kaamil** metre are formed with three metrical phrases which are separated by a vertical line (|). Each metrical phrase consists of seven morae. Stress should preferably fall on the penultimate mora of each unit of seven morae. This stress falls on the last syllable when it is heavy or on the penultimate syllable when the verse ends in two light syllables. Stress is indicated by an accent (ˋ) on the stressed syllable. The symbols for a light syllable (◡) and a heavy syllable (—) are taken from the traditional way of marking rhythm in poetry. The word internal syllable boundaries are represented by a raised point. In the following lines, the morae are divided over the syllables in the way that is prescribed by the **kaamil** metre (Gaden & Tyam 1935:2).

cem·ᵐbìn·ⁿdi ⁿjìr·wu·ⁿdi faa·ʔi·dàa·ri ⁿdi yer·ɓa·tàa
— ˋ — ◡ ˋ — | ◡ ◡ — ◡ ˋ — | ◡ ◡ — ◡ ˋ —

ɓam·tìi·ⁿdi sàw·tu ⁿda·nèe·ri ᵐbùul·di ⁿdi haa·ɓa·tàa
— ˋ — ◡ ˋ — | ◡ ◡ ˋ — ◡ ˋ — | ◡ ◡ — ◡ ˋ —

'Vigorous, glorious, impressive one, who doesn't stagger;
with a strong voice, white with a spot on the face, who won't get exhausted.'

The first syllable **ᵐbuul** of the word **ᵐbuul·di** with a CVVC shape takes the same position as the syllable **daa** with a CVV shape in the word **faa·ʔi·daa·ri** in the first line. This shows that a CVV and a CVVC syllable have equal metric value. It is also possible to replace the long syllable with two short syllables and vice versa, as can be shown in the following lines in **kaamil** metre (Gaden & Tyam 1935:6).

ɗòon ruŋ·ⁿji màc·cu·ɗo fèc·ci·to·yi les·ɗèe·le kà·la
ˋ — ˋ — ◡ ˋ — | ◡ ◡ ˋ — ◡ ◡ ◡ | — ˋ — ◡ ˋ ◡

ɓèen jùul·ɓe fàa·de ʔe kùf·ru màŋ·ⁿgu ⁿgu tuu·ba·tàa
ˋ — ˋ — ◡ ˋ — | ◡ ◡ ˋ — ◡ ˋ — | ◡ ◡ — ◡ ˋ —

'There he went away the servant (of Allah), he went to cross each of many countries of those Muslims, in the direction of paganism that wouldn't convert'.

The sequences of two light syllables **to·yi** and **ka·la** in the first sentence are balanced with one heavy syllable **maŋ** or **taa** respectively in the second sentence. Gaden adds that such a replacement is only allowed at the end of a metrical phrase.

Syllable weight also determines the correct sequence of light and heavy syllables in a word. Some phonological changes show that there is a preference for light and heavy syllables to alternate. A sequence of three unstressed light syllables CVCVCV is ill-formed. The rule preventing such a sequence deletes the vowel of the middle syllable. This results in an anti-iambic sequence (a heavy followed by a light syllable: CVC-CV).

ˣjaŋⁿg-in-ata	**jaŋ·ⁿgin·ta**	'will teach'
		read-CAUS-R.INCOMPL
ˣfill-an-ɔtɔ	**fil·lan·tɔ**	'will tell for'
		tell-DAT-M.R.INCOMPL
ˣnan-ir-ɛtɛ	**na·nir·tɛ**	'will be heard with'
		tell-CIRC-M.R.INCOMPL
ˣwaɗ-ir-udɛ	**wa·ɗir·dɛ**	'to do with'
		do-CIRC-INF

A long vowel in the first syllable in a sequence of two heavy syllables is often shortened, the result being an iambic rhythm (a light syllable followed by a heavy syllable). This rule applies especially in word final position but also at the beginning of words.

ˣtaanee-wel	**tàa·ne·wel**	'small anvil'	**taanèɛ-rɛ**	'anvil'
ˣⁿgaaj-ii-ɗaa	**ⁿgaa·ji·ɗàa**	'you have chatted'	**ⁿgaaj-ìi-mi**	'I have chatted'
ˣhiir-aa-ⁿdɛ	**hi·ràa·ⁿdɛ**	'evening meal'	**hìir-dɛ**	'to be evening'
ˣᵐbooɗ-eefi	**ᵐbo·ɗèe·fi**	'goodness'	**wòoɗ-udɛ**	'to be good, beautiful'

This vowel shortening is optional: the following examples show alternative forms that were both attested in Maasina.

ⁿgɛ·lɔ̀ɔ·ba	also	**ⁿgɛɛ·lɔ̀ɔ·ba**	'camel'
ɟi·wɔ̀ɔ·ⁿdɛ	also	**ɟii·wɔ̀ɔ·ⁿdɛ**	'rain storm'

The word is the domain of syllabification and of rules depending on syllable weight.

4.3 WELL-FORMEDNESS OF THE CVVC SYLLABLE STRUCTURE

4.3.1 MARGINALITY OF THE CVVC SYLLABLE

Although the CVVC syllable appears to be equal in weight to the CVV and CVC syllables in poetry, some phonetic and phonological shortening rules indicate that a CVVC syllable is considered to be slightly overweight. This gives the impression that both elements (V and C) contain weight and that both elements are added to the CV-core. The overweight may be the reason why CVVC is a marginal syllable structure. The limited distribution of the CVVC syllable is an indication of its marginal status. The marginal CVVC syllable mainly occurs in transparent productive word formations. Extra heavy syllables are more commonly found in word final position but in Fulfulde the CVVC syllable only occurs word initially. The situation in Fulfulde is fostered by the morphological structure of the word: morphemes with an underlying CVVC structure are mostly (verb) roots; the place of the root is word initial; when the root is followed by a consonant initial suffix a CVVC syllable may be the result.

Sometimes the CVVC syllable is subject to vowel shortening even though vowel length is a very steady phonological feature in Fulfulde. A difference must be made between stressed and unstressed CVVC syllables. Unstressed syllables are more likely to be shortened. Vowel shortening also occurs more frequently in less transparent derivations in the lexicon. The following examples show the shortening of a long vowel in a closed syllable.

ˣ**hiir-naaⁿgɛ**	**hir-nàaⁿgɛ**	'west'	**hiir-dɛ** 'be evening' + **naaⁿgɛ** 'sun'
ˣ**jɔɔm-suudu**	**jɔm-sùudu**	'partner'	**jɔɔm** 'owner' + **suudu** 'house'
ˣ**waas-r-udɛ**	**wày-rudɛ**	'do without'	**waas-udɛ** 'to lack' + **-r-** CIRC

Stressed CVVC syllables are less rare. There is no clear difference in the distribution of vowel shortening between productive and less productive word formations. The stress placed on the syllable might prevent vowel shortening in those CVVC syllables. Nevertheless, there are a few examples where variation occurs in the vowel length of long vowels in stressed closed syllables.

tèw	(**tèew, tèewu**)	'meat'
kàw	(**kàaw, kàawu**)	'maternal uncle'
kɔ̀rɗɔ	**kɔ̀ɔrɗɔ**	'female slave'
tìrrɛ	**tìirrɛ**	'difficulty'

This shortening of a CVVC syllable to CVC is not obligatory in the Fulfulde of Maasina. The distribution of the short and long vowels might be connected to the speech-rate, i.e. the vowel is often shortened in fast speech. It can also be related to regional differences. Speakers of Kunaari and Gimballa say that Fulfulde speakers from Tenenku (Maasina centre) gave the impression of talking slowly, of dragging their language ("Ils tirent leur langue"). This impression might be caused by a more frequent occurrence of long vowels in closed syllables in the Fulfulde of Tenenku. In a number of dialects, such as the Fulfulde of 'Yola (Aadamaawa) and Kaceccereere (Nigeria) the occurrence of the CVVC syllable is

more restricted. McIntosh (1984:13-18) makes a distinction between common and irregular syllable structures in Kaceccereere. She states that the commonest syllables are CV, CVV, and CVC (McIntosh 1984:13). The irregular syllable structures in this dialect are a closed syllable with a long vowel (CVVC) or a long final consonant (CVCC). The only example of a syllable with such a CVVC structure given is **ʔaan** 'you' which is an independent pronoun. The other irregular structure CVCC is only found in the words ending in **koyŋ** (class-marker of plural diminutive) and in the independent pronoun **minn** 'me'. McIntosh (1984:15) gives the following derivations and inflections where a CVVC morpheme shortens its vowel before another consonant initial morpheme in order to avoid a CVVC syllable.

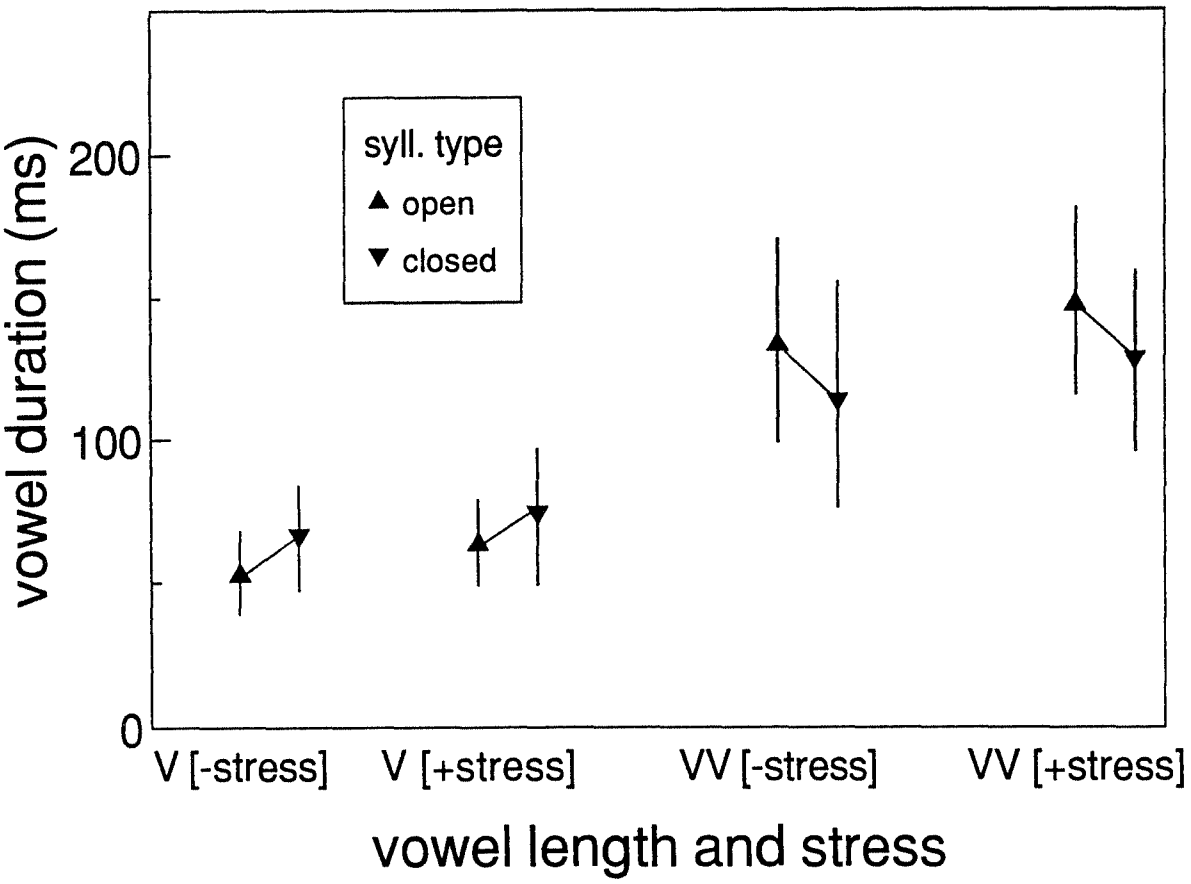
long vowel morpheme		short vowel allomorph	
ʔon ɲaam-ay	'You will eat.'	**raa no ɲam-r-at-on**	'See how you eat.'
		ɲam-ⁿdu wal-aa	'There is no food.'

The stem **ɲaam-** 'eat, food' alternates with **ɲam-** as a result of vowel shortening in closed syllables in Kaceccereere.

4.3.2 A PHONETIC EXPERIMENT ON VOWEL LENGTH IN CVVC SYLLABLES

During field work on Maasina, it was not immediately clear whether underlying long vowels in closed syllables were shortened or not. It seemed that long vowels in closed syllables were shorter than long vowels in open syllables. However, speakers were mostly convinced of the length of certain long vowels in a closed syllable. The speaker's perception of vowel length could have been influenced by the underlying phonological length of the vowels. Sometimes the underlying structure seems to have more reality in the speaker's perception of his/her language than the actual phonetic realization of a word. The frequent disagreement on the pronunciation of vowel length in particular words made it clear that there was a problem with the interpretation of vowel length in closed syllables in the Fulfulde of Maasina.

A phonetic investigation into the length of vowels in open and closed syllables was carried out. Both phonologically long and short vowels were measured. The results are given in Appendix 2. The length of long and short vowels was measured in open and closed syllables, in stressed and unstressed syllables. The following table shows the average length of the different groups of vowels with the standard deviation.



Stress has a slight influence on the length of a vowel. This effect can only be registered when a large group of measurements is taken.

The effect of the presence of a coda (syllable final consonant) on the duration of a long vowel is the opposite of the effect exerted on a short vowel followed by a coda. Long vowels are significantly shorter in closed syllables, short vowels are significantly longer in closed syllables. This is contrary to the pattern found in most languages where the coda has a shortening effect on all vowels (Vincent van Heuven, personal communication). Fulfulde deviates from the common pattern because short vowels in closed syllables are longer than those in open syllables (rather than vice versa). Possibly, this can be explained by syllable weight. CV is a light syllable containing one mora. CVC, CVV and CVVC are heavy syllables, they both contain two morae. The vowel in a CVVC syllable may be shortened to reduce overweight (it contains phonological material for three morae). The vowel lengthening in CVC makes this syllable to become more similar (in duration) to the other two heavy syllable structures. Perhaps this facilitates the perception of all heavy syllables as distinct from the light CV syllable.

The phonetic change due to closedness of the syllable in the duration of long and short vowels does not result in a complete overlap of the vowel length in CVC and CVVC syllables, they are still significantly different.

4.3.3 SHORTENING OR COMPENSATORY LENGTHENING (CVVC vs. CVCC)

In Fulfulde dialect comparison, alternations can be found between a CVVC and a CVCC stem. At first sight this looks like compensatory lengthening. However, the alternative forms CVCC and CVCC are caused by reduction of the marginal CVVC syllable structure. Rather than one being derived from the other, both structures, CVVC and CVCC, are derived from an underlying CVVC·C sequence. A geminate consonant often shortens in fast speech when the final consonant in a CVVC syllable is the first element of this geminate consonant. Depending on the features linked to the geminate consonant, either the long vowel or the long geminate of the underlying CVVCCV sequence is shortened. In Maasina a difference must be made between prenasalized geminates and the other geminates, i.e. plain oral or plain nasal geminates. Plain geminate consonants are not usually shortened in order to avoid extra-heavy syllables, shortening of the VV being the preferred strategy.

The last consonant of a CVVC syllable can be deleted when it is the first of a prenasalized geminate. The results of such a process are forms like **huu^{n}dɛ** 'thing' and **lii^{n}gu** 'fish'. This shortening of a prenasalized geminate can also be found in the following forms where CVVCC alternates with CVVC when CC is a geminate prenasalized consonant.

^{n}juun^{n}di, ^{n}juu^{n}di	'length'
ɗaan^{n}di, ɗaa^{n}di	'pack-ox'
wiin^{n}dɛ, wii^{n}dɛ	'corral'

The long vowel of a CVVC syllable can be shortened when it precedes geminate consonants which are plain oral or plain nasal, as in **kullɛ** 'things' and **liɗɗi** 'fishes'. The following alternative forms show this shortening of CVVCC to CVCC when CC is plain oral or plain nasal geminate consonant.

puuddi, puddi	'henna'	**biillɛ, billɛ**	'corrals'
^{n}juukki, ^{n}jukki	'length'	**tuunnudɛ, tunnudɛ**	'to be dirty'
ɓɔɔddɛ, ɓɔddɛ	'balls'	**loonnudɛ, lonnudɛ**	'to wash clothes'
tiirrɛ, tirrɛ	'difficulty'		

In Maasina the paradigms of **huu^{n}dɛ/kullɛ** 'thing' and **lii^{n}gu/liɗɗi** 'fish' show a CVVC vs. CVCC alternation which results from the shortening of underlying CVVCCV forms. This alternation can be found within a paradigm, but not within one word in one particular dialect. However, this CVVC/CVCC allomorphy can be found when comparing dialects.

	Maasina	Liptaako	Gombe	Ringimaaji
'fish'	**lii^{n}gu**	**lii^{n}gu**	**liŋ^{n}gu**	**liji^{n}gu**
'ashes'	**^{n}doo^{n}di**	**^{n}don^{n}di**		
'thing'	**huu^{n}dɛ**	**hun^{n}dɛ**	**huu^{n}dɛ**	**hu^{ʔ}u^{n}dɛ, huu^{n}dɛ**
'snake'	**^{m}boddi**	**^{m}boodi**	**^{m}boddi**	**^{m}bo^{ʔ}odi**
'snakes'	**bɔllɛ**	**bɔɔlɛ**	**bɔllɛ**	**bɔ^{ʔ}ɔlɛ**
'things'	**kullɛ**		**kuujɛ**	**kuujɛ**
'fishes'	**liɗɗi**			**lijji**

The alternation of CVVC with CVCC in the examples above might be interpreted as examples of compensatory lengthening, but they are not. These two sequences are the result of the application of two different (dialect related) repair rules to avoid the marginal CVVC structure. Depending on the word and the dialect in question, either the long vowel or the geminate consonant in a CVVCCV sequence can be shortened. The following distribution of shortening rules can be formulated for the different dialects:

	Maasina	Liptaako	Gombe	Ringimaaji
$CVVC_iC_i$	shorten VV	shorten CC	shorten VV	shorten CC
$CVVN^nC$	shorten CC	shorten VV	shorten VV	shorten CC

The conclusion is that the alternation of CVVC with CVCC is not an example of compensatory lengthening. Within one dialect, the CVVC/CVCC variation is not found within one word. A given CVVCC sequence can only be shortened in one way: either the vowel is shortened or the consonant. The choice is determined by the features of the geminate consonants. The alternative forms support the analysis that there is a tendency to avoid the marginal CVVC syllable structure.

4.4 SONORITY AND SYLLABLE STRUCTURE

Sonority is a phenomenon connected with the syllable. An utterance can be characterized by successive peaks and valleys of sonority. In Fulfulde a peak of sonority will always coincide with the nucleus of a syllable. An utterance has as many syllables as there are sonority peaks. Sonority is an acoustic feature that is not easily defined. Terms such as loudness and openness are used to describe sonority (Bloomfield 1933: 98). Bloch and Trager (1942:22) try to define sonority in terms of articulatory gestures as follows (cited by Goldsmith 1990:110):

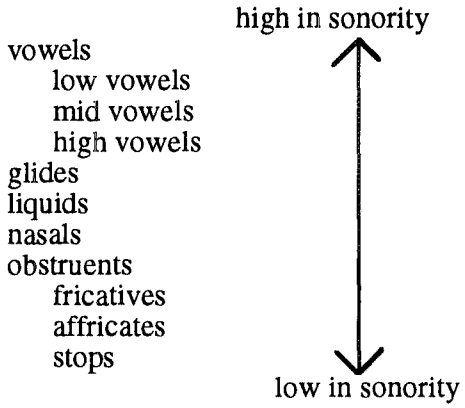
> The sonority of a sound is primarily determined by the size of the resonance chamber.

There certainly is a correlation between the acoustic and the articulatory features of speech sounds. The sonority of a speech sound is related to the size of the resonance chamber during its production, as defined by Bloch and Trager. But voicing is also very important for the sonority of a segment. The voiced vowel [**a**] is definitely more sonorant than the voiceless vowel [**ḁ**], not withstanding the fact that in articulatory terms the resonance chamber of both sounds are equal.

In this study sonority is thought to be an acoustic feature that should be defined in terms of audibility. Sonority is a feature with relative values that should alternate in time in an utterance. The audibility of the utterance increases if sonorant segments alternate with less sonorant segments, i.e. if vowels alternate with consonants. One reason for not describing sonority in terms of the articulatory apparatus is the fact that phonological rules related to the sonority of a segment are very different in nature from the phonological rules involving articulatory features. The kinds of rules conditioned by a certain articulatory feature specification of adjacent segments usually involve assimilation: spreading of an articulatory feature. Sections 4.4 and 4.5 describe some phonological structure constraints and phonological rules related to sonority. The motivation for the constraints and rules

involving sonority are not conditioned by simple adjacency: the structure of the syllable plays an important role in the conditioning of changes in sonority. Rules involving sonority describe these alternations of sonority in time, i.e. they describe the alternations of sonority of speech sounds in the syllable. The inherent sonority of a segment plays an important role in determining its position in the syllable.

The following table gives a representation of the ranking of segments according to their inherent sonority. The sonority hierarchy in this table is how the ranking is usually described (Goldsmith, 1990:111).



The sonority hierarchy in Maasina and the restrictions on the sequence of segments according to their sonority are discussed in more detail in the following sections. In Fulfulde, sonority seems to play a role in the sequence of consonants even if, by the rules of syllable structure, those consonants are in different syllables. In the description of the sonority pattern of syllables, a distinction must be made between open and closed syllables. The open syllables have the templates CV and CVV. Their sonority patterns are identical. The first time slot in a syllable (the onset) may be any consonant, any consonant being less sonorant than any vowel. The vowel in an open syllable is the sonority peak of that syllable. Open syllables in Fulfulde contain a short or a long vowel. The second vocalic time slot in a VV sequence is always identical to the first.

There are no diphthongs in Fulfulde. An important argument for analyzing the sequences of a short vowel followed by [**y**] or [**w**] as VC is the fact that [**y**] and [**w**] do not spread ATR harmony in this environment, while [**i**] and [**u**] would (see section 2.9.3).

The closed syllables CVC and CVVC are characterized by a consonantal time slot in the coda of the syllable. The sonority pattern of a closed syllable consists of the same initial CV pattern as described for an open syllable, but the final segment in a closed syllable has to obey a number of constraints related to the sonority hierarchy. The sonority hierarchy and its related rules in Maasina are compared with the sonority hierarchy of coronals described by Paradis (1986, 1987b) and with the phonological rules related to the syllable posited by Klingenheben (1941, 1953). He states a number of rules whereby the syllable final position causes certain sound changes (Silbenauslautgesetze). In the next section these syllable final sound changes are described as rules preventing ill-formed sonority sequences. The syllable final consonants that undergo these changes have to obey the sequential ordering determined by the sonority hierarchy.

It is useful to make a distinction between word internal syllables and word final syllables, because sonority constraints in a syllable are more strict word finally than word internally. Stennes (1967:14) distinguishes word final syllables from the other (word internal) syllables in Aadamaawa. He says that word internally any consonant can be found in the syllable coda. Stennes describes the following word final restrictions: the laryngealized stops [ɓ] and [ɗ] do not occur word finally; voiceless stops do not occur word finally except in ideophones; other stops occur only under restricted conditions in this position.

In Maasina a syllable cannot end in an obstruent. This constraint is true without exception for word final syllables. Only glides, liquids and nasals can be found in the coda in Maasina when the closed syllable occurs word finally. This is described in Klingenheben's rules involving the syllable final position. Word internally, however, obstruents can occur syllable finally under a number of conditions, for example as part of a geminate consonant.

After discussing the sonority hierarchy in Maasina, the phonological rules that repair ill-formed sequences in terms of the sonority (cf. Vennemann 1988) are given in more detail.

4.4.1 KLINGENHEBEN'S "SILBENAUSLAUTGESETZE"

Klingenheben's name is linked to a rule of coda weakening in Hausa (Westermann 1934, Newman & Salim 1981:108). This rule describes the historical change of syllable final labial and velar obstruents into the labio-velar glide [w]. Klingenheben's Law in Hausa involves the following historical phonological changes.

all dialects:	***K > w / __$**	**(*K = {k, g, ƙ})**
standard Hausa:	***P > w / __$**	**(*P = {p/f, b, ɓ})**

For Fulfulde, Klingenheben (1941:38-46) also described a number of laws involving syllable final segments which he calls "Silbenauslautgesetze". These laws describe historical phonological rules that explain dialectal variants of the same word. In these rules it is the syllable final position that triggers the sound changes. Klingenheben made use of the data of Gaden (1913, 1914) on Pulaar, of Cremer (1923) on Liptaako, and of Westermann (1909) on the Fulfulde of the Hausa states. Klingenheben's examples show syllable final (palato-)alveolar or palatal obstruents that have become [y].

lesdi	**leydi**	'land'
kosⁿgal	**koyⁿgal**	'foot'
ɓesda	**ɓeyda**	'increase'
tokoso	**tokoyru**	'small'
gaska	**gayka**	'hole'
les	**ley**	'under'
yesre	**yeyre**	'breasts (woman), udder (cow), below the belt (man)'
gasna	**gayna**	'cause to end' < **gas-a** 'end'
casɗe	**cayɗe**	'acacia trees' < sg. **cas-ki**
woʔot-	**woʔoyre**	'one'

hat	**hay**	'even'
***garat-ɗo**	**garay-ɗo**	'who usually comes'
lajre	**layre**	'limp'
ɗoj-	**ɗoyru**	'cough'
ɗojude	**ɗoyru**	'to cough - a cough'
ɲaj-	**ɲayre**	'adorn - pearl'
kaaje	**haayre**	'stones - stone'
taj-	**tayre**	'cut off - part'
laʔ-	**laykikin-**	'limp - pretend to limp'
bappaaɲo	**bappayɓe**	'father's brother - pl.'
gaɲɔ	**wayɓe**	'enemy - pl.'
saɲ-	**caycayɗo**	'weave - weaver'
keeɲe	**heeyre**	'livers - sg.'
daɲ-	**dayɗo**	'give birth - '(slave) who has given birth (by her master)'

He also lists a number of examples where a syllable final labial obstruent has become [**w**].

ɗopta	**ɗowtude**	'to accompany, to lead'
habre	**hawre**	'to fight'
nabde	**nawde**	'to take away'
woɓru	**wowru**	'mortar'
safara	**sawrude**	'medicine - to heal, to cure'
suftaade	**suutaade**	'to flee (from husband)'
naafki	**naawki**	'armpit'
naafde	**nawde**	'to carry under the arm - to carry away'
nofru	**nowru**	'ear'
sofru	**sowru**	'chicken, young bird'
deftere	**dewtere**	'book'
faamru	**faawru**	'frog'
wumde	**wuwre, ʔuure**	'abscess - pimple'

These sound changes are called "weakening" processes (Goldsmith 1990:125), and because in this case the weakening takes place in the coda it is called "coda weakening" (Vennemann 1988:23-26, 50). Coda weakening involves the change of a syllable final segment into a more sonorant segment with (more or less) the same place features.

In syllable final position a (palato-)alveolar or a palatal obstruent is replaced by the more sonorant palatal approximant [**y**]; a labial obstruent is replaced by a more sonorant labio-velar approximant [**w**]. The examples of a velar obstruent weakening in syllable final position are rare. Klingenheben (1941:44) provides only two of such examples:

1) The two variant forms **waklude** and **waylude** 'to form' where the syllable final velar obstruent [**k**] alternates with the more sonorant palatal approximant [**y**].

2) Words where the syllable final velar obstruent [**g**] changes into the more sonorant labio-velar approximant [**w**] like in ***bag-ɗi > baw-ɗi** 'drums'. These are however more likely to be examples of assimilation of an underlying [**w**] to the initial [**g**] of the class suffix **-gu** in the singular ***ᵐbaw-gu > ᵐbag-gu** 'drum'.

The phonological rules related to syllable positions that Klingenheben described for Fulfulde have not received much attention in later studies. The changes these rules describe are however difficult to explain by adjacency to a following consonant alone because they also occur word finally. It therefore has to be the position in the syllable that conditions the "Silbenauslautgesetze". Such rules are coda-weakening, assimilation, and deletion of the consonant in the coda.

Klingenheben (1963:18) gives the following examples of consonant deletion conditioned by the syllable final position. In these examples the laryngeal consonants (**h** and **ʔ**) and the consonants (**l**, **r**, **ɗ**) are replaced by more sonorant vowels in syllable final position.

wiʔ-	**wiita**	'say - say again'
teʔ-	**teegal**	'marry - marriage'
fah-	**faare**	'deaf'
duh-a	**duuta**	'put on trousers - take off trousers'
***dammugal-ru**	**dammugaaru**	'house with many doors'
***gerlal-ye**	**gerlaaye**	'partridge coloured cow'
***waɗ-n-**	**waani**	'cause to make'
***waɗ-r-**	**waari**	'make with'
yiɗde	**yiide**	'love'

The deletion of these consonants and their replacement by vowels is called compensatory lengthening. This effect of compensatory lengthening only occurs when a consonant in syllable final position is deleted. This effect is different from the effect of the loss of a consonant in syllable initial position. Compensatory lengthening probably takes place to maintain the weight of the heavy syllable. The loss of a syllable initial consonant is not compensated for and usually results in the reduction of the number of syllables.

4.4.2 CODA CONSTRAINTS IN MAASINA

At first sight there seems to be no restriction on the occurrence of consonants in syllable final position. The only type of consonant which is never found in syllable final position is a prenasalized consonant. Obstruents occur in syllable final position when they are the first part of a geminate consonant, as is shown in the following examples.

ʔab·ba	'father'	**maj·ju·dɛ**	'to be lost'
wad·dii	'has brought'	**hɛc·cɔ**	'fresh'
hɔg·gɔ	'corral'	**nɛɗ·ɗɔ**	'person'
kop·pi	'knees'	**ɓiɓ·ɓɛ**	'children'
lek·ki	'tree'	**moj·ji**	'(it) is good'
yɔt·taa·dɛ	'to arrive'	**joʔ.ʔin·ⁿdɛ**	'to put down'

The sonority restrictions in Fulfulde are the following: Each vocalic segment represents a peak in sonority, and as such a syllable nucleus. Each consonantal segment represents a "minimum" (lowest) point in sonority; such elements functions as syllable onsets. Any other segment is syllabified as a (pure) coda segment; such segments are always sonorant,

and they must be higher on the sonority hierarchy than the onset of the following syllable in the same word.

Geminate consonants are fully covered by these statements. As segments, they represent a sonority minimum in the chain; they are linked to two successive time slots belonging to two syllables (coda and onset). Not being pure coda segments, there are no relevant restrictions concerning the sonority of geminates.

There are some counter-examples where a consonant [**ɓ**] occurs in the coda of a syllable, this consonant [**ɓ**] is not sonorant, often it is not allowed as a pure coda.

mooɓudɛ	'to be together'
mooɓtudɛ, mooptudɛ, moottudɛ, mottudɛ	'to gather'
moopti, mopti, mootti, motti	'Mopti'
yoɓudɛ	'to pay'
ⁿjoɓdi, ⁿjobdi	'(negotiated) wages'

Variant forms with partial or total assimilation of syllable final [**ɓ**] to the consonant in the following onset indicate that the appearance of the consonant [**ɓ**] in syllable coda is less well-formed. The consonant [**ɓ**] assimilates in voice only to [**t**] in the sequence [**ɓt**] which results in the occurrence of an obstruent [**p**] in the coda in **mooptudɛ** 'to gather, assemble' which is a variant of **mooɓtudɛ**. The underlying sequence [**ɓt**] has merged into a geminate [**tt**] in the variant form **moottudɛ** 'to gather, assemble'.

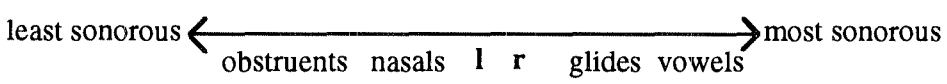
The sequence [**ɓd**] shows assimilation of voice in the alternative sequence [**bd**] in the variant forms **ⁿjoɓdi, ⁿjobdi** 'wages'. From the above examples it appears that [**ɓ**] is the source of the counter-examples to the rule which states that an obstruent can only occur in the syllable coda if it is part of a geminate. To put these counter-examples in a broader perspective, it must be emphasized here that the restriction on the syllable coda is an innovation of the Maasina dialect. In the dialects of Fuuta Tooro and Fuuta Jallon obstruents can occur in syllable final position. In Maasina, underlying laryngealized consonants often change into nasal consonants in syllable final position (see section 3.2.2).

4.4.3 PARADIS' SONORITY HIERARCHY OF CORONAL CONSONANTS

Paradis' (1986:210, 1987:128) Sonority Condition on Coronal Consonants describes a sonority constraint on the sequential order of coronal consonants .

> The first consonant within a sequence of two coronal consonants must be more sonorous than the second. Paradis (1986:210, 1987:128)

Paradis uses the feature coronal for both palatal and (palato-)alveolar consonants. In this study the feature coronal is used in the same way. The coronal consonants are the palato-alveolar and the palatal consonants {**t, r, d, l, s, j, ȷ, c**}. For Pulaar, Paradis (1986:211, 1987b:129) describes the following sonority hierarchy, i.e. the ordering of segments from the least sonorant to the most sonorant segments.



The sonority condition thus prohibits a number of consonant sequences that indeed do not occur in Pulaar. But the condition only applies to coronal consonants. However, the sonority constraint could be extended because obstruent-glide sequences (e.g. ***kw** ***ky** etc.) are also not permitted in either Maasina or Pulaar, regardless of the place features.

Paradis describes the coronal sonority constraint as a restriction on the sequence of two consonants. She does not explicitly link this sonority condition to the syllable structure. There is however a clear link with the syllable structure: the more sonorant segment of the two consonants in sequence is always placed in the syllable coda. As demonstrated by Klingenheben, the syllable coda in Fulfulde is a position where coda weakening (i.e. phonological changes increasing the sonority of a segment) occurs. These are reasons for the improving upon the sonority constraint for Fulfulde (as proposed by Paradis).

Paradis uses this sonority constraint to explain the allomorphy of the suffixes of the NDI, NDE and NDU classes. For example, the suffixes of the NDE class can have the forms **-ɛrɛ**, **-rɛ** and **-dɛ** (Paradis does not list the possible suffix form **-ⁿdɛ** here), so one is vowel-initial (**-ɛrɛ**) and the other suffix forms are consonant initial (**-rɛ** and **-dɛ**). The following table lists a number of combinations of these class suffixes with stems ending in a coronal obstruent. The restrictions stated in the sonority constraint on coronals exclude the suffix forms **-r**V and **-d**V from the NDI, NDE, and NDU class suffixes.

woot-uru	'one'	***woot-ru**	***woot-du**
wɔj-ɛrɛ	'hare'	***wɔj-rɛ**	***wɔj-dɛ**
nad-ɛrɛ	'belt'	***nad-rɛ**	***nad-dɛ**
hes-iri	'new'	***hes-ri**	***hes-di**

The last two columns list ill-formed sequences that violate the sonority hierarchy of coronal consonants in Pulaar, in combination with the other forms of the same class marker. The coronal obstruents {**t**, **j**, **d**, **s**} cannot precede [**r**] because [**r**] is more sonorant than an obstruent. An obstruent cannot precede [**d**] because they are equal in sonority. Therefore, according to Paradis, the only possible remaining form of the class suffix is the vowel-initial one.

There are two problems with this explanation. Firstly, the coronal sonority constraint explains only the choice for the vowel initial allomorphs of the NDI, NDE, and NDU class suffixes (in Grade A). I think that only the suffix forms of grade A are phonologically conditioned (see Chapter six). The forms of grades B, C, and D are chosen because of their specific meaning and not because of the phonological shape of the stem (including the degree of sonority of its last consonant). Secondly, the sequence [**sd**] is well-formed in Pulaar. In dialects where the sequences [**sr**] and [**sd**] are ill-formed (as in Maasina) coda weakening to [**yr**] and [**yd**] respectively can also prevent ill-formed sequences. Therefore, the sonority constraint does not suffice to explain the choice of the vowel initial suffix form.

4.4.4 SONORITY HIERARCHY IN MAASINA

The rules involving the sonority hierarchy differ from dialect to dialect. One of the reasons why the coronal sonority constraint involves only the alveolar and palatal consonants is the fact that in Pulaar, the dialect described by Paradis, the labial and velar obstruents can occur before [**r**]. The following dialect comparison shows that the sequences [**br**] and [**kr**] are well-formed in Pulaar, but ill-formed in Maasina.

Pulaar (Mauritania)		Maasina (Mali)	
faab-ru	'frog'	**faa^{m}b-uru**	'frog'
caak-ri	'couscous'	**^{n}daak-iri**	'bull with coloured neck'
		hɛɛb-ɛrɛ	'stirrup'

There are more sonority restrictions in the Maasina dialect than in Pulaar. Morphemes ending in a single velar or labial obstruent also combine with a vowel initial suffix form in grade A in Maasina, as is shown in the comparison of the suffixes of the above stems in Maasina and Pulaar. The well-formedness and ill-formedness of all possible consonant sequences (in terms of sonority) in Maasina are listed below. Geminates are not included because they consist of only one segment (linked to two consonantal time slots).

well-formed	limited distribution	ill-formed	
N-O	(O-O)	^{x}O-N	O = Obstruent
M-O	(R-L)	^{x}O-L	N = Nasal (except [**m**])
R-O	(M-L)	^{x}O-R	L = [**l**]
L-O	(M-L)	^{x}O-M	R = [**r**]
G-O	(M-R)	^{x}O-G	M = [**m**]
M-N		^{x}N-L	G = Glide
R-N		^{x}N-R	
L-N		^{x}N-M	
G-N		^{x}N-G	
L-M		^{x}L-R	
R-M		^{x}L-G	
G-M		^{x}R-G	
G-R		^{x}M-G	
G-L			
G-G			

The sequences with limited distribution (which are put between brackets) can occur, but certain phonological changes are sometimes operative to change it. This is an indication that such a sequence is less preferred although well-formed. Some sequences of segments with equal sonority are allowed. The limited distribution indicates that these structures are less well-formed. There is no absolute boundary between well-formed and ill-formed syllable structures. This is also the reason why Vennemann (1988) speaks of "Preference Laws" when he tries to explain the sound changes that are conditioned by the syllable.

A generalization of the above well-formed and ill-formed consonant sequences in Maasina will have to state the fact that in a sequence of two consonants the first consonant is not allowed to be less sonorant (stronger) than the second consonant. The constraint is formulated in terms related to the syllable structure, rather than in terms of two sequential consonants only.

The Maasina sonority constraints are formulated as in section 4.4.2: Each vocalic segment represents a peak in sonority, and as such a syllable nucleus. Each consonantal segment represents a "minimum" (lowest) point in sonority; such elements function as syllable onsets. Any other segment is syllabified as a (pure) coda segment; such segments are always sonorant, and they must be higher on the sonority hierarchy than the onset of the following syllable in the same word.

The explicit relation of sonority with the syllable structure makes the reason for these restrictions more obvious, and it shows the relation with coda weakening. Segments in the syllable coda tend to become more sonorant in order to obey the tendency towards open syllabicity. The tendency to open syllabicity is defined as a preferred tendency for a syllable to end in a segment with a high degree of sonority.

The order of the segments in the sonority hierarchy of Maasina is very much the same as the sonority hierarchy stated by Paradis for Pulaar. The sonority hierarchy or "hierarchy of consonantal strength" that occurs in Maasina is given below.

most sonorant ⟵ least sonorant

vowels	glides	r	l	nasals	obstruents	ʔ	h
i	w			m	f, s		
e	y			n	b, d, g		
ɛ				ɲ	p, t, k		
a				ŋ	ɓ, ɗ, ʄ		
ɔ					c, j		
o					ᵐb, ⁿd, ⁿj, ᵑg		
u							

The positions of [ʔ] and [h] on the sonority hierarchy are difficult to determine because of their limited distribution. Both consonants cannot combine with other consonants. The glottal stop can occur as a geminate (very rare though). The consonants [ʔ] and [h] only occur as single consonants in the onset of the syllable which is the least sonorant position in the syllable. They are put at the lowest end of the sonority scale. The diagram of the sonority hierarchy combined with the sonority constraint reads as follows: A consonant cannot be followed by another consonant if this second consonant is less sonorant, i.e. a consonant to its left side in the diagram.

For example: the sequence [rn] is allowed, but the sequence *[nr] is not. The labial nasal [m] occurs in a number of sequences which are exceptions to these rules which cause some confusion about the particular place of the labial nasal [m] in the sonority hierarchy.

4.4.5 PLACE OF [m] IN THE SONORITY HIERARCHY

The consonant sequences **mr/rm** and **ml/lm** disturb the sonority constraint, although some phonological sound changes of the sequences [**mr**] and [**ml**] indicate that they are less well-formed. The exceptions of sequences with [**m**] are discussed in more detail in the next section. The consonant sequences [**mr**] and [**rm**] occur e.g. in **nimrɛ** 'darkness' and **sirmɛ** 'butter ball'. The [**mr**] sequence is the less preferred sequence since sometimes metathesis occurs. For instance in the variant forms of the place name **sɛmra** and **sɛrma** (**sɛmra** is the older form). The (morphologically irregular) form **sirmɛ** 'butter ball' could be derived from a (morphologically regular) form ***simrɛ** etymologically. The suffix **-rɛ** from the NDE class is a probable suffix for round forms (ball) and for small units of a larger mass noun (e.g. butter). In Maasina the following words contain the sequence [**mr**]. A very short epenthetic vowel [ə] sometimes occurs to break up the sequence of [**mr**].

ⁿjuumri, ⁿjuumᵊri, ⁿjuumiri	'honey'	**yuum-aadɛ**	'to collect honey'
ɲaam-ri	'cereals'	**ɲaam-udɛ**	'to eat (lit.)'
lam-ru	name giving day'	**laɓ-udɛ**	'to shave'
ɓeem-ri	'yearly ebb'	**ɓeeɓ-udɛ**	'to dry up'
ɓuum-ri	'a cold, flu'	**ɓuuɓ-udɛ**	'to be cold'
ɲam-rɛ / ɲaɓ-ɓɛ	'gain'	**ɲaam-udɛ**	'to gain (fig.)'
fim-rɛ / piɓ-ɛ	'knot'	**fiɓ-udɛ**	'to tie'
nim-rɛ / niɓ-ɛ	'darkness'		
hɛm-rɛ, hɛmɛrɛ	'hundred'		
ʔam-rɛ	'tortoise'		

The sequences of [**ml**] and of [**lm**] also indicate the irregular position of [**m**] in the sonority hierarchy. The following alternative forms show that the [**ml**] sequence is not stable.

		alternative forms
ɲaml-aadɛ	'to lend from'	**ɲalm-aadɛ**
ɗɛm-lɛ	'tongues'	**ɗɛl-lɛ**
pɔɔm-lɛ	'hills'	**pɔɔɓ-ɛ**

The sequence of [**lm**] shows no variation, the sequence [**ml**] does. This confirms the exceptional and less preferred status of [**ml**]. It is possible that the nasal [**m**] can precede the very sonorant [**l**] and [**r**] sounds because it has a more sonorant nature than the other nasals. The alternative forms **ɲamlaadɛ** and **ɲalmaadɛ** 'to lend from' show that metathesis can prevent the less well-formed [**ml**] sequence.

4.5 SYLLABLE CONTACT RULES

The well-formedness conditions describing the sonority hierarchy of the time slots in the syllable motivate a number of sound changes which are called syllable contact rules by Vennemann (1988:50). The syllable contact rules that can be shown to be operative in the Fulfulde of Maasina are described in the following sections.

4.5.1 HEAD STRENGTHENING OF [r]

The trill [r] is more sonorant in Maasina than the lateral [l] and the nasal [n] and therefore the sequences *[lr] and *[nr] are not permissible. Head strengthening can occur to avoid these sequences. Sometimes the same rule applies when a morpheme final [r] is followed by a morpheme initial [r], thus preventing the sequence *[rr]. The rule of head strengthening is described in a SPE-type structural formula since it is difficult to represent the multi-valued feature of sonority and the syllable structure in autosegmental phonology.

P-rule 19

r -> **d** / C ___
[alveolar]
[less or equally sonorant]

P-rule 19 says that the consonant [r] becomes less sonorant in the syllable onset when it is preceded by a consonant that is less or equally sonorant. This rule applies when [r] is preceded by [l], [n] or [r] in the underlying structure. The [r] changing to [d] occurs in the onset or "head" of the syllable, that is why this rule is called head strengthening (Vennemann 1988:13-20). The rule of head strengthening is related to the syllable sonority constraint because it avoids the sequence of a consonant in the coda followed by a more or equally sonorant speech sound in the following onset.

***ɓil** + **r** + **u** + **gal**	>	**ɓil-d-u-gal**	'stick to fasten peg on loom'
***wul** + **r** + **i**	>	**wul-d-i**	'be hot with'
***wuul** + **ri**	>	**ᵐbuul-di**	'bull with white face'
***wor** + **ru**	>	**wor-du**	'male; thumb'
***ʔɔɔl** + **rɛ**	>	**ʔɔɔl-dɛ** (**ʔɔɔl-ɛrɛ**)	'yellow'
***janan** + **rɛ**	>	**janan-ⁿdɛ** (**janan-ɛrɛ**)	'strange'

The change of *[nr] to *[nd] is further subject to the automatic rule that voiced plosives become prenasalized after a nasal ([nⁿd]) in the derivation of the word **janan^{n}dɛ** 'strange'. The rule of head strengthening shows a number of complications which are related to the possible forms of the grade A suffixes of the NDE, NDI, and NDU classes because the suffix grade cannot be determined from the surface form of the suffix alone. The fact that the forms **jananɛrɛ** 'strange' and **ʔɔɔlɛrɛ** 'yellow' are identified by the consultants as correct (though rare) forms indicates that the suffix here is most probably a grade A suffix. The underlying consonant sequence *[rr] changes to [rd] when a stem ending in the consonant [r] combines with a grade A suffix -rV of the classes NDI, NDE or NDU. This is an indication that the geminate [rr] resulting from the assimilation of *[rl] has a different status. The geminate [rr] which results from the underlying *[rl] sequence does not undergo head strengthening. Words with a geminate [rr] in Maasina mostly have cognate forms with the sequence [rl] in other dialects. The change from [rl] to [rr] is optional since some words with [rl] do occur in Maasina.

cɛɛr-lɛ	'divorces'	
gɛrr-al	'wild partridge'	(FT: **gɛrlal**)
fɛrr-ɔ	'bush with trees'	(FT: **fɛrlɔ**)

The merger of [**l**] and [**r**] into [**rr**] does not occur when there is a morpheme boundary between the [**r**] and [**l**] as in **cɛɛr-lɛ**, the plural of **cɛɛr-gal** 'divorce'.

4.5.2 CODA WEAKENING

Coda weakening occurs when an obstruent occurs in the underlying structure of a word in syllable final position (except in some words where this consonant is [**6**]). This rule repairs ill-formed structures that would violate the sonority constraint (see section 4.4.2). The syllable final segment may not be an obstruent (but it may be a geminate consonant). In other words, an obstruent may not fill the coda position of a syllable unless it is simultaneously linked to the onset of the next syllable. When the syllable is word final, the Maasina dialect does not allow obstruents in syllable final position at all. The constraint is again described in terms related to the syllable structure, because the changes in sonority involved are motivated by the organization of sonority in the syllable.

The coda weakening of obstruents can take different forms. Fricatives that occur morpheme finally become glides in syllable final position. Klingenheben's syllable final weakening rules (see section 4.4.1 above) do occur synchronically in Maasina. The following word derivations show (dialect) internal evidence for the synchronic rule of coda weakening in Maasina.

***hɛs-**	'new'	
kɛ·sɔ	'new'	['O class]
hɛy·rɛ	'new'	[NDE class]
***gaf-**	'millet'	
ga·fɛɛ·lɛ	'sorts of millet'	['DE class]
gaw·ri	'millet'	[NDI class]
***hɔs-**	'step'	
kɔy·^{n}gal	'foot'	
kɔ·sɛ·kɔ·sɛ	'sound from a cow's feet when it is walking'	
ho·su·dɛ	'to make a step, put one foot down'	

Klingenheben takes his evidence for coda weakening from the comparison of dialects. Dialect comparison shows that this rule is productive in Maasina, whereas its occurrence is more exceptional in other dialects.

Maasina	Pulaar	Aadamaawa	
howru		**hofru**	'knee'
foowtudɛ	**fooftudɛ**		'to rest'
ley		**les**	'under'
heyri	**hesiri**	**hesri**	'new' [NDI class]
kɔy^{n}gal		**kos^{n}gal**	'foot'

Not only the fricative [s] but also the palatal obstruents and the palatal nasal change to the more sonorant palatal approximant [y] in syllable final position.

***haaj-**		
haay·rɛ	'stone'	[NDE class]
kaa·jɛ	'stones'	['DE class]
***ɲɛɛɲ-**		
ɲɛɛ·ɲɔ	'craftsman'	['O class]
ɲɛɛy·ɓɛ	'craftsmen'	['BE class]
***yaaj-**		
yaa·ju·dɛ	'to be wide, large'	
^{n}jaay·ri	'plain'	[NDI class]

In Maasina the rule of coda weakening involving the change of fricative consonants to glides in syllable final position operates synchronically. The exceptionless application of the coda weakening of fricatives is an innovation of the Fulfulde dialect of Maasina. The alveolar fricative [s] changes to [y] and the labial fricative [f] changes to [w] in syllable final position. The basic change is that the fricative becomes [+voiced]. The feature [+spread] is delinked in syllable final position, the feature [+voiced] is linked to the underlying fricatives [f] and [w]. The interpretation of [+voiced] fricatives as [y] and [w] follows from other structure conditions.

Some derivations show an alternation that seems to be the weakening of a laryngealized consonant to a nasal in syllable final position.

stem final laryngealized consonant		coda weakening to nasal	
***fiɓ-**			
fiɓ-udɛ	'to tie'	**fim-t-udɛ**	'to untie'
piɓ-ɛ	'knots'	**fimrɛ**	'knot'
***mɔɔɓ-**			
mooɓ-udɛ	'to be compact'	**moom-ɗ-udɛ**	'to be round'
***hiiɗ-**			
hiiɗ-udɛ	'to be old, worn out'	**kiŋ-ka**	'old, worn out' (adj. KA class)

The change from an underlying laryngealized consonant to a more sonorant nasal in syllable final position does occur synchronically in variant forms of the following verb stems which combine with verb focus (VF).

ʔɔ wadu tan	also	**ʔɔ wan tan**	'he only does (it)'
ʔɔ heɓu tan	also	**ʔɔ hɛm tan**	'he only has got (it)'

These verb stems are very frequently used. With less frequently used verb forms, the conjugational suffix expressing verb focus is mostly the vowel final **-u**.

4.5.3 CONTACT METATHESIS

There are a few examples where it can be demonstrated that metathesis has occurred. The metathesis is called contact metathesis because the metathesized consonant sequence has resulted from the contact or combination of a morpheme final and a morpheme initial consonant in the underlying structure which violates the correct order of sonority. A comparison of Maasina words with cognate forms in other Fulfulde dialects shows the occurrence of metathesis in Maasina.

Ringimaaji	Aadamaawa	Maasina	
ranβ-ugɔ	**ranw-ugɔ**	**rawn-udɛ (rann-udɛ)**	'to be white'
ɓalβ-ugɔ	**ɓalw-ugɔ**	**ɓawl-ugɔ**	'to be black'
lɛlwa	**lɛlwa**	**lɛwla (lɛlla)**	'antelope'
lelbi	**lelji**	**lewli (lelli)**	'antelopes'
βolβ-ugɔ	**wolw-ugɔ**		'to speak'
		wowl-udɛ	'to howl'
ɲalβ-ugɔ			'to rise high (of sun)'
	ɲalw-ugɔ	**ɲawl-udɛ**	'to reach zenith'
	ɓolw-ugɔ		'to melt'
	tunw-ugɔ	**tuun-udɛ (tunn-udɛ)**	'to be dirty'

The above forms in the Fulfulde of Ringimaaji and of Aadamaawa contain the sequences nasal-glide and lateral-glide which are not allowed in Maasina. In Maasina metathesis has occurred. The forms in the example below show that the associative extension **-w-** follows the noun stem ***nay** in Maasina without metathesis because the **yw** sequence is well-formed. Segments that are equal in sonority can occur in sequence.

Ringimaaji	Aadamaawa	Maasina	
nayβ-ugɔ	**nayw-ugɔ**	**nayw-udɛ**	'to be old'

The motivation for the occurrence of metathesis is to repair an incorrect sequence of sounds with regard to their sonority. Metathesis can also provide an explanation for the etymologies of a few words that would otherwise have to be postulated with suppletive stems.

	stem final sonorant		metathesis	
ml -> lm	**ɲaam-**			
	ɲam-aaⁿdɛ	'credit'		
	ɲaml-udɛ	'lend v (to)'	**ɲalm-aadɛ**	'to borrow, take credit'
nw -> wn	**ran-**			
	ran-ɛ	'white cow'	**rawn-udɛ**	'to be white'
lw -> wl	**ɓal-**			
	ɓal-ɛ	'black cow'	**ɓawl-ugɔ**	'to be black'
lw -> wl	**ɲal-**			
	ɲal-ɔɔma	'afternoon'	**ɲawl-udɛ**	'to reach zenith'

There are a few alternative names that show the occurrence of metathesis. The place names **sɛmra** and **sɛrma** were already mentioned (see section 4.4.5). The Fulfulde name **Mayrama** can also be explained by metathesis. This name goes back to the Arabic name for Mary, i.e. **Mariyama**. The form shortens to **Maryama** because a sequence of four light syllables is ill-formed in Fulfulde. The ill-formed sequence ***ry** in the form **Maryama** is subject to metathesis which results in the form **Mayrama**. The following list shows variant forms with and without metathesis.

sɛmra	**sɛrma**	'Serma (place name in Haayre)'
mar(i)yama	**mayrama**	'girl's name'
piiⁿdal	**piirnal**	'flowering season'
garuwal	**gawral**	'house made of mud or concrete'
kɔrɔwal	**kɔwral**	'bobbin'
ɲamlaadɛ	**ɲalmaadɛ**	'to borrow; to lend'

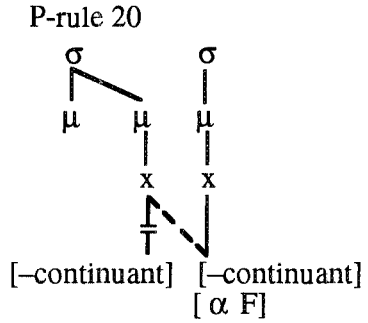
The plural **garuujɛ** suggests that the form **gawral** resulted from deleting the unstressed vowel **[u]** in **garuwal** 'stone/mud house'. A similar etymology is proposed for **kɔrɔwal** 'bobbin' with an alternative form resulting from shortening and metathesis **kɔwral/kɔwrɛ** 'bobbin'. Possibly the verb **hawraadɛ** 'to spin' is formed on the basis of the word **kɔwral** 'bobbin' (with vowel assimilation in the stem). The form **piiⁿdal** may have been derived from an underlying form ***piinral** with the phonological rules of head strengthening (->***piindal**), nasal spreading (->***piinⁿdal**), and geminate shortening (->**piiⁿdal**) applying.

4.5.4 TOTAL ASSIMILATION OR GEMINATION

Another rule that prevents the occurrence of obstruents in the coda of ill-formed syllables is total assimilation to the consonant in the following onset which results in a geminate consonant. A comparison of words derived from the same roots show the underlying forms of the stems in which the last consonant is affected by total assimilation.

	stem final obstruent	gemination	
*tC > CC	**juut-udɛ**		'to be long'
	***ⁿjuut-ⁿdi**	**ⁿjuunⁿdi, ⁿjuuⁿdi**	'long' (adj. NDI class)
	***juut-ⁿgal**	**juuŋⁿgal, juuⁿgal**	'long' (adj. NGAL class)
	***juut-ki**	**juukki, jukki**	'long' (adj. KI class)
	***juut-ɗɔ**	**juuɗɗɔ, juɗɗɔ**	'long' (adj. 'O class)
*tr > rr	**naat-udɛ**		'to enter'
	***naat-rɛ**	**naarrɛ, [narrɛ]**	'entrance of the water'
*ɗr > rr	**tiiɗ-udɛ**		'to be difficult'
	***tiiɗ-rɛ**	**tiirrɛ, [tirrɛ]**	'difficulty'
*ɗn > nn	**hoɗ-udɛ**		'to settle'
	***hɔɗ-n-udɛ**	**honnudɛ**	'to cause to settle'
*gd > dd	**dog-udɛ**		'to run'
	***dog-du**	**doddu**	'course'
*kl > ll	**seek-udɛ**		'to tear'
	***seek-l-udɛ**	***seelludɛ, seeludɛ**	'to tear totally into pieces'
*nr > rr	**won-udɛ**		'to be'
	***won-r-udɛ**	**worrudɛ**	'to be with'
*dn > nn	**ɓad-aadɛ**		'to approach'
	***ɓad-n-udɛ**	**ɓannudɛ**	'to make s.o. approach'
*ɓt > tt	**mooɓ-udɛ**		'to be compact, together'
	***mooɓ-t-udɛ**	***moottudɛ, mottudɛ**	'to be gathered'

The derivations where total assimilation occurs show an ill-formed order of sonority in the underlying structure. The following figure shows the sound change resulting in total assimilation.



Assimilation of an obstruent to the following consonant is a possible repair rule because obstruents are allowed in syllable final position when they are linked to two time slots (part of a geminate consonant). All examples of total assimilation appear to involve at least one underlying alveolar consonant. Most derivations with this rule are not productive. Total assimilation is only productive in a few adjectives. P-rule 20 does not apply to the sequences [**mn**] and [**rl**] in e.g. **rimnudɛ** 'to cause to give birth' and **cɛɛrlɛ** 'divorces'. Possibly total assimilation does not need to apply when the first consonant is more sonorant than the second. This would imply that [**m**] is more sonorant than [**n**].

4.5.5 CODA DELETION AND COMPENSATORY LENGTHENING

The consonant in the coda is deleted when it is underlyingly the consonant [**h**] or [**ʔ**]. These two consonants cannot occur in the coda. They also cannot follow another consonant. In the following words the stem final glottal approximant [**h**] is deleted in the coda in Maasina.

yah-an	'will go'	**yaa-dɛ**	'to go'
yih-an, (yiy-an)	'will see'	**yii-dɛ**	'to see'

In Maasina the glottal stop and [**y**] alternate sometimes in variant forms of the same word. Both consonants are deleted and compensatory lengthening of the preceding vowel occurs in syllable final position. There are also a number of paradigms that show deletion of the glottal stop [**ʔ**] in the coda in Maasina.

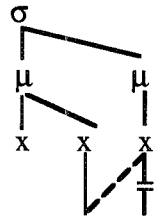
waʔ-i, (way-i)	'looks like'	**waa-dɛ**	'to look like'
wiʔ-an, (wiy-an)	'will say'	**wii-dɛ**	'to say'
yiʔ-an, (yiy-an)	'will see'	**yii-dɛ**	'to see'

An alternation of a vowel with either [**h**], [**ʔ**], or [**y**] is thought to be the result of a phonological rule that is similar to the rule describing the deletion of a syllable final glottal stop. The deletion of the glottal stop is compensated for by the lengthening of the preceding vowel. This has happened in the following singular forms.

hɔɔ-rɛ / kɔh-ɛ	'head'
saa-rɛ / cɛh-ɛ, cah-ɛ, cih-ɛ	'village (not of Fulbe)'
waa-rɛ / bah-ɛ	'beard'
ᵐboori / bohi	'bull: head (front) has different colour'
wɔhɛ / bohi	'cow: head (front) has different colour'
ᵐbɛɛwa / bey, beʔi	'(she)goat'
ⁿgaari / gay, gɛy, gaʔi	'bull; male calf'

The intervocalic glottal stop is deleted in the plural forms **bey** goats' and **gay** 'bulls' which can also occur as **beʔi** 'goats' and **gaʔi** 'bulls' in other dialects. The vowel [**i**] of the plural suffix has fallen into syllable final position and is therefore interpreted as the consonant [**y**]. The consonant [**h**] is deleted and compensatory lengthening of the preceding vowel occurs in the word **ᵐboori** 'bull with different colour head' which is based on a stem ending in [**h**] that occurs in the plural and masculine form of the word. Consonant deletion in the coda almost always results in compensatory lengthening.

P-rule 21 (CV**h**, CV**ʔ** -> CVV before a syllable boundary)



[α F] [least sonorant]
{ **h**, **ʔ**}

It is not yet clear how the rules repairing ill-formed sonority sequences can be formulated in such a way that it is transparent that they affect the features of a segment and the interpretation of the segment as a vocalic or consonantal element. The aim of describing the rules related to sonority here is to show their relation to the syllable structure.

Compensatory lengthening does not occur in case of the shortening of a CVVC syllable to CVV because the aim of the phonological rule is to reduce the weight of the syllable. The deletion of a consonant in the coda of the CVVC syllable prevents this less well-formed syllable structure. The nature of the rule (avoiding overweight) makes compensatory lengthening impossible. Examples of deletion of the final consonant in a CVVC syllable in Maasina involve mostly the first time slot of a geminate prenasalized consonant (a N^{n}C sequence).

4.5.6 EPENTHESIS OR THE BLOCKING OF VOWEL DELETION?

The most common repair rule to prevent ill-formed syllables is the choice of vowel initial allomorphs.

haɓɓ-i̱d-ii	***haɓɓ-d-ii**	'tied together'
mɔɗ-u̱-dɛ	***mɔɗ-dɛ**	'to swallow'
haɓɓ-u̱-dɛ	***haɓɓ-dɛ**	'to tie'
mɔɗ-ɛ̱rɛ	***mɔɗ-rɛ**	'tablet'
haɓɓ-ɛ̱rɛ	***haɓɓ-rɛ**	'bundle'
tɔɔb-ɛ̱rɛ	***tɔɔb-rɛ**	'furrow, esp. for millet'
hin-ɛ̱rɛ	***hin-rɛ**	'nose'
^{n}daak-i̱ri	***^{n}daak-ri**	'bull with coloured neck'

This process looks very much like epenthesis. Epenthesis of an intervening vowel could be a possible repair rule to prevent such ill-formed syllable structures. And indeed, epenthesis is often given as an explanation for a -VCV(C) vs. -CV(C) morphophonological allomorphy in the literature on Fulfulde. In this study, however, the epenthetic status of these vowels is called into question. The vowels are presumed to be present in the underlying lexical forms and they can be deleted in certain environments, their deletion is blocked in other environments.

The main argument for this position is that the vowels that are called epenthetic have a range of qualities that are not always predictable from the phonological environment in which they occur. Syntactic or lexical information is necessary to predict the correct quality of many of the so-called epenthetic vowels. Given this state of affairs, it seems more

plausible to reverse the assumption of epenthesis. Instead of giving a rule for the appearance of such a vowel, rules can be stated for the deletion of these vowels in certain phonological environments. The postulation of a vowel in the underlying structure can also explain the examples where such an "epenthetic" vowel does occur even if the well-formedness conditions without this vowel would not be violated. The occurrence of an epenthetic vowel is difficult to explain in such an environment.

The different vowels which are considered to be epenthetic are listed in the following table. The vowels said to be epenthetic in the literature (Klingenheben 1963:16, 188, 192) or anaptyctic (Arnott 1970a:55) are underlined.

vowel quality	*morphemes*	*environment*
assimilating	**ɛ̲rɛ**	Grade A noun suffixes of NDE, NDI, NDU class.
	i̲ri	
	u̲ru	
[i]	**i̲t i̲r i̲d'**	Verbal extensions.
	i̲ⁿd i̲n i̲d	
	i̲s i̲ŋkin	
[u]	**u̲**	Active voice participles, id. imperatives, id. infinitives.
assimilating	**a̲ta**	Incompletive conjugational suffixes .
	ɔ̲tɔ ɔ̲tɔɔ	
	ɛ̲tɛ ɛ̲tɛɛ	
	a̲taa	
	a̲takɔ	
	a̲takɛ	

The assimilating first vowel occurring in the nominal class suffixes **-ɛrɛ**, **-iri**, **-uru**, the vowel **[u]** occurring in conjugational suffixes of the active voice verbs, the initial vowel of the incompletive conjugational suffixes, and the vowel **[i]** occurring in verbal extensions all occur in similar phonological environments. The reason why it has been claimed that these vowels are epenthetic lies in their distribution. All of the vowels mentioned occur (obligatorily) when the preceding morpheme ends in two consonants (either two different consonants or a geminate consonant) or after a morpheme that ends in a consonant that cannot precede the consonant that follows this so-called epenthetic vowel.

Short unstressed vowels are often deleted unless their deletion would cause an ill-formed syllable structure. The phonological environments where unstressed short vowels can be deleted are the mirror image of the environments for epenthesis. For example, these vowels would not be deleted if their deletion would cause a syllable with a coda with two consonantal time slots, as shown in the words derived from the root ***haɓɓ-*** 'tie'.

haɓɓ-i̲d-ii	'tied together'	(verbal extension + completive)
haɓɓ-ɛ̲rɛ	'bundle'	(grade A suffix NDE class)
haɓɓ-u̲-dɛ	'to tie'	(active voice infinitive)
haɓɓ-u̲	'tie!'	(active voice imperative)
haɓɓ-a̲taa	'will not tie'	(incompletive: negative)

These vowels are also not deleted when they prevent the occurrence of syllables with an obstruent in the coda, for example, following the stem final [t] in the words derived from the stem **lɔɔt-** 'wash'.

loot-i̱t-an	'will wash'	(verbal extension + incompletive)
loot-u̱-dɛ	'to wash'	(active voice infinitive)
loot-u̱	'wash!'	(active voice imperative)
lɔɔt-ɛ̱tɛ	'will be washed'	(incompletive: passive)
wɔɔt-ɛ̱rɛ	'one'	(grade A suffix NDE class)
woot-u̱ru	'one'	(grade A suffix NDU class)
ⁿgoot-i̱ri	'one'	(grade A suffix NDI class)

However, these vowels are often deleted if deletion does not lead to ill-formed syllable structures, especially when these short vowels are unstressed:

hɛy-ɗ-an	'will be new'	(verbal extension + incompletive)
war-dɛ	'to come'	(active voice infinitive)
war	'come!'	(active voice imperative)
loot-ir-tɛ	'will be washed with'	(incompletive: passive)
hɛy-rɛ	'new'	(grade A suffix NDE class)
hey-ru	'new'	(grade A suffix NDU class)
hey-ri	'new'	(grade A suffix NDI class)

The fact that the deletion is not obligatory is an argument for the analysis of these vowels as being part of an underlying form of the morpheme to which they are always adjacent. The following examples show the so-called epenthetic vowels where their deletion would not cause an ill-formed syllable structure.

won-u-dɛ, wɔnⁿdɛ	'to be'
war-u-dɛ, wardɛ	'to come'

The conclusion is that the so-called epenthetic vowels are not epenthetic but part of the underlying structure. A rule describing the possible deletion of vowels in unstressed open syllables can also describe their distribution because these vowels also occur when no ill-formed syllable or consonant sequence would arise if they were deleted.

The assimilating short vowel occurring in incompletive conjugational suffixes is proposed to be [**a**] in the underlying structure. When this underlying morpheme ***at** marking the incompletive occurs in the last syllable of the verbal word, the quality of the vowel that appears on the surface is also [**a**]. The conjugational suffix of the general incompletive has the surface form **-an** (**-at** or **-ay** in other dialects). The short vowel occurring in incompletive conjugational suffixes is different from the other vowels discussed here in that it cannot be deleted when it occurs directly after the verb root. It is deleted only when it occurs after a verbal extension.

short unstressed vowel in incompletive verbs

tɛf-ata	'will search for'	(relative incompletive)
war-ataa	'will not come'	(negative incompletive)
yin-ɔtɔ	'will swim'	(middles incompletive)
nan-ɛtɛ	'will be heard'	(passive incompletive)

deletion of short unstressed vowel in incompletive verbs

jaŋⁿg-in-ta	'will teach'	(relative incompletive)
fill-an-tɔ	'will tell to'	(middle incompletive)
nan-ir-tɛ	'will be heard with'	(passive incompletive)

Any unstressed short vowel (here the underlying vowel [**a**]) in open syllables often undergoes assimilation to the vowel in the following syllable. This rule of regressive vowel assimilation is also described by Endresen (1993a).

There are a number of words where a variant form occurs with a vowel [ə] between two consonants that violate the sonority hierarchy. Sometimes they are assimilated to the next vowel, as is the case with the following variant forms noted in Maasina.

wurwudɛ, wurəwudɛ, wuruwudɛ	'to churn'
ⁿjuumri, ⁿjuuməri, ⁿjuumiri	'honey'

These synchronic alternations show that some of the vowels that are easily deleted may historically have an epenthetic origin. The assimilating vowel in the grade A suffixes of the NDE, NDI, and NDU class could have arisen historically from this same epenthetic vowel [ə] which subsequently assimilated in vowel quality to the vowel in the next syllable.

The vowels discussed here occur always after geminate consonants and sometimes after CVVC syllables, but they can also occur where their deletion would not lead to ill-formed structures. A considerable amount of syntactic and lexical information is needed to predict their correct vowel quality. Therefore the distribution of Ø (zero) / V (vowel) is explained by a vowel deletion rule. The epenthetic status of the vowels discussed here is rejected.

The fact that the deletion of an unstressed vowel in an open syllable cannot take place if otherwise an ill-formed syllable structure would occur provides another tool to show the marginal status of the CVVC syllable. The following examples show that the deletion of the active voice marker [**u**] in infinitives usually does not occur following a CVVC morpheme, thus preventing the occurrence of the less preferred CVVC syllable structure.

wardɛ	'to come'	***war-**
waddɛ, waɗudɛ	'to make'	***waɗ-**
yaadɛ	'to go'	***yah-**
ⁿdaardɛ, ⁿdaarudɛ	'to look for'	***ⁿdaar-**
tiiddɛ, tiiɗudɛ	'to be difficult'	***tiiɗ-**
hoorudɛ	'to protect'	***hɔɔr-**
fiirudɛ	'to fly'	***fiir-**
waasudɛ	'to lack'	***waas-**

From the syllable contact rules described here, it should be clear that the well-formedness of syllables is not determined by the prescribed syllable templates alone but also by the correct sequence of sonority value of the segments within the syllable. The rules related to sonority make a further distinction between the behaviour of place features and manner features. Manner features change due to rules related to sonority. Sonority is independent of place features. A few minor changes of place always co-occur and depend on manner changes, e.g. **s-y**, **s-c**, and **f-p**. Total assimilation changes the mapping of both place and manner features of the segment in the coda.

4.6 STRESS

4.6.1 PREVIOUS ANALYSES

The different descriptions of the place of word stress in the literature are rather contradictory. It has been generally assumed in the English and French literature on Fulfulde that stress falls on the first syllable of a word. The quotes from Noye (1974:11) and Arnott (1965:78) below are representative of this opinion.

> C'est presque toujours la première syllabe qui est accentuée, sauf dans certaines formes verbales où l'on remarque un déplacement de l'accent ... (Noye 1974:11)

> In nearly all words of more than one syllable the salient syllable is the first, but there are a few exceptions to this rule, ... (Arnott 1965:78)

The exceptions that Arnott mentions are some numerals, adverbs, question words, and verb forms. Some examples of such words without stress on the first syllable (according to Arnott) are given below.

numerals:	**cappánd'e**	'tens'
	joowéego$^{?}$o	'six'
	teemérre / teemed'd'e	'thousand(s)'
adverbials:	**ammáa**	'but'
	kor'ii	'hopefully'
interrogatives:	**ndeyé**	'where'
	moyé	'who'
	kiyé	'which' [qw. of KI class]
negative verb forms:	**mi-naŋ^{n}gáaka**	'I was not caught'
	mi-noddáayi-mo	'I didn't call him'
	mi-$^{?}$anndáa-mo	'I don't know him'
	mi-noddátaa	'I won't call'

The position taken in the present study does not agree with the rule that places the stress on the first syllable of a word in Fulfulde. Stress indicated in the examples of Arnott and Noye is indicated with an acute accent because I think they wrongly equated high pitch with stress. I note stress with a grave accent because stress is most often marked by a lowering in

pitch. It appears that Arnott, Noye and others who follow the assumption that stress is word initial were mislead by the peculiar realization of stress in Fulfulde.

Pitch plays a role in the realization of stress in Fulfulde, but stress is not always realized with a high pitch. Word stress in Fulfulde is realized by an increase in amplitude and also by a change in pitch. The direction of the change in pitch, i.e. the lowering or the raising of the pitch, is determined by the intonation pattern of the sentence.

For example, a declarative sentence has a general declination of pitch. In a declarative sentence the word that receives the focus (phrasal stress) has its stressed syllable realized with a relative high pitch. But the words that are not in focus have their stressed syllable realized with a lowering in pitch that exceeds the gradual lowering of the declarative sentence. When a word is pronounced in isolation it receives the intonation of a declarative sentence. The result is the following tonal pattern on the words **rawàa^{n}du** 'dog', **danèejum** 'white', and **jaŋ^{n}gìrdɛ** 'school'.

The tonal patterns of the words **rawàa^{n}du** 'dog', **danèejum** 'white', and **jaŋ^{n}gìrdɛ** 'school' show an initial syllable that is higher in tone than the following two syllables. But it is the amplitude that marks a stressed syllable. In relation to the intonation pattern, any large drop of pitch indicates a stressed syllable. What determines the place of stress is the syllable structure of the word.

An interpretation of high pitch as stress leads to the rule of stress assignment as described by Arnott and Noye. However, the stress in these words falls on the second or penultimate syllable. Noye (1974:11) and Arnott (1965:78) wrongly place the accent on the first syllable in the following examples:

Noye		Arnott	
ráwaa^{n}du	'dog'	**ráwaa^{n}du**	'dog'
dáneejum	'white' ['DUM]	**jáŋ^{n}girde**	'school'

This study agrees with Klingenheben (1963:4-5, 321) who puts the stress in the word **rawáa^{n}du** 'dog' on the penultimate syllable. He marks stress with an acute accent. Klingenheben states the following about stress assignment.

> Die Betonung, d.h. der dynamische Akzent oder Starkton, liegt bei mehrsilbigen Fulwörtern häufig auf der vorletzten Silbe,... (Klingenheben 1963:4)*

The following examples of Klingenheben show the correct stress assignment.

* The stress of Fulfulde words consisting of more than one syllable is frequently placed on the penultimate syllable.

rawáaⁿdu 'dog'
laamíiɗo 'chief'
jumʔáarɛ 'Friday'

Klingenheben enumerates some exceptions to his rule.

oohó	'yes'
mhḿ	'yes'
masín	'very much'
o waráay	'he hasn't come'
ʔúsoko	'welcome'
témᵐbuɗugo	'to be naked'

Klingenheben explains some of the exceptions by syllable weight. He states that the anti-penultimate can be stressed when the penultimate syllable is an open syllable with a short vowel (i.e. a light syllable). This explains the stress on the first syllable in **ʔúsoko** 'welcome', but it does not explain the position of the stressed syllable in the other exceptions.

McIntosh (1984:20) is the first to arrive at an accurate description of stress placement in nouns. She uses the structure of the syllable to predict the correct assignment of stress in nouns.

> In nominals, [stress] generally occurs on the last non-final CVC or CVV syllable. In the absence of such a syllable, the initial syllable of the nominal is stressed, regardless of its structure. (McIntosh 1984:20)

McIntosh gives examples like **kacéccereʔen** 'the people of Kaceccere' where the heavy syllable (i.e. CVC or CVV) is not the penultimate syllable and where the stress is "pushed back" to the first heavy syllable that precedes the penultimate syllable. McIntosh (1984:82) is more reluctant to give a rule for stress assignment in verbs.

> In listening to verbal complexes, it is tempting to search for a stressed syllable, which can then be neatly marked in the transcription. In the event, such a search proves difficult, and, I suspect, futile. For the fact is that since vowel length is phonemic in Fulfulde, a long-vowelled syllable often sounds "stressed" to the ear - or at least to the English ear. Yet closer examination proves that there is always one, or more than one, high-pitched syllable in the complex, which often does not sound "stressed" at all. (McIntosh 1984:82)

This quote demonstrates clearly that equation of stress with high pitch has complicated the correct description of rules for stress assignment. Stress is realized as a change in pitch, not necessarily as a high tone, and amplitude plays an important role in its realization. The direction of the tonal change depends on the intonation.

McIntosh was probably right in hearing stress on the long vowels in a conjugated verb form even when those syllables did not contain a high pitch. This would confirm the

analysis proposed here for stress assignment in Fulfulde: stress is assigned to the last heavy syllable in a word. If there are no heavy syllables the stress falls on the first syllable of the word. The last syllable in nouns is extra-metrical. The extra-metricallity of the last syllable in nominals means that this syllable is not counted, i.e. it never receives stress. These rules (further developed in section 4.6.2) can explain the placements of stress on nouns which have it, according to Arnott and Klingenheben, mainly on the first or on the penultimate syllable albeit a large number of exceptions. Arnott and Klingenheben mark stress with an acute accent. The stressed syllable according to my proposal is underlined. My proposal correctly predicts the placements of stress in their exceptions.

Arnott: first syllable stressed + exceptions

nominals:	**débbo**	'woman'
	cappándʼe	'tens' (noun)
	teemérre	'thousand' (noun)
	joowéegoʔo	'six'
verbals:	**ammáa**	'but'
	koríi	'hopefully'
	ʔoɗón	'durative'
	mi-nanngáaka	'I was not caught'
	mi-noddáayi-mo	'I didn't call him'
	mi-ʔanndáa-mo	'I don't know him'

Klingenheben: penultimate syllable stressed + exceptions

nominals:	**rawáandu**	'dog'
	jumʔáare	'Friday'
	témmbuɗugo	'to be naked'
verbals:	**o waráay**	'he hasn't come'
	masín	'very much'
	ʔúsoko	'welcome'

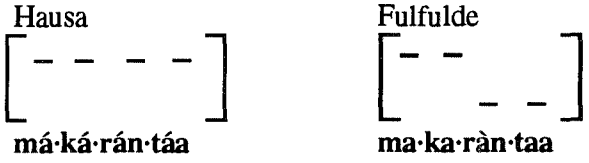
A number of exceptions (of Arnott and others) to the stress assignment rules can only be explained when it is assumed that Arnott, Noye and others wrongly put stress on a syllable with a relative high pitch that did not have stress itself but was followed by a stressed low pitch syllable. In the following example Arnott assigns stress one syllable too early to the syllable preceding the one where pitch lowering occurs (in a declarative sentence).

mi-noddátaa 'I won't call' rather: **mi noddatàa**

It is not clear why Arnott puts stress on the last syllable in the interrogatives **ndeyé** 'where', **moyé** 'who', and **kiyé** 'which' [KI class]. Perhaps the rising intonation of a question has something to do with it.

In the phonetic experiment on the length of vowels (see Appendix 2) the measurements show that vowels are relatively longer in stressed syllables. Vowel length is phonemic in Fulfulde but stress does influence its phonetic realization. This distinction confirms the stress assignment in words as proposed in this study.

Another argument for the present analysis of stress assignment and its realization (as pitch lowering in a declarative sentence) was given by a consultant from 'Yola in Nigeria. The word **makarantaa** 'school' is pronounced in the following different ways in Hausa and in Fulfulde.



The word **mákárántáa** has high tones throughout in Hausa. In Fulfulde this loan-word receives a tonal pattern like H H L L. The lowering of the pitch is placed exactly on the syllable that receives stress in Fulfulde because stress falls on the last heavy syllable (the last syllable being extra-metrical). The rules for assigning stress in Fulfulde are given in the following section.

4.6.2 STRESS ASSIGNMENT RULES

Stress assignment in the Fulfulde of Maasina is described with the parameters set out by metrical phonology (Goldsmith 1990:169-216, Hayes 1986).

parameters for the metrical structure in Fulfulde*:
1. last syllable is extra-metrical in nominals
2. left-headed feet
3. quantity sensitive feet
4. unbounded feet
5. right-headed word level structure

The rules deriving the metrical structure according to these parameters predict that the stress falls on the last heavy syllable (before the last syllable in nominals) or else on the first syllable.

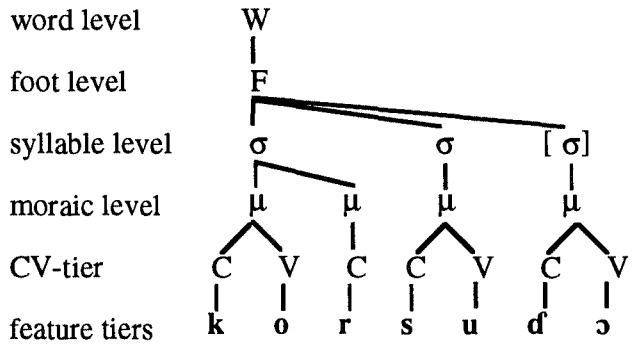
A quantity-sensitive foot is a foot where the prominent syllable is a heavy syllable, the other syllables in the foot are light syllables. A foot is built on a heavy syllable that is the head of the foot. Directionality is not important because the foot in Fulfulde is quantity sensitive and left-headed, it follows that a foot consists of a heavy syllable and all the light syllables that follow it. A left headed foot is a unit of syllables where the first is prominent, it receives (secondary) stress. If the foot is left headed and there is no heavy syllable in a word, then the first light syllable of this word is the head of the foot. An unbounded foot is a foot that can contain more than two syllables. A right headed word level structure implies that the last foot in a word receives the word stress.

The fact that the last syllable is extra-metrical in nominals only is interesting because this last syllable mostly contains the noun class suffix. The hypothesis (cf. Sapir 1971, Doneux 1975) is that the noun class suffix evolved historically from a weak demonstrative

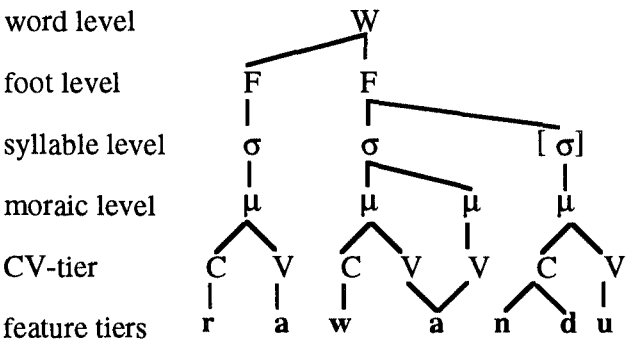
* Bruce Hayes [personal communication] has given me some suggestions for these Fulfulde parameters during a phonology conference at the Max Planck Institute, Nijmegen, September 1986 for which I want to thank him here. All misinterpretations and mistakes are of course my own.

or definite article following the noun. The fact that the syllable in which the noun class suffix occurs does not count in the assignment of stress is perhaps a trace of the fact that once there was a word boundary between the noun stem and the noun class suffix. Perhaps the stress assignment rules can be taken as another argument for the hypothesis that Fulfulde or a language stage before Fulfulde once had noun class prefixes, not suffixes. An extra-metrical syllable is attached to a previous foot, it doesn't receive stress because only the head of a foot can receive stress. Extra-metricallity is indicated by square brackets around the extra-metrical syllable: [σ].

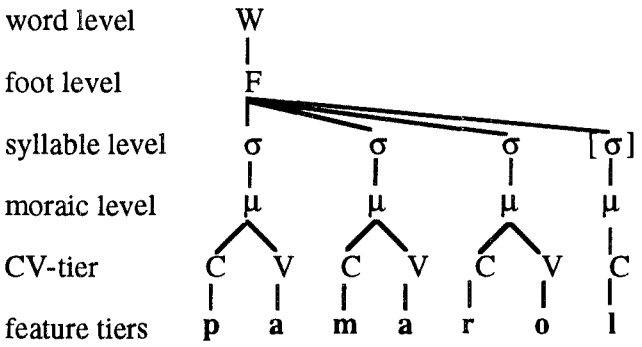
The metrical structure can be built on top of the syllable structure described above in section 4.1. It should be noted that a heavy syllable is defined as a syllable containing two morae and a syllable that is light contains only one mora. The proposed combination of the XMS-model extended with an explicitly derived CV-tier and the arboreal metrical system makes it possible to maintain this definition in the model. A heavy syllable is branching. The following figure shows the metrical structure of the word **kòrsuɗɔ** 'cherished one'.



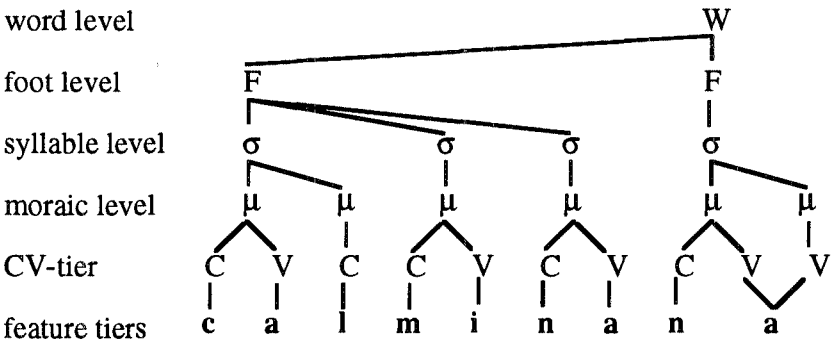
The stress falls on the first syllable in the word **kòrsuɗɔ** 'cherished one' because it is the last heavy syllable (which is not word final). The metrical structure of the word **rawàaⁿdu** 'dog' is given below.



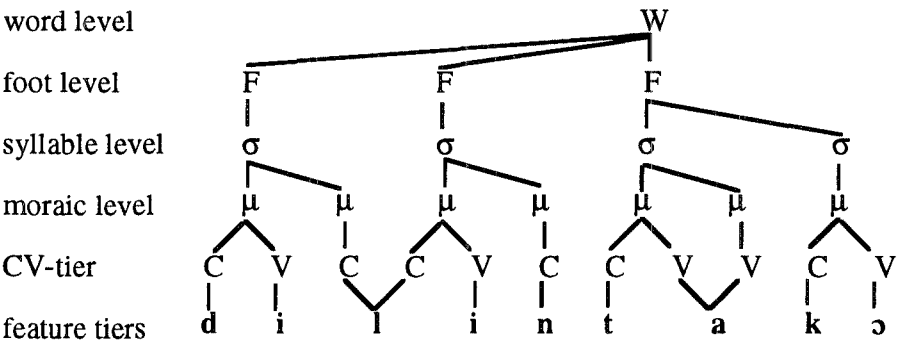
The word **rawàaⁿdu** 'dog' shows that the word stress falls on the head syllable of the last foot in the word. There is no heavy syllable preceding the extra-metrical last syllable in the metrical structure of **pàmarol** 'small', hence it consists of only one foot.



The word **pàmarol** 'small' shows that the last syllable in nominals does not count in the assignment of stress. The last syllable **rol** containing the noun class suffix **-ol** is heavy but the stress falls on the first syllable because there are no heavy syllables before this extra-metrical syllable. The fact that the last syllable is not extra-metrical in verb forms is shown by the metrical structure of **calminanàa** 'you should greet for'.



The word stress falls on the heavy syllable of the last foot in the verbal form **calminanàa** 'you should greet for'. The metrical structure of **dillintàakɔ** 'can't move' shows penultimate stress.



The word **dillintàakɔ** 'can't move' shows that stress on the negative morpheme **-aa-** is not lexical but follows from the fact that this long vowel belongs to the last heavy syllable of the verbal word.

The syllabic and the metrical structure of a word are derived from the time-tier and the feature specifications linked to it. The derivation goes (in the above pictorial representations) from bottom to top. The lexicon only contains information on the linking

of features to time slots. The structure at the CV-tier, the moraic or μ-level, the syllabic or σ-level, the foot or F-level, and the word or W-level are all derived by rules.

4.7 INTONATION

Unlike most of its neighbouring African languages, Fulfulde is not a tone language. Fulfulde does make use of intonation patterns. This is clearly stated by Arnott:

> Fula is an intonational rather than a tonal language, in the sense that the main outlines of the pitch contours of a sentence are determined by the type of sentence, rather than by the tonal characteristics of individual words and complexes. Arnott (1970a:62)

Intonation patterns are placed on phrases and sentences, usually depending on the positions of (phonological or semantic) stress. An intonation pattern can carry an independent specific meaning. The relative consistent meaning of a certain intonation pattern is sometimes difficult to define. The meaning of intonation often has a function in the conversational discourse. Certain patterns can indicate that the speaker gives someone else permission to speak. Intonation can reveal certain attitudes. For example, the "insecurity pattern" in English indicates that the speaker wants to express (generally) her (or his) uncertainty. The fact that the uncertainty pattern is used more by women than men is an indication that such a pattern also can confirm social roles, rather than indicating that the speaker is indeed more uncertain about the statement. An intonation pattern can be used to express the illocutionary force of an utterance such as the fact that it is a statement, a command or a question (see Bolinger & Sears 1981, Cruttenden 1986).

Arnott (1965) discusses a number of intonation patterns. Many of them are linked to verbal morphemes that do not occur in Maasina. The most important questions that have to be asked in order to describe the intonation patterns in brief are the following:

1) What intonation patterns do occur (what is their form and meaning)?
2) How are these intonation patterns anchored on the words in a sentence?

Only two intonation patterns are discussed here: the pattern of the declarative sentence (section 4.7.1) and the pattern of the yes-no question (section 4.7.2). The latter is the same as the intonation of a topic phrase. The typical intonational behaviour of monosyllabic a-tonic words is described in section 4.7.3. The influence of a focused constituent on the intonation of an utterance is discussed in section 4.7.4.

4.7.1 DECLARATIVE PHRASE

Neutral declarative phrases have an intonation contour where pitch lowering occurs on each stressed syllable. The following neutral declarative sentence shows the downward steps in pitch on the stressed syllables.

dèb·bɔ soo·dìi di·sàa·rɛ

woman buy-COMPL wrapper

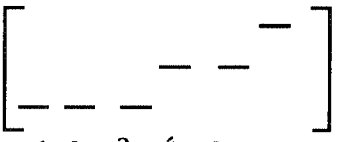
'The woman has bought a wrapper.'

The last syllable in a declarative sentence has the lowest pitch. The example shows that unstressed syllables generally copy the pitch of the preceding syllable.

4.7.2 YES-NO QUESTIONS AND TOPIC PHRASES

A yes-no question is a question that asks for the affirmation or negation of a statement. A topic phrase always precedes another declarative clause. It forms a constituent about which the following statement is made. The topic forms a phrase by itself which usually ends in a topic marker. The intonation pattern of yes-no questions and topic phrases are identical and can be described in the following way:

Topic phrases and yes-no questions have an intonation pattern which is almost the mirror image of the declarative pattern. This pattern is characterized by a rising contour, where pitch raising occurs on each stressed syllable and also on the phrase final syllable. The stressed syllables which trigger rising of pitch in such an utterance are marked with an acute accent.



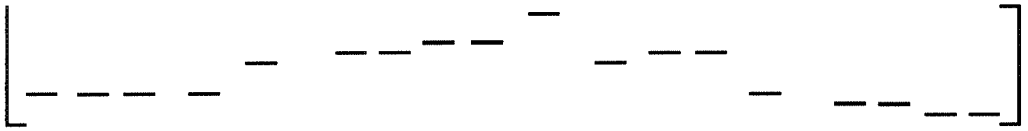
súudu ʔamín ley to

house our in there

'In our (excl.) house?'

In the above question the pitch rises on the stressed last heavy syllable of the possessive form **ʔamín** 'our (excl.)' and on the last syllable in the phrase **to** 'there'. The last syllable in such a phrase is higher in tone than the rest of the syllables even if that syllable normally does not receive word stress

The same pattern is found in the topic phrase **faa sɔ mi jaŋⁿgii seeɗa seeɗa duu** 'and also even if I have read a little bit' (the speaker was talking about not understanding the Arabic writing of the Koran, having visited the Koran school not long enough to understand Arabic).

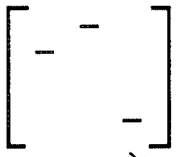


fáa sɔ mi jaŋⁿg-íi séɛɗa séɛɗa dúu, mi faam-atàa sànnɛ sànnɛ
even if I read-COMPL very little TM, I understand-N.INCOMPL very much
'Also even if I have read a little bit, I do not understand very much.

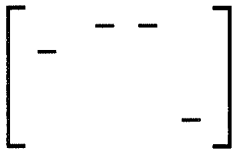
The topic marker **duu** ca be translated as 'also, on top of that', being the last syllable in the topic phrase it gets the highest tone. The topic phrase is followed by a declarative phrase with an intonation pattern as described in section 4.7.1.

4.7.3 THE A-TONIC WORDS

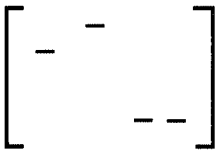
Arnott (1965:81) describes the pronouns, pronominal concords, and a number of other monosyllabic words as "a-tonic" words. In Arnott's description of intonation this means that such words are never accented. And indeed the pronouns and pronominal concords are often lower in pitch compared to the pitch of the following word in declarative phrases, yes-no questions, and topic phrases, especially when these a-tonic words occur phrase-initially. A-tonic words copy the pitch of the preceding syllable when they are preceded by another word in the same phrase. The a-tonic words **sɔ** 'if' and **mi** 'I' copy the pitch of **faa** 'even' in the topic phrase **faa sɔ mi jaŋⁿgii** 'even if I have read' (see section 4.7.2). The pitch of the phrase initial subject pronouns **mi** 'I' and **mɔ** 'he/she/it' in the following examples of declarative sentences is lower than that of the word which immediately comes after these pronouns.



mi wa·rìi
'I have come'



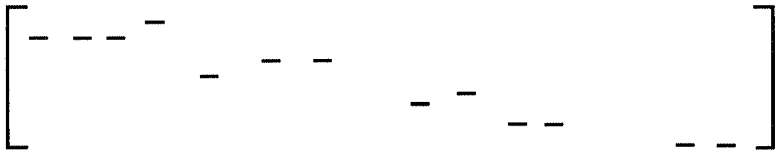
mɔ wa·ra·tàa
'He won't come.'



mɔ wa·ràa·li
'He hasn't come.'

This intonation pattern is probably responsible for the erroneous placement of stress on the penultimate syllable by Arnott in **warátaa** 'won't come'.

The following sentence consisting of a topic phrase followed by a declarative clause demonstrates both the relevant intonation patterns and the behaviour of a-tonic words.



ʔá·du·na né, yɔ súu·du ⁿdu ma·hàa·ki sàn·nɛ
world TM COP house CL build-N.M.COMPL well
'Concerning this world, it's a house that is not built well.'

The highest pitch in the topic phrase falls on the last syllable, on the topic marker **ne**. The highest pitch in the declarative sentence is on the stressed syllable of the word **súudu**

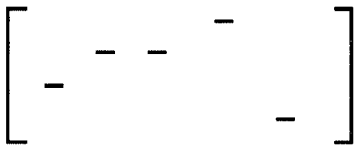
'house' which is followed by a relative clause. The pitch lowers on the stressed syllable of the words **mahàaki** 'is not built' and **sànnɛ** 'very well'. The a-tonic words are **yɔ** (copula) and **ⁿdu** (relative pronominal concord). The a-tonic words **yɔ** and **ⁿdu** are lower in pitch than the following verb stem.

ʔa faa·màa·li
You didn't understand?'

The subject pronoun **ʔa** 'you' is lower in pitch than the verb that it precedes (see also **mi** in the example **mi warìi** 'I have come'). The pitch rises on the stressed penultimate syllable in **faamàali** 'don't understand' and on the last syllable of the same word because of the yes-no question intonation pattern.

4.7.4 FOCUS

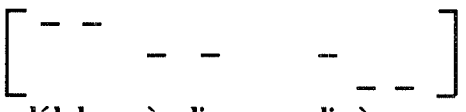
Focus also has an important influence on the intonation pattern. Focus is marked intonationally by assigning a high pitch (the highest in the phrase) to the stressed syllable of the focused word.



ⁿdu dɛ̀b·bɔ máw·ɗɔ
'It is of an óld woman.'

The focus and phrasal stress in the last example is on the first syllable of **máwɗɔ** 'old'. This syllable receives the highest pitch in the sentence because of focus. The a-tonic subject pronoun **ⁿdu** (here in a non-verbal sentence) receives a pitch that is lower than that of the following word (see section 4.7.3). The last syllable in the word **mawɗɔ** is the syllable lowest in pitch in the declarative sentence.

Focus emphasizes a constituent in a sentence. Focus has consequences for the choice of the verbal conjugation and for the syntactic structure of the sentence in question. Focus is mostly located in the initial word position of the sentence, as is the case in the following example of a declarative sentence with focus. Focus has no distinctive intonational realization when it falls on the first word in the phrase, which is the most common position for a focused constituent.



dɛ́b·bɔ sòo·di di·sàa·rɛ
woman buy-R.COMPL wrapper
'It's the woman that bought a wrapper.'

There are a number of words that attract phrasal stress because they are inherently focused. Focus is indicated by an acute accent because it is realized as high pitch on the stressed syllable. Examples of words with inherent focus are the following:

fuʔ:	**yimɓɛ fúʔ**	'All people, everybody.'
fay:	**fáy huuⁿdɛ**	'Nothing, not even a thing.'
nii:	**miɗɔ níi winⁿda**	'I am exactly now writing.'
buy:	**ʔana ʔooldi búy**	'It is very yellow.'
ɗɔn:	**ʔɛɓɛ ɗɔ́n duka**	'They are here arguing.'

The focused word receives the highest pitch in the above phrases.

The examples in the sections 4.7.1 to 4.7.4 show the intonation patterns of the declarative phrases and the yes-no questions and topic phrases. More research is necessary on the other intonation patterns that occur in Fulfulde. The question word questions can have the same pattern as declarative sentences with focus on the question word, but sometimes the yes-no question pattern is also found there. The types of intonation discussed here do not describe patterns that convey attitudes. It is possible that there are different intonations for a neutral command and an angry command. Hopefully the above rules give some tools for the description of other patterns as well. The statements about stress indicate that the phonetically distinct features of stress must be searched for in amplitude. Changes in pitch are also an indication of stress.