



1994

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### Recommended Citation

Roberts, James S. (1994) "Nontonal floating features as grammatical morphemes," *Work Papers of the Summer Institute of Linguistics, University of North Dakota Session*: Vol. 38 , Article 11.

DOI: 10.31356/silwp.vol38.11

Available at: <https://commons.und.edu/sil-work-papers/vol38/iss1/11>

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# Nontonal Floating Features as Grammatical Morphemes

James S. Roberts

*The concept of floating tones is no longer controversial in tonal analysis; important insights into the morphology of numerous tonal languages have relied on the positing of morphemes that are composed simply of prosodically unlicensed tones. Employing data from three of Africa's four major language families, this paper builds on this notion by recognizing the existence of nontonal floating features — morphemes composed solely of phonological features that have no segmental support. The first example, from Kanembu (Nilo-Saharan, Chad), shows that the [+ATR] feature is the sole marker of incompletive aspect in the verb. Again, in Mafa and Podoko (Chadic, Cameroon), certain aspects of the verb are marked by floating labial and palatal features. One of the noun class markers in Aka (Bantu, C.A.R.) consists only of the floating feature [+voice]. And finally, the marker of the completive aspect in Mokulu (Chadic, Chad) is a morpheme that is comprised simply of the feature complex [+voice] and [+high]. In conclusion, after noting that a similar floating feature analysis may be appropriate in other languages such as Ngbaka (Ubangian, Zaire), we consider the general characteristics of floating features as full grammatical morphemes.*

## 1. Introduction

The existence of floating tones is no longer controversial in phonological and morphological analysis. Abundant evidence has been advanced to show that the phonological structure of certain morphemes may consist of nothing more than a tonal feature (or a bundle of tonal features), without any segmental support, that is, not associated with any unit of the skeletal structure. These floating tones are manipulated by the phonological rules of the language, and are usually realized phonetically via an autosegmental association with the syllables of other morphemes in the environment. Furthermore, important insights into the morphology of numerous tone languages have relied on the recognition of such floating tones. Floating tone morphemes also provided important arguments for the appropriateness of autosegmental representations. The existence of such morphemes raises a theoretical question: are such phenomena limited to tonal features, such that this is a unique property of tone? We answer that it is not; tonal and nontonal features share more properties than some have assumed.

The present paper provides abundant evidence that a wide variety of *nontonal* phonological features by themselves constitute full morphemes, just like floating tone morphemes. These floating features are prosodically unlicensed, having no segmental support. They are manipulated in regular fashion by the phonological rules of the language and are realized by being associated with segmental units already existing in the skeletal structure of neighboring morphemes. Theoretically, this possibility comes as no surprise, since it is provided for within the current models of multilinear phonology. However, the existence of nontonal floating features has until now been largely ignored. This paper thus provides examples that may fill an empirical gap.

The evidence we present comes from a wide variety of languages, representing three of the four major African language families. The first examples are suggested by published descriptions, and the latter examples, from Aka and Mokulu, come from more recent unpublished research.

## 1. Kanembu

Our first example comes from Kanembu, a Nilo-Saharan language of the Saharan subgroup, spoken in Chad and Niger in the areas near Lake Chad. Jouannet (1982) reports that the difference between the completive and noncompletive aspects of the verb is marked by the quality of the vowels: the noncompletive form is characterized by tense vowels and the corresponding completive verb form by lax vowels. The two sets of vowels and their correspondences are given in Table 1. Note, however, that the central tense vowel  $\Lambda$  (symbolized by Jouannet as  $\varepsilon$ ) corresponds to the two lax vowels [ə] and [a]. Some examples of the relevant verbal forms that Jouannet cites are given in (1)-(4).

Table 1. Kanembu Vowels

Tense vowels:	i	e	$\Lambda$	o	u
Lax vowels:	ɪ	ɛ	ə a	ɔ	ʊ

	<i>Completive</i>		<i>Incompletive</i>	
(1)	'gónə̀k̀	<i>I took</i>	'gónɔ̀k̀	<i>I am taking</i>
(2)	'dállə̀k̀	<i>I got up</i>	'dállɔ̀k̀	<i>I am getting up</i>
(3)	dálls'k̀	<i>I soaked</i>	dálls'k̀	<i>I am soaking</i>
(4)	bàrénə̀s'k̀	<i>I cultivated</i>	bàrénɔ̀s'k̀	<i>I am cultivating</i>

These forms are composed of the verb root, inflected for completive or incompletive aspect, followed by the first person subject pronoun marker *-nəkɪ* or *-nɔkɪ*. Note that this suffix harmonizes with the rest of the word in the quality of its vowels. (The tonal and accentual variations on the person marker suffix are determined by the verb root.)

Our interpretation of this data is that the completive is the unmarked aspect, and that the incompletive aspect morpheme is the floating feature [+ATR]. This feature spreads by a lexical rule to all the syllables of the word, including those of the suffix. When there is no [+ATR] feature present, the [-ATR] feature is filled in by a late rule. Compare the incompletive forms of examples (1) and (4) with their derivations, represented as (5) and (6). (Capital letters indicate vowels unspecified for the [ATR] feature.)

$$(5) \quad \begin{bmatrix} [+ATR] \\ \phantom{[+ATR]} \end{bmatrix} \begin{bmatrix} \phantom{[+ATR]} \\ \text{gO} \end{bmatrix} \begin{bmatrix} \phantom{[+ATR]} \\ \text{nɛkɪ} \end{bmatrix} \rightarrow \begin{bmatrix} [+ATR] \\ \phantom{[+ATR]} \end{bmatrix} \begin{matrix} \cdot \cdot \cdot \cdot \cdot \\ \text{gO nɛkɪ} \end{matrix}$$

$$(6) \quad \begin{bmatrix} [+ATR] \\ \phantom{[+ATR]} \end{bmatrix} \begin{bmatrix} \phantom{[+ATR]} \\ \text{bArE} \end{bmatrix} \begin{bmatrix} \phantom{[+ATR]} \\ \text{nɛkɪ} \end{bmatrix} \rightarrow \begin{bmatrix} [+ATR] \\ \phantom{[+ATR]} \end{bmatrix} \begin{matrix} \cdot \cdot \cdot \cdot \cdot \\ \text{bArE nɛkɪ} \end{matrix}$$

Similar patterns obtain with other person markers. Examples with *-i* (3rd person singular), *-yei* (3rd person plural), and *-nəmi* (2nd person singular) are given in (7)-(9).

	<i>Completive</i>		<i>Incompletive</i>	
(7)	'fâi	<i>he woke up</i>	'fâi	<i>he is waking up</i>
(8)	'gârcèi	<i>they encircled</i>	'gârcèi	<i>they are encircling</i>
(9)	'dârrèmì	<i>you strolled</i>	'dârrèmì	<i>you are strolling</i>

Jouannet notes two cases in which the distinction between the completive and incompletive forms of a verb is neutralized; such cases have the tense ([+ATR]) vowel pattern exclusively. This situation confirms to us that the [-ATR] vowels are unspecified for this feature in underlying representation. Whenever a [+ATR] feature is specified, it will spread to all the vowels of a word as we have seen previously.

The first case of neutralization concerns verb roots which have an inherent tense vowel pattern. Here the completive and incompletive verb forms are identical. We attribute this to a [+ATR] which forms part of the underlying specification of the verb root. The second case involves forms with the first and second person plural subject markers. These two suffixes, *-nei* and *-noi*, have invariable tense vowels; whenever they occur, they force all the vowels of the verb to be tense, regardless of aspect. We suggest that these two suffixes involve a [+ATR] specification in their underlying form, in parallel fashion to the previous case.

In conclusion, then, we note that the harmonizing [+ATR] vowels of a Kanembu verbal form may be traced to one of three sources: (1) a feature of [+ATR] that is part of the verb root, (2) a feature of [+ATR] that forms part of the person marker suffixes of the first and second person plural, or (3) a floating [+ATR] feature that *is* the incompletive aspect affix. In the first two cases, the morphemes in question involve the feature [+ATR] along with segmental material. In the last case, however, this feature is the only element making up the grammatical morpheme of incompletive aspect.<sup>1</sup>

## 2. Mafa and Podoko

Our next examples come from two Chadic languages of the Biu-Mandara branch, spoken in northern Cameroon. Chadic languages are well-known for their prosodies of palatalization and labialization, which exercise a phonological effect on certain consonants and vowels within their domain, usually the syllable or word. In most cases these prosodies are useful only to the phonological analysis of the language. But there is no reason why such suprasegmental features might not be exploited for grammatical purposes. And in fact, we have found two examples of just this phenomenon, which give further examples of floating features functioning as complete morphemes with full grammatical effect.

The phonology of Mafa is characterized by prosodies of both palatalization and labialization, as described by Barreteau (1987). The phonetic realization of these prosodies on the vowels and/or consonants of a word are determined by a precise set of rules, which Barreteau describes. Labialization, for example, causes the rounding of vowels and of certain consonants. Either prosody,

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<sup>1</sup> To complete the picture of completive and incompletive verb forms in Kanembu, Jouannet notes the existence of a second class of verbs, whose forms are more complex. This class does not complicate the analysis given above, however. In this class of verbs, the incompletive aspect is characterized by the tense vowel pattern we have already treated and also by a low tone on the last syllable of the person marker suffix. The completive aspect of these verbs, in contrast, is marked by the lax vowel pattern and by a high tone on the last syllable. One simple analysis of the forms of this class recognizes an additional floating tone characterized as "Class 2" morpheme. The incompletive aspect is still analyzed simply as a floating [+ATR] feature, regardless of the "class" of verb.

or both, may constitute a distinctive part of morphemes, as may segmental material (vowels or consonants).

In addition, Barreteau says that the feature of labialization is also used with a grammatical function, serving to form the perfective stem of the verb. Further, it seems that this is the *only* mark of the perfective aspect. No overt affix is added to the verb root. (The final low vowel of the perfective forms is supplied for phonological reasons, and its quality is determined by what prosodies affect the word as a whole.)

	<i>Verb root</i>		<i>Perfective stem</i>
	<i>(underlying)</i>	<i>(surface)</i>	
			<i>(underlying)</i> <i>(surface)</i>
(10)	pan-	pán-	to wash <sup>w</sup> pan-    póna
(11)	təv-	táv-	to brown <sup>w</sup> təv-    túva
(12)	<sup>j</sup> bat-	bét-	to cradle <sup>w</sup> <sup>j</sup> bat-    boʔte
(13)	<sup>j</sup> mən-	mín-	to spin cotton <sup>w</sup> <sup>j</sup> mən-    mánc
(14)	<sup>w</sup> ndas-	ndos-	to blunt <sup>w</sup> ndas-    ndosa
(15)	<sup>w</sup> səm-	súm-	to buy <sup>w</sup> səm-    súma
(16)	<sup>j</sup> wndzak-	ndʒœk <sup>w</sup> -	to harvest <sup>j</sup> wndzak-    ndʒœk <sup>w</sup> e
(17)	<sup>j</sup> wbək-	buk <sup>w</sup> -	to bark <sup>j</sup> wbək-    buk <sup>w</sup> e

Here we claim that the perfective morpheme is simply a floating feature of [LAB].<sup>2</sup> When this feature associates with a verb root, its phonetic realization is determined in the same way as for the prosodic feature of [LAB] which forms a part of certain roots such as /<sup>w</sup>ndas/ or /<sup>w</sup>səm/, as Barreteau himself points out. Consider the derivations of (10), (12), and (15), which are represented as (18)-(20) below:

- (18) 
$$\begin{bmatrix} [\text{LAB}] \\ \phantom{[LAB]} \end{bmatrix} \begin{bmatrix} \phantom{[LAB]} \\ \text{p a n} \end{bmatrix} \rightarrow \begin{bmatrix} [\text{LAB}] \\ \phantom{[LAB]} \\ \phantom{[LAB]} \\ \phantom{[LAB]} \\ \text{p a n} \end{bmatrix}$$
- (19) 
$$\begin{bmatrix} [\text{LAB}] \\ \phantom{[LAB]} \end{bmatrix} \begin{bmatrix} \phantom{[LAB]} \\ \text{b a t} \\ [\text{PAL}] \end{bmatrix} \rightarrow \begin{bmatrix} [\text{LAB}] \\ \phantom{[LAB]} \\ \phantom{[LAB]} \\ \phantom{[LAB]} \\ \text{b a t} \\ \phantom{[LAB]} \\ \phantom{[LAB]} \\ [\text{PAL}] \end{bmatrix}$$
- (20) 
$$\begin{bmatrix} [\text{LAB}] \\ \phantom{[LAB]} \end{bmatrix} \begin{bmatrix} [\text{LAB}] \\ \phantom{[LAB]} \\ \text{s ə m} \end{bmatrix} \rightarrow \begin{bmatrix} [\text{LAB}] \\ \phantom{[LAB]} \\ \phantom{[LAB]} \\ \text{s ə m} \end{bmatrix} \text{ (reduction by OCP)}$$

In each case, the perfective morpheme is represented as the floating [LAB] feature prefixed to the verb. The verb root /pan/ in (18) involves no inherent prosodies; the perfective feature [LAB] will thus associate to it in straightforward fashion. In (19) the root has a palatal prosody as part of its lexical representation and its perfective form involves the double association of both [LAB] and

<sup>2</sup>We leave aside in this discussion the precise definition of the feature (or complex of features) involved in what we have labeled as [LAB].

[PAL] with the segments of the verbal form. The last example is of a root with an inherent labial prosody. Barreteau notes that, in such cases, there is no difference between the verb root and its perfective stem. This causes no problems to the analysis; when the [LAB] of the perfective is affixed to the verb root, the two identical [LAB] features are collapsed by the Obligatory Contour Principle.

A similar example, but this time with the palatalization prosody, is provided by Podoko. The phonology of Podoko has been described by Swackhamer (n.d.) and its grammatical system by Jarvis (1989). A prosody of palatalization plays a central role in the phonology. It may affect a whole word and in so doing changes the phonetic realization of a number of segments falling within its domain. The vowels /ə/ and /a/ are regularly realized as [i] and [e] when affected by this prosody, for example, and the alveolar consonants /s/, /z/, /ts/, and /dz/ are realized as [ʃ], [ʒ], [tʃ], and [dʒ], respectively.

In the grammatical system, the palatalization prosody is all that marks a verb in its transitive imperfective form. Witness the following verb roots, along with their corresponding transitive imperfective forms.

	<i>Verb root</i>			<i>Transitive imperfective</i>	
	<i>(underlying)</i>	<i>(surface)</i>		<i>(underlying)</i>	<i>(surface)</i>
(21)	bat-	bat-	<i>eat (flour)</i>	<sup>j</sup> bat-	bet
(22)	ʃəz-	ʃəz-	<i>destroy</i>	<sup>j</sup> ʃəz-	ʃiʒ
(23)	dzak-	dzak-	<i>teach</i>	<sup>j</sup> dzak-	dʒek
(24)	ndəl-	ndəl-	<i>cut</i>	<sup>j</sup> ndəl-	ndil
(25)	sul-	sul-	<i>roast</i>	<sup>j</sup> sul-	ʃul
(26)	pəts-	pəts-	<i>change</i>	<sup>j</sup> pəts-	pitʃ
(27)	<sup>j</sup> nan-	nən-	<i>despise</i>	<sup>j</sup> nan-	nən
(28)	<sup>j</sup> dzər-	dʒir-	<i>watch</i>	<sup>j</sup> dzər-	dʒir

According to the parameters of transitivity and aspect (perfective/imperfective), any verb may appear in one of four forms; the corresponding affixes are summarized in the following table, taken from Swackhamer 1992.

(29)

	<i>Imperfective</i>	<i>Perfective</i>
<i>Intransitive</i>	-i	-aha
<i>Transitive</i>	<sup>j</sup> _	-a

This chart raises other intriguing questions of morphological analysis, which we will not pursue.<sup>3</sup> Of the four affixes presented, it is the transitive imperfective affix that interests us here, the prefixed prosody of palatalization. The form of this affix is unique in that there is no segmental material

<sup>3</sup>For example, it might be argued that the palatalization prosody is the mark simply of imperfective aspect, since palatalization seems to be involved in both the transitive imperfective and the intransitive imperfective affix -i (analyzable as the palatalized version of the vowel ə). This would imply that the transitive category is unmarked as such, but that the intransitive is marked by an additional affix (-ə in the imperfective, and perhaps -ah in the perfective). If this reanalysis is accepted, it might then be more appropriate to refer to the floating [PAL] feature as simply the marker of imperfective, rather than specifically transitive imperfective. We will continue to use the full label used by Swackhamer for this morpheme, however.

associated with the morpheme, only the floating feature [PAL].<sup>4</sup> All the others are "normal" affixes, involving simply segmental material. We provide the derivations of examples (23) and (27), represented as (30) and (31). Note that in (27)/(31), the transitive imperfective form is identical to the verb root, since the verb root itself has an inherent feature of [PAL].

$$(30) \quad \left[ \begin{array}{c} \text{[PAL]} \\ \text{ } \end{array} \right] \left[ \begin{array}{c} \text{ } \\ \text{dz a k} \end{array} \right] \rightarrow \left[ \begin{array}{c} \text{[PAL]} \\ \vdots \\ \text{dz a k} \end{array} \right]$$

$$(31) \quad \left[ \begin{array}{c} \text{[PAL]} \\ \text{ } \end{array} \right] \left[ \begin{array}{c} \text{[PAL]} \\ \text{n a n} \end{array} \right] \rightarrow \left[ \begin{array}{c} \text{[PAL]} \\ \vdots \\ \text{n a n} \end{array} \right] \quad (\text{reduction by OCP})$$

### 3. Aka

We now turn to an example from Aka, a Bantu language of Zone C, spoken by the Pygmies of the Central African Republic. The data presented here come from Kosseke and Sitamon (1993). Consider the following pairs of singular and plural nouns, from classes 5 and 6.

	<i>Singular (class 5)</i>	<i>Plural (class 6)</i>	<i>Gloss</i>
(32)	dɛŋgɛ	màtɛŋgɛ	<i>piercing tool</i>
(33)	dɔ̀tɔ̀	màtɔ̀tɔ̀	<i>cartridge</i>
(34)	gásá	màkásá	<i>palm branch</i>
(35)	gìni	màkìni	<i>fly</i>
(36)	bòkí	màpòkí	<i>arch of the eyebrows</i>
(37)	bàpùlákà	màpàpùlákà	<i>lung</i>
(38)	βòndú	màφòndú	<i>goiter</i>
(39)	βókó	màφókó	<i>hole</i>
(40)	dʒú	màsú	<i>cheek</i>
(41)	dʒèlé	màsèlé	<i>lizard (sp.)</i>

At first glance, it seems that class 5 has a zero prefix, and class 6 a *ma-* prefix. However, there is an additional difference: the noun roots in class 6 all begin with a voiceless obstruent, while the class 5 singulars all begin with a voiced consonant. An additional peculiarity is that the voiceless counterpart of *dʒ* is *s* (seen in 40, 41). This is not problematical, though, when we realize that there is no *z* nor *tʃ* in the language and that these two constitute a voiced-voiceless pair just like *b/p*, *d/t*, or *g/k*.

Contrast now the behavior of these pairs with the straightforward pairs of singular-plural nouns from classes 9 and 6, below:

<sup>4</sup>As we did in the treatment of [LAB] in Mafa, we leave aside questions of the precise specification of the feature (or features) involved in the cover term [PAL] we are using here.

	<i>Singular (class 9)</i>	<i>Plural (class 6)</i>	<i>Gloss</i>
(42)	təŋgú	màtəŋgú	navel
(43)	kùŋgà	màkùŋgà	body hair
(44)	kómbó	màkómbó	name
(45)	séǎá	màséǎá	horn
(46)	sópó	màsópó	earth
(47)	ǎúmà	màǎúmà	house

Here it is clear that the class 9 prefix is indeed zero, and that the class 6 prefix is simply *ma-*. Given that the class 6 prefix is *ma-*, then the noun roots of (32)-(41) must begin with voiceless consonants. Whence then the voicing in the singular class 5 forms?

Our analysis simply posits a floating feature of [+voice] as the class 5 marker. When the noun class prefixes are added to the roots by morphological rule, the floating feature then associates rightward to the first consonant of the root. In cases like (41), a low-level rule will specify that *s* associated with [+voice] is phonetically *dʒ*. Following are derivations for (36) and (41).

$$(48) \quad \left[ \begin{array}{c} [+voice] \\ \vdots \\ \end{array} \right] \left[ \begin{array}{c} p \ o \ k \ i \\ \vdots \\ \end{array} \right] \rightarrow \left[ \begin{array}{c} [+voice] \\ \vdots \\ p \ o \ k \ i \\ \vdots \\ \end{array} \right]$$

$$(49) \quad \left[ \begin{array}{c} [+voice] \\ \vdots \\ \end{array} \right] \left[ \begin{array}{c} s \ e \ l \ e \\ \vdots \\ \end{array} \right] \rightarrow \left[ \begin{array}{c} [+voice] \\ \vdots \\ s \ e \ l \ e \\ \vdots \\ \end{array} \right]$$

Given this analysis of the class 5 forms, we would expect noun roots that begin with voiced consonants to be unaffected by the class 5 prefix: both singular (class 5) and plural (class 6) forms would begin with a voiced consonant. This is indeed true, as shown in the following examples.<sup>5</sup>

	<i>Singular (class 5)</i>	<i>Plural (class 6)</i>	<i>Gloss</i>
(50)	gǎlà	màgǎlà	game of imitation
(51)	dǎmbà	màdǎmbà	mud
(52)	lǎkèlò	màlǎkèlò	pineapple

However, there are some idiosyncrasies to take note of. First, it seems that all of the bilabial and alveolar voiced obstruents that begin noun roots of class 5 are implosives. One sole example has been found of a class 5 noun root beginning with a plosive *b* (example 55).<sup>6</sup>

<sup>5</sup>These noun forms of class 5 look identical to those of class 9. The membership of a noun in one or the other class can be determined only by the concord markers it calls for: e.g. its possessive marker is *dǎá* if it belongs to class 5, but is *ǎ* if it belongs to class 9.

<sup>6</sup>The exceptional behavior of this form may be related to the fact that its meaning suggests that it might be an ideophone; ideophones often exhibit exceptional phonological characteristics.



	<i>Singular (class 5)</i>	<i>Plural (class 6)</i>	<i>Gloss</i>
(53)	bómbá	màbómbá	package
(54)	bódù	màbódù	elephant's trunk
(55)	bèlèlè	màbèlèlè	sound of a waterfall
(56)	dóká	màdóká	elbow of a hoe
(57)	dùṅgí	màdùṅgí	honey (sp.)

It seems that the voicing of these root-initial consonants has been reinforced by making them implosive, thus further differentiating them from noun roots which begin with a voiceless consonant. (It is interesting to note that none of the class 9 noun roots in the data begins with simple voiced obstruents either, but only with prenasalized ones.)

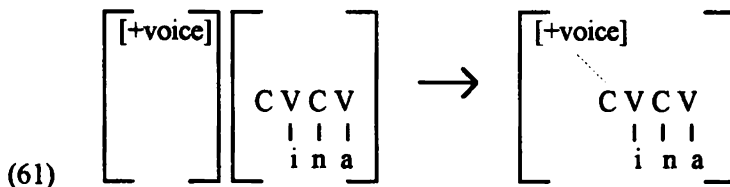
More serious questions are raised about the analysis when we consider a handful of vowel-initial noun roots. The class 5 prefix seems to exhibit two other allomorphs in these cases,  $\alpha$  before roots beginning with *i*, and  $d\zeta$ - before roots beginning with other vowels:

	<i>Singular (class 5)</i>	<i>Plural (class 6)</i>	<i>Gloss</i>
(58)	dínà	mínà	name
(59)	dísò	mísò	eye
(60)	džémè	mémè	pregnancy

The existence of these allomorphs suggests that perhaps we should recognize the underlying form of the class 5 prefix to actually be the segment  $d'$  or  $d\zeta$ . If the noun root begins with a vowel, the consonant of the prefix remains; but if the root begins with a consonant, the prefix consonant disappears, lending its voicing to the initial consonant of the root. This analysis is possible, of course, but other alternatives should be considered.

Perhaps the most straightforward alternative is to treat the three allomorphs as distinct, not all traceable to a single underlying form. The two or even three forms of the morpheme must be spelled out by lexical rules: [+voice] before consonants;  $\alpha$  before *i*; and  $d\zeta$ - before other vowels.

But there is even another alternative which traces the three allomorphs from a common underlying form, the floating feature [+voice]. Let us assume that noun roots must always begin with a consonant. In the cases of (58)-(60) this is an empty consonant which we will represent as C. When the class 5 prefix [+voice] is added, we get structures such as the following:



Let us further assume that the empty C will receive an alveolar point of articulation by default, so that the complex of C associated with [+voice] yields something like *d*. When preceding a nonhigh vowel, this consonant becomes  $d\zeta$  by a lexical rule specific to class 5; when preceding the vowel *i*, the consonant further changes to  $d'$  by the same rule that is used for (56)-(57), if the latter are to be derived from underlying initial *d*.

The plural forms such as *mina* of class 6 pose a further question for this analysis, if the prefix is indeed *ma-* as in the other cases. Here it might be hypothesized that the empty C of the root is deleted

if it is still unassociated after the affixation of the noun class prefix. This would then pave the way for the further deletion of the *a* of the prefix when it precedes a vowel:

(62) [ma] [Cina] → [ma] [ina] → [m] [ina] → mina

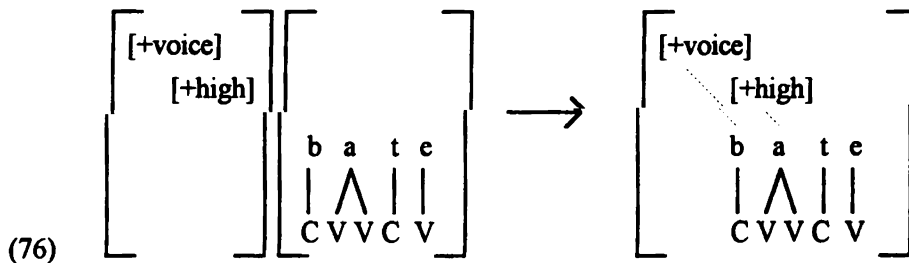
4. Mokulu

Our last main example comes from Mokulu, an Eastern Chadic language spoken in the Guéra region of Chad. The data used here are all recorded in Jungraithmayr's (1990) lexicon, and the morphological analysis follows that of Sharp (forthcoming). The interest of this example comes from the fact that the morpheme to be studied involves a complex of two unrelated features, each of which has a different effect when attached to a verb root.

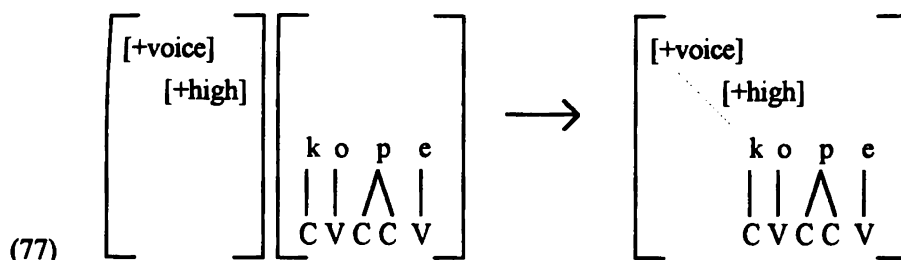
Consider the following verbal paradigm, which includes the citation (root) form<sup>7</sup> and the form of the completive aspect:

	<i>Citation form</i>	<i>Completive</i>	<i>Gloss</i>
(63)	pélkè	bílkè	to chat, converse
(64)	bààtè	bíitè	to lack
(65)	đírse	đírse	to lean on
(66)	kóppé	gúppé	to swim
(67)	gárkè	gírkè	to practice divination
(68)	cààcé	jiicé	to deceive
(69)	jüidè	jiidè	to add
(70)	séllè	zillè	to appease, console
(71)	zòòrikè	zùòrikè	to expect
(72)	èèpé	ùipé	to fill a receptacle
(73)	óópé	úupé	to be left over
(74)	lékkè	líkkè	to live
(75)	nààbé	niibé	to work

Note that the completive forms are uniformly characterized by an initial voiced consonant and a high vowel. In many cases these correspond to initial voiceless consonants and/or lower vowels in the verb root. But in no case is the syllable structure of the completive any different from that of the root. We thus analyze the completive aspect morpheme as composed of the complex of the two floating features [+voice] and [+high]. These two features belong to different tiers, and exhibit different behavior when attached to verb roots. The [+voice] feature associates to the first C slot of the root, if one exists, and the [+high] feature associates to the first (and only underlying) vowel of the root. The derivations of (64) and (66) are sketched below:



<sup>7</sup>This form is called the subjunctive by Jungraithmayr (1990); it is, however, the one closest to the verb root in its basic form.



The formation of the completive forms is completely regular and productive. There are only a couple of idiosyncrasies that are worth noting. As seen above, a root vowel *a* becomes *i* in the completive. This suggests to us that any vowel affected by the [+high] feature will become *i* by default unless the vowel is additionally specified as [+round].<sup>8</sup> The second exceptional fact about the formation of the completive aspect is that an initial *t* of a verb root is excepted from the voiceless-voiced alternations. All other obstruents participate in regular fashion – *p/b*, *c/j*, *k/g*, *s/z* – but *t* remains voiceless in the completive:

	<i>Citation form</i>	<i>Completive</i>	<i>Gloss</i>
(78)	tàtté	titté	to try
(79)	térlè	tírlè	to spin cotton
(80)	tóògè	túùgè	to refuse to give

This fact may be related to the use of *t* as a liaison consonant before certain vowel-initial verb roots in certain contexts. *t* thus seems to be the default consonant for Mokulu, and its features are left unspecified. It may then be required that the [+voice] feature attach only to consonants with some feature specification. It is clear that the [+voice] feature of the completive does not always end up attached, at any rate; in the case of vowel-initial roots the [+voice] feature likewise fails to attach to any consonant (see examples (72) and (73)).

We finish our consideration of Mokulu by noting again the complete productivity of the effects of the completive morpheme. It even associates, in regular fashion, to borrowed roots whose phonological structure is somewhat exceptional.

	<i>Citation form</i>	<i>Completive</i>	<i>Gloss</i>
(81)	pòm pé	bùm pé	to pump, inflate
(82)	pàbriké	bìbriké	to make, manufacture
(83)	kùmàndé	gùmàndé	to order
(84)	ràz é	rìz é	to arrange, line up
(85)	sàz é	zìz é	to change

Note especially (84) and (85), loan words from French that contain nasalized vowels which are foreign to the phonological system of Mokulu. Even here the [+high] feature attaches as it would to any native Mokulu vowel, producing the parallel phonetic effect.

<sup>8</sup>Two considerations seem to confirm this fact. First, [i] is the default vowel in the Mokulu system; it is the only one which can appear in medial positions of polysyllabic words. Secondly, there is a class of verb roots with the vowel /o/ which become [i] in the completive (e.g. *gòrbá* 'to cut grass', completive *gìrbá*; *kòddípè* 'to tie in knots', completive *gìddípè*). I consider that the underlying vowel of these verbs is unspecified for the feature [round]; this vowel may be the reflex of a central *a*, which does not exist in the language today.

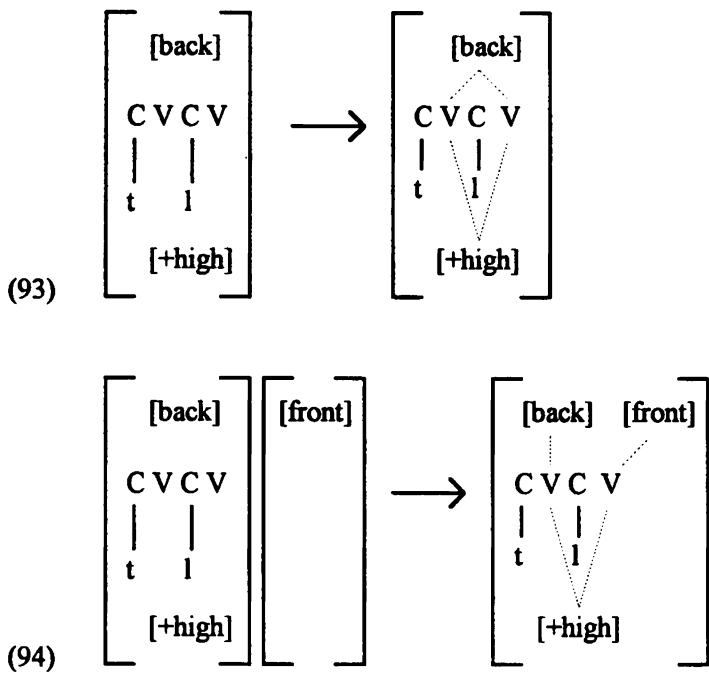
5. Conclusion

The burden of the present paper has been to establish the existence of floating feature morphemes. The variety of the examples presented and the simplicity of their analysis given the possibility of floating features argue strongly that a wide variety of features, not merely tonal features, may constitute full morphemes. Undoubtedly many more examples of this phenomenon can be adduced from other languages. However, we caution that some putative cases of floating feature morphemes may be alternatively analyzable as including actual segmental slots.

In Ngbaka (a Ubangian language of Zaire), for example, the definite forms of nouns involve a suffix that might be composed simply of floating features. Witness the examples of (86)-(92), taken from Grand'Eury 1991:

	<i>Noun</i>	<i>Definite</i>	<i>Gloss</i>
(86)	tūlū	túlí	<i>clothing</i>
(87)	fəlò	fəlē	<i>elephant</i>
(88)	bòlò	bòlē	<i>war</i>
(89)	fāndē	fāndé	<i>raffia</i>
(90)	kfi	kfí	<i>fear</i>
(91)	gbēlē	gbélé	<i>old person</i>
(92)	kùlā	kùlá	<i>maternal aunt</i>

It may be possible to analyze the definite morpheme as simply a floating feature [front], along with a floating high tone which raises the last tone of the word.<sup>9</sup> Compare the suggested derivations of the nondefinite and definite forms of (86), represented as (93) and (94):



<sup>9</sup>In the following discussion, I ignore the tonal components of the definite morpheme. I assume, however, that a single floating High tone feature can account for the several tone changes attested in the noun forms, based on the framework of Snider's (1993) register tone theory.

However, a comparison with other forms of the same paradigm makes this analysis less certain.

	<i>Nondefinite</i>	<i>Definite</i>	<i>Gloss</i>
(95)	nù	nūī	earth
(96)	sìkó	sìkóé	chimpanzee
(97)	gbànù	gbānūī	guinea fowl
(98)	lē	lé·	village

In particular, one may need to recognize that the definite suffix involves a segmental (vowel) timing slot in addition to the [front] feature. In the first three examples it might be possible to argue that the diphthong at the end of the definite forms is actually a contour of the sequence [back][front] associated with the single V slot which originated as part of the noun root – in other words, that the addition of the suffix in fact does *not* add any new *segments* to the word. It would seem, however, that the definite forms *nui* or *sikóé* have one more timing unit than their nondefinite counterparts. And in (98) the definite form involves a lengthened vowel but *no* contour of vowel quality. This suggests that the definite suffix may be composed of a segmental slot as well as the features of [front] and high tone. If this is so, the forms of (86)-(92) have a more complex derivation, involving the reduction of the VV sequence that arises as a result of suffixation.

Again, we note that affixes usually involve some segmental elements; to find morphemes composed just of features is much less common, although theoretically allowable and empirically attested. From a diachronic point of view, it might be suggested that morphemes begin as fully specified for segmental timing slots, as well as for additional features defining specific consonants and vowels. In some cases, the underlying content of the morpheme may erode to the point that the last segmental slot is dropped, leaving only a feature or features without segmental support to mark it. Although the Ngbaka definite marker may at present involve a V slot as part of its content, it is possible that, at some future point, the segmental slot will drop, leaving only the floating features of [front] and High tone as the markers of the morpheme.

In conclusion, let us consider what generalizations can be made about floating feature morphemes. First of all, we note that there seem to be no real restrictions on what phonological features can be involved. In addition to tonal features, we have found laryngeal features (voice) and supralaryngeal place features (LAB, PAL, high, ATR). There are also examples of the feature [+nasal] used as a floating feature morpheme, although we have not noted an example from an African language. (This seems clear from Bendor-Samuel's (1960) description of the Brazilian language Terena. The first person marker is simply a floating feature [+nasal] which spreads, when added to a root, to each of the root's segments, starting from the left and continuing up to the first obstruent.) It seems impossible to characterize only a certain class of features as usable for grammatical purposes.

If there are no phonological restrictions on what features can be used for grammatical purposes, is there any morphological characterization that can be made about these cases? It may be tempting to note that all the examples given in this paper have been of inflectional affixes. Also, the realization of the effects of the floating feature has in each case been completely transparent and productive. As such, it seems that such morphemes are added on the last stratum of the lexicon. Will this prove to be true of all floating feature morphemes? While these characteristics may prove to be appropriate for most examples, we note a couple of cases that potentially counter this generalization. It may be argued, on the one hand, that the trilateral roots of Semitic morphology constitute morphemes that are composed of merely complexes of phonological features without any segmental support. In this case, the morpheme in question would be a root, not an inflection, and as such must be present at the very first stratum in the morphological derivation of the word. On the other hand, it may not be that the

effects of floating feature morphemes are always totally transparent and productive. The behavior of consonant mutation systems of languages such as Fula are notoriously exceptional; if a floating feature morpheme is used to account for such phenomena, it is likely that the exceptional effects may again have to be treated at an early stratum within the lexicon.

Finally, we suggest that only the *marked* value of a phonological feature may be used to constitute a full morpheme. This relates to the fact that the presence of each morpheme must contrast with its absence in the grammatical structure. Thus, in order for a phonological feature to mark a grammatical distinction, it must be the marked value of that feature which is used. Although this may seem obvious, the observation provides a criterion for determining what is the marked value of a phonological feature. For example, a language which uses floating grammatical low tones must have a nondefault feature of Low tone; such a Low tone may not be an instance of [-High tone], for example, but specifically [+Low tone].

We conclude, then, that floating nontonal morphemes must be recognized; these are well attested, using a variety of features and occurring in a variety of languages. As a result, the behavior of tonal and nontonal features are shown to be more parallel and more closely related than is often assumed.

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