

CONSONANT GRADATION IN FULA SUFFIXES:  
THE UGLY TRUTH\*

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Skousen [1972] has made the important observation that the complex set of phonological alternations found with respect to the initial consonant of Fula suffixes is nearly identical to that found with stem-initial consonants. He suggests that, in view of this fact, the alternations in question are due to the application of the same phonological rules, with the extra complications that are characteristic of suffixes being due to the existence of further rules that apply only in suffixes. With the exception of Marantz [n.d.], subsequent researchers have adopted (some "tentatively") this aspect of Skousen's analysis (cf. Anderson [1976], Lieber [1984]), although none accept the rules themselves in the form presented by Skousen. In this paper, I will argue that Skousen's account of the differences between stems and suffixes requires substantial revision and elaboration. I will argue further that the complexities of the behavior of suffixes preclude the possibility of providing an insightful analysis in terms of autosegmental phonology/morphology (contra Lieber [1983, 1984], Marantz [n.d.]). Instead, the alternations found in suffix-initial consonants, like those in stem-initial consonants [Churma 1986b], require a fairly extensive use of morphophonological diacritics. Indeed, it would appear that an optimal account of gradation phenomena (or at least those that have been heavily grammaticized, such as in Fula and Celtic), will never crucially make use of autosegmental tier-separation and association (cf. Churma [1986b], Willis [1986]), although I will not be able to address this issue here.

1. The Basic Data

My discussion will be confined to three "eastern" dialects of Fula, those that provided the basis for the descriptions of Klingenberg [1963],

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\*This paper began as Churma [1986a], but came to be so large that I felt

Stennes [1967] (both which are said to be descriptions of 'Adamawa' dialects of northeastern Nigeria), and Arnott [1970] (based on the variety spoken in the town of Gombe, which is also in northeastern Nigeria). The latter is the dialect on which all generativist researchers have for the most part based their work, with the exception of Skousen, whose account is based on Klingenheben's description.

The consonantal alternations found in Gombe Fula stems are given in Table 1 below, where the consonants involved are divided into three different categories which I will refer to, following Skousen, as "grades".<sup>1</sup>

Table 1: *Consonant gradation alternations*

Consonant alternations								Grade
f	s	h	r	y	y	w	w	continuant
p	sh	k	d	j	g	b	g	stop
p	sh	k	nd	nj	ng	mb	ng	(pre)nasal

That is, a consonant that surfaces as *f* in the continuant grade appears as *p* in both the stop and nasal grades, one which has the form *r* in the continuant grade appears as *d* in the stop grade and *nd* in the nasal grade, etc. While most of these alternations take place regardless of

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it necessary to divide it into three separate papers, one concerned primarily with the morphology of Fula gradation, another which is a fairly extensive treatment of the phonology of stem gradation [Churma 1986b], and the present work. I would like to thank Alec Marantz for discussion of the Fula facts and their relationship to current phonological theory (although we disagree on perhaps every theoretical issue addressed here), as well as Russell Schuh and an anonymous reviewer for helpful comments on an earlier version of this paper. This paper was written while I was a visiting scholar in the Department of Linguistics at Stanford. I would like to thank the members of the department for their hospitality and the Center for the Study of Language and Information for providing me with invaluable word processing facilities and support staff, the latter primarily in the person of Emma Pease, whom I would like to thank especially voluminously.

<sup>1</sup>The terms "continuant", etc., are used here as cover terms. The symbol *j* represents a voiced alveopalatal affricate, and the digraphs other than *sh* (a voiceless alveopalatal fricative) represent monosegmental pre-nasalized stops. Gombe *sh* is cognate with Adamawa *c*, a voiceless alveopalatal affricate.

which vowel follows, the  $y/j/nj$  alternation occurs only before the back vowels  $a$ ,  $o$ , and  $u$ , whereas the  $y/g/ng$  alternation is found only before front  $e$  and  $i$ ; similarly, while the  $w/b/mb$  alternation is found before any vowel,  $w/g/ng$  occurs only before back vowels.<sup>2</sup>

The grade of the initial consonant in Fula noun stems is determined by the noun class to which the noun in question belongs, or, equivalently, but perhaps more perspicuously, by the suffix which is characteristic of the noun class. Each stem must be marked for the "unmarked" singular class to which it belongs, although there are a number of semantic quasi-regularities. Given the singular class, it appears to be possible to predict which plural class a stem will belong to [Arnott 1970:81, 85-86]. In addition, stems may combine with any of a set of diminutive and augmentative suffixes, each of which, in effect, brings with it its own specification of classhood. Because of this, a given noun stem may appear in up to seven noun classes. Nominal modifiers, which agree in class with the nouns they modify, may therefore appear in any one of the 25 classes.

As noted above, suffix-initial consonants show alternations that are for the most part identical to those exhibited by stem-initial consonants,<sup>3</sup> with the grade of the consonant depending idiosyncratically on the stem to which the suffix is attached. The effect of class/suffix on the stem-initial consonant and the allomorphy of the 25 class suffixes in Gombe are basically as illustrated in Table 2 on the following page (see Arnott [1960] for details). The terminology employed by Arnott, Anderson, Lieber, and Marantz is given in the top row, and Skousen's, together with a new term introduced by Skousen for a phenomenon that occurs only in suffixes (the

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<sup>2</sup>In addition to these consonants, there are a number of consonants that never alternate. These include the simple nasals ( $m$ ,  $n$ ,  $ny$ ,  $\eta$ ), the glottalized consonants ( $\beta$ ,  $\delta$ ,  $\gamma$ ), glottal stop ( $'$ ),  $t$ , and  $l$ . Glottalized  $\delta$  is actually involved in an apparently related alternation in a number of suffixes (see below for the details); stem-initial  $\delta$  never alternates.

<sup>3</sup>This is not true for certain dialects not considered here (cf. Arnott [1960:259-260] and Miyamoto [1986]). For further discussion of these dialects, which are of some theoretical interest, see Churma [1986b, 1987].

Table 2: *Noun class suffixes, suffix grades, and effects of class on stem-initial consonant*  
(after Arnott [1970:88] and Lieber [1984:330])

Class	Grade A ("zero")	Grade B (continuant)	Grade C (stop)	Grade D (nasal)	Effect on Stem
1	-o	-jo	-d <sup>o</sup>	-d <sup>o</sup>	S
2	-be	-'en/-be	-be	-be	C
3	-el	-yel	-gel	-ngel	S
4	-al	-hal	-kal	-kal	S
5	-um	-yum	-gum	-ngum	S
6	-on	-hon	-kon	-kon	N
7	-a	-wa	-ga	-nga	N
8	-o	-ho	-ko	-ko	N
9	-re/-de	-re	-de	-nde	C
10	-ri/-di	-ri/-di	-di	-ndi	N
11	-ru/-du	-ru/-du	-du	-ndu	C
12	-a	-wa	-ga	-nga	N
13	-e	-ye	-ge	-nge	C
14	-o	-wo	-go	-ngo	C
15	-u	-wu	-gu	-ngu	N
16	-al	-wal	-gal	-ngal	S
17	-ol	-wol	-gol	-ngol	S
18	-a	-ha	-ka	-ka	N
19	-i	-hi	-ki	-ki	S
20	-o	-ho	-ko	-ko	C
21	-ol	-hol	-kol	-kol	S
22	-am	-jam	-dam	-dam	N
23	-um	-jum	-dum	-dum	S
24	-e	-je	-de	-de	S
25	-i	-ji	-di	-di	S

(C = continuant-initial, S = stop-initial, N = prenasal-initial)

'zero grade'), in the second row.<sup>4</sup> I will use the two kinds of terminology interchangeably.

Thus, a noun stem such as *wor-* 'man' will take a suffix whose initial consonant is in the stop grade, regardless of which particular suffix/class is present, whereas *waa-* 'monkey' invariably takes a suffix that begins with a nasal grade consonant. In short, noun stems determine the grade of suffix-initial consonants, and suffixes determine the grade of the initial consonant of the stem to which they attach. Sample noun paradigms illustrating this complex system of gradation are given in Table 3 on the following page, where the parenthesized grade information indicates the grade of the suffix that the stem in question triggers.<sup>5</sup>

The first three paradigms show stem-initial alternations of exactly the type that one would expect based on the system outlined in the last column of Table 2. The fourth, however, does not. In particular, even in classes which normally take the continuant grade (in this case, Class 14), we find a stop. There are other stems whose initial consonant normally participates

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<sup>4</sup>For reasons that I do not understand, the Grade B Class 2 allomorph is "typically" (to use Arnott's term) *-'en*, but there are a fair number of stems with the *-ŋe* that might be expected. The alternants in Grades A and B in Classes 9, 10, and 11 are phonologically governed, with the *d*-initial variants occurring after stem-final *r*, *l*, and *n*. Arnott gives only one example of a Grade B stem that ends in an appropriate consonant, Class 11 *masar-du* (which will be discussed, together with other consonant-final Grade B stems, in section 4), and he does not discuss the fact that there are no Class 9 Grade B stems which take a *d*-initial suffix. His discussion of this alternation on p. 123 makes it clear that the gap is not due simply to a misprint. It seems likely that the gap is just an accidental one, given the paucity of consonant-final Grade B stems (he mentions only three in the entire book). This gap is sufficiently surprising that Lieber [1984], in her version of Table 2, states simply that the *r*-initial suffixes "alternate with *dV* in Grades A, B", apparently having missed the fact that Arnott does not give such a variant for Class 9 Grade B stems.

<sup>5</sup>A few remarks concerning the semantics of the classes are in order here. Classes 1 and 9-23 are unmarked singular classes, while Classes 3-5 and 7 are diminutive and augmentative singulars, respectively. Class 6 is the diminutive plural and Class 8 the augmentative plural. Classes 2, 24 and 25 are unmarked plural classes. Stems that take Class 1/2 suffixes refer exclusively to human beings in Gome.

Table 3: *Noun Paradigms*

	wor- 'man' (stop)		waa- 'monkey' (nasal)		hufine- 'cap' (continuant)		daag- 'sleeping mat' (zero)
Class 1	gor-d <sup>o</sup>	11	waa-ndu	9	hufinee-re	14	daag-o
2	wor- <sup>be</sup>	25	baa-d <sup>i</sup>	24	kufinee-je	24	daag-el
3	gor-gel	3	baa-ngel	3	kufine-yel	3	daag-el
5	gor-gum	5	baa-ngum	5	kufine-yum	5	daag-um
6	ngor-kon	6	m <sup>baa</sup> -kon	6	kufine-hon	6	ndaag-on
7	ngor-ga	7	m <sup>baa</sup> -nga	7	kufine-wa	7	ndaag-a
8	ngor-go	8	m <sup>baa</sup> -ko	8	kufine-ho	8	ndaag-o

in the gradation system, but which is invariant throughout a paradigm, such as hawsaajo/hawsa'en 'Hausa' and beeb<sup>e</sup>ejo/beebe'en/beeb<sup>e</sup>ehon 'deaf/mute'. Stems in which we find a continuant in the continuant grade and either a plain voiced stop or a prenasalized stop in both the stop and nasal grades, however, do not exist. The asymmetry concerning which kinds of "partially variable" stems are found is of some importance in determining which of the alternants is basic (cf. section 2.1).

Although it seems clear that Skousen is right that the system of consonant alternations found in suffixes is essentially identical to that found in stems, there are three respects in which suffixes differ significantly. One, of course, is the existence of the "zero grade" in suffixes. Secondly, the  $\emptyset/j/d/d^i$  alternation in the Class 1 and Classes 22-25 suffixes (cf. Table 2) has no parallel in stems. Finally,  $\gamma$  alternates with  $g$  and  $ng$  even before the back vowel  $u$  in the case of the Class 5 suffix in G<sup>o</sup>mbe and in the variety of Adamawa described by Stennes [1967:62], although in Klingenheben's Adamawa, the continuant grade shape of the initial consonant is the expected  $w$ . It is these differences with which this paper will be primarily concerned.

## 2. Previous Analyses: General Accounts of Gradation

In this section, I will present enough of the content of the various analyses of Fula gradation that a discussion of the stem-suffix differences

can be carried out. This presentation is extremely sketchy, and the interested reader is urged to consult the original analyses.

2.1. Underlying representations. In all of the traditional accounts in which a position on the matter is taken, including those of Klingenheben, Stennes, and Arnott, the continuant grade alternant in stems is taken as basic and the other alternants derived from it. The main reason for this, it seems, is the asymmetry with respect to partially alternating stems: since it would not be predictable whether or not a given stop would alternate with a continuant if stops are taken as basic (and similarly for prenasalized stops), the continuant grade consonant must be considered the basic alternant in those stems which have a continuant grade-initial allomorph. This position is argued for at some length in Anderson [1976] and Churma [1986b]. However, as Skousen points out, there is no way on this kind of account of predicting which stop *w* will alternate with when it is followed by a back vowel, since the required phonological rule would produce the same output from *w*, despite the fact that it should produce labials in some cases and velars in others.<sup>6</sup> On the basis of this evidence, Skousen argues that it is the stop grade consonants which are found in underlying representations. In the autosegmental accounts of Lieber and Marantz, the alternating consonants have an "archisegmental" representation, i.e. they are lexically "underspecified" with respect to (at least) the features involved in the gradation system.

2.2. Rules. On Skousen's account, only those stems which are marked lexically with the diacritic [+A] will alternate. The gradation alternations in stems are actually triggered by another pair of diacritics that are part of the lexical representations of suffixes, [+AC] for those which appear with a continuant-initial stem and [+AN] for those that take the nasal

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<sup>6</sup>Anderson handles this problem by setting up abstract phonologically distinct representations for the phonetically identical *w*'s in such cases. For an argument that the distinction should be encoded by means of a diacritic feature, see Churma [1986b:sec.2.2].

grade. The required rules would have the following form (p. 92).<sup>7</sup>

(1) [+cons,-cont,+vcd] → [+nasal] / [\_\_X]<sub>stem</sub> + [+AN]<sub>suffix</sub>

(2) [+cons,-cont] → [+cont] / [\_\_X]<sub>stem</sub> + [+AC]<sub>suffix</sub>

If the suffix has neither of these diacritics, or if the stem does not have the feature [+A], no rules will be applicable, and the stem-initial consonant will surface in its underlying form. Skousen does not give rules for the alternations in suffixes. Presumably he would require analogous rules that affect suffix-initial consonants and which are triggered by the diacritics [+AN] and [+AC], which would also be part of the lexical representations of the relevant stems.<sup>8</sup>

Anderson does not formulate any rules, noting only that, in the case of the stem alternations, what is involved is "a system of consonantal correspondences which are correlated with noun classes" (p. 101), and that "we can reduce the suffix alternation to a special case of the ... alternation in stems, conditioned by ... the classification of stems as A/B, C, or D" (p. 104). Thus, apparently, rules which take the continuant grade as input

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<sup>7</sup>I have reformulated these rules slightly so that they conform to the framework that Skousen develops later in his paper (pp. 94-95). Rule (1) would presumably create simple nasals rather than prenasalized stops, so it would have to be altered in some way to get the right results. Exactly how it should be altered depends on what the representation for prenasals should be. An autosegmental approach in which a prenasal would be, roughly, a sequence of nasal stop and oral stop melodies associated with a single C slot appears to me to be the most likely candidate at present. See Churma [1986b:sec. 5.1] for further discussion.

<sup>8</sup>Note that, although the rules for suffix alternations and the corresponding rules for stem alternations would be quite similar, they would not be identical. If it is in fact the case, as Skousen himself argues, that the "two" kinds of alternation are really a single phenomenon of consonant gradation, this consequence of the analysis is clearly unfortunate. Note further that partially variable stems like *daag-/ndaag-* (see Tables 2 and 3) will cause problems for this kind of analysis, since this stem would be an exception to the continuant-formation part of gradation, but not to the nasal-formation part (cf. Anderson [1976:120-122] and Churma [1986b:sec. 2.1] for further discussion).



and are sensitive to information about nominal class membership and diacritically marked grade properties of stems will produce the relevant alternations.

My own approach [Churma 1986b] is a sort of cross between Skousen's and Anderson's: continuant-basic representations are affected by diacritic-sensitive rules. The diacritics in question are properties of the affected morphemes and are the result of subcategorization information present in the lexical representations of stems and suffixes. Thus, for example, part of the representation of *waa-* (cf. Table 3) is that it requires that any suffix contain a diacritic [+n], to which the nasal grade-formation rule is sensitive, and the Class 3 suffix contains the information that any stem to which it attaches must have a [+s] diacritic, which triggers the stop grade-formation rule. The same rules thus can handle both the stem and suffix alternations.<sup>9</sup>

(3) [C,+s] → [-cont] /+\_\_

(4) [C,+n] → (prenasal) /+\_\_

That is, a ([+cont]) consonant that bears the diacritic [+s] is converted to the corresponding "stop" morpheme-initially, and similarly for consonants with the feature [+n]. Thus, after *waa-* and *-ye!* combine, the former will contain the diacritic [+s] and hence undergo rule (3), whereas the latter will receive the feature [+n] from the stem and so undergo (4) (cf. Table 3). When *waa-* combines with *-wa*, which carries the lexical information that stems to which it attaches receive the diacritic [+n], on the other hand, the stem-initial consonant will undergo rule (4) and surface appropriately with a prenasalized stop, as will the suffix-initial consonant.

The autosegmental approaches, roughly, make use of floating autosegments which supply the features involved in gradation by means of association of the features on the different autosegmental tiers.<sup>10</sup> For example,

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<sup>9</sup>Concerning the output of rule (4), see note 7.

<sup>10</sup>Exactly how the floating autosegments that trigger stem gradation get positioned is somewhat of a problem, since the relevant autosegment and the

waa- will have in its lexical representation a final floating prenasal auto-segment, which will be associated with the underspecified initial C slot of the suffix by means of a Fula-specific association rule.

### 3. "Unusual" Suffix Behavior

In this section, I will discuss those aspects of suffix behavior which might not be expected on the basis of the behavior of stems. These include the existence of the zero grade and the  $j/d/d'$  alternation, the behavior of the Class 5 suffix, and the existence of consonant-final Grade B stems. In the final subsection, I will investigate some aspects of suffix behavior that have not yet been addressed in a generative account of the behavior of Fula suffixes. Taken as a whole, the behavior of suffixes provides massive evidence in favor of a diacritic approach to the alternations found in suffixes.

3.1. The zero grade. As both Arnott and Skousen note, stems that take suffixes in the zero grade are characteristically consonant-final, whereas those that take continuant-grade suffixes, with a very few exceptions, are not. This fact leads Skousen to propose that the zero grade allomorph is derived from the Grade B alternant by means of a strictly phonological rule (p. 84):

(5) [-cons, -syll]  $\rightarrow$   $\emptyset$  / [-syll] + \_\_

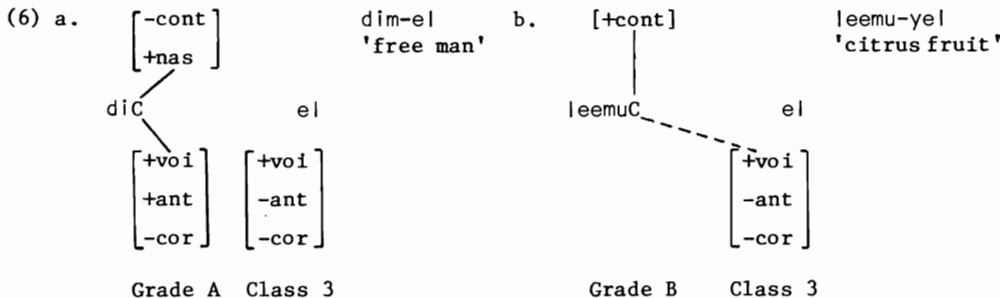
This rule is restricted so as to affect only glides (including  $h$  for Skousen), in view of the fact that suffixes with initial  $\beta$  and  $r$  in Grade B always retain this consonant even in the zero grade (cf. Table 2). However,  $j$  is deleted, although it is not a glide. Skousen suggests that it is a glide at the relevant level of derivation (cf. section 3.2 for discussion). Skousen also notes the existence of consonant-final stems that unexpectedly, on this account, take continuant-grade suffixes (cf. section 3.2), but he does not discuss how they might be handled within his account. Presumably,

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suffix must be separated by the stem, despite the fact that there appears to be only a single morpheme involved. For present purposes, the details of stem gradation can be safely ignored. See Churma [1986b:sec. 5] for discussion.

they could simply be marked as exceptions to rule (5).

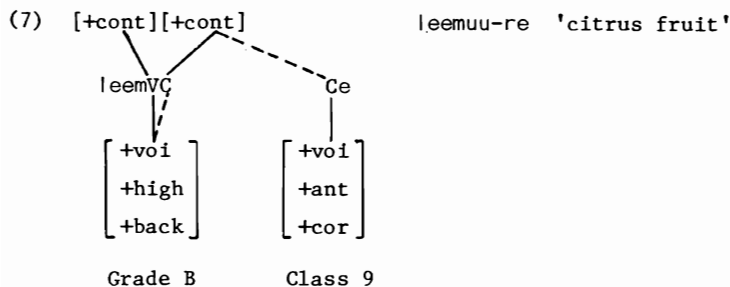
Both Lieber and ("tentatively") Anderson accept Skousen's account of the zero grade. Marantz's analysis, however, departs radically from the deletion approach. The characteristic property of Grade A stems, on this account, is that they end in a C slot that is associated with all relevant features. Grade B stems end in a C slot (despite the fact that they are phonetically vowel-final) that is associated with a [+cont] autosegment but no other feature specifications. Suffixes with alternating initial consonants, on the other hand, begin with point of articulation features, voicing features, etc., but no C slot and no specification for [cont] or [nas]. The suffixal features will eventually be associated with the stem-final C slot if it is not already associated with such features (as would be the case for Grade A stems). An illustration of how this system works is given in (6) (cf. Marantz [n.d.:5-6]):



In (6a), the floating melody unit of the Class 3 suffix cannot associate with the stem-final C slot, I presume because of the incompatibility of the non-gradation features, and the "stranded" features are not realized phonetically. In (6b), however, this unit can associate with the final semi-floating C slot of leemu-, and through this C slot with its [+cont] specification, surfacing as  $\gamma$ .

The initial consonant of the Class 2 suffix is fully specified, which is why it surfaces invariably as  $\beta$ . Suffixes whose initial consonant shows the -r/-r/-d/-nd alternation have everything specified except [cont] and [nas]. The presence of an initial C slot in these suffixes is said to ex-

plain why a consonant is present even in the zero grade (although [+cont] must be supplied in the zero grade by a language-specific "markedness convention"). The treatment of such suffixes is illustrated in (7):



Here the suffix-initial C slot is associated, apparently by means of a language-specific rule, to the final [+cont] of the stem, and the stem-final C slot "ends up attached to the preceding vowel features" (p. 6) by means of an unspecified mechanism in order to account for the vowel lengthening that invariably takes place before *r*-initial suffixes in Gombe (cf. (6b)).<sup>11</sup>

Although I have not gone into the details of this analysis, "the general outline of the solution should be clear", as Marantz puts it (p. 7).

3.2. The *j/d/d̥* alternation. Skousen, noting (pp. 81, 85) that the expected *j* of the Class 1 suffix appears as *w* when following an *o*:-final stem (and a "couple of stems" that are *a*-final), suggests that at some stage of the derivation this consonant is actually *ɣ*. Having this ab-

<sup>11</sup>Deletion-based accounts of the zero grade would presumably also require a special rule to account for such lengthening, which also occurs before *j*-initial suffixes in Gombe. Skousen [1972:90n] formulates a strictly phonological rule to account for the latter but does not mention the existence of the former phenomenon. It is actually impossible to tell from Klingenberg's grammar whether there is pre-*r* lengthening in his Adamawa dialect, since all of the stems he gives that take *r*-initial suffixes either have underlying long vowels or are not given in their diminutive or augmentative forms (note that the "ordinary" plural of a vowel-final stem that takes an *r*-initial suffix in the singular will necessarily take a *j*-initial suffix in the plural and hence undergo lengthening in both the unmarked singular and plural). In the variety of Adamawa described by Stenness, the lengthening facts are radically different (cf. section 3.2 for discussion.)

stract segment would appear to allow one to explain a number of otherwise puzzling facts. First, of course, it would explain why the initial consonant does not appear in the zero-grade, despite the fact that otherwise only glides are deleted (cf. rule (5)). It would also make the appearance of *w* in the environment just noted easy to understand, although what exactly the rule that would derive it should be is unclear in view of the apparent stem-specific nature of the variation, at least in the case of *a*-final stems.<sup>12</sup> And finally (although Skousen does not actually say so), *ɣ* is, at first glance, a fairly reasonable output of the rule for suffixes that corresponds to (2), given *ɗ* as input, at least more so than *j*, which is not even a continuant. But such an account would not explain why the output of this rule is not the glottalized continuant 'y or *r*, which is the only voiced alveolar continuant in the language and which is derived from *d* (cf. rule (2)). It would also require a rule that would "... make a stop [and, eventually, an affricate, in the dialects in question—DGC] out of *ɣ*" (p. 86) in just this kind of case, a rule that Skousen does not state and which would apparently be thoroughly ad hoc.

Anderson, on the other hand, "... prefer[s] simply to differentiate morphologically between the behavior of *j/ɗ* in suffixes and that of *j* or *ɗ* in stems" (p. 104). How exactly this would be done is not made clear. Presumably he would need to amend or add to Skousen's glide deletion rule in order to account for the zero grade forms,<sup>13</sup> and he would also need a rule that converts only suffixal *j* to *ɗ* in the stop and nasal grades. Since there are no *j*'s in suffixes other than the ones in question, there would be no need to distinguish these from other *j*'s that conceivably could exist as the stop grade variants of underlying *ɣ*. Finally, as noted above, a further rule would be needed in order to handle the alternation

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<sup>12</sup>All of the *o*:-final stems that Skousen gives are agentives. Arnott (p. 124) in fact describes the allomorphy in question in terms of the agentive suffix.

<sup>13</sup>Due to the small number of Grade B suffix-initial consonants, it is possible to characterize the full class of segments that undergo deletion as simply as it is to describe the class of glides (assuming that the dele-

with *w*, as would one to take care of the fact that stem-final vowels are lengthened before *j* (and *r*).<sup>14</sup> All of these rules would be morphologically conditioned, in the sense that they would somehow have to refer to the fact that the segments in question are suffix-initial. I take it that this kind of account would be preferable to that advocated by Skousen, since it does not require positing underlying segments that never surface as such, although neither alternative is particularly satisfying—and, it turns out, neither works quite right (see section 3.5 below).

Lieber does not discuss this problem, aside from agreeing in a footnote with Anderson that this alternation "... must be provided for specially..." [Anderson 1976:103], but it would appear to be particularly problematic for a strictly autosegmental approach, i.e. one that attempts to attribute all alternations of initial consonants primarily to the effect of autosegmental

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tion rule precedes gradation in a continuant-basic account). We need only distinguish *ʃ* and *r* from those consonants that are deletable, viz. *j*, *ɣ*, *w*, and *h*. Since the latter are all [-ant], while the former are [+ant], the class in question is simply those segments that are [-syll, -ant]. In view of the small size of the entire class of Grade B suffix-initial consonants, it is open to question whether this is just an accident, as is the fact that 3/4 of the deletable consonants and half of all possible Grade B suffix-initial consonants are glides (the basis for Skousen's formulating the rule as one of glide deletion). I suspect that the true explanation for what is going on here is diachronic in nature: many, but not all, of the clusters that would have occurred had deletion not taken place are impermissible for what are apparently strictly phonological reasons in Fula (at least for Stennes' Adamawa speakers—see the chart on p. 31 of his grammar). The extension of initial consonant deletion to all cases in which suffixes had the initial consonants in question (even if the input cluster is not prohibited) would be due to a diachronic process of analogical extension. The class of consonants in question could thus be an entirely arbitrary one from a synchronic perspective. Further discussion of the synchronic fate of clusters that arises via suffixation will be given in section 3.5.

<sup>14</sup>The "anaptyctic vowel" that Arnott posits as occurring in order to break up certain kinds of consonant clusters that arise when consonant-final stems combine with *r*-initial suffixes, among others, is not lengthened, presumably because the rule inserting such vowels is ordered after the lengthening rule (cf. Arnott [1970:110-111]). See section 3.5 for further discussion of the role of anaptyxis in the gradation system.

association,<sup>15</sup> since it is hard to see how it could be considered as being part of an alternation involving essentially only different values for the features [cont] and [nas]. Since the floating autosegments in question are part of the stem morphemes, there would be either no way of preventing the features supplied by these stems from attaching to the suffix-initial melodies or, if they can be prevented from attaching, no way to account for the fact that the suffix-initial consonants do in fact alternate. The problem here is that a different kind of phonological alternation is found in the same morphological environments as those in which we find "normal" gradations, and unlike in rule-based accounts, there is no way to get the effect of having different morphologically conditioned phonological rules to produce different alternation patterns, given that the alternations are held to be due solely to the "phonological" nature of the stems in question.

It might be suggested that one could simply maintain that certain stems end in floating autosegments other than those "normally" found which, when associated with the underspecified suffix-initial consonants, have this different alternation type as a result. This kind of approach could conceivably work for nouns with Class 22 or 23 singulars (and no diminutive or augmentative forms), since these stems would take suffixes that show only the alternation in question (cf. Table 2). However, most stems have either a plural form, e.g. -b̥e/-'en in the case of Class 1/2 nouns, or a singular form, e.g. r/d/nd for Class 11, that displays a different alternation type, so (even ignoring potential diminutive and augmentative forms) this kind of approach would fail to account for the behavior of the suffixes that show normal gradation behavior. Thus, a strictly autosegmental theory of gradation is quite restrictive, allowing only one basic kind of phonological alternation per morphological context. But these kinds of cases appear

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<sup>15</sup>Due to the existence of the s/sh alternation and those alternations that are partially conditioned by the quality of the following vowel, it is not possible to provide a truly strictly autosegmental account of Fula gradation even apart from the alternation in question (see Churma [1986b:2.3, 4.1] for details).

to indicate that it would be overly so.<sup>16</sup> Even if some of the gradation facts could be handled neatly using a strictly autosegmental approach, then, one would apparently have to use the same kind of brute force rules that rule-only theories would require for the rest, in addition to all of the requisite autosegmental machinery. Note that these rules either would entail setting up an abstract segment that does not otherwise exist in the language (this is Marantz's approach—see below) or would require reference to noun class information (only the five suffixes in question exhibit the aberrant alternation type), which is available only in cumbersome fashion under both Lieber's and Marantz's approaches, since the only indications of class in the lexicon are the floating autosegments that trigger the stem alternations and the suffixes themselves.

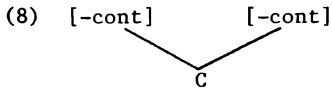
Marantz [n.d., p.1] argues, however, that it is in fact possible to give an elegant autosegmental account of the facts in question. This account depends partially on analyzing  $\delta$  as being "doubly articulated" and

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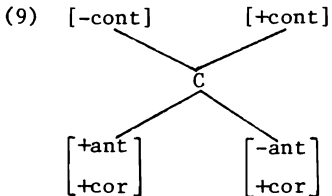
<sup>16</sup>Fula is not unique in presenting a problem of this nature. For example, in the case of the Welsh and Breton "soft mutations" [Willis 1986:2], whereby voiced stops are spirantized, voiceless ones become voiced (but not spirantized), and *m* becomes *v*, we find three quite different kinds of alternations (although, as Willis points out, they appear to be related, at least from a functional perspective, by virtue of all being forms of lenition). It is difficult to see how an autosegmental account could handle all three of these in terms of a single template or floating autosegment. Lieber [1983:173, 175] proposes to account for the soft mutation facts in Welsh by means of a floating [+cont,+voice] autosegment, which might lead one to expect spirantization of all oral stops. Lieber proposes (p. 175) that all "forms that begin with voiceless stops ... have a lexically preattached [-cont] feature", a fact that would either be outlandishly improbable or would require a curious morpheme structure constraint; she has nothing to say about the *m/v* alternation. See Zwicky [1984] for criticism of Lieber's account of Welsh on quite different grounds and Willis [1986] for an extensive argument that the Celtic mutations are best analyzed in terms of morphosyntactic diacritics. Some of the other West Atlantic languages reported on in Sapir [1971:67] will present massive difficulties for such an approach. For example, both Bedik and Basari have, in addition to Fula-like alternation types, an *l/d/n* alternation, and the former also has  $\delta/\delta/m$  and  $'y/'y/ny$  alternations; these latter are cognate with  $\tilde{w}/\delta/m$  and  $\tilde{y}'y/ny$  alternations in Basari. It is hard to see how such alternation patterns could be characterized in terms of a single set of floating autosegments.



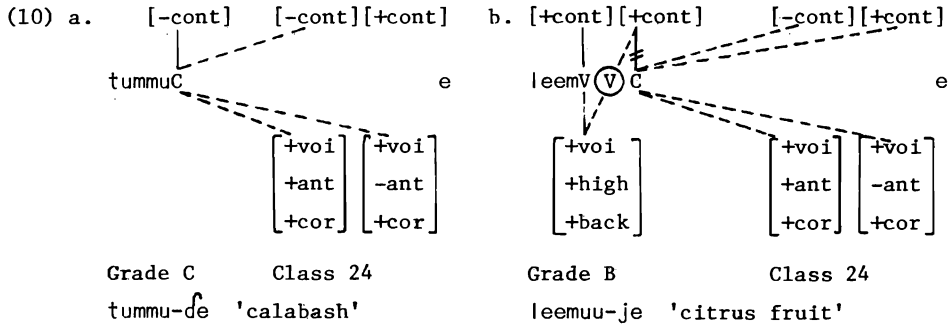
thus represented as in (8):



Given that there is no evidence that implosives are in fact phonetically doubly articulated in the way that this representation suggests (the two closures for glottalized consonants at the glottis and in the oral cavity are simultaneous, not in sequence), this is somewhat suspicious. Furthermore, it violates the Obligatory Contour Principle [Leben 1973, 1978] in a way that, as far as I know, has never before been suggested, in that a sequence of identical melody elements is attached to a *single CV-tier slot*. Equally suspicious is his highly abstract representation of the *j* that alternates with *d*<sup>h</sup> (other *j*'s are, roughly, palatal stops), which is as in (9):



That is, it is an affricate whose first part is alveolar and whose second part is palatal—despite the fact that there is no phonetic difference between the "two kinds of *j*'s", that the kind of *j* represented in (9) occurs only in suffixes, and that the single phonetic [ʃ] described by Arnott [1970:384] is "an alveo-palatal affricate, with tip of tongue down". Assuming such representations, however, it is possible to "explain" why the phonetically alveopalatal *j* alternates with alveolar *d*<sup>h</sup>. The relevant suffixes will begin with, roughly, the representation in (9), but without the *C* slot. When attached to a stem with a final floating *C* slot preattached to [-cont], the first of the suffixal autosegments on the uppermost tier and both of those on the lowest tier will associate, for reasons not specified by Marantz, with the stem-final *C* slot, as in (10a):



The result of association is thus a C slot associated with a sequence of two [-cont] autosegments and with alveolar point of articulation features, i.e.  $\underset{\cdot}{d}$ . As illustrated in (10b), Grade B stems somehow end up with all of the floating suffixal autosegments associated with stem-final C slot, to give (eventually) surface [j], and the circled V slot is inserted by an unspecified mechanism and is associated with the [+cont] that was originally pre-attached to the final C slot, in order to handle the requisite pre-j lengthening.

Via the use of these various pieces of autosegmental machinery, the language-specific "markedness convention" mentioned above, and the required unstated, and apparently language-specific, association rules, this analysis does appear to account for the data considered as well as the phenomena discussed in section 3.1 (although one can't be certain, given that, as we have seen, Marantz (p. 7) "skip[s] over certain details of execution"). But the analysis requires making ad hoc distinctions between putatively different kinds of j (precisely the five suffixes that exhibit the j/ $\underset{\cdot}{d}$ / $\underset{\cdot}{d}$  alternation would have the representation in (9)), and a way of representing glottalized consonants that should probably be universally disallowed. This kind of account, like that of Lieber, will also encounter a redundancy problem: given that all but one of the kinds of grade properties of stems has been specified in their lexical entries, it is possible to predict the grade properties of the remaining stems. Since this account already employs a "markedness convention" that supplies the feature [+cont] to segments that are not specified in any other way for this feature, representing stems that

take continuant grade suffixes as having a final [+cont] seems to require making use of a significant amount of redundant lexical information. But since the lexical representation of Grade B stems plays a role in handling the lengthening of stem-final vowels before suffixal *r* (cf. (7)), eliminating the redundancies would also result in the loss of an account of pre-*r* lengthening. Thus, either redundancy-free representations of stems or the autosegmentally-based account of this lengthening phenomenon must be given up.<sup>17</sup> A further problem concerns the fact that *j* also alternates with *w*; it is hard to see how a straightforward account of this alternation could be given (although the environment would presumably be strictly "phonological"). Finally, this kind of approach would also entail the existence of a regularity that could only be considered an accident in such a system, since all Grade B, C, and D stems would end in a C slot specified only for [cont] (and [nas] in the case of Grade D stems). But this regularity cannot be expressed, since the notion *grade* has no independent existence in the system, all of the grade effects being derivative of the nature of the stem-final floating C slot of individual lexical items.

Furthermore, there is evidence that the vowel length alternation, at least, is morphologically conditioned, rather than being due to (pseudo-) phonological properties of stems or suffixes, as Marantz's account would have it.<sup>18</sup> In the Liptako (Burkina Fasso) dialect, Bideau and Prost [1982: 22] (who adopt Arnott's class numbering system) note that "avant les suffixes *re*, *ri*, *ru* des classes 9, 10, 11, avant les suffixes *jo* de la classe 1 et *je*, *ji* des classes 24, 25, les voyelles qui les précèdent sont

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<sup>17</sup>In addition, since this kind of approach makes use of lexical marking in the case of all four grades (whereas the zero grade was held, at least tentatively, to be derived phonologically from the continuant grade in earlier analyses), it might appear that still more redundant material is specified. However, it will turn out that there are problems for the phonological deletion approach (see section 3.5 for discussion).

<sup>18</sup>If this is so, then it would be clear evidence of the incorrectness of Marantz's position that "morphologically triggered phonological rules must be banned entirely" (p. 1). See Churma [1986b:sec. 6] for further discussion of this issue.

allongées". That is, lengthening occurs before only three of the five j-initial suffixes, unlike in Gombe, where all five trigger lengthening. Note that it would not be possible to alter the phonological representations of the Class 22 and Class 23 suffixes, since doing so would make it impossible to account for the fact that these suffixes have the  $j/d/d'$  alternation. Even more problematic, if anything, are the facts about lengthening for Stennes' Adamawa speakers. Basically, underlying short vowels "are long unless the [following morpheme] begins with a semivowel or faucal  $y, w, ' , h$ " (p. 43), i.e. lengthening occurs here before a strikingly larger set of consonants than in either Gombe or Liptako. Indeed, Stennes appears to be suggesting (p. 43n) that the long vowels in question are basic, and the short variants derived via some kind of shortening rule. Furthermore (p. 45), some stem-final vowels (some of which, at least, occur in words that "are known to be borrowed") fail to undergo lengthening, e.g. *maapindi-jo* 'huge person'. Since for these speakers a partial determinant of whether a given vowel undergoes lengthening is simply the stem of which it is a part, any analysis which attributes lengthening solely to the way in which the suffix-initial consonant is represented phonologically, such as that of Marantz, will be unable to account for such data. Thus, even if the formal extravagances that Marantz makes use of are permitted, such an analysis will not be tenable for all dialects.<sup>19</sup> Even in Gombe, there are vowel length alternations that do not come under those that this analysis is set up to account for. Arnott notes (p. 116) that "the stem-final vowel of the generalized relationship terms with stem in *-ira(a)-* ... is long before the [Class 1 allomorph *-wo* and the Class 2, Grade B atypical allomorph *-be* ], but short before all the diminutive and augmentative suffixes, as well as the ordinary [Class 2, Grade B] suffix *-'en*". Here again, it is not possible to attribute the lengthening effects to "phonological" properties of the suffixes in question, since they do not cause lengthening when attached to other kind of stems.

Stems like that in (10a) will also turn out to be problematic for this kind of approach. Arnott (p. 55) treats this stem as being basically

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<sup>19</sup>This kind of treatment of suffixes will also cause problems for an analysis of the stem-initial alternations. See Churma [1986b:sec. 5.1].

tumm- , with the second u being the result of anaptyxis, on the basis that "the few forms of this type would [otherwise] be the only examples of stem-final short vowel" among Grade C and D stems (p. 117). Thus, if Marantz's analysis of such stems is accepted, there will be an extremely odd distribution of (phonetically) stem-final short vowels in such stems. Moreover, Marantz's approach will not work for Grade B adjective stems with two final consonants on Arnott's analysis, e.g. 'yukk- 'hunched, humped' (p. 111), since the anaptyctic vowel, according to Arnott (pp. 55, 87), is u except before an r-initial suffix, in which case it takes on the quality of the following vowel.<sup>20</sup> In order to maintain an analysis in which the allegedly anaptyctic vowel is present underlyingly in such cases, an additional rule or rules would be needed in order to adjust the vowel quality appropriately.

Marantz does not say why he departed from Arnott's account, but it appears that attempting to give an analogous account in his system would cause fairly serious problems. The floating features of the suffix must attach to the stem-final C slot in order to be realized phonetically, but if the final C slot is already specified for place of articulation (and nasality in this case), as in Arnott's account, then whatever prevented attachment of the suffixal features in (6a) will presumably also prevent attachment of the suffixal features in this case. (Even if these features could associate, the wrong results would be derived unless much fixing up takes place.) That is, only "dummy" C slots allow the system to work properly, so it might be suggested that we could simply add one at the end of this stem: tumm[C, -cont]- . This would in fact get the suffix-initial consonant right, as in (7), and anaptyxis could supply the needed u . But it would require setting up representations that contain three consecutive morpheme-

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<sup>20</sup>It is not possible to find analogous noun stems, since (roughly—see below) the rule that deletes suffix-initial (Grade B) consonants effectively bleeds anaptyxis, except when the suffix-initial consonant is  $\text{b}$  or  $\text{r}$  . Since the former is present only in Class 2, which is the plural that corresponds exclusively to Class 1 singulars, there could never be a noun stem that takes both kinds of suffixes ( r-initial suffixes being characteristic of Classes 9, 10, and 11 only).

internal C slots, which do not otherwise occur, and the difference between pre-r anaptyctic vowels and the u found in other phonological contexts would have to be accounted for in some way.

3.3. The Class 5 suffix. Recall that in the Gombe and Stennes-Adamawa varieties of Fula, the Class 5 suffix displays an uncharacteristic y/g/ng alternation, since the initial consonant precedes a back vowel. As Anderson [1976:126-127] points out, the existence of this alternation adds further support for a fully-specified continuant-basic position of the type argued for in Anderson [1976] and Churma [1986b]. Assuming a fully-specified underlying /y/ would allow one to "state the facts about the alternation of y as follows: underlying /y/ becomes [j] in the stop grade and [ɲ̥] in the nasal grade before back vowels in roots; otherwise, /y/ becomes [g] in the stop grade and [ŋ̥] in the nasal grade", where the otherwise clause would include, among other things, all cases of suffixal /y/. Note that, if we were to posit an underlying velar (or velar melody unit) here, then even if we were to invoke a stem/suffix distinction, we would be unable to distinguish this segment from the corresponding initial velar of the Class 15 suffix, which also precedes a back vowel, but alternates "appropriately" with w. Apparently, unless an underlying /y/ is posited in the case of alternations involving this segment, a thoroughly ad hoc rule that refers explicitly to the Class 5 suffix will be required.<sup>21</sup> Note further that, even if a palatal (or palatal melody unit) is posited, the rule would not work unless one is able to appeal to the stem/suffix distinction. Thus, the behavior of this suffix provides further support for the position that (fully-specified) continuant grade alternants are present in underlying representations.

3.4. Consonant-final Grade B stems. An important type of data that has been discussed in generative terms only by Skousen is the existence of consonant-final Grade B stems. Although there are only a few such stems (see

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<sup>21</sup>This would be another counterexample to Marantz's claim about the non-existence of morphologically triggered phonological rules (cf. note 18).

(11) below for a list of all that are known to me), the fact that they exist at all is somewhat of an embarrassment to any account which attributes the lack of a suffix-initial consonant in Grade A to the presence of the stem-final consonant, despite the fact that, as noted above, all Grade A stems surface with a final consonant. All of the accounts considered here have this property in some form or another (for Marantz, the crucial property of Grade A stems is that they have *fully-specified* final consonants). If some version of Skousen's glide deletion rule is accepted (cf. note 13), then, as noted above (section 3.1), the unusual stems would presumably have to be simply marked as exceptions to this rule, say by virtue of the diacritic [-DEL], if the "standard theory" of diacritic features is adopted (cf. Zonneveld [1978] and the references cited there). Notice that, as was the case in Skousen's gradation rules, the exception feature would not be part of the affected morpheme, but of the morpheme whose final consonant would otherwise be expected to trigger application of the rule.

In Churma [1986b:secs. 3,6], I developed an approach to diacritic features which shows promise of making it possible to eliminate entirely from linguistic theory this kind of use of diacritic features, thereby allowing for a relatively restrictive theory of diacritic features. Within this approach, such stems would instead subcategorize for taking suffixes that have this feature, and the deletion rule would then be blocked when the input segment, rather than the environment, was [-DEL]. I will argue in this subsection and the next that the existence of consonant-final Grade B stems, together with the variety of possible ways of dealing with suffixation-induced clusters, requires extensive use of some variety of the diacritic approach.

On Marantz's account (assuming, as he apparently does, an approach strictly without exception features), one would probably have to set up stems that end in a fully specified consonant followed by a C slot that is preattached only to the feature [+cont], so that the suffix-initial melody unit would have a C slot and a value for continuancy after autosegmental association. The only difference between ordinary Grade B stems and those under discussion, assuming this kind of approach, would be that the final un-

derspecified consonants happen to be preceded by fully specified consonants, rather than vowels, in the case of the latter. This does not sound at all implausible assuming that one accepts the overall approach, and in fact, given that there are stems that end phonetically in a sequence of two consonants, e.g. dept- 'book', 'yulb- 'charcoal' (cf. Arnott [1970:111]), this kind of account would appear to predict the existence of such stems. But it would provide no explanation for the extremely small number of stems that appear to violate the rule that deletes suffix-initial consonants (cf. rule (5) and note 13). I found exactly three in Arnott's grammar, and Skousen presents three different ones that he found in that of Klingenberg. Nor is there any evidence for the existence of stems that end in a real consonant plus a floating C slot with an attached [-cont]. Furthermore, when we examine these stems more closely, we will find that they in fact will present problems for this kind of approach. All six are given in (11) cf. Arnott [1970:399, 401] and Skousen [1972:85]):

- (11) a. masar-di 'maize' (see note 8 on the suffix-initial d)  
 b. mekes-je 'scissors'  
 c. bos-wa 'bus'  
 d. yakatab-wo/yakatab-je type of shoe  
 e. pampam-wu/pampam-ji 'empty peanut shell'  
 f. merlem-ru/merlem-ji type of frog

Not surprisingly, Arnott notes (p. 399) that (11c) is a loan word (ultimately from English, via Yoruba and then Hausa). The word in (11b) is very likely a loan ultimately from Arabic, since the Classical Arabic word for 'scissors' is *miqaṣṣ* (Mohamad Abd-Rabbo, p.c.), and the fact that the word for 'maize' in Hausa is *masara* indicates that some borrowing has taken place in this case as well (perhaps from a separate additional language or languages, in view of the post-masar material). None of the Fula dictionaries and lexica I have consulted contain any of these words, with the exception of (11a), which occurs in Labouret's [1955] *lexique*, where it is noted that it is restricted to the "dialectes orientaux", and in fact is cited as Class 15 *masaru* with the "expected" Grade A suffix allomorph.



Furthermore, the semantics of at least most of these words, together with the nature of traditional Fulani culture (nomadic pastoralism), makes it unlikely that these words are native to the language. Thus, three of these words are clearly borrowings, and there is reason to suspect that the remaining three are borrowed as well. But it would seem thoroughly unlikely that a loan would have a representation like the one suggested, since an abstract representation of this type would presumably be posited only if the facts of the language force it (one cannot hear a C slot with a preattached [+cont]). Indeed, the facts of the language would force such an analysis once the forms have been adopted as they now stand. But the original borrowers would not have been faced with such surface facts; rather, they would have discovered simply that the Hausa word for *bus*, for example, is *bos*. Since they would have had no evidence to the contrary, they must have set up the lexical representation /bos/. Once borrowed, this noun will have to belong to some nominal class. In this case, rather than putting it into the catch-all Class 23 (cf. Arnott [1970]), the original borrowers apparently "decided" that it should go into the augmentative Class 7, buses being inherently rather large. The representation for the entire word would then be, roughly, /bos + [-ant,-cor,+voi] a/ , i.e. the stem has a fully specified final consonant, while the initial underspecified segment of the suffix has no C slot and no specification for continuancy or nasality. Such a representation should surface as \*[bosa] (compare (6a) above), however. In order to derive the correct form, we would have to hypothesize that the borrowers decided, out of the blue, to add a C slot preattached to [+cont] at the end of the stem. But of course there is absolutely no reason to believe that this is actually what happened, so the approach suggested for handling such cases has severe drawbacks.

Exception feature approaches would fare no better, however, since within such approaches it would have to be hypothesized that the forms in question had been borrowed into the language either with the feature [-DEL], or subcategorizing for a suffix with that feature, depending on the approach to exception features adopted. There is no more reason to believe that borrowers would gratuitously add such a feature to the lexical representations in

question than there is to accept that they for some reason added a (nearly) empty final C slot. In order to understand what is really going on here, I feel that it is necessary to investigate in more detail what happens to consonant clusters created by the addition of underlyingly consonant-initial suffixes to underlyingly consonant-final stems.

3.5. The fate of consonant clusters created by suffixation. As Arnott makes clear in his discussion of such cases (pp. 49-53, 110-119), there are a number of different ways of dealing with this kind of situation, in addition to deletion of the suffix-initial consonant.<sup>22</sup> Since it would be helpful if we could tell whether or not a given process is strictly phonological, i.e. exists by virtue of being able to eliminate a cluster that violates a real phonotactic constraint, rather than morphologically or lexically conditioned, and since it is not always possible to tell with certainty from Arnott's discussion the nature of the processes in question, I will make liberal use of the chart in Stennes [1967:31], which lists the number of tokens of each logically possible cluster type (excluding geminates) that occur in a 1,816-cluster corpus. Using this chart to supplement Arnott's description is not without methodological shortcomings. First, two different dialects are involved. In addition, there are the drawbacks that are inherent to corpus-based work, such as not being able to tell whether or not a gap is due to chance (although in this case Stennes does indicate the existence of clusters for which "there is a known occurrence" outside the corpus) or whether a given example should be considered an exception to a presumably valid generalization (cf. the case of word-initial *sf* clusters in English). The former kind of problem is potentially especially worrisome in the context of Gombe clusters, since "the single consonants *b*, *g*, *p*, *sh*, and *k* are relatively rare in [stem-]final position" (p. 42) and since the 35 cluster types represented by a single token in Stennes' chart is an uncomfortably large number. Decisions about the nature of a given process, then,

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<sup>22</sup>For purposes of discussion, I will presuppose that suffixes begin with fully-specified continuants at the stage of the derivation that is relevant for present purposes.

must be considered somewhat tentative.

In addition to consonant deletion, we also find the following phenomena. First, and probably most commonly, a cluster may be broken up via the insertion of the "anaptyctic" vowel (recall that this vowel is -u-, except before an r-initial suffix, where it takes on the quality of the post-r vowel). This phenomenon occurs (p.55) when the stem "ends in two consonants [including geminates—cf. p. 111] or a single consonant in the range sh, k, t, d, j, g, nd, where it serves to avoid [clusters] which appear to be incompatible in the system of the language." Here Arnott is clearly attributing the application of this process to the existence of an (unformulated) phonotactic constraint, but the class of "single consonants" that triggers this process is sufficiently unusual that it is open to question whether this is in fact the case, e.g. why are the labial stops not included, why is only a single prenasalized consonant present?<sup>23</sup> In Stennes' chart, c (the Adamawa cognate to Gombe sh) does not occur at all as the first member of a cluster (although it is particularly dangerous to generalize across dialects in this case, given the phonetic disparity), nor does j. The stem sook- 'poor, deficient' has the form sook-<sup>u</sup>be when in Class 2 (p. 111), and Arnott notes (p. 111n) that there is variation with respect to whether the anaptyctic vowel is present before r-initial suffixes for this stem, so it seems clear that the rule is not totally phonological in the case of k-final stems. Furthermore, there is one token of a kr cluster and six tokens of k| in Stennes' chart. This latter cluster type is relevant because the Grade C and D suffixes in Classes 3, 6-8, 24, and 25

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<sup>23</sup>There is a similar phenomenon that occurs in verbs, although in this case it appears to be the nature of the cluster that would result if a syncope rule were allowed to apply that is relevant. Here the set of final consonants includes all of those listed above plus h, b, ng, 'y, and ' (pp. 56-57). The consonants ' and h are explicitly noted by Arnott to behave differently in nouns and verbs, and 'y does, too, at least in "a few individual stems" (see below), but I can see no reason why the others would result in clusters that are unacceptable only in verbs. This suggests that the strangeness of the class under discussion is more apparent than real, due at least in part to the vagaries of the distribution of stem-final consonants (from a synchronic perspective, at any rate).

have "atypical" allomorphs "of relatively frequent occurrence" that are l-initial, especially in the case of the latter two classes—cf. Arnott [1970: 124-126].

There are also two tokens of tk, three for tg, and one for t<sup>h</sup>, so anaptyxis into t-initial clusters may well also occur for reasons that are not totally phonological. The behavior of stem-final d is complicated by the fact that it assimilates totally before r-initial suffixes in (p. 114) "a few individual stems" in addition to triggering anaptyxis in the case of other stems. (Arnott does not say what happens to final d in the former kind of stem before other consonants.) There is a single d-initial cluster type in Stennes' chart, dn (one token), but since no nominal suffix begins with n, the existence of such a cluster is irrelevant as to whether clusters involving d and possible suffix-initial consonants are impermissible on strictly phonological grounds.

g-initial clusters in the chart include those with d, d<sup>h</sup>, and r, with three tokens of the first type, and one each of the other two. No prenasalized stops occur as the first member of a cluster, so the presence of only nd in Arnott's set is curious. There is at least one non-nd prenasal-final stem, doomb- 'rat'. Here the oral component is lost before the Grade A Class 11 suffix -ru (p. 114), so it may be possible to put all of the prenasals into the set in question, as long as the prenasal-simplification rule that would handle this alternation applies before anaptyxis. But there is good reason to question whether all of the clusters that are broken up via anaptyxis are in fact "incompatible in the system of the language", at least from a strictly phonological point of view.

Consider now the consonants that Arnott did not mention as triggering the process in question. As far as the absence of the labial stops is concerned, p does occur as the first member of a relevant cluster, pk, although this cluster type is instanced by only a single token. There are, however, four tokens of b| and eight of br, so it is likely that Arnott was excluding at least b for empirical reasons. The glottalized consonants appear to cluster fairly freely, with four tokens each of ʘg and ɖg in the chart, fifteen of ʘr, and eight of ɖ<sup>h</sup>, although in Gombe

(pp. 52, 114), at least one final  $\text{d}$  (on Arnott's analysis) assimilates totally to a following  $\text{b}$ . The chart shows no  $\text{dr}$ ,<sup>24</sup> and no '-initial clusters (see below). Unfortunately, 'y has merged with ' in the speech of Stennes' informants, so there is of course no information in his chart concerning the clustering behavior of the former. In the five examples that Arnott gives (p. 114), it is deglottalized. In any event, since some of the glottalized consonants do cluster with possible suffix-initial consonants, their failure to trigger anaptyxis is not unexpected. As for the remaining consonants (the continuant grade consonants, liquids, pure nasals, and glottals), aside from the latter, which will be treated below, it is hard to generalize. Some potential suffixation-induced clusters are instanced in Stennes' chart while others are not, with little in the way of a relevant pattern being apparent. At least one of the uninstanced cluster types, s-h, does exist in Gombe; Arnott (p. 80) gives *bos-ho* and *mekes-hon*, although, as noted above, both of the stems in question are probably fairly recent borrowings.

In sum, the only consonants for which a really solid case can be made that epenthesis is the result of a purely phonological constraint are the prenasals and the affricates (and the descendant of an affricate in the case

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<sup>24</sup>There are also no *tr*, *dr*, *lr*, or *nr* clusters. The class of consonants that do not appear to cluster with the following *r* is sufficiently homogeneous that it is likely that a genuine phonotactic constraint is involved here. If *l* is [-cont] (cf. Chomsky and Halle [1968:318] on the somewhat ambiguous status of [l] with respect to this feature), then the class of consonants that fails to cluster with the following *r* is the non-continuant coronals. Note that if *l* is instead [+cont], then since *sr* clusters are not uncommon (there are three tokens in Stennes, and cf. also Arnott, p. 94), this class cannot be characterized as either [-cont,+cor] or simply [+cor]. Geminate *r* also occurs, at least as the result of total assimilation of *d* in expected *dr* clusters (see above), but would presumably be immune to the effects of anaptyxis and deletion of the suffix-initial consonant by virtue of some version of the "geminate inalterability" constraint (cf. Hayes [1986] and the references cited there). As pointed out in note 4, underlying heteromorphic *r+r* clusters surface as *rd*, at least in nominal stem-suffix combinations. If the *r*-dissimilation rule precedes the other rules that affect clusters, the full range of facts concerning *r*-initial clusters can be derived.

of Gombe sh , although the apparent existence of this constraint in Gombe may thus be simply an accident of history).<sup>25</sup>

Anaptyxis is not the only alternative to deletion of the stem-initial consonant. When the stem ends in a glottal h or ' , the final consonant is lost and the preceding vowel compensatorily lengthened. According to Arnott, this process "occurs regularly in relevant nominals" (p. 50), but it is "normal, though apparently optional, in *some* relevant verbal forms, but not in all, especially in deliberate speech" [*italics in original*]. Otherwise, the cluster may be broken up via insertion of an anaptyctic vowel (p. 295). "[I]n a few individual stems" (pp. 52, 114), 'y loses its glottal closure,<sup>26</sup> and ny is denasalized. In at least one stem (p. 111), woot- 'one, single, the same', the final t is deleted before r-initial suffixes, although anaptyxis applies before -be in the Class 2 form. The final w of Grade A (for Arnott) rew- 'female' also appears to be deleted before stem-initial y, w, and h, but not b, r, or j (pp. 95, 113). Arnott treats the behavior of this stem (p. 113) as being the result of normal behavior of the suffix, but with the stem exhibiting extensive allomorphy (cf. Class 1 debb-o, Class 2 rew-be, Class 3 dey-el, Class 7 ndew-a, and Class 8 ndeh-o). On this kind of account, it is simply an accident that the "stem-final" consonant in the case of the latter three examples is the same as the initial consonant of the Grade B allomorph of the

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<sup>25</sup>Perhaps significantly, these consonants are precisely those that are "complex segments", i.e. ones which would have two melody units in the standard autosegmental representation. From this point of view, only triconsonantal clusters (on the melody tier) would be broken up. Unfortunately, Stennes' chart shows that affricates and prenasals occur relatively frequently as the second member of a cluster, so it cannot be quite this simple, although it would not be difficult to formalize the generalization in question even if one allows for this fact.

<sup>26</sup>If pre-consonantal glottals are treated as having the point of articulation of the preceding vowel, then this latter process could be considered as being part of the same process as glottal 'deletion'. What would be going on in the case of deletion would be, under this approach, simply loss of the glottal constriction (together with voicing of the resulting voiceless second mora of a long vowel), which is exactly what happens when there is deglottalization.

suffixes in question, whereas if the final *w* is deleted as suggested above, thereby bleeding the rule that deletes suffix-initial consonants, the actual surface forms can be accounted for without resorting to the massive stem allomorphy that Arnott posits.

As for the geminate *bb* in Class 1 (and Classes 22-25), it appears to arise in the following manner, at least historically (see note 29 on the qualification). There are "a few individual stems" (pp. 50-51, 112-113), all of which take Grade A suffixes on Arnott's account, that end in a non-geminate continuant grade consonant which alternates with the corresponding stop grade consonant. As far as I can tell from Arnott's examples, the stop grade alternant appears only in Classes 1, 24, and 25 (with two exceptions—see below). The relevant shared property of these classes appears to be that the initial consonant of the class suffix in Grade B (its underlying form) is *j*, although it is not clear to me why this property should be relevant. Thus, there seems to be some kind of diacritically-triggered rule that changes continuant grade consonants appropriately before *j*.<sup>27</sup> This rule could account for the presence of a *b*, though not of course for the gemination. Now there is another alternation, found again in "a few individual stems", between a single consonant and the corresponding geminate, with the geminate appearing, again, before suffixes whose Grade B alternant

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<sup>27</sup>Note that formulating the rule in these (quasi-)phonological terms predicts that there should be Class 22 and 23 stems that show the stop grade alternant. Arnott does not give any such examples, but evidence will be presented below for their existence, at least at an intermediate stage of the derivation (cf. note 30 and the related discussion). It would be nice if the alternation in question, which looks for all the world like gradation, could be handled by the already existing gradation rules. Unfortunately, it can't, as the gradation rules now stand (cf. section 2.2), since they require morpheme-initial position. This requirement could not be removed, since doing so would cause all non-exceptional stems with a final continuant grade consonant to exhibit this alternation, which is actually found "in a few individual stems". For further evidence that morpheme-initial position is a necessary part of the environment for gradation, see Churma [1986b, sec. 4.4]. Historically, the two phenomena undoubtedly were one, but the synchrony requires two separate rules (per alternation type, most likely—cf. Churma [1986b, section 4.1]).

begins with *j*.<sup>28</sup> If we suppose that the *j* is assimilating totally to the stem-final consonant in such cases, we will have an explanation for the otherwise unexpected occurrence of the geminate only in those cases in which the Grade B suffix is *j*-initial, although since this process, too, would be found to operate only in "a few individual stems", our explanation would be lacking somewhat in that the stems that trigger this process would have to be marked diacritically.<sup>29</sup>

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<sup>28</sup>Class 15 *pucc-u* 'horse' (pp. 50, 112) would be an exception to this generalization, since the Grade B allomorph of the Class 15 suffix is *w*-initial. The only way of accounting for this form within the approach being presented would be to posit radical stem allomorphy along the lines of Arnott's approach (cf. the diminutive *push-el*, where *cc* is regularly the geminate version of *sh*, at least for most Gombe speakers). The plural, *pucc-i*, behaves as expected, and may well have been the basis for reanalysis of the singular, if what I have to say is correct. Interestingly, however, Arnott [1960:263] reports that "in some varieties of Fula", this word "requires the ... agreement characteristic of" Class 23 nouns, for which the Grade B suffix allomorph is *j*-initial. It is tempting to speculate that this word, which is for cultural reasons likely to be a borrowing, originally took, like other loans, Class 23 agreement and no overt suffix [Arnott 1970:75, 391], but was for some reason later reassigned to Class 15, which Arnott characterizes in terms of its "meaning content" as containing "some animals", as well as some things that are decidedly not animals like "some collectives and abstract nouns ..." (pp. 390-391). Since the suffix vowel in both classes is *u*, it is not hard to imagine that the gemination that is characteristic of Class 23 suffixes would also be transferred to the newly-Class 15 stem. Further support for this suggestion comes from the fact that, as Russ Schuh has pointed out to me, the word for 'mare' in the dialect described by Labouret is the stem for 'female' *rew-* seen above plus the Class 15 suffix: *ndewu*. Apparently, this class is the one used for horses! The reassignment in question could not have been very recent, given that the singular for this stem is Class 15 in all dialects for which I have the relevant information, although whatever the cognate would be in the Gambian dialect that is the basis for Gamble and Baldeh's [1981] dictionary does not appear there. The word for 'cotton' would also be an apparent exception (see note 29 for discussion).

<sup>29</sup>There is some evidence that, while this is how the alternation in question came about diachronically (roughly—the stem-specificity of these processes would have to be accounted for other than by using diacritics), there is some reason to be suspicious concerning its synchronic status. The diminutive of what would presumably be underlyingly /*hotol-*/ 'cotton' is *kotol-a*, whereas the unmarked singular form is Class 20 *hottol-o*



If we put these two analyses together, we predict the occurrence of stems which, on Arnott's account, show an alternation between a final continuant grade consonant and the corresponding geminate stop grade consonant: the stop-formation rule alluded to above will convert the underlying continuant to the corresponding stop, to which the initial *j* will then assimilate. This is exactly what we find in the case of *rew-* and a few other stems (cf. Arnott, p. 113).<sup>30</sup> Such stems will be doubly marked diacritically, as triggering both stop-formation and *j*-assimilation. If this analysis is accepted, then there is yet another process that may affect a cluster, viz. deletion of stem-final *w*, but once again not all such consonants will be subject to the deletion rule (cf. *bow-* 'mosquito' (p. 90), which invariably retains its final *w*). We would also have to move the morpheme boundary in the forms cited above one segment leftward, except in the case of the Class 2 form.

One final indication that the rule that deletes suffix-initial consonants is not fully phonological in nature is the existence of what on Arnott's account is an "atypical" allomorph of the Grade A Class 12 suffix,

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(p. 112). This latter form is doubly problematic in that not only do we find unexpected gemination of the final *l*, but also of the medial *t*. Thus, it may be that speakers have reanalyzed this phenomenon in such a way that there is now simply a rule that says, roughly, "double all but the initial consonant for certain stems in certain classes". It is tempting to treat this particular case in terms of a "gemination prosody" (in the Firthian sense) that applies to all but the initial consonant in the relevant classes, although the fact that this example may be the only one of its kind in Fula should make one a bit hesitant; in any event, an analysis along these lines is unformulable in any current generative theory, as far as I can tell. Further suggestive evidence that an ad hoc rule of gemination is the correct synchronic description can be found in Churma [1987].

<sup>30</sup>The fact that geminate *bb* appears in Classes 22 and 23 is evidence in favor of stating the rule that derives stop grade consonants from the corresponding continuant in the terms used above (cf. note 27 and accompanying discussion), since this rule must apply in order to derive the input to the *j*-assimilation rule. Interestingly, the stem *wuy-* 'thievish' has a stem-final *jj-* (on Arnott's account) in Class 1 and Classes 22-25, and variants with final *y-* in the case of the latter four classes (p. 95), further evidence in favor of the quasi-phonological formulation.

-wa (pp. 112, 126), which is "found with three stems" ( *lel-wa/lell-i* 'gazelle', *mbee-wa/be'-i/be'-el* , etc. 'goat', and *ndaw-wa/dabb-i* 'ostrich', where the Class 25 plural suffix in these cases is underlyingly *-ji* ). Arnott treats this allomorph as being on a par with the other atypical suffixal allomorphs, i.e. in terms of what appears to be simple suppletion. But while this kind of approach is clearly called for in cases such as that of the Class 2 Grade B suffix ( *-be/-'en* ), it neglects the fact that in the case under discussion this allomorph is phonetically identical to the Grade B allomorph. If the underlying representation of the Class 12 suffix is */wa/* , then we can see why this suffix has this shape, although again an appeal will have to be made to rules triggered by arbitrary diacritics. In the case of the first of the above forms, the stem *lel-* would be marked as failing to trigger deletion of the suffix-initial consonant and as triggering *j*-assimilation. In the case of the second, the underlying shape of the stem would be */be?/* , and the glottal-deletion rule mentioned above, together with rule (4), would derive the first variant. Note that in this case there is a conflict between the glottal-deletion rule and the one that deletes suffix-initial consonants. For the first variant, the former rule "wins", while the latter takes precedence in the case of the others. This suggests that the latter rule should be broken up into two or more rules, since presumably we would want to mark this stem as failing to trigger deletion of suffix-initial *w* , while not preventing the deletion of *j* or *y*.<sup>31</sup> The final stem would also have to be specified as not triggering *w*-deletion and as triggering *j*-assimilation. Note that if this analysis is accepted,

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<sup>31</sup>Actually, things are probably even more complicated than this. As it stands, the analysis being sketched predicts that the initial *w* of the Class 7 suffix would also not be deleted. Arnott does not discuss this form; he simply gives the Class 3 form (in this case, *lel-el* ) in a column headed "3a-8a" and adds "etc." after the presumably representative Class 3 form. If this stem does in fact behave like other Grade A stems with respect to this suffix, then the diacritic would have to refer directly to the class of the only suffix that fails to lose its initial *w* . The fact that the suffixes for Classes 14-17 never lose their initial *w* would be attributed to the accidental failure of the lexicon to contain any relevant stems with the appropriate diacritic.

there will be not just two, but three different kinds of *w*-final stems: *rew-*, in which the *w* is deleted; those in which it is not deleted and also fails to trigger deletion of the suffix-initial consonant (*daw-*); and stems that behave 'normally', i.e. which cause deletion of all deletable suffix-initial consonants and surface as the first element of a cluster otherwise such as *bow*.

The upshot of all this is that it is often not possible to predict the fate of a cluster that arises as a result of suffixation. Furthermore, the processes that deal with such clusters, including rule (5) or its equivalent, are not purely phonological, at least in modern Gombe and/or for Stennes' Adamawa speakers. Some of the unpredictability can be eliminated if the rules in question are ordered judiciously, but it will not be possible to account in this way for cases in which the applicability of a given process depends, apparently, simply on the stem involved. Thus, for example, in order to distinguish those *d*-final stems in which the *d* assimilates to a following *r* from those for which anaptyxis applies, we would need some sort of lexical information. In this kind of case, one could conceivably posit a "phonological" difference, with the latter ending in a bare *V* slot, at least as long as we are willing to make *u* the unmarked vowel in Fula and order the rule that would handle the behavior of the anaptyctic vowel before *r* before those that would make unspecified *V* slots *u*. But notice that this kind of solution could not be extended to handle the behavior of *woot-*, in which the final consonant is lost before *r*, but anaptyxis applies before *ɓ*. Similarly, for those speakers who break up *kɓ* clusters, but not *kr* clusters, in the case of *sook-*, the floating *V* slot solution will not work.

The fact that a number of the non-anaptyxis processes are specifically noted by Arnott to apply only in the case of "a few individual stems" also would require distinguishing in the lexicon stems that end phonetically in the same way, and at least some such cases must be dealt with via the use of diacritic features that are part of the lexical entries of stems. In fact, there would appear to be no good reason for not positing that most stems have as part of their lexical representations a diacritic that specifies

which of the myriad possible quasi-phonological processes that could apply actually do. Under such an approach, and assuming on the basis of the behavior of stems such as *woot-* and *sook-* that there are two separate rules of anaptyxis, the lexical representation of the latter in the case of the kinds of speakers in question would contain the diacritics [+UANAP] and [-VANAP], indicating that epenthesis of *u* is applicable, but that the "copy-cat" vowel is not to be inserted. (It is conceivable, and probably desirable, that rules that require a positive diacritic specification apply only when such a specification is present and do not apply if there is no mention of the diacritic in question. If this is the case, then only the former specification would be necessary.)

Similarly, *rew-* would have the feature [+YWHDEL] to indicate that the final *w* is to be deleted before *y*, *w*, and *h*, *woot-* would be marked [+TDEL] in order to trigger a rule of final *t*-deletion, as well as [+UANAP], etc. At this point, it might be questioned whether it might not be better to abandon the attempt to derive the surface forms by means of the quasi-phonological rules in question and simply list them in the lexicon. This might be feasible in the case of nouns, but the behavior of loans (cf. (11)) suggests that suffixation is quite productive and that the Grade B allomorph is basic. Furthermore, the fact that nominal modifiers may appear in any of the 25 classes makes this kind of approach much less palatable. There are regularities here. In particular, the class suffix is readily identifiable, and the putative underlying representation of the stem appears in most of the classes, with the exception of *rew-* in the case of the latter property.

Notice now that, if all native (and nativized) stems carry with them one or more diacritics that indicate their behavior in clusters, we have an automatic explanation for why recent borrowings are not subject to any of the rules in question (cf. section 3.4): they have none of the relevant diacritics. It is hard to see how an autosegmental approach could mimic this kind of approach, at least if it eschews the use of diacritics, so it would appear quite unlikely that any real explanation for the behavior of the forms in (11) will be possible unless substantial use of diacritics is per-

mited.

#### 4. Conclusion

The above discussion has, I trust, established that the morphophonemic alternations found in Fula suffixes are complex and in many cases totally unpredictable on strictly phonological grounds. The only reasonable way of analyzing such facts, it would appear, requires making extensive use of ad hoc diacritic features, thereby reflecting the ad hoc item-by-item nature of the conditions on the applicability of the rules in question. Thus, diacritic-free versions of autosegmental phonology, such as those that are apparently advocated by Lieber and Marantz, are incapable of providing an account of the behavior of Fula nominal suffixes.<sup>32</sup>

The picture that I have painted is not a pretty one, but it is, I would maintain, an accurate portrait of the phenomena under discussion. The lack of beauty may cause concern for some, but when truth and beauty clash in science, it is the latter that must yield. Claiming that a complicated set of facts is simple is just as wrong as claiming that real simplicity-inducing generalizations do not exist. Some consolation can be taken from the fact that the theory of diacritics employed in the analysis presented here is relatively restrictive (cf. Churma [1986b] for discussion). In the case at hand, furthermore, the ugliness will diminish if we take a step back and look at the overall picture, since treating phenomena that are not really

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<sup>32</sup>It might be objected that it is unreasonable to demand of a theory that it do completely without diacritics. But autosegmental theory makes available a device, viz. "preattachment" of a feature that is normally supplied by a spreading rule (or a default rule), that in many cases allows a diacritic-free account of what one might be otherwise tempted to treat in terms of diacritics, and this fact is taken to be a significant advantage for the autosegmental approach. Thus, for example, non-alternating stems like *hausa-* (cf. section 1) can be analyzed as having a preattached [+cont] autosegment, thereby making them immune to association of other floating autosegments (cf. Lieber [1984]). In full-specification/segmental accounts (Anderson [1976], Churma [1986]), these would simply be marked [-GRADATION]. If both preattachment and diacritics are allowed, then there will be a general problem of deciding on a principled basis which kind of account to use for any given phenomenon.

phonological separately from those that are will allow a more highly constrained, maximally articulated, and perhaps even aesthetically appealing, theory of honest-to-God phonology (cf. Churma [1986b]). This would appear to be, at least in principle, a general result of appropriately modularizing the grammar (cf. Chomsky [1972], Zwicky [1983]). Thus, in this case, recognizing the inordinate ugliness that it is possible to find in the morphophonological module of the grammar may well allow one to see through all the morphophonological mess to the beauty that is pure phonology.<sup>33</sup>

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<sup>33</sup>There may be a purely pragmatic reason for making this kind of distinction as well, since knowing (more or less) in advance the kinds of phenomena that are susceptible to elegant synchronic explanation could prevent what would otherwise be an enormous, but wasted, expenditure of both time and intellectual endeavor. In this case, which is far from unique in my opinion, probably the only way of finding a truly insightful explanation of what is going on synchronically is doing a careful historical reconstruction, using not only (pseudo-)internal reconstruction, as is still often the case in synchronic analysis, but also comparative evidence.

## REFERENCES

- Anderson, Stephen R. 1976. "On the description of consonant gradation in Fula." *Studies in African Linguistics* 7:93-136.
- Arnott, David W. 1960. "Some features of the nominal class system of Fula in Nigeria, Dahomey and Niger." *Afrika und Übersee* 43:241-278.
- Arnott, David W. 1970. *The Nominal and Verbal Systems of Fula*. London: Oxford University Press.
- Bideau, Lucien and Andre Prost. 1982. *Manuel de langue peule, dialecte de Liptako*. Paris: Publications Orientalistes de France.
- Chomsky, Noam. 1972. "Some empirical issues in the theory of transformational grammar." In Stanley Peters (ed.), *Goals of Linguistic Theory*, pp. 63-130. Englewood Cliffs, NJ: Prentice Hall.
- Chomsky, Noam and Morris Halle. 1968. *The Sound Pattern of English*. New York: Harper and Row.
- Churma, Donald G. 1986a. "Evidence from a *ganoore* against an autosegmental morphological treatment of consonant gradation in Fula." Paper presented at the 17th Conference on African Linguistics, Indiana University.
- Churma, Donald G. 1986b. "Fula consonant gradation as a segmental phonological process." Ms., Stanford University.
- Churma, Donald G. 1987. "On geminate complex segments." Ms., Stanford University.
- Gamble, David P. and Mary Umah Baldeh. 1981. *Gambian Fula-English Dictionary*. San Francisco, CA.
- Hayes, Bruce. 1986. "Inalterability in CV phonology." *Language* 62:321-351.
- Klingenheben, August. 1963. *Die Sprache der Ful (dialect von Adamaua)*. Hamburg: Augustin.
- Labouret, H. 1955. *La langue des peuls ou foubé: lexique français-peul*. Mémoires de l'Institut Français d'Afrique Noire, no. 41. Dakar, Sénégal: IFAN.
- Leben, William R. 1973. "Suprasegmental phonology." PhD dissertation, MIT. [Published 1979, Garland Publishing.]
- Leben, William R. 1978. "The representation of tone." In Victoria Fromkin (ed.), *Tone: a Linguistic Survey*, pp. 177-219. New York: Academic Press.
- Lieber, Rochell. 1983. "New directions in autosegmental morphology: consonant mutation." *WCCFL* 2:165-175.
- Lieber, Rochelle. 1984. "Consonant gradation in Fula: an autosegmental approach." In Mark Aronoff and Richard T. Oehrle (eds.), *Language Sound*

- Structure, pp. 329-345. Cambridge, MA: MIT Press.
- Marantz, Alec. n.d. "Fula class suffixes and autosegmental theory." Ms., University of North Carolina at Chapel Hill.
- McCarthy, John. 1986. "OCP effects: gemination and antigemination." *Linguistic Inquiry* 17:207-263.
- Miyamoto, Ritsuko. 1986. "A note on some features of Fula in Sokoto State, Nigeria." Paper presented at the 17th Conference on African Linguistics, Indiana University.
- Sapir, J. David. 1971. "West Atlantic languages: an inventory of their noun class systems and consonant alternations." In Thomas Sebeok (ed.), *Current Trends in Linguistics*, vol. 7, pp. 45-112. The Hague: Mouton.
- Skousen, Royal. 1972. "Consonant alternations in Fula." *Studies in African Linguistics* 3:77-96.
- Stennes, Leslie. 1967. *A Reference Grammar of Adamawa Fulani*. African Language Monograph, 8. East Lansing, MI: African Studies Center, Michigan State University.
- Willis, Penny. 1986. *The Initial Consonant Mutations in Welsh and Breton*. Bloomington, IN: Indiana University Linguistics Club.
- Zonneveld, Wim. 1978. *A Formal Theory of Exceptions in Generative Phonology*. Dordrecht: Foris.
- Zwicky, Arnold. 1983. "An expanded view of morphology in the syntax-phonology interface." *Proceedings of the International Congress of Linguists* 13:198-208.