1983

A prosodic account of Arabic broken plurals

John J McCarthy

Chapter 18

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0. INTRODUCTION

One of the most difficult problems of morphological analysis -- in both structuralist and generative theoretical frameworks -- is the complex system of verbal and nominal derivation that pervades the Semitic languages. The nature of this difficulty can be stated very simply. Most theories of morphology are designed to give easy expression to operations of morpheme concatenation, where each morpheme is made up of one or more segments, and where words are made up of sequences of morphemes strung together in a rigid linear order. But even the most casual inspection of any Semitic language reveals formal and semantic regularities that cannot be stated on isolable, concatenated morphemes. Rather, such regularities hold of units, interspersed throughout the word, that correspond roughly to the Semiticists' traditional notions of roots and vowel patterns.

The only earlier morphological theory known to me which attempts anything like a rigorous analysis of this problem is Harris's system of long components, particularly as it is applied to Biblical Hebrew by Harris (1941) and to Modern Hebrew by Chomsky (1951). These analyses, although extremely successful in capturing many fundamental insights, are subject to a number of specific criticisms which I have made elsewhere (McCarthy 1979a, 1981b). The most compelling of these is the observation that Chomsky, in order to express certain regularities of vowel patterns ignored by Harris, is required to invoke an unrestrictive and relatively unmotivated transformational apparatus to effect the intercalation of consonantal roots with vowel patterns.

In recent work (McCarthy 1979a, 1981a, 1981b), I have proposed a new theory of morphology which gives direct and elegant expression to the regularities attendant on Semitic morphological systems, which is descriptively superior to and more restrictive than long component analysis, and which can be revealingly integrated into a broader theory of phonological representation. The fundamental characteristics of this prosodic model of morphology are as follows. On one level, called the prosodic template, there is a representation of just the canonical syllable structure of a form --

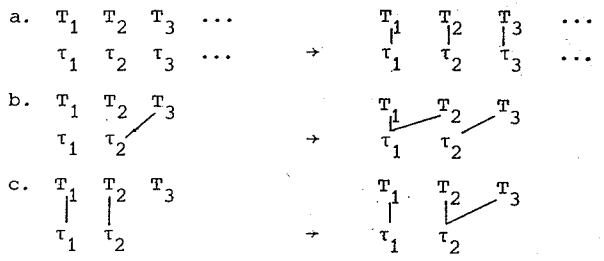
the distribution of long vowels, consonant clusters, and so on -- in terms of the major class features [segmental] and [syllabic], notated in the obvious way as C and V. On other levels appear the distinctive features for point and manner of articulation of vowels and consonants, with each level containing the information about only one single morpheme. In a Semitic language in particular, vowel patterns and consonantal roots will appear on different levels, since the patterns and roots are clearly distinct morphemes. This situation is illustrated in (1) with the Classical Arabic stem *kattab* 'caused to write':[1]

(1)

The root *ktb* is a morpheme appearing in forms referring to writing; the vowel pattern *a* is the characteristic morpheme of the perfective active; and the prosodic template [CVCCVC] is itself a morpheme which indicates, among other things, the causative/factive verbal derivational category.

Association between levels in a prosodic representation is, as in (1), effected by autosegmental principles (Goldsmith 1976). Specifically, the theory of tonal association of Clements and Ford (1979), which seems to be the best articulated one available, provides a basis for this analysis. Clements and Ford offer three universal conventions for association of tonal elements (τ) with tone-bearing elements (T) in an autosegmental representation. These are summarized in (2):

(2) Universal Association Conventions



Briefly, Convention (2a) provides for a left-to-right one-to-one mapping of several unassociated tones to several unassociated tone-bearing elements, (2b) gives precedence in spreading to an unassociated tone over one that has been previously associated -- for instance, by the application of a language-particular rule, (2c) ensures that all tone bearing elements will have at least one association, garnered if necessary from the tonal element on the left. A more detailed discussion of these conventions can be found in McCarthy (1981b).

Under the prosodic model of morphology presented here, these association rules will apply to the autosegmental units of roots and vowel patterns, mapping them on to C and V positions respectively of the prosodic template. We will further assume that this mapping is subject to a prohibition against many-to-one association of several autosegmental units with a single position on the prosodic template (McCarthy 1979a, 1981b), which rules out the possibility of individual segments with multiple specifications for point and manner of articulation, at least in the unmarked case. This is a natural provision to make in the autosegmental analysis of non-tonal systems.

It is demonstrable that this theory is able to capture all of the generalizations inherent in the root and pattern system of Semitic morphology. Moreover, it has a number of possibly unexpected consequences as well. For example, note that the apparent reduplication of the vowel *a* or the consonant *t* in (1) is represented by a one-to-many association of a vocalic or consonantal unit with several V or C slots of the prosodic template. In this respect and in others, the Semitic morphological system, when analyzed in this way, bears striking resemblances to tonal melody paradigms like those in Tiv (McCawley 1970, Goldsmith 1976). For this reason, we will often refer to roots or vowel patterns, considered prosodically, as melodies.

In what follows I will illustrate and refine this prosodic theory by examining in some detail the system of broken plural formation in Classical Arabic. Section 1 presents an outline of the basic data and of the functional characteristics of broken plural morphology. Section 2 deals with the major broken plural patterns, arranged by the prosodic templates of their associated singulars. Section 3 extends this treatment to the diminutive, a fully productive derivational category in Classical Arabic that bears striking formal resemblances to the broken plural. And in section 4 I will treat briefly of the remaining, minor or irregular broken plural patterns, showing that they can, at least, be integrated descriptively into the rest of the system.

1. PLURAL FORMATION IN CLASSICAL ARABIC

Perhaps the most difficult aspect of the already complex Semitic-type morphological system is the usual mode of plural formation obtaining in the South Semitic languages. In these languages, which include Ethiopian Semitic, Classical Arabic, and all modern Arabic dialects, an apparently productive set of rules functions to form plurals with substantial distortion of the original shape of the singular stem, thus called broken. An illustrative, but by no means exhaustive, list is given in (3):

(3)

Singular	Plural	Gloss
jundab	janaadib	'locust'
sultaan	salaatiin	'sultan'
ʕankabuut	ʕanaakib	'spider'
xaatam	xawaatim	'signet ring'
jaamuus	jawaamiis	'buffalo'
šimaal	šamaaʔil	'left hand'
nafs	nufuus	'soul'
ḥukm	ʔaḥkaam	'judgment'
qiḍḥ	qiḍaaḥ	'arrow'
ʕinab	ʔaʕnaab	'grape'
saamir	summar	'conversing at night'
janaab	ʔajnibat	'wing'
ʔamiir	ʔumaraaʔ	'commander'

Clearly, whatever formal regularities may inhere in this system are not transparent. Moreover, the initial impression of chaos is reinforced by the observation that, while most nouns have only a single broken plural, some have several formally different but synonymous ones, and some have several with different nuances of meaning. Further, there exists an entirely different type of plural formation, the sound plural,[2] that is applicable with certain classes of nouns. A preliminary treatment would yield little more than a list of marginal regularities, an analysis that is pursued in some detail in the two synchronic studies of broken plurals know to me, a Firthian one by Palmer (1962) on the Ethiopian Semitic language Tigre and a standard generative one by Levy (1971) on Modern Standard Arabic.

There is, however, reason to believe that the basic logic of this system is far more substantial than it at first appears. First, we shall see below

that, under a sufficiently rich conception of the apparatus of phonological representation, the formal connections of different broken plural patterns with one another and with the diminutive emerge quite clearly, providing a great deal of internal structure to the system. Second, nouns with broken rather than sound plurals virtually monopolize the Arabic lexicon. The only lexical (as opposed to productively derived) nouns that regularly take sound plurals belong to certain delimited categories: the names of the letters of the alphabet (*ʔalif*, *ʔalifaat* 'aleph'), some unassimilated loans (*šaadurwaan*, *šaadurwaanaat* 'fountain (jet d'eau)'), proper nouns (*hind*, *hindaat*: *ʕuθmaan*, *ʕuθmaanuun*), and sporadic nouns of no particular type (*ʕaqaar*, *ʕaqaaraat* 'landed property'). Third, broken plural morphology is ordinarily extended according to expected patterns to loan words, like several forms in (3) or, say, *ʔusquff*, *ʔasaaqif* 'bishop (Ἐπίσκοπος)', to lexical derived nouns (*miftaaḥ*, *mafaatiiḥ* 'key'), and to broken plurals themselves to form plurals of plurals (*jamal*, pl. *jimaal*, pl. pl. *jamaaʔil* 'he-camel').

All of this goes to show that broken plural formation is a productive part of Classical Arabic morphology, with at least the potential to offer non-trivial insights into its makeup. This is not to say, however, that broken plural formation is the functional equivalent of, say, the English plural rule. For some classes of nouns, the form of the broken plural is predictable only in part or only as a limitation to certain possiblities. And most interestingly, nonlexical nouns -- those created by the application of clearly productive rules of derivation, like diminutives, participles, and other categories -- are subject only to sound, not broken, plural morphology (Levy 1971). This fact, coupled with the observation that different broken plurals can have different nuances of meaning (*bayt* 'house, verse of poetry', *buyuut* 'houses', *ʔabyaat* 'verses'), argues that broken plural formation is diacritically triggered, or equivalently, that it is lexical. Therefore nonlexical nouns cannot form broken plurals. It follows, then, that rules of broken plural formation of the sort developed below function redundantly to capture these consistent lexical specifications and generatively to account for the extension of broken plural morphology to neologisms. I will therefore consider them to be morphological redundancy rules.[3]

A final point. Since, as with any lexical process, there are significant areas of exceptionality in broken plural formation, I often have occasion below to make statements about the relative frequency of different plural patterns with respect to some class of nouns. All such statistical judgments

are based on Murtonen's (1964) count of the broken plurals occurring in a large portion of a Classical Arabic dictionary, with some reference also to Levy's (1971) similar count of Modern Standard Arabic. In most cases, I confine statistical comparisons to other broken plurals and ignore the possibility of sound plural morphology, which is not directly relevant to this study.

2. BROKEN PLURALS

2.1. Nouns [CVCCV(V)C]

All nouns with the canonical pattern [CVCCV(V)C] in the singular have broken plurals like those in (4). Such nouns are related to quadriliteral roots (4a), to triliteral roots by reduplication of one radical (4b), to triliteral roots also by affixation of a prefix like *m* (4c), and to biliteral roots by reduplication of the whole root (4d); for convenience I will refer to this entire class (incorrectly) as quadriliteral. As in all broken plurals, the feminine suffix *+at* is not regarded as part of the stem and is ignored (4e):

(4) a.	jundab	janaadib	'locust'
	šaytaan	šayaatiin	'devil'
	sultaan	salaatiin	'sultan'
b.	šu?buub	ša?aabiib	'shower of rain'
	nuwwaar	nawaawiir	'white flowers'
c.	maktab	makaatib	'office'
	miftaah	mafaatiih	'key'
d.	zalzalat	zalaazil	'earthquake'
	judjud	jadaajid	'cricket'
e.	zi9nifat	za9aanif	'fin of a fish'
	fuqqaa9at	faqaaqii9	'bubble'

Two distinct generalizations about the plural morphology can be extracted from (4). At the level of vocalism, we find a characteristic melody of the plural, with *i* mapped onto the final syllable and *a* mapped onto the other two syllables, regardless of the vocalism in the singular. At the level of the prosodic template, we find singulars of the pattern [CVCCV<V>C] corresponding to plurals of the pattern [CVCVVCV<V>C], where the quantity

of the final vowel is held constant.[4] The consonantism remains unchanged, simply associating with the four available C positions of the plural prosodic template.

This broken plural morphology, then, requires two separate stipulations on distinct levels of phonological representation. The first is that there exists a plural morpheme in the form of a vowel melody:

(5) Plural Vocalic Melody

[a i]

We shall see later that the [a i] melody of (5) functions in other broken plural types; the problem now is to account for its mode of association with the prosodic template. A language-particular rule of association, which finds some independent motivation in the passive morphology of the verb as well (McCarthy 1979a, 1981b), is given in (6):

(6) Vowel Association

V(V)C]

⋮

i]

This rule says simply that final melodic *i* is to be associated with the first V position of the last syllable of the prosodic template. Vowel Association takes precedence over the Association Conventions, yielding a representative derivation like that in (7):

(7)

Rule (6) [CVCVVCVVC]
a i

Convention (2b) [CVCVVCVVC]
a i

Convention (2c) [CVCVVCVVC]
a i

Second, the grammar must also stipulate the relationship between the singular and broken plural prosodic templates. A number of ways of giving formal expression to this generalization come to mind; I will present one that, although somewhat more elaborate than others, nevertheless will turn out

to have significant heuristic value when we analyze the broken plurals of other singular types.

Consider first of all the possible syllable structures of Classical Arabic. A syllable must begin with a consonant, and may contain a simple nucleus (a CV syllable), a long nucleus (CVV), or a simple nucleus and a coda (CVC). Extralong (CVVC and CVCC) syllables are permissible in very limited circumstances (McCarthy 1979b), but not at the stem level with which we are dealing here. Under a somewhat simplified version of nonlinear models of syllabic representation (Kahn 1976, Halle and Vergnaud 1978, Kiparsky 1979, McCarthy 1979b, Selkirk forthcoming), the syllabification of the stem templates of the corresponding quadriliteral singular and plural forms will appear as in (8):

(8) a. Singular Plural

b. Singular Plural

We can consider the stem-final consonants in (8b) to be (temporarily) extrametrical; they belong to no syllable at this stage of the derivation since CVVC syllables are prohibited, though they will later be adjoined as onsets to syllables formed by the suffixation of case and gender desinences.

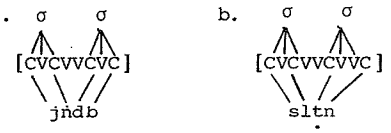
With the aid of this sort of representational apparatus, an initial statement of the regularity in forming the broken plural template can be made quite easily: a VV sequence is inserted after the initial syllable of the singular stem. This insertion rule is formulated in (9a):

(9) a. Plural Template VV-insertion

$$\emptyset \rightarrow VV \;/\; [_{\sigma} \_\_\_ \;/\; \text{Plural}$$

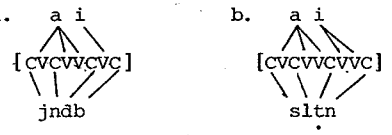
The immediate output of (9a) appears in (10):

(10) a. b.



Like the output of any rule of affixation, the forms in (10) are then subject to resyllabification in conformity with the basic canons of Arabic syllable structure. Although, as we will see, this resyllabification occasionally involves modifications of the template, here it is quite straightforward. Its results are the two representations on the right in (8), with the second consonant in the template shifted from the initial to the newly-formed syllable. The association of consonantal material with the C positions of the template remains unchanged throughout this restructuring. Full prosodic representations of a pair of examples appear in (11):

(11) a. b.



An interesting source of additional evidence about the nature of the plural template comes from nouns with more than two singular stem syllables, which can be conveniently (but also inaccurately) referred to as quinqueliteral. Such forms, although often loan words or acronyms and not part of the ordinary singular noun apparatus of Arabic, nevertheless do form broken plurals, as in (12):

(12)	9ankabuut	9anaakib	'spider'
	9andaliib	9anaadil	'nightingale'
	jaḥmariš	jaḥaamir	'lazy old woman'
	safarjal	safaarij	'quince'
	namuuδaj	namaaδij	'type'

Clearly what is going on in (12) is not the simple infixation of a VV sequence between two syllables, as predicted by (9a). Instead, (12) shows a maximum plural template [CVCVVCV(V)C] that appears regardless of the canonical form of the singular. We can express this generalization by adding to the grammar an output filter on broken plurals (9b) which functions in addition to the insertion rule (9a):

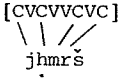
(9) b. Plural Template Filter

$$*[\text{CVCVVCV(V)C}]_{[\text{plural}]}$$

Recognition of a template filter in addition to template affixation rules is essential as well to the analysis of the Arabic verbal derivational system in McCarthy (1979a, 1981b).

This filter (9b) has several worthwhile consequences in the treatment of nouns of this type. First, it generates broken plurals of constant shape regardless of the anomalous canonical form of the singulars in (12), a result that cannot be achieved with VV-insertion. Second, while the broken plural prosodic template filter (9b) has only three syllables and four C positions, many of the roots in (12) have five or six consonants. The supernumerary consonants are lost, typically at the right end of the stem. This follows directly from the left-to-right association convention, if the template is limited to the shape [CVCVVCV(V)C], as illustrated in (13):

(13)



The extra consonants at the right end of the stem remain unassociated by the conventions in (2). These universal conventions do not require that every tonal element bear an assocation, and consequently these consonants receive no phonetic realization. Occasionally other reductions of the consonantism are found -- elimination of nonroot consonants or arbitrary consonants (*dumustuq*, *damaasiq* 'Byzantine governor') -- but all with the goal of fitting the material onto a four consonant template. Moreover, it appears that loss of the final consonants, as in (13), is the preferred mode and is permissible with any noun.

A third consequence of adopting the filter (9b) is that quinqueliteral nouns will not be expected to maintain the same vowel quantity in the stem-final syllable of the singular and plural. On this they should differ from the ordinary quadriliterals in (4), where the constancy of the length of that vowel is accounted for by considering the plural template to be derived from the singular one by VV-inserion. This prediction is borne out: compare the plural *ʕanaakib* of *ʕankabuut* with the plural *ʔasaaṭiin* of *ʔusṭuwaanat* 'pillar'. In other words, the length of the stem-final vowel is unpredictable or arbitrary in the plurals of quinqueliteral nouns.

A remaining idiosyncrasy of quadriliteral broken plurals is the sometimes variable appearance of the feminine suffix *at* with the plurals of a minority of these nouns, chiefly loan words or certain gentilics. This suffix regularly induces shortening of the final vowel of the stem by a rule we will formulate in section 4.2 below:

(14)	qaysar	qayaasirat	'Byzantine emperor'
	miṭraan	mataariin	'metropolitan bishop'
		mataarinat	

2.2. *Nouns [CVVCV(V)C]*

A small but not insignificant number of triliteral nouns have singulars constructed on the prosodic template [CVVCVVC]. A very large number have the template [CVVCVC]. In the latter group are also included the lexicalized masculine active participles of the first verbal derivational class, with the vocalism *CaaCiC*. Since these participles form plurals in a way different from that of other CVVCVC nouns, we will delay consideration of them until section 4.1.

Apart from these participles, essentially all masculine and feminine nouns of this type form broken plurals like those in (15):[5]

(15) a.	xaatam	xawaatim	'signet ring'
	baa9iθ	bawaa9iθ	'motive'
	saa9iqat	sawaa9iq	'thunderbolt'
	ḥaamil	ḥawaamil	'pregnant'
b.	jaamuus	jawaamiis	'buffalo'
	qaanuun	qawaaniin	'canon (of law)'

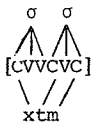
It is apparent that the broken plurals in (15) share many of the characteristics of the quadriliteral broken plurals discussed in section 2.1, once a sufficiently rich phonological representation is available. First, they clearly have the same vocalic melody (5) with its concomitant mode of association (6). Second, the broken plurals in both cases are formed on the same prosodic template, including the transference of vowel quantity in the stem-final syllable between singular and corresponding plural (compare (5a) and (5b)).

The identity of vocalic melody in the two plural types clearly requires

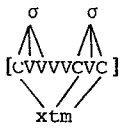
no additional stipulations. The identity of prosodic templates can also be derived from independent considerations. The basic problem in this case is to account for the way in which the singular template with three C positions develops a fourth in the plural and for the source of the *w* associated with the plural template.

Consider the immediate output of the plural VV-insertion rule (9a) applied to these forms:

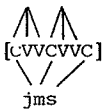
(16) a. Singular



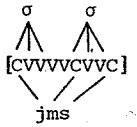
Output of (9a)



b. Singular

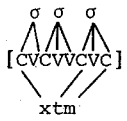


Output of (9a)

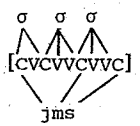


The sequences of four vowel morae in the representations on the right obviously cannot be parsed by the rules of Classical Arabic syllabification, nor do they conform to the output template (9b). We may assume that in cases of this sort the prosodic template is minimally adjusted -- here, by the change of the second V to C -- to render the string syllabifiable and to bring it into conformity with the output filter. This restructuring of the template will produce the representations in (17):

(17) a.



b.



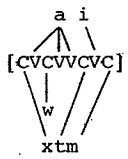
These forms each have one new C position, created so as to render the syllables well-formed, which as yet bears no association with any melodic material. As is clear from (15), this position ought to be associated with *w*, a result that can be accomplished by the application of rule (18):

(18) *w*-insertion

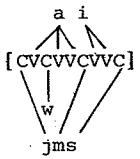
w-insertion need not have a context to limit its scope to precisely the second C position of certain plural templates. The independently necessary principle ruling out many-to-one associations of melodic with segmental material will exclude application of (18) to any consonantal slots on the template which already bear associations.

The final result of these rules appears in (19):

(19) a.



b.



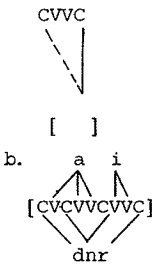
The *w* is represented on a separate autosegmental tier from either the root or the vowel melody, although this cannot be conveniently depicted on the page.

Some interesting support for the details of the analysis of this broken plural type, particularly the rule of *w*-insertion, comes from a class of about ten triliteral nouns with [CVVCVVC] singulars and a slightly different plural pattern:

(20)	diinaar	danaaniir	'dinar' (monetary unit)
	diibaax	dabaabiix	'brocade'
	qiiraat	qaraariit	'carat'

These broken plurals are formed on the expected prosodic template and have the anticipated [a i] melody. What they lack, however, is the inserted *w* associated with the second C position. Instead we observe reduplication of the second root consonant, a result of the minor rule of association (21a), which yields the representation in (21b):

(21) a. Minor Association



Minor Association precedes and therefore takes precedence over *w*-insertion, correctly deriving the apparent medial reduplication.[6]

2.3 Nouns [CVCVVC]

The class of nouns with the canonical pattern [CVCVVC] in the singular has a good deal more variety in broken plural formation than the previous triliteral class, so for the moment we will limit the discussion to only one fairly well defined and common type, leaving the others until section 4.2. Virtually all feminine nouns of this sort, whether they are formally feminine (with suffixal *at*) or grammatically feminine have a broken plural that bears some similarities to those treated above. A few masculine nouns also have this broken plural:[7]

(22) a. Formal Feminine

jaziirat	jazaaʔir	'island'
sahaabat	sahaaʔib	'cloud'

b. Grammatical Feminine

šimaal	šamaaʔil	'left hand'
ʕajuuz	ʕajaaʔiz	'old woman'

c. Masculine

damiir	damaaʔir	'pronoun'
wasiid	wasaaʔid	'court'

It is clear that these forms have the same prosodic template and vocalic melody as the broken plurals already discussed. But they do not appear to have the inserted *w* of the triliteral broken plurals treated in the preceding section, nor do they have inserted material in the second C position of the template. What they display instead is ʔ in the broken plural,

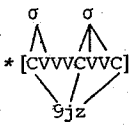
associated with the third C slot.

Consideration of a little allomorphy partly illuminates the first aspect of this problem. There is a fairly general process that changes *w* or *y* to ʔ when preceded by long *aa* and followed by short vowel (Erame 1970) /qaawim/→ *qaaʔim* 'arising', /saayir/→ *saaʔir* 'becoming', /xafaay+un/→ *xafaaʔun* 'secrecy (nom.sg.)'. We therefore can abstract away from a broken plural like *jazzaaʔir* a more remote representation /jazaawir/ with a *w*, arguably introduced by *w*- insertion, associated with the third C position of the template.

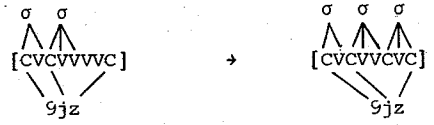
The problem is now reduced to that of integrating this singular type into the purview of the template rule (9). The plural forms in (22) are clearly compatible with the filter (9b). But if we consider the syllabification of the singular template, which is given in (23a), it is clear that infixation of VV after the *initial* syllable by the insertion rule (9a) will, as in (23b), yield the wrong result. On the other hand, infixation of VV after the *second* syllable produces a template (23c) that can, by minimal adjustment of a V to a C, be made compatible with the filter as well as the rules of syllabification.

(23) a.

b.



c.



The representation (23c) will be restructured as indicated bringing it into conformity with the filter and the newly-created C position will be filled by *w*-insertion (18). Obviously this presupposes some modification of the VV insertion rule. In fact, an interesting possibility presents itself: insert the VV sequence after the leftmost heavy (CVC or CVV) syllable. In all the singular patterns discussed, [CVC__CV(V)C], [CVV__CV(V)C], and [CVCVV__C], such a rule would correctly put VV in the indicated positions.

The characterization of notions like "leftmost heavy syllable" has been the object of study in many analyses of stress (Halle and Vergnaud 1978, McCarthy 1979b, Hayes 1980), and several fairly detailed formal proposals have appeared. Because a full discussion of these alternatives would take us too far afield, we will eschew these formulations here in favor of a straightforward stipulation, as in (24a).

(24) Broken Plural Template Rule

a. $\emptyset \rightarrow$ VV / [Q σ ___

Condition: Q does not contain a heavy syllable.

b. [CVCVVCV(V)C]$_{[\text{plural}]}$

This new version of the rule generates the correct results for all broken plurals considered thus far. In particular, it provides for a difference in the locus of *w*-insertion in the two triliteral noun types, the [CVVCV(V)C] and the [CVCVVC] singulars. The unassociated C position created by restructuring in the former (17) follows the first syllable while it follows the second syllable in the latter (23c). This accounts for the two different slots where *w* (or the ʔ derived from *w*) can appear.

2.4 Nouns [CVC(V)C]

Like the nouns of the preceding section, these forms also show a discrepancy in plural formation between masculine and feminine gender. Something over 90% of the masculine nouns with the singular template [CVCC] take one of the three broken plural patterns in (25); a smaller but significant percentage of feminine nouns of the same pattern take these plurals, whereas others, under lexical government, have a different broken plural type discussed below in section 4.3.[8]

(25) a. CaCC

nafs	nufuus	'soul'
bahr	bihaar	'sea'
farx	ʔafraax	'young of a bird'
qasʕat	qisaaʕ	'dish'

b. CuCC

hukm	ʔahkaam	'judgment'
rumh	rimaah	'spear'
burd	buruud	'robe'

ruqʕat	riqaaʕ	'scrap of paper'

c. CiCC

himl	ʔahmaal	'load'
qidh	qidaah	'arrow'
dirs	duruus	'molar'
hiqbat	huquub	'period of time'

The varying broken plural patterns of masculine forms have been listed in order of frequency, from greatest to least. Thus, nouns *CaCC* are more likely to have plurals *CuCuuC* than are singulars *CuCC*. Apart from these relatively uninteresting aspects of statistical preponderance, there is no effect of the singular vocalism on the form of the plural, and all three plural types occur with each singular type. For the less common feminine broken plurals, I have given just one example of the most frequent plural of each type.

Again, some considerations of allomorphy considerably simplify the morphological analysis. Two of the three broken plural types in (25) share the same prosodic template [CVCVVC]; the third has initial ʔ*a* with a following [CCVVC]canonical pattern. Levy (1971) has argued that the underlying form of this last type is *CaCaaC*, but subject to a morphologically-restricted rule of methathesis and ʔ epenthesis which she formulates. Such a rule has considerable independent support from other aspects of Arabic morphology, and I will assume its application here.

We have, then, three basic broken plural patterns in this class: *CiCaaC*, *CuCuuC*, and *CaCaaC*. All are obviously formed on the prosodic template [CVCVVC] and consequently differ only in the vowel melody associated with it. The three melodies are given in (26); it is clear that selection among them is entirely lexical:[7]

(26) Vowel Melodies

a. [i a]

b. [u]

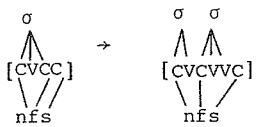
c. [a]

These melodies present no problems of association; the universal conventions in (2) will work without additional stipulations.

There is an apparent similarity between the [CVCVVC] template of this plural class and the templates generated by the Plural Template rule (24). As is clear in (27), insertion of VV after the only heavy syllable of

[CVCC] singulars yields the correct plural form:

(27)



This noun type, then, is subject to the same insertion rule as the previous classes. It can be fully incorporated into the analysis by slightly broadening the scope of the Plural Template Filter as in (24b'):

(24) b'. [CVCVVC(V(V)C)] [plural]

No other distiction between the different singular types need be made.

Disyllabic singulars [CVCVC], however, do offer a fairly interesting difficulty. Although this singular class is significantly less common than the [CVCC] type, nevertheless it quite regularly forms plurals along the lines in (28):

(28)

CVCVC		
qadam	ʔaqdaam	'footstep'
ʕinab	ʔaʕnaab	'grape'
jabal	jibaal	'hill'
kabid	kubuud	'liver'
raqabat	riqaab	'neck'

Clearly these forms are identical to the plurals of [CVCC] singulars. The most direct analysis would be to transform the template [CVCVC] to [CVCC] by a new rule, ordered before VV-insertion:

(29) Vowel Ellipsis

V → ∅ / [CVC__C] / Plural

After Ellipsis applies to the prosodic template, the derivation of broken plurals from erstwhile [CVCVC] singulars will proceed exactly as in (27) above.

The rule of Vowel Ellipsis has independent motivation from a somewhat unexpected quarter -- a singular/plural type we have not yet discussed. Arabic has a large number of adjectives referring to colors and bodily defects, related to a corresponding verbal derivational class. The masculine

singulars of these words are of the form *ʔaCCaC* (with irregular feminine *CaCCaa*) and the common gender plural is *CuCC*. This pattern is exemplified in (30):

(30)

ʔahmar	humr	'red'
ʔahdab	hudb	'hump-backed'

The masculine singulars are derived from underlying [CVCVC] templates by a rule of metathesis and ʔ-epenthesis we have already discussed (Levy 1971), so this pattern, together with the [a] melody, comprises the characteristic morphology of adjectives of color or defect. In the plural this template is subject to Vowel Ellipsis (29) and it arguably receives the [u] melody in (26b).

A comparison of the ordinary [CVCVC] noun pattern and the formally identical color and defect category is revealing. Although both types are subject to a morphological rule of ellipsis in the plural, only the former also undergoes VV-insertion, bringing it into conformity with the template filter. Technically, the color and defect class is exceptional with respect to insertion and the filter, and permits only one of the three vowel melodies for disyllabic plurals.

Excursus: Some Properties of Weak Roots

Weak roots -- those that contain a high glide *w* or *y* as one of their radicals -- contribute substantially to the allomorphy of Arabic. A full study of this problem far exceeds our goals here, as it involves many other aspects of nominal morphology as well as the verb (see Brame 1970, Levy 1971). But certain facets of this complex whole do touch directly on the representation of broken plurals as well as contribute to our understanding of the prosodic theory. This analysis is, then, by no means exhaustive.

Roots known as III-weak -- meaning they have a high glide as the third radical -- present relatively simple alternations in the plurals of the [CVVCVC] singular base. The forms in (31) are representative:

(31)

baadiyat	bawaadii	'desert'
jaariyat	jawaarii	'girl'

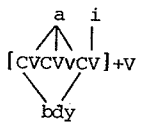
As these plural forms are cited, they include one of the case desinences *u* 'nominative' or *i* 'genitive' suffixed to the stem. Therefore, *bawaadii* might be analyzed as *bawaadiy* + *u* or *i*, with the final vowel showing the

effects of progessive assimilation. (The accusative, with suffix *a*, is *baadiya*.) The final root consonant *y* is lost by virtue of a rule that deletes a C on the template intervocalically after a short vowel, providing that C is associated with a high glide:

(32) C → Ø / CV ____ V
[-cons, +high]

A final formulation of this rule would clearly be much more complicated, since it must exclude sequences like *iya* as well as others, but this version will suffice.

Since rule (32) applies on the template level only, it leaves the associated root material, the high glide itself, stranded without an association. The unassociated material receives no phonetic realization, the equivalent of being deleted:

(33)


The unassociated C position then undergoes *w*-insertion (18).

Although formulating this glide deletion rule prosodically offers no improvement over a segmental rule for the forms in (31), it does make a very interesting difference with the plurals of [CVCVVC] nouns formed on weak roots. Final radical high glides render the broken plurals of this noun type extremely opaque:

(34) a. III-*y* Roots

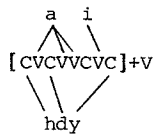
hadiiyat	hadaayaa	'present'
nuqaayat	naqaayaa	'pick, choice'

b. III-*w* Roots

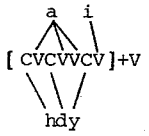
ʔitaawat	ʔataawaa	'tax'
hiraawat	haraawaa	'stout stick'

Although there is much that is puzzling in these plural forms, note in particular that, in the third C position of the template, instead of ʔ derived from inserted *w*, we find the root glide *w* or *y*. This observation is fundamental to our analysis of these forms.

Consider the representation of one of these broken plurals immediately before the application of *w*-insertion:

(35)


The most important assumption we will make is that this form is then subject to rule (32), ordered before *w*-insertion. By association convention (2b), the now-stranded final high glide of the root will reassociate with the adjacent free C position in the template, yielding the output in (36). In other words, the root material persists despite the deletion of the template position with which it was associated:

(36)


This reassociation, which preserves the final high glide of the root, does not occur with the plurals of [CVVCVC] nouns, as in (33), because of the prohibition against many-to-one associations. In that case, the stranded *y* or *w* cannot map onto the already occupied C-position on its left, and therefore remains unassociated.

The reason for the final long *aa* in *hadaayaa*, which is invariant in all three cases, is unclear. Conceivably some new rule deletes the melodic element *i*, with the result that the *a* spreads to the stem-final vowel and triggers assimilation of the desinential vowel. But it is difficult to find independent support for such a process, and so the problem must remain open.[8]

3. DIMINUTIVES

There are very striking similarities between diminutives and the broken plural patterns discussed above. These similarities are apparent from the data in (37), which are representative of the diminutive pattern of essentially all nouns regardless of their broken plural pattern:

(37)

	Singular	Plural	Diminutive
a.	jundab	janaadib	junaydib
	sultaan	salaatiin	sulaytiin
b.	ʕankabuut	ʕanaakib	ʕunaykib/ʕunaykiib
	safarjal	safaarij	sufayrij/sufayriij
c.	xaatam	xawaatim	xuwaytim
	jaamuus	jawaamiis	juwaymiis
d.	diinaar	danaaniir	dunayniir
e.	jaziirat	jazaaʔir	juzayyir
	šimaal	šamaaʔil	šumayyil
f.	nafs	nufuus	nufaysat[9]
	ḥukm	ʔaḥkaam	ḥukaym
	qiḍḥ	qiḍaaḥ	qudayḥ
	qadam	ʔaqdaam	qudaym

The diminutive is an entirely productive category in Classical Arabic; it is therefore of some interest to incorporate this system into our analysis.

In fact, the addition of diminutives to the grammar is almost trivially simple. It is apparent from all the forms in (37) except (37f) that the vocalic melody of the diminutive is [u a i]. It is also apparent that the diminutive prosodic template is identical to that of the broken plural except for the presence of an internal VC sequence (phonetically *ay*) rather than a VV sequence. Let us suppose that the diminutive template is actually the same as the plural one. A left-to-right mapping of the [u a i] melody onto this template, purely in accordance with the conventions in (2), will yield the output in (38):

(38) a. [CVCVVCVC]
u a i

b. [CVCVVCVVC]
u a i

c. [CVCVVC]
u a i

It is a fact of Arabic syllable structure that *ai* and *au* sequences are always realized as vowel plus glide combinations -- that is, the high portion is nonsyllabic. Thus we may consider the change of V to C in the prosodic template to be a further consequence of the minimal restructuring needed

to bring the representation into conformity with the canons of Arabic syllabification. The output will appear as in (39):

(39) a. [CVCVCCVC]
u a i

b. [CVCVCCVVC]
u a i

c. [CVCVCC]
u a i

To achieve this result, it is also necessary to designate the diminutive melody as an exception to the Vowel Association rule (6). This ensures that only the universal conventions apply to yield a left-to-right pattern of association.

It follows, then, that for the diminutive precisely the same template apparatus as the broken plural is sufficient. The grammar must only stipulate the diminutive melody [u a i]. For completeness we will go through each diminutive type in detail.

The quadriliteral diminutives in (37a) need no comment, but we can note that the quinqueliteral ones (37b) show the same pattern of loss of consonantal material described in section 2.1, as well as the indeterminacy of final vowel length predicted by their arbitrary selection of template. The diminutives of [CVCV(V)C] nouns have the same pattern of inserted *w* as the broken plurals, whereas the exceptional broken plurals of this class (37d) retain their special pattern of root-to-template association in the diminutive, showing that Minor Association (21a) applies to diminutives as well.

The diminutives of nouns [CVCVVC] have a somewhat suprising geminate *y* between the second and third syllables. Since these forms are subject to *w*-insertion, we would expect a sequence *yw* like **juzaywir*. Not surprisingly, a rule /yw/→*yy* is not difficult to motivate on independent grounds. For example, the diminutive of *ʕurwat* 'handle', in which the *w* is radical rather than inserted, is *ʕurayyat* from /ʕuraywat/. So these forms present no special complications.

Finally, the diminutives in (37f) have several interesting characteristics. The diminutive of *ḥukm* shows the underlying form of the prosodic template, before the application of metathesis and ʔ-insertion in the broken plurals. This metathesis is inapplicable in the diminutive because the first vowel

is *u* rather than *a*. The lack of any surface *i* vowel in the diminutive follows simply from the shortage of V positions in the disyllabic prosodic template. The left-to-right association, then, accounts for this difference between the vowel patterns of diminutives depending on their length. The diminutive of *qadam* includes prior application of the Vowel Ellipsis rule (29), which must therefore include the diminutive category in its scope.

The end result is as claimed: diminutives require no addition to the descriptive apparatus other than a new vocalic melody. This is fairly striking confirmation for the analysis.

4. OTHER PLURAL TYPES

A number of other broken plural types occur, some as options with noun classes already discussed, some confined to particular singular patterns, and some with wide distribution but very low frequency. All are systematic exceptions to the VV-insertion rule and template filter in (24). We will very briefly consider the most interesting of these here, and in the concluding subsection outline a few of the others.

4.1. [CVVCVC] Participles

Masculine active participles of the first verbal derivational class take the pattern [CVVCVC] with [a i] vocalism. When entirely productively derived they form sound or suffixing plurals, as described in section 1. But when at least partly lexicalized, the majority of these words select, under lexical government, one of the two broken plural patterns in (40):[10]

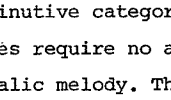
(40)	a.	saajid	sujjad	'prostrating oneself'
		saamir	summar	'conversing at night'
	b.	haakim	hukkaam	'judge'
		jaahil	juhhaal	'ignorant'

No other nouns except occasional feminines of the same type form their plurals in this way.

Clearly we could simply stipulate, as any analysis must, that these plurals are formed this way, and leave it at that. But there are significant generalizations to be captured if we attempt a more thorough treatment under the prosodic theory. It is apparent that the plurals in (40a) have almost exactly the same canonical pattern as the corresponding

singulars, but that they substitute gemination of the medial consonant for length of the first vowel. This generalization can be expressed by an autosegmental rule (41) that adds an association of the middle root consonant with the second V position of the prosodic template:

(41) Participle Plural Rule



The addition of this line of association yields a representation like that in (42), which will be automatically restructured by changing the V associated with consonantal material to a C:

(42)

About half of these forms are also subject to an additional rule lengthening the vowel of the second syllable in the plural (40b). Some lexical items undergo this rule or not, in free variation.

The other aspect of the problem presented by this plural type is the vowel melody [u a]. Although this is unrelated to any other vowel melody developed so far, we shall see shortly that it is characteristic of certain kinds of plurals with human referents, like all the participles [CVVCVC].

4.2 Nouns [CVCVVC]: Other Plural Types

Although, as we saw in section 2.3, most feminine nouns [CVCVVC] have trisyllabic plural stems, as do a few masculines, nevertheless most masculine nouns of this type form their plurals rather differently. There are two main lexical types. In the first, a basic distinction is made between human and nonhuman referents, with about three-fourths of the former taking the broken plurals in (43a) and a large majority of the latter taking those in (43b) (many of the remainder exceptionally have the same plural pattern as the feminine nouns in (22)).

(43)	a.	Human		
		waziir	wuzaraa?	'vizier'
		?amiir	?umaraa?	'commander'

	baxiil	buxalaa?	'stingy'
	hakiim	hukamaa?	'wise'
b.	Nonhuman		
	janaab	?ajnibat	'wing'
	himaar	?ahmirat	'ass'
	ʕamuud	?aʕmidat	'pillar'
	qadiib	?aqdibat	'branch'

The plural forms in (43) all have a feminine suffix: *aa?* in the human nouns and *at* in the nonhuman ones.

Let us first consider the vowel melodies associated with these broken plural types. The melody [u a] is characteristic of human broken plurals, both of these nouns and the participles discussed in the preceding section. It is an obvious virtue of this analysis that we can isolate this melody, apart from other aspects of the plural forms, as a human plural morpheme on an autosegmental tier. The other, nonhuman melody [a i] can be identified with the vocalism of the trisyllabic plural stems given in (5). So neither melody actually represents a morpheme not independently needed.

The treatment of the prosodic template of these forms also does not present any truly new difficulties. We can, in fact, consider the stem template of the broken plural to be identical to that of the singular [CVCVVC], subject only to suffixation of one of the two feminine endings. Two rules that have already been motivated then apply. The first, discussed in section 2.1, shortens stem-final vowels before feminine suffixes in the plural. It is applicable in some quadriliteral plurals as well as the forms in (43):

$$(44)\quad V \rightarrow \emptyset \;/\; V \_\_ C\,]_{+\,\text{Feminine Plural}}\,]$$

A second rule, which is needed independently for the broken plurals of section 2.4, takes underlying /CaCVC/ to /?aCCVC/ by metathesis and insertion of a glottal stop. This rule will apply in (43b) to yield the correct plural forms.

The other major plural type for [CVCVVC] nouns is illustrated in (45):

(45)	kitaab	kutub	'book'
	sariir	surur	'throne'
	safiinat	sufun	'ship'

Clearly we can identify the [u] plural melody of this pattern with that of

[CVC(V)C] nouns in (26b) as well as that of the color and defect adjectives. But the prosodic template of the plural is rather problematic, since no independently motivated rule will account for the shortening of the vowel in the second syllable. We might formulate such a rule nevertheless, or we might suppose that the feminine suffix has been truncated in these forms, but neither alternative is particularly compelling. It may be that this plural type, like those below in 4.4, represents a case in which a plural template simply replaces the singular one.

4.3 Feminine [CVCC]

Nouns of this type have two basic modes of plural formation, largely under lexical government. One, a complication of the feminine sound plural, is applicable regardless of the stem vocalism. The other, a broken plural form, is confined chiefly to those nouns with a high stem vowel in the singular. The special property of [CVCC] feminine nouns is that their plurals retain the vocalic melody of the singular, unlike any other pattern discussed thus far.

The sound plural suffix *aat*, when applied to this class, induces insertion of a vowel into the stem-final cluster:

(46)	a.	?ard	?aradaat	'earth'
		jafnat	jafanaat	'dish'
	b.	kisrat	kisiraat/kisaraat	'fragment'
		sidrat	sidiraat/sidaraat	'lotus tree'
	c.	ǧurfat	ǧurufat/ǧurafat	'upper chamber'
		ðulmat	ðulumaat/ðulamaat	'darkness'

As is apparent from (46), this inserted vowel can be either a copy of the stem vowel or *a*. It is unclear whether this variation was free or dialectal in Classical Arabic (in the contemporary language *a* has prevailed). The insertion itself is also variable, at least with the forms in (46b) and (46c).

Clearly a rule like (47) is needed to account for these facts:

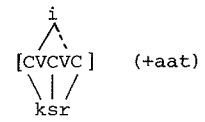
$$(47)\quad \emptyset \rightarrow V \;/\; [\,CVC\_\_C\,] \;/\; \text{Feminine Plural}$$

Rule (47) is systematically suppressed with II-weak roots (*jawzat*, *jawzaat* 'nut') and biliteral roots, which have gemination of the second radical (*šaddat*, *šaddaat* 'charge').[11] These factors should ultimately be incorpo-

rated into the environment of the rule.

There are at this point two options. In one case the inserted vowel is bound directly to *a*, yielding forms like *kisaraat*. In the other case, where the inserted element is unspecified on the melodic tier, the stem vocalism spreads by the operation of the association conventions to this new V position. This is illustrated in (48):

(48)



It is obviously unnecessary to stipulate that the inserted vowel copies the stem vocalism, since that property can be derived from the prosodic model.

The other type of plural formation, which predominates with [CVCC] feminines with characteristic vowel *u* and *i*, involves insertion of *a* into the stem-final cluster, but without the sound plural suffix:

(49)	a.	rukbat	rukab	'knee'
		ʔummat	ʔumam	'nation'
		kuurat	kuwar	'district'
	b.	qitʕat	qitaʕ	'piece'
		limmat	limam	'lock of hair'
		siirat	siyar	'mode of walking'

These forms are subject to insertion of a V bound to *a* in the plural, and nothing else. This rule is apparently distinct from (47), since it is not variable, it lacks the possibility of inserting an unspecified V, and it can (unlike (47)) apply to II-weak and biliteral roots.

4.4 Other Plural Types

There is quite a large number of broken plural patterns that have not been treated in this study, perhaps as many as fifty. The great majority of these are of extremely low frequency, occurring with no more than twenty different words, and then usually as one of several options. There are, however, some patterns of somewhat higher frequency that merit at least brief notice. A few are given in (50):

(50)	a.	fals	ʔaflus	'copper coin'
		wajh	ʔawjuh	'face'
		ʕanaaq	ʔaʕnuq	'female kid'
		yamiin	ʔaymun	'right hand'
	b.	waral	wirlaan	'lizard'
		jurað	jirðaan	'field-rat'
		ǧulaam	ǧilmaan	'boy'
	c.	ʕabd	ʕubdaan	'slave'
		balad	buldaan	'town'
		xaliil	xullaan	'friend'

These data are not unanalyzable. First, it is reasonable to suppose that the plural pattern in (50a) has the underlying template [CVCVC], subject to metathesis, with a melody [a u]. Second, the grammar should also note that the patterns in (50b,c) differ only in the stem melody or the plural, and in fact [u] and [i] are used almost interchangeably here.

What is absent, however, is a significant connection between the form of the singular and the form of the plural. In words like these, singular and plural apparently share only the same root, with neither the vowel melody nor the prosodic template carried over in any form to the plural. This feature of retaining only the root in a morphological relationship is characteristic of Arabic derivational processes (McCarthy 1979a, 1981). It is met with in broken plural formation only rarely, as in these minor patterns.

5. CONCLUSION

This analysis has provided an account of all major properties of Classical Arabic broken plural formation in terms of the prosodic theory of morphology. The major features of the analysis include a unified formal statement of the several broken plural patterns described in section 2 and a recognition in the grammar of the close connection between broken plural and diminutive formation. Other aspects of importance are the use of melodic levels to characterize regularities in weak root allomorphy and distribution of broken plural vocalism. Finally, various minor plural patterns involve reasonable extensions of the formal apparatus needed for more widespread plural types.

NOTES

I am indebted to Nick Clements, Morris Halle, and Alan Prince for their assistance at various stages in the development of this work. A preliminary version of some of this material appears in McCarthy (1979a).

The transcription system used here has its usual values except for the following. *ʕ* and *h* are the voiced and voiceless pharyngeal glides, respectively. *j* is the voiced alveopalatal affricate and *ð* is the voiced interdental spirant. A subscripted dot in *ṭ*, *ḍ*, *ṣ*, and *ðˑ* indicates pharyngealization, often known as emphasis. Long vowels are analyzed as bimoraic.

1. Strictly speaking, the units *a* and *ktb* in representations like (1) are not segments, but archisegments undefined for the features [segmental] and [syllabic]. For convenience, however, these archisegmental feature bundles will be notated as if they were fully defined segments.

2. Sound plurals are formed by suffixing nominative *uuna* or genitive/accusative *iina* in the masculine and *aat* plus case desinence in the feminine. (These suffixes are analyzed prosodically in McCarthy (1979a).)

3. The position I take here may appear to be inconsistent -- how, one may ask, can a rule be lexical or diacritically governed yet also productive and applying to a vast majority of the possible cases? This alleged inconsistency follows only from entirely unwarranted and unsupported assumptions about what characterizes a class of rules called minor. Clearly productivity is orthogonal to lexical government, if only because productivity is scalar (Aronoff 1976) and lexical government is binary -- yes or no. And statistical preponderance, although a useful tool, cannot be an absolute measure, as it is too sensitive to accidental frequency effects (as in the strong verbs in English).

4. Sporadic forms are inconsistent with this latter property of the plural template, like *muftiṛ*, *mafaaṭiir* 'one who breaks the fast', *ʔiʕṣaar*, *ʔaðˑaasiṛ* 'dust-storm'.

5. Root-initial *w* is subject to a special rule of dissimilation to *ʔ* in the broken plural pattern exemplified in (15): *waasilat*, *ʔawaasil* 'joining'.

6. Possibly as an accident of such a small category, the application of Minor Association (21a) is restricted to [CVVCVVC] singular nouns with [i a] vocalism. A variant of *w*-insertion attaches *y* to the free position in a few nouns of this type: *diibaax*, *dayaabiix* 'brocade' (also *dabaabiix*).

7. Roots whose first or second radical is *y* do not occur with the [i a] plural melody, presumably to avoid *yi* and *iy* sequences.

8. For reasons that I do not fully understand, doubly-weak roots -- those II-*w* and III-*w* or *y* -- have identical broken plural forms for [CVVCVC] and [CVCVVC] singulars: *zaawiyat*, *zawaayaa* 'corner'; *hawiiyat*, *hawaayaa* 'intestine'. A straightforward analysis along the lines in (36) accounts for the latter but not for the former without some new stipulation.

9. *nafs* is a feminine noun which exceptionally lacks the *at* suffix of the feminine. This exceptionality is lost under derivation, as in the diminutive.

10. A few [CVVCVC] active participles form plurals with the pattern *CaCaC+at*, a minor type. III-weak roots inexplicably fail to form the broken plural in (40), instead showing up as, for example, *quḍaat* from *qaaḍii* 'judge. This is apparently identical to the other human plural pattern below in (33a), but with the feminine suffix *at* rather than *aaʔ*.

11. The biliteral analysis of these so-called geminate roots is developed and supported in McCarthy (1981b).

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