

# MORAS OR SKELETAL UNITS? A QUESTION OF PARAMETRIC VARIATION

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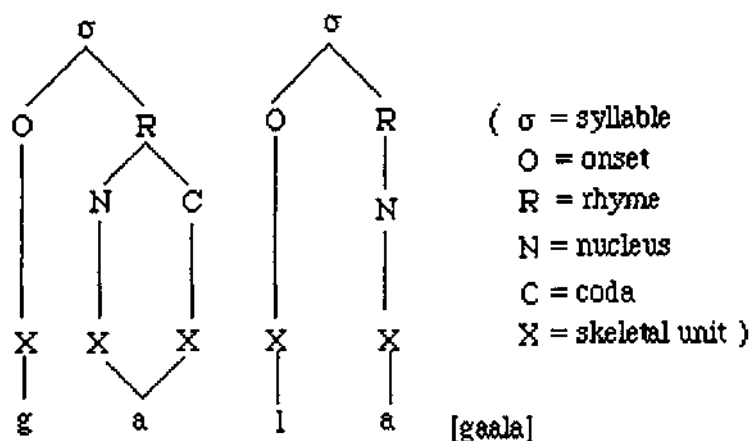
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One major issue that is being addressed in recent phonological research is whether the phonological representation has to recognize the existence of moras or skeletal units as primitives. The present paper argues that both approaches are not necessarily mutually exclusive, since there exists the possibility that some phonological processes have to refer to both phonological entities in order to account for all the facts of a language. In fact, this dichotomy wrongly appeared by facing Hayes' (1989) moraic theory with other theories of syllable structure. However, if one takes into account that neither the skeleton can be disregarded nor syllable weight is always a phonological variable, a new ordering of phonological primitives can be suggested, which does not correspond to alternative prosodic theories but reflects the parametric variation that languages show between moraic and syllabic structure.

## **1. Introduction.**

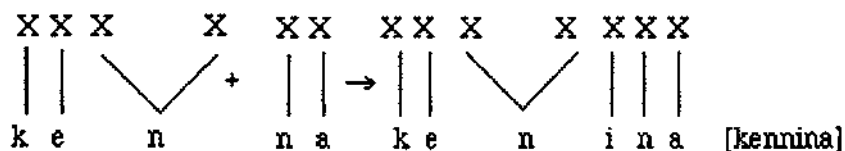
One major contribution of non-linear phonology to the general phonological theory has been the introduction of the *skeleton* (McCarthy 1979) as an intermediate level between syllabic constituents and melodic segments.

(1)



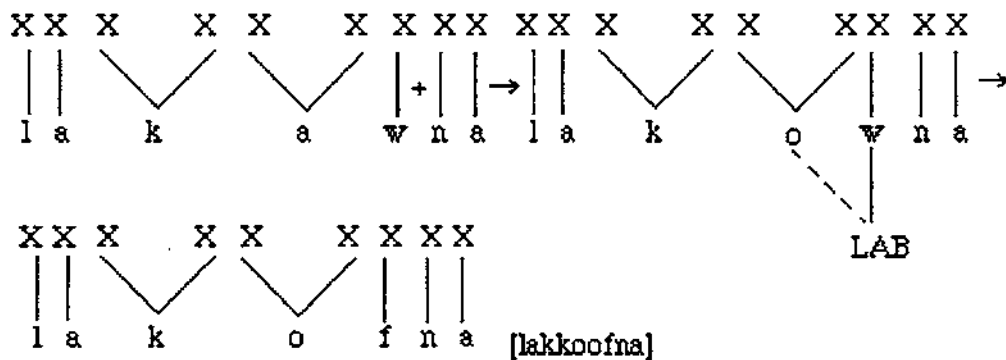
The independence of this level with respect to the others plays an important role in the description of some segments (long vowels, geminate consonants, complex segments) as well as in the justification of certain phonological processes (total assimilations, compensatory lengthenings, reduplications). For example, the representation of long segments as two skeletal units associated with the same melody captures and satisfactorily expresses the ambiguous behavior of long vowels and consonants, which sometimes act as if they were two segments while others as if they were a single entity. In the Cushitic Oromo language, for instance, phonological processes that affect quantity, such as epenthesis, treat long consonants as a sequence of two segments: the epenthetic vowel [i], which is inserted to avoid triconsonantic sequences, occurs after two heterogeneous consonants (2a) as well as after a geminate consonant (2b).

- (2) a. arg+na -> argina 'we see'      gonf+ta -> gonfita 'you (sing.) adorn'  
 b. kenn+na -> kennina 'we give'      mudd+ta -> muddita 'you press'



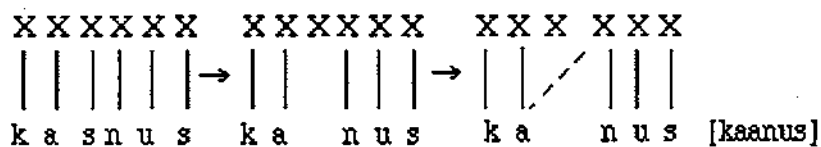
However, processes that involve melodic changes, such as labialization, treat long segments as a single entity: [w] spreads its labial characteristic to a preceding vowel, whether this is short (3a) or long (3b).

- (3) a. ilbiisaw+na -> ilbiisowna -> ilbiisofna 'we are simple'  
 b. lakkaaw+na -> lakkoowna -> lakkoofna (\*lakkaofna) 'we count'



The presence of a skeletal tier is also proved through the analysis of phonological processes such as compensatory lengthenings. In Latin, for instance, deletion of /s/ before anterior sonorants entails lengthening of a preceding vowel (4). If one assumes the existence of a skeletal tier, compensatory lengthening can be universally justified as a spreading process that repairs ill-formed structures resulting from the appearance of empty X positions, which otherwise could not be incorporated into the prosodic structure.

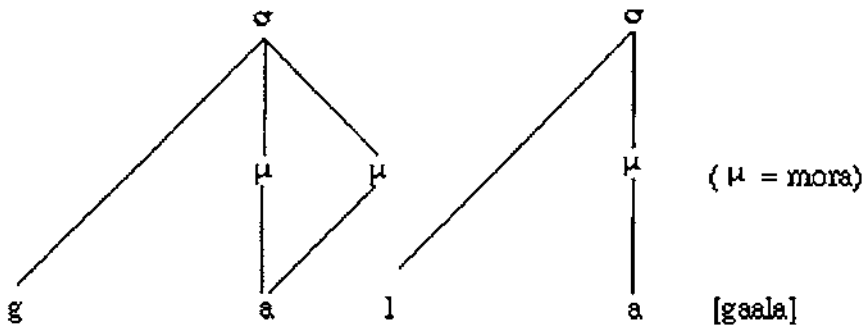
- (4) \*kasnus -> kaanus 'gray'  
 \*kosmis -> koomis 'courteous'



Although the previous data seem to adequately justify the presence of a skeleton, during the last decade an alternative prosodic representation has been proposed (Hayes 1989, among others),

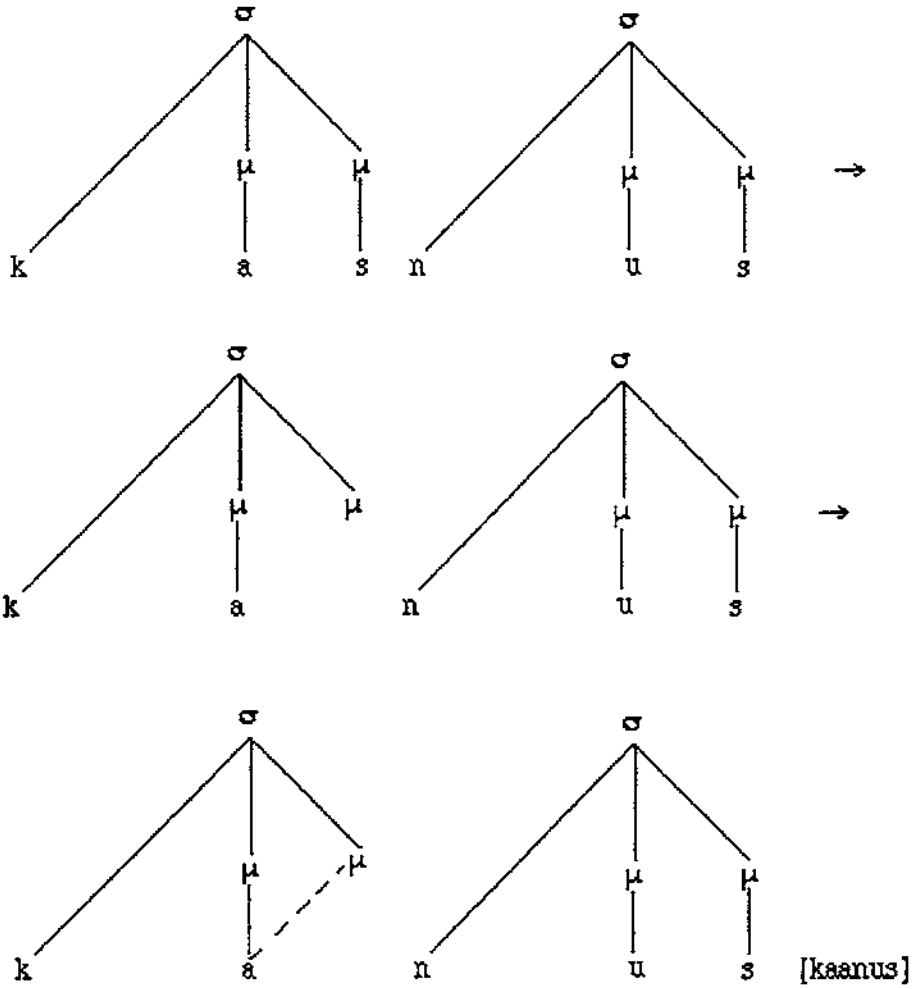
according to which the skeletal units (X) and the syllabic constituents (O, R, N, C) are replaced by *moras* (5). Using this approach, moras do not merely represent a segment (as X did) but play two different roles: they count as phonological positions (i.e. they are phonological primitives) and also represent the contrast between light (or monomoraic) and heavy syllables.

(5)

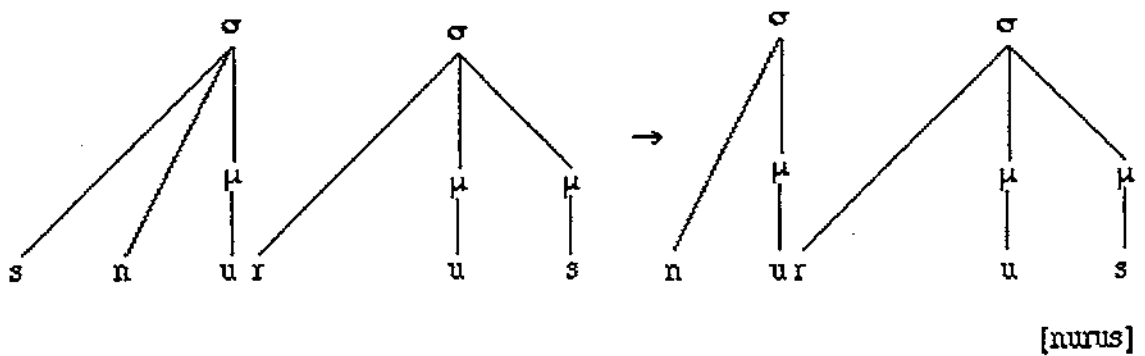


The defenders of such an approach regard this theory as superior to the one that claims the existence of a skeleton and syllabic structure, because moraic representation does not only capture the duality of some segments (e.g. long segments) but justifies the phonological processes that involve syllable weight (e.g. compensatory lengthening) better than previous approaches. For example, moraic theory explicitly captures the cross-linguistic generalization that only segments deleted in coda position trigger lengthening of an adjacent segment. Thus, in Latin deletion of /s/ entailed compensatory lengthening in coda position (4 and 6a) but not word-initially (6b), because in this position /s/ does not have moraic value. Note that in order that the theory that assigns skeletal positions to all the segments accounts for the data in (6b), one has to idiosyncratically stipulate that melodies only spread to syllable-final empty positions, so that the empty word-initial X position is not filled by spreading but deleted through convention because of its stranded character (6b'). In moraic theory, however, this is independently motivated because only syllable-final consonants make their syllable heavy, i.e. they have moraic value.

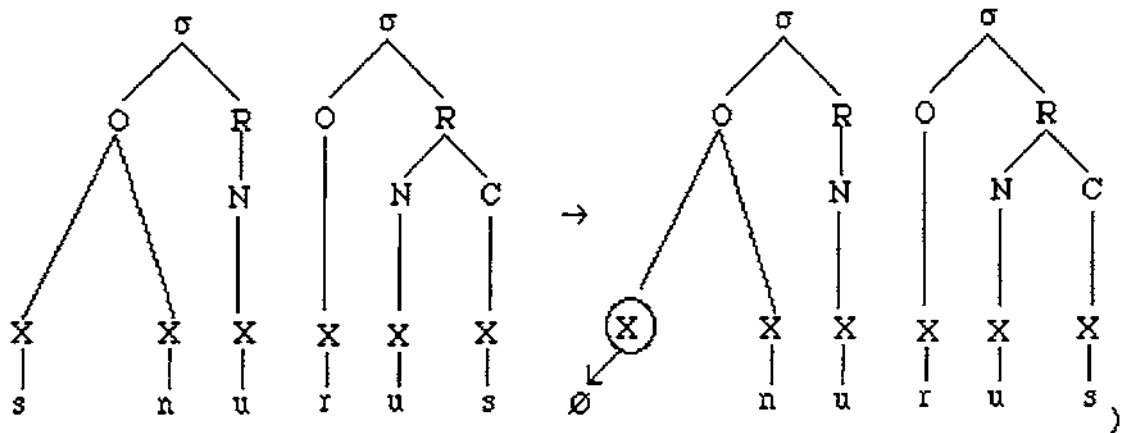
- (6) a. \*kasnus -> kaanus 'gray'  
 \*kosmis -> koomis 'courteous'



- b. \*snurus -> nurus 'daughter-in-law'  
 smereo -> mereo 'I deserve'



Cf. b'



As a consequence of this reanalysis of the prosodic structure, two alternative prosodic theories are presented nowadays in the literature: *the theory of syllable structure*, whose primitives are the skeletal units (X), the syllabic constituents (O, R, N, C), and the syllables ( $\sigma$ ), and the *moraic theory*, which replaces the skeletal units and the syllabic constituents by moras ( $\mu$ ).

- (7) *Prosodic theories:*
- a. Theory of syllable structure (X; O, R, N, C;  $\sigma$ )
  - b. Moraic theory ( $\mu$ ;  $\sigma$ )

The aim of this paper is to prove that both theories are not necessarily mutually exclusive but their differences correspond to some kind of parametric variation that languages show. In general, the distinction established by moraic theory between light and heavy syllables turns out to be crucial (i.e. phonologically relevant) for languages that show a phonemic contrast between short and long vowels, as it was already pointed out by Troubetzkoy (1939).<sup>1</sup> However, syllable weight is not a phonological variable in languages without phonemic vowel length. In these languages, instead, the internal structure of the syllabic constituents becomes relevant.

The article is organized as follows. We first provide data to support the claim that the dichotomy presented in (7) does not match the real facts of the languages. Section 2 justifies the level of skeletal representation even in languages with well-motivated moraic structures while section 3 shows that the role of the skeleton can not be taken over by melodic structure either.

With this done, we suggest a new ordering of phonological primitives from which the parametric variation that languages show can be correctly established (section 4).

## 2. Skeleton and Moras.

Hayes (1989) claims that skeletal units are empirically unnecessary because compensatory lengthening does not take place systematically whenever a segment deletes leaving an empty prosodic position behind, but only comes along in certain positions, which, not accidentally, always have moraic value.<sup>2</sup> In Oromo, however, there exists a case of compensatory lengthening that can only be justified with the presence of the skeleton.<sup>3</sup>

Oromo shows a phonemic contrast between short and long vowels and, thus, syllable weight functions as a phonological variable. The language treats CV and CVC syllables as monomoraic or light, while CVV and CVVC syllables are treated as heavy or bimoraic.<sup>4</sup>

- (8) *Oromo*: Light or monomoraic syllables: [CV]<sub>μ</sub>, [CVC]<sub>μ</sub>  
 Heavy or bimoraic syllables: [CV]<sub>μ</sub>[V]<sub>μ</sub>, [CV]<sub>μ</sub>[VC]<sub>μ</sub>

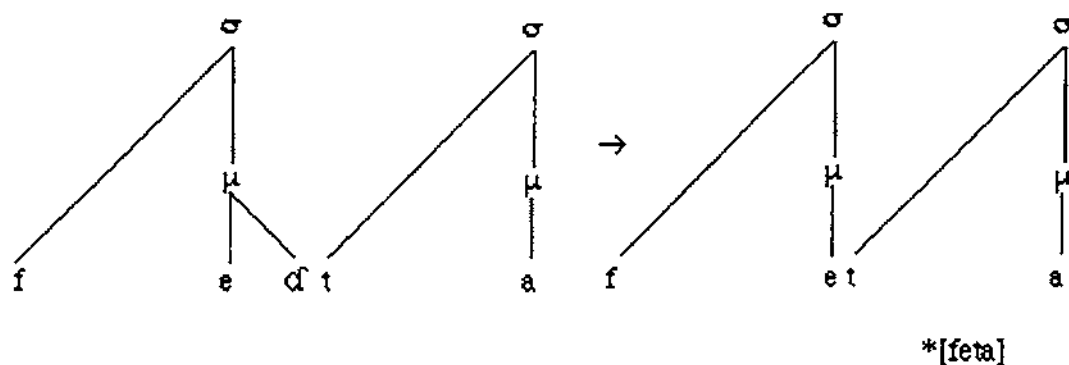
This division between the two different types of syllables turns out to be crucial, for instance, to justify the behavior of such syllables in relation to the general constraint that the language shows on the syllable structure of the words, namely Oromo does not allow long vowels in two successive syllables unless the second is also word-final. If concatenation of morphs puts together syllables with long vowels (9a), the vowel of the second syllable obligatorily shortens. This constraint, however, does not concern CVC syllables (9b).

- (9) a. gaal+oota -> gaa l o ta 'camels' (cf. nam+oota -> na moo ta 'men')  
 afcaal+oom- -> afcaa lo m- 'be kind' (cf. ko?+oom- -> ko ?oo m- 'be busy')
- b. fard+oota -> far doo ta 'horses'  
 lugn+oom- -> lug noo m- 'be coward'

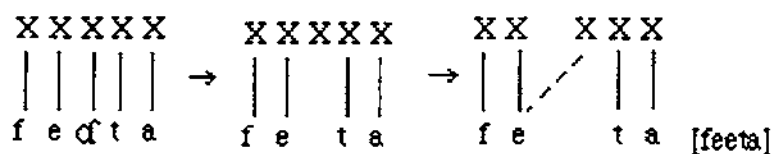
With these precisions established on the weight of the Oromo syllables, let us now look at the peculiar compensatory lengthening process that the language shows. Oromo has a deletion process that erases the melodic content of a glottal consonant (i.e. glottal stop /ʔ/ and implosive /ɗ/) in syllable-final position. This deletion entails lengthening of the preceding vowel (10). According to Hayes' moraic theory, this kind of deletion should not yield compensatory lengthening because the deleted glottal consonant does not leave an empty mora behind (10a). (Remember that in Oromo final consonants do not add weight to the syllable, i.e. they have no moraic value.) However, the data prove that such lengthening occurs, which can only be justified by the presence of a skeleton (10b).

- (10) feɗ+na -> feena 'we wish'  
 aʔ+ta -> aata 'you push'

a.



b.

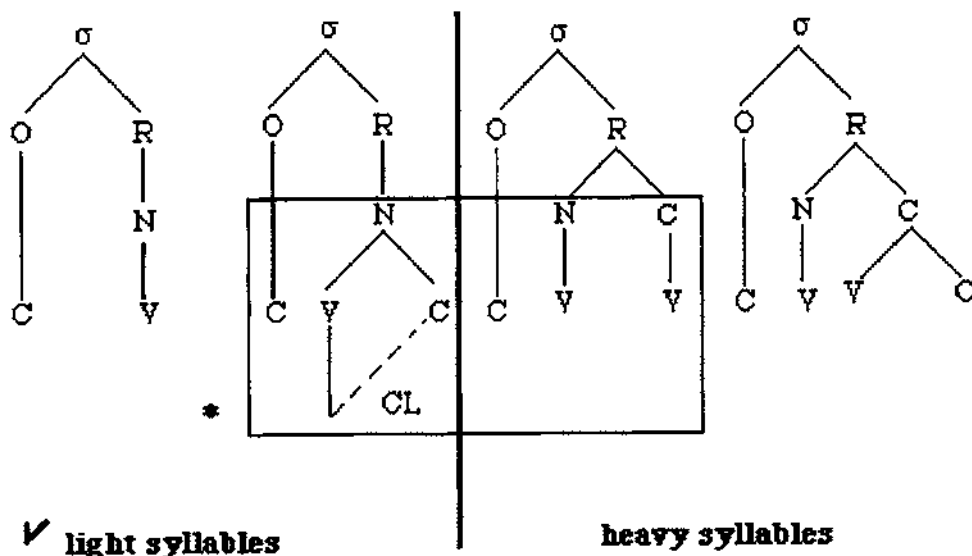


Since Oromo seems to require the presence of a skeleton, one could think that the language does not need to refer to its moraic structure but, instead, its syllable structure would function as a phonological variable. We will next show, however, that syllable structures are unable to account for the Oromo facts. This will prove that in Oromo, as in any language with phonemic vowel length, syllable weight is a phonological variable, which is better expressed through moraic representation.



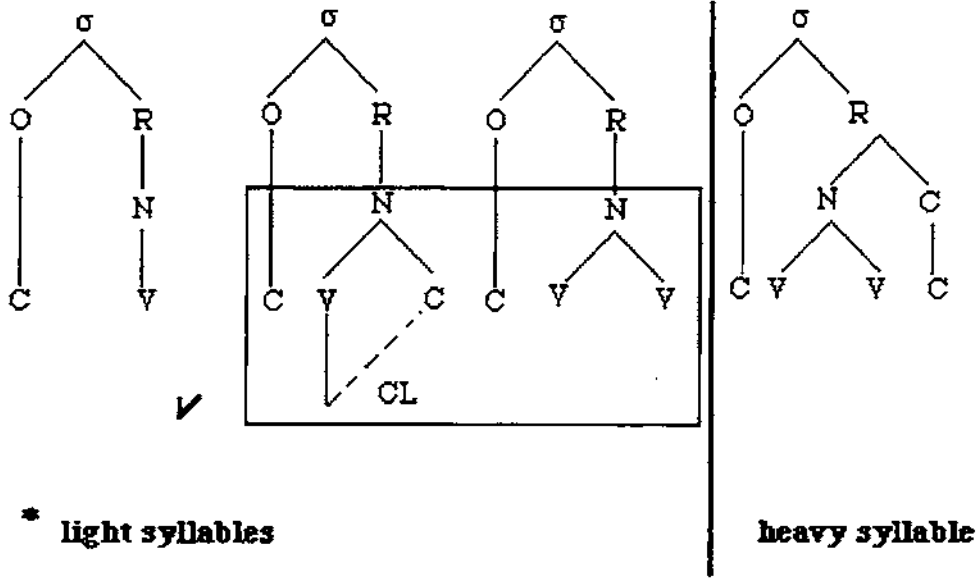
If we assume that Oromo has the syllable structure shown in (11), we correctly capture the Oromo syllable division between light CV(C) and heavy CVV(C) syllables: the rhyme of light syllables consists only of nucleus while the rhyme of heavy syllables consists of nucleus and coda. However, the representation of (11) cannot justify the compensatory lengthening process (CL) that the language shows, because the deleted final consonant occupies a position different from that occupied by the second part of a long vowel, namely the former is included within the nucleus while the latter constitutes the coda, and there is no reason to claim that the language has two different types of long vowels.

(11)

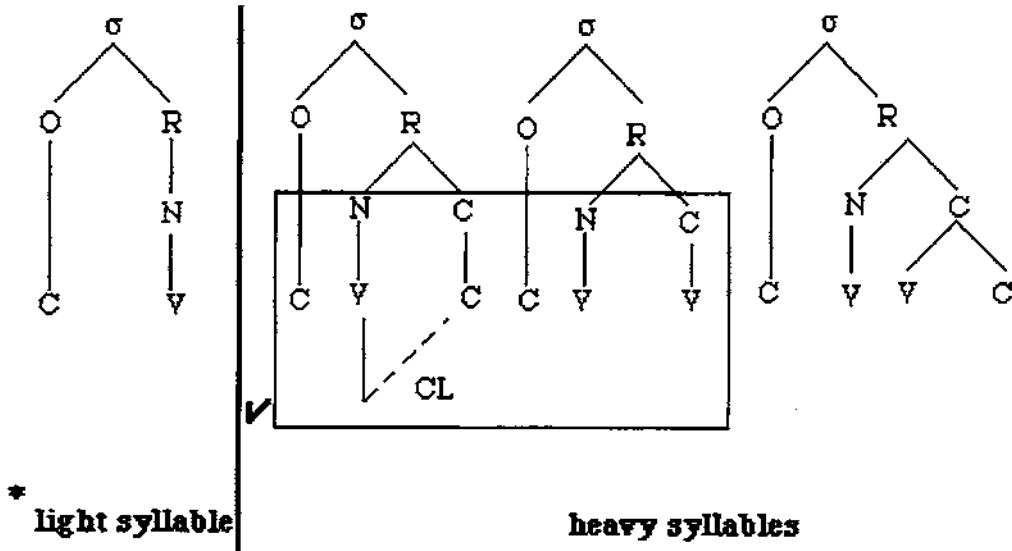


The syllable structures represented in (12) and (13) are also untenable for Oromo. In this case the compensatory lengthening process can be adequately represented because the vowel lengthened as a consequence of the deletion of a final consonant results in a long vowel with the same structure of underlying long vowels (i.e. a complex nucleus in (12) or a branching rhyme in (13)). Note, however, that in these cases the division between light and heavy syllables is incorrectly established.

(12)



(13)



Oromo presents a further piece of evidence in defense of the skeleton. Hayes (1989) and McCarthy and Prince (forthcoming) present as an advantage of the mora account the fact that there are not phonological processes that count segments, although many processes count syllables or moras. Oromo, however, shows a case that contradicts such a claim, namely there is a rule of consonant gemination which applies when the nominalizer "ii" is attached to a verbal stem that consists of more than three segments, independently of the nature and prosodic position of these segments.<sup>5</sup>

(14) a. *No gemination:* CVC: bad+ii -> bad ii 'destruction'  
ham+ii -> ham ii 'gossip'

VVC: aar+ii -> aar ii 'anger'  
oos+ii -> oos ii 'scream'

b. *Gemination:* CVVC: gaaf+ii -> gaaff ii 'question'  
haam+ii -> haamm ii 'harvesting'

(C)VCV: aram+ii -> aramm ii 'weed'  
marag+ii -> maraggii 'plastering'

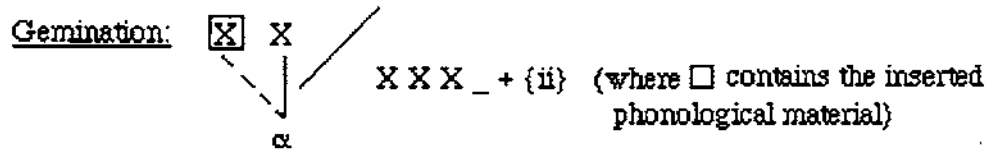
(C)VCVVC: adeem+ii -> adeemm ii 'walking'  
duguug+ii -> duguuggii 'stripping'

CVCCVC: dorrob+ii -> dorrobb ii 'approaching birth'  
korkod+ii -> korkodd ii 'tying'

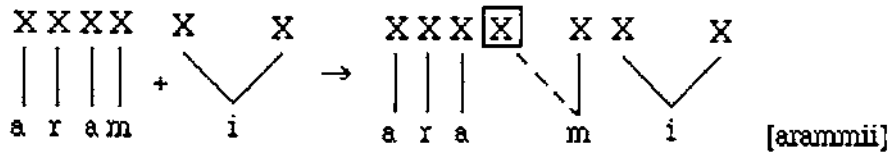
(C)VCCVVC: arraab+ii -> arraabb ii 'licking'  
hammaar+ii -> hammaarr ii '(one) scoop'

The previous data sustain the morphologically restricted rule (15), whose structural description is exclusively determined by the number of segments that the stem has.

(15)



For example:



To summarize so far, the Oromo data on compensatory lengthening and consonant gemination argue in favor of the presence of the skeleton, even though the phonological behavior of the language is better accounted for through moraic representation. This result favors Hyman's (1985) theory of phonological weight, where each segment starts out with a skeletal position upon which moras and syllables are built. (We will turn to this point in section 4.)

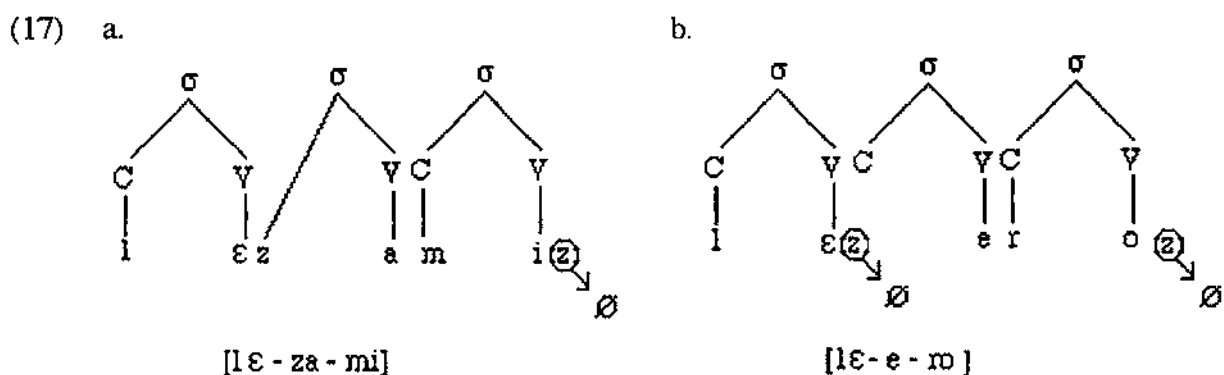
### 3. Skeleton and Root Nodes.

In the previous section we proved that the skeletal tier cannot be replaced by moras. Now, we will argue that it can not be taken over by bare melodic root nodes either, as Itô (1989), among others, suggested.

Within the syllable theory, the presence of the skeleton was supported by means of the existence of empty skeletal positions (Clements and Keyser (1983), Kaye and Lowenstamm (1984), among others). For example, in French the contrast between vowel-initial words (16a), which attract as onsets the final consonant of a preceding word,<sup>6</sup> and *h-aspiré* words (16b), which do not fill their onsets through resyllabification, can be satisfactorily accounted for by assuming that the latter group underlyingly begins with an empty X position, which is syllabified as onset and thus blocks the resyllabification of a preceding consonant as onset (17).

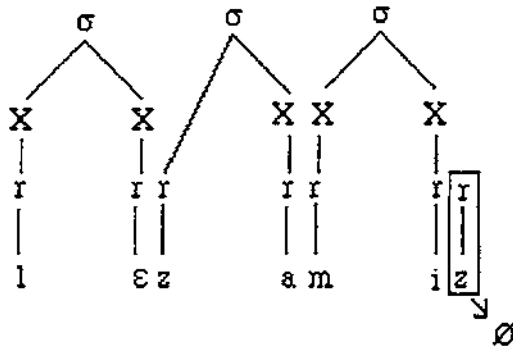
Note that in this case the syllabification rules of French have to explicitly allow the prosodic incorporation of an empty skeletal position as onset. Furthermore, in order to explain that final consonants are only realized when they are followed by a vowel-initial word (e.g. /z/ in *les* or /t/ in *petit*), it has to be also assumed that French has 'floating' consonants (i.e. consonants which are not associated with any skeletal position). Again, rules of syllabification will have to explicitly allow the prosodic incorporation of floating consonants as onsets.

- (16) a. ami [a-mi] 'friend'  
 les amis [lɛ-za-mi] 'the friends'  
 petit ami [pə-ti-ta-mi] 'little friend'
- b. héros [e-ro] 'hero'  
 les héros [lɛ-e-ro] (\*[lɛ-ze-ro]) 'the heroes'  
 petit héros [pə-ti-e-ro] (\*[pə-ti-te-ro]) 'little hero'



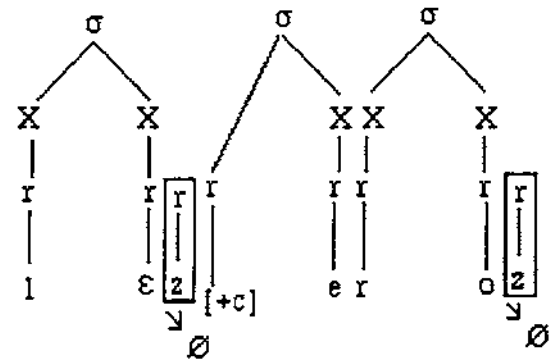
If we now consider that the skeleton is constituted by entities that do not show their vocalic or consonantic nature (i.e. a skeleton made of X instead of C and V), the empty consonantic positions of (17b) can be reinterpreted as bare root nodes with the sole specification of [+cons] (18b). Obviously, the syllabification rules of French will have to specify the possibility of incorporating as onsets floating consonants. As we previously saw, final consonants are floating segments too, but in contrast with the representation of *h-aspiré*, these have melodic specification. Note that under the proposed analysis, final consonants and *h-aspiré* are unitarily treated as floating segments, with different degrees of melodic specification, which can be prosodically incorporated as syllable onsets.

(18) a.



[lɛ - za - mi]

b.



[lɛ - e - m]

([+c] = [+cons])

In sum, these French data argue in favor of the existence of the skeleton, because if we accept Itô's (1989) suggestion that the skeletal tier may be replaced by the tier of the root nodes, we will not be able to distinguish 'floating' segments from 'normal' or non-floating ones.

#### 4. Conclusion.

On the whole, we can assert that neither the mora tier nor the melodic root tier can completely replace the skeleton. This favors the presence of the skeletal tier within the phonological representations.

The unavoidable presence of the skeleton along with the adequacy of moraic representation for languages with phonemic vowel length and the suitability of syllable-structure representation for the remaining languages lead us to suggest a new ordering of phonological primitives (19). All languages have skeletal units ( $X$ ) upon which either moras ( $\mu$ ) or syllabic constituents ( $O$ ,  $R$ ,  $N$ ,  $C$ ) are built, depending on whether the language does or does not show a phonemic vowel length contrast. Both types of subsyllabic elements are finally grouped into syllables ( $\sigma$ ).

(19) *Phonological primitives of the prosodic theories:*

$X$  and  $\sigma$ , organized either by means of  $\mu$

or by means of  $O$ ,  $R$ ,  $N$ ,  $C$ .

We cannot conclude this paper without referring to, and somehow vindicating, Hyman's (1985) moraic proposal. The present-day literature always refers to Hayes' (1989) model as "the" moraic theory. An appealing aspect of this account is its non-segmental prosodic nature, because moras replace both skeletal units and syllabic constituents.<sup>7</sup> However, before Hayes' proposal Hyman (1985) suggested a different moraic representation, which in the light of the data presented here shows two clear advantages over Hayes':

(a) On the one hand, Hyman's model starts up with skeletal positions (which represent the phonological weight of each segment) upon which moras and syllables are built. In this sense, Hyman's proposal is superior to Hayes' because it assigns phonological status to the skeleton.

(b) On the other, Hyman explicitly states that his model is adequate for languages whose syllable weight is phonologically relevant. He refers specifically to the fact that a VC rhyme counts as heavy only if the language also has VV rhymes. The concept of syllable weight is thus necessarily tied to the existence of a vowel length opposition. Consequently, Hyman's moraic proposal is, unlike Hayes', specifically posited for languages with phonemic vowel length, which is not incompatible with the parallel existence of theories that claim the suitability of syllable-structure representations for other types of languages.

The final conclusion to be drawn from this study is that there does not exist a dichotomy between moras and skeletal units. This dichotomy wrongly appeared by facing Hayes' moraic theory with other theories of syllable structure. However, if one takes into account that neither the skeleton can be disregarded nor syllable weight is a universal phonological variable, one can clearly establish a new ordering of phonological primitives (19), which is not alternative but corresponds to the parametric variation that languages show.

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## Notes

<sup>1</sup> See Newman (1972) for a general statement on the importance of the syllable weight concept.

<sup>2</sup> See the previous Latin example in (6).

<sup>3</sup> The following Oromo data are taken from Lloret (1988).

<sup>4</sup> Note that Oromo contrasts with Latin in treating CVC syllables as light.

<sup>5</sup> There are only two exceptions, which have to be lexically marked:

- (i) k'irit'+ii -> k'irit' ii (\*k'irit't'ii) 'chisel' (t' = ejective or glottalized t)
- (ii) hiik+ii -> hiik ii (\*hiikkii) 'extension'

<sup>6</sup> This phenomenon is traditionally referred to as *liaison*.

<sup>7</sup> The other prosodic theories are segmental in the sense that the number of prosodic segments intuitively corresponds to the number of melodic segments.

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