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Quirky Mutations in an Autosegmental Framework

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Consonant mutation or gradation is a morphological or morphosyntactic phenomenon which for a long time received very little attention from linguistic theory. It is relatively rare as morphological processes go, and in the days when theories of morphology were theories of *concatenative* morphology, its rarity permitted it, for the most part, to be ignored.[1] With the advent of autosegmental morphology some five or six years ago, however, a new way of analyzing consonant mutation, and indeed all sorts of nonconcatenative morphology, presented itself. I have argued in several places (Lieber 1983, 1984) that consonant mutations in languages like Fula and Nuer ought to be analyzed autosegmentally.

Still, it is possible to call into question the autosegmental analysis on the following grounds. Most languages that display morphological consonant mutations exhibit mutations which are phonetically consistent. By consistent I mean the sort of mutation illustrated in the hypothetical example in (1):

(1)	Environment 1	Environment 2
	p	f
	t	s
	k	x
	b	β
	d	z
	g	γ

In a language that has a mutation like that in (1), stops appear uniformly in one environment, continuants in another. More generally, in consistent mutations, a single natural class of segments occurs in each environment. The mutations in Fula and Nuer come close to being consistent in this way, and are easily treated autosegmentally. Still, there are other languages that display mutations which are not phonologically consistent. By an inconsistent or quirky mutation I mean one like the hypothetical example illustrated in (2):

(2)

Environment 1	Environment 2
p	b
t	d
k	g
b	mb
d	nd
g	ŋg

In such a mutation both voiced and voiceless stops occur in one environment, voiced and prenasalized stops in the other. More generally, in inconsistent mutations we find two (or more) classes of segment in each environment. Both Mende and Welsh have mutations that are inconsistent in some way. In fact, in Mende, as we will see, the correspondences between the two morphological environments are so varied and inconsistent that one is at first tempted to merely list them, and leave it at that. In cases such as these it is difficult to see how an autosegmental analysis could account for the phonetic correspondences between the initial consonants in the various environments.

In this paper I will try to argue that autosegmental theory not only can handle these quirky mutations, but that it ought to, since it makes apparently correct predictions about possible and impossible quirky mutations that no segmental account of mutation can make. I will organize my argument as follows. First I will set out some general assumptions about autosegmental theory and some specific assumptions about the analysis of mutation within autosegmental theory. Next I will briefly sketch the autosegmental analysis of the phonetically consistent mutation in Fula. In the third section I will present a possible account of quirky mutations using as my example the very complex case of Mende. Finally, I will compare the autosegmental analysis with a possible segmental one and show that the autosegmental one is the more restrictive of the two.

The autosegmental theory I am using makes many of the familiar assumptions of current autosegmental theories, as well as a couple which might be considered controversial. Some of these are listed in (3):

(3) GENERAL ASSUMPTIONS

a. Distinctive features are projected onto two or more tiers, a melody, a skeleton and possibly one or more independent tiers. (For the purposes of this article, it does not matter whether the skeleton contains features or is merely a timing tier. I will continue to represent it as a sequence of Cs and Vs.)

b. Association rules contain a language particular parameter, attaching a feature $[\alpha F_i]$ on one tier to another feature $[\beta F_j]$ on another tier, one to one, L to R or R to L.

c. Spreading rules also contain a directional parameter. For each tier in addition to melody and skeleton, a language must choose whether association lines spread, and if so, in what direction.

d. Association lines may not cross.

e. Distinctive features may be duplicated on more than one tier. In particular, if a distinctive feature F_j normally appears on a tier T_j in some language, F_j might appear on a segment of another tier T_i in some idiosyncratic cases. If F_j appears on T_i we will say that F_j is <u>prespecified</u> in that case.

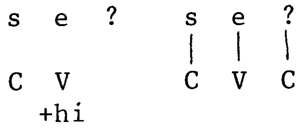
f. If an association or spreading rule tries to attach a feature F_j to a segment which already has F_j prespecified, then the prespecified value of F_j takes precedence over the other value.

Most of these are just the usual assumptions about autosegmental theory; all are defended in detail in Lieber (forthcoming). The last two assumptions are especially important for the argument which follows, however, and deserve direct justification here. The assumptions in (3e) and (3f) are, in fact, a generalization of a notion used by Marantz in his (1982) paper on reduplication. There Marantz discusses a process of reduplication in Akan in which the first CV of the stem is copied, and the vowel of the copy is made high, as illustrated in (4):

(4) se? 'say' --> sise?
sɔ? 'light' --> sʊsɔ?

According to Marantz, Akan reduplication can be analyzed as the prefixation of CV to the skeleton of the verb; the V of this skeletal prefix is prespecified with the feature [+high].

(5)



Given (3e) and (3f), if the reduplicative prefix is prespecified for the feature [+high], when association of the copied melody occurs, the association rule will attach all of the melody features except [high] to the V slot. What (3e) and (3f) in effect state is that exceptionally or idiosyncratically placed features take precedence over features occurring on their normal tier. We will return to this notion shortly.

(6) contains some specific assumptions about the autosegmental analysis of mutation:

(6) MUTATION

a. Mutation features are projected on their own tier. They are not part of the melody or skeleton.

b. Since mutation involves the projection of an independent tier, there must be an association rule which attaches the mutation tier (usually) to the skeleton. There are no spreading rules.

c. Mutation is triggered by floating features which either are or are a part of morphemes. In most cases mutation is nothing more that affixation (occasionally cliticization).

d. Normally stem segments (either initial or final, depending on the language) will be underspecified for the mutation features.

Again, I will not be able to justify all of these assumptions here; see Lieber (forthcoming) for detailed justification of each assumption.[2]

The general assumptions in (6) can be illustrated with a relatively straightforward example from Fula, a West Atlantic language which exhibits a phonetically consistent initial mutation (see Lieber 1983, 1984 for detailed discussion of this case). Fula has a noun classifier system in which nouns are divided among twenty-five possible classes such that each noun stem belongs to a singular class, a plural class, and up to five diminutive and augmentative classes for a possible maximum of seven classes. Class membership is signalled in a number of ways, one of which is a change in initial consonant, as illustrated by the paradigm in (7):

(7) data and numbering system from Arnott (1970)

'monkey'	CLASS	11	waa-ndu
		25	baa-di
		3	baa-ŋgel
		5	baa-ŋgum
		6	mbaa-kon

(7) cont'd CLASS 7 mbaa-ŋga
8 mbaa-ko

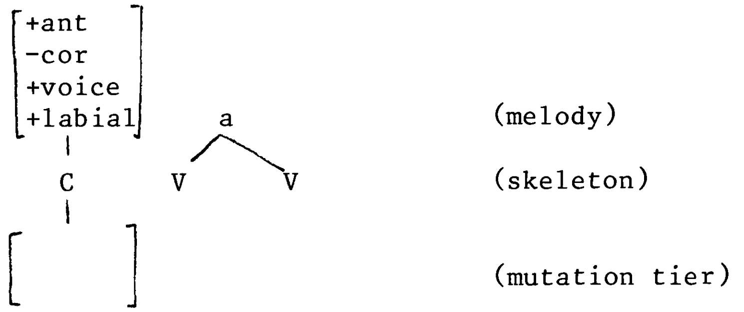
In some noun classes (11, for example), initial consonants always begin with continuants, in others (e.g. 25, 3, 5) with stops, and in still others (e.g. 6, 7, 8) with prenasalized stops. The complete set of gradations is illustrated in (8):

(8)

	labial		alveolar		palatal	velar/glottal		
continuant	w	f	r	s	y	y	w	h
stop	b	p	d	sh	j	g	g	k
prenasalized stop	mb	p	nd	sh	nj	ŋg	ŋg	k

Since the gradation in initial consonants is based on the features [continuant] and [nasal], these will be projected on an independent tier in Fula. The initial consonant of the noun stem 'monkey' will be underspecified for those features and will have the lexical representation in (9):

(9)



In (9), the empty brackets below the C are merely meant to represent the fact that the initial C of 'monkey' is underspecified for [continuant] and [nasal].

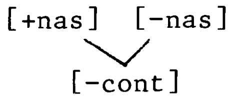
Each Noun Class will be represented by a prefix which contains only the mutation tier features [continuant, nasal]. These are illustrated in (10):

(10) Class Prefixes

a. Classes 2,9,11,13,14,20 $\begin{bmatrix}+\text{cont}\\-\text{nas}\end{bmatrix}$

b. Classes 1,3,4,5,16,17,19,21,23,24,25 $\begin{bmatrix}-\text{cont}\\-\text{nas}\end{bmatrix}$

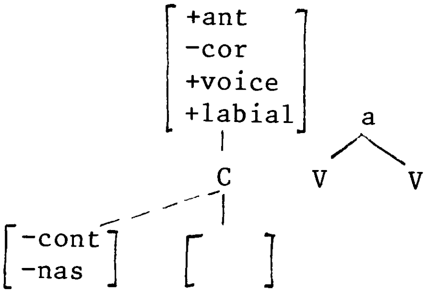
c. Classes 6,7,8,10,12,15,18,22



(10a) contains the features for continuants, (10b) for stops, and (10c) for prenasalized stops.

Let us say then that the process of mutation in Fula is merely a process of linking the prefix which consists only of a phonetic autosegment to the underspecified stem, as illustrated in (11):

(11)

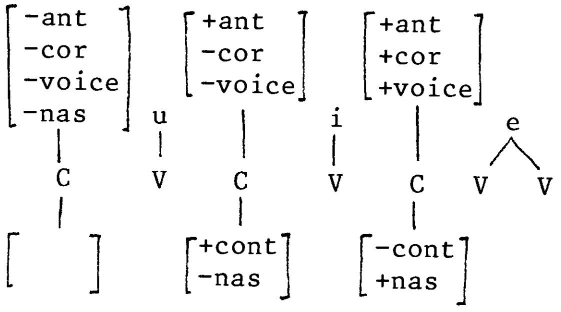


= baa (Class 3 form of 'monkey')

Thus, in phonetically consistent mutations, like that in Fula, each morphological environment can be represented as a single floating autosegment.

Actually, if the reader looked closely at the chart in (8), she or he will have noticed that the initial mutations in Fula are not perfectly consistent. That is, voiceless consonants actually have only two variants; they exhibit continuants in the continuant environments, but stops in both the stop and prenasalized stop environments. We can account for this aberration as follows. Let us say that voiceless consonants are redundantly prespecified as [-nasal] in Fula. This is to say that in the initial segment of the noun stem the feature [-nasal] appears *on the melody tier* for stems beginning with these consonants. This is illustrated in (12) for the noun stem 'cap,' which appears as *hufinee* in continuant grades and as *kufinee* elsewhere:

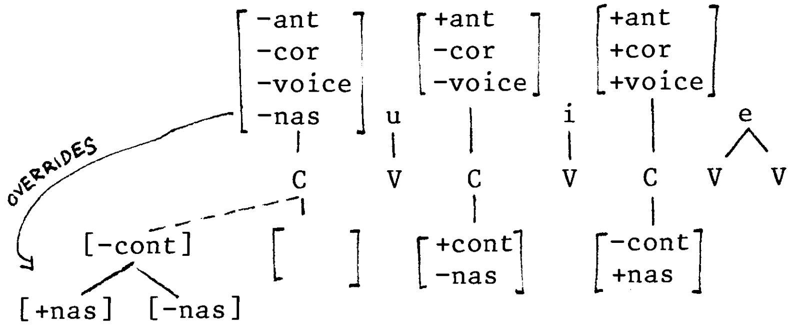
(12)



= lexical representation for 'cap' (hufinee ~ kufinee)

When the Class 6 prefix attaches to this stem, as illustrated in (13), the prespecified value for [nasal] will override the values supplied by the regular prefix as stated in (3f). The value of the feature [continuant] will be supplied by the prefix.

(13)



For Fula, the case of the voiceless consonants can be handled simply by using the independently needed device of prespecification. This solution to the problem created by a relatively minor quirk in Fula mutations now suggests a general way of dealing with the major quirks that appear in the mutations of a language like Mende; it may still be possible to characterize each mutation environment with a single floating autosegment and to attribute all phonetic inconsistencies to features prespecified on the initial melody segment. I will argue next that it is possible to maintain such an analysis for Mende.

The mutations found in Mende are listed in (14). For our purposes it is not necessary to go into the morphosyntactic environments in which each set of consonants occurs, although this in itself is an interesting story (cf. Lieber, forthcoming). Here it is the actual alternations that are important. The alternations in (14) come from Rice and Cowper (1984) which also provides illustrative data:

(14)	Environment 1	Environment 2
a.	f	v
	s	j
b.	p	w
	t	l
c.	k	g
	kp	gb
d.	mb	b
	nd	l
	nj	y
	ŋg	y
		w
e.	v	v
	j	j
	b	b
	d	d

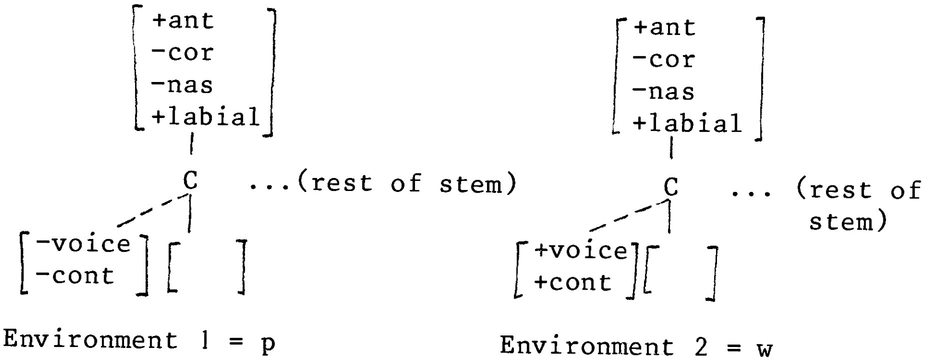
(14) cont'd

	Environment 1	Environment 2
e.	g	g
	gb	gb
	m	m
	n	n
	ny	ny
	ŋ	ŋ
	l	l
	h	h
	w	w
	y	y

Looking at (14), it is evident, first of all, that many segments in Mende never take part in consonant mutation at all; those segments that are voiced, but not prenasalized in Environment 1 appear unchanged in Environment 2. Of the other segments in (14), the Environment 1 continuants appear voiced in Environment 2. Most Environment 1 noncontinuants appear as voiced continuants in Environment 2, but <u>k</u> and <u>mb</u> are exceptions here. At first glance, at least, it is not easy to see what sorts of floating autosegments could produce these effects.

Let us say, however, that the mutation features for Environment 1 are [-voice, -continuant], and those for Environment 2 [+voice, +continuant]. Let us assume as well that these features are normally projected on their own tier in Mende, and that initial consonants of stems will to some extent be underspecified for these features. Not all initial consonants will be completely underspecified, however. In fact, of all the stems listed in (14), only those beginning with the consonants in (14b) will be completely unspecified for the features [voice]and [continuant]. The initial consonants in (14b) will have representations like those in (15) after the mutation features have been added:

(15)



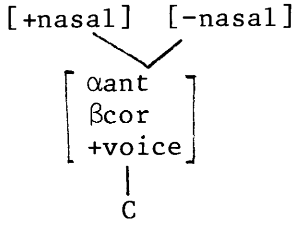
The mutation autosegment supplies both missing features in both environments.

For all of the consonants in (14e), in other words all those which do not alternate, we must assume that initial consonants of stems are prespecified for both [voice] and [continuant]. Thus when the mutation autosegments are prefixed, they are automatically overridden by the prespecified features.

The remaining cases in (14) all require some degree of prespecification. Stems beginning with the consonants in (14a) will be prespecified [+continuant], so that only voicing will be supplied by the floating autosegments. Stems beginning with the consonants in (14c) will be prespecified [-continuant]. Again, only voicing will be supplied by the mutation autosegment, but the initial consonants in these stems will remain stops in both environments.

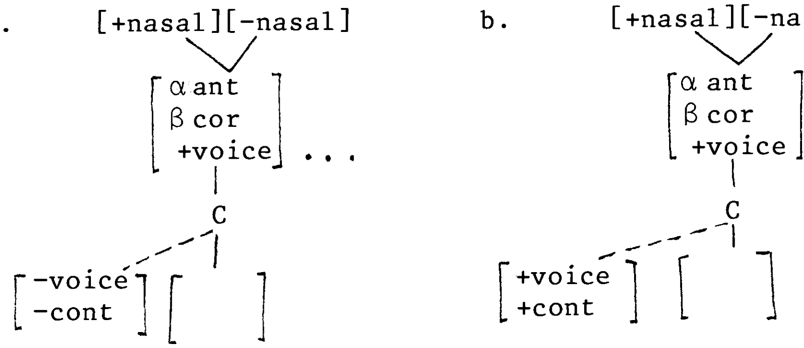
Even the facts in (14d) can be accounted for without great difficulty using the device of prespecification. Let us say that stems beginning with the consonants in (14d) actually have representations something like that in (16):

(16)



In other words, the class of consonants in (14d) will be inherently prenasalized. When the mutation autosegments are attached, we get representations like those in (17):

(17)



Env. 1 = nd, ŋg, mb, etc. depending upon the values for α and β.

Env. 2 = *nl, *ny, *ŋw, etc.

In Environment 1, the [voice] feature on the stem melody overrides the feature provided by the autosegment. This results in the required voiced, prenasalized stops. But the analysis of the Environment 2 consonants in (17b) is inadequate as it now stands, since the output is incorrectly prenasalized. Still, we can remedy this problem easily enough. Suppose that the grammar of

Mende has a low-level phonetic rule like that in (18), which states in effect that all continuants are nonnasal.

(18) [+cont] --> [-nas]

(18) will change the first [+nasal] to [-nasal], and subsequently degemination of this feature will occur.

At this point the correct result will be obtained for all but the labial consonants. In other words, the labial prenasalized stop mb alternates with a stop b, rather than with a continuant. Let us assume that after the nasal features have been degeminated in this case the result is the bilabial voiced continuant [β]. Since this is not a surface segment of Mende, let us then assume that another low level phonetic rule changes this to a stop [b], so that the alternation that appears on the surface is mb ∿ b.[3]

It is thus possible to characterize the phonetically inconsistent mutation of Mende as the effect of floating autosegments. Still, the analysis requires the use of a good deal of prespecification, and it is certainly worth asking at this point whether this is the best available analysis of quirky mutation.

The alternative to an autosegmental analysis of these mutations would probably be an analysis that uses redundancy rules. The following are a set that could plausibly characterize some of the Mende mutations:

$$\text{(19) a.}\quad [+\text{cont}] \;\text{-->}\; [+\text{voice}] \qquad \text{f --> v; s --> j}$$

$$\text{b.}\quad \begin{bmatrix} -\text{cont} \\ -\text{voice} \\ +\text{ant} \end{bmatrix} \;\text{-->}\; \begin{bmatrix} +\text{cont} \\ +\text{voice} \\ +\text{son} \end{bmatrix} \qquad \text{p --> w; t --> l}$$

$$\text{c.}\quad \begin{bmatrix} -\text{cont} \\ -\text{voice} \\ -\text{ant} \end{bmatrix} \;\text{-->}\; [+\text{voice}] \qquad \text{k --> g}$$

The rest of the Mende mutations could also be characterized by redundancy rules, provided we allow redundancy rules to refer to more than one tier, and provided also that we assume the low-level phonetic rule in (18). Rather than working out all of the specific details of this analysis, however, I would like to argue instead that all redundancy rule analyses of mutation should be rejected on general grounds.

Although segmental redundancy rules look comfortingly simple, there is a larger theoretical reason why they cannot be correct. In principle, a segmental treatment of mutation would allow us to express any sort of hypothetical mutation at all. It places no restrictions on the sorts of quirky mutations that we should expect to find in languages. Consider, for example, the hypothetical mutation in (20):

(20)

Environment 1	Environment 2
b	p
d	t
g	k
f	b
θ	d
x	g

We could easily write the set of segmental rules in (21) to describe this mutation:

(21) $$[+\text{voice}] \dashrightarrow [-\text{voice}]$$

$$[+\text{cont}] \dashrightarrow \begin{bmatrix} +\text{voice} \\ -\text{cont} \end{bmatrix}$$

But as far as I know, there is no language which has a mutation like this. And significantly, there seems to be no way of using floating autosegments and prespecification to express this mutation. If, for example, we propose that the floating autosegment for Environment 1 is [-voice, -continuant], then we would have to say that *b*, *d*, and *g* are prespecified [+voice]. *f*, *θ* and *x* would have to be prespecified [+continuant]. But then, no matter what we would propose as the floating autosegment for Environment 2, *b*, *d* and *g* would remain voiced and *f*, *θ* and *x* continuant. If we propose, on the other hand, that the floating autosegment in Environment 1 were [+voice, +continuant], *b*, *d* and *g* would have to be prespecified [-continuant], and *f*, *θ* and *x* [-voice]. Again, regardless of what the floating autosegment is taken to be in Environment 2, *f*, *θ* and *x* could not show up as voiced stops. I will leave it to the reader to confirm that either of the two remaining logical possibilities for the Environment 1 floating autosegment leads to exactly the same sort of problems. Thus, the autosegmental theory would predict -- correctly, as far as I know -- that there should be no language with the particular quirky mutation in (20). The autosegmental treatment of mutations therefore makes predictions as to what a possible mutation might be. Insofar as these predictions appear to be correct, the autosegmental theory is to be preferred over a less restrictive segmental analysis.

NOTES

[1] Within generative literature, Anderson (1976) and Skousen (1972) are exceptions.

[2] Lieber (forthcoming) also argues that the underspecifica-

tion mentioned in (6d) does not have to be stipulated.

[3] Larry Hyman (personal communication) informs me that in Kpelle the expected bilabial continuant occurs, although it is implosive.

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