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Classical Arabic Apophony

0. Introduction

The purpose of this paper is twofold. On the one hand, a cohesive account is provided of the economy of vowel alternations within the verbal system of Classical Arabic (henceforth CA). On the other hand, we intend the analysis offered to stand as evidence for the associated underlying assumptions.

The analytical issues we address can be summed up as follows. The verbal system of CA comprises several "conjugations". Within each conjugation a double dichotomy opposes Voice and Aspect, thus yielding four forms, an Active and a Passive Perfective, and an Active and a Passive Imperfective. The vocalization patterns of Form I Actives are reputed to be unpredictable. Accordingly, they are construed as reflecting lexical properties of individual verbs. All other verbal forms, by contrast display regular vocalization. It is usually assumed, following McCarthy (1979, 1981) that the regularity of the forms of the second group is to be credited to four underlying melodies characteristic, not of individual verbs, but of the relevant Voice and Aspect categories, themselves.

Our position will be that no such dichotomy obtains. Rather, one and only one unified system controls all aspects of vocalization in the CA verbal system. Moreover, we argue that the "regular" melodies have no lexical status. They are derived from one single underlying basic melody, /a/. In effect, we make a case for a genuine apophonic system.

The analysis put forth in this paper developed as an unexpected consequence of an attempt to gain insight into the verbal morphology of the language (Guerssel & Lowenstamm, in preparation). Accordingly, the first section of this paper recapitulates the essentials of that morphological analysis. The second section is a detailed discussion of the facts of apophony. In section three we propose a version of the apophonic relations at work in CA. In section four, that version is shown to account for the entirety of the verbal forms of the system. Section five is a precise statement of the highly reduced role of the lexicon in the economy of CA apophony.

impf. C₁ en syll. dériv.: 5.30 !

13

1. The Canonical Pattern of Verbal Derivation

This section provides a synopsis of the basic ingredients of the system of morphological derivation provided in Guerssel and Lowenstamm (in preparation) for the derived verbal patterns of Classical Arabic. It is not our intention to motivate the approach advocated. We merely introduce the bare essentials of that approach, that we believe are necessary for a proper understanding of the central issues pertaining to the vocalism of Classical Arabic that are addressed later.

The objective of the morphological analysis to be sketched out in this section is to provide an answer to the following question: Why does Classical Arabic display all and only the verbal forms it does? We approach this question by tracing all verbal forms back to one single template. Our answer to the question posed is as follows. The set of verbal forms of Classical Arabic is the set of derivational possibilities resulting from the concatenative and nonconcatenative resources of the language, operating within the limitations of that one template.

The following table is an illustration of the first ten derivational categories of the active perfective paradigme of a Classical Arabic triliteral root, where the root utilized is lbs "wear".[1]

(1)   Active Perfective

I.	labis
II.	labbas
III.	laabas
IV.	albas
V.	talabbas
VI.	talaabas
VII.	nlabas
VIII.	ltabas
IX.	lbasas

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[1] As is well known, the root expresses a basic meaning, and each Form supplies some modification of that meaning. Form I is somewhat unmarked, Form II is a causative or an intensive, Form III is typically a reciprocal, Form VII an inchoative, and so on. It should also be noted that in addition to the ten forms given in (1), there are five additional forms, traditionally referred to as "rare forms". For the sake of brevity, such forms have not been included. The analysis to be proposed is applicable to such forms mutatis mutandis.

X.   stalbas

In what follows, we show that at the root of the above set of derived verbs is a single template. The template in question appears in (2).

(2)   C V [DS C V] C V C V

Two observations are in order. The template consists exclusively of an alternating sequence of C's and V's. The reader is referred to Kaye, Lowenstamm and Vergnaud (1991) for a justification of this view of the syllable structure of Arabic. We merely note that in such a framework, configurations known as a light open syllable, a closed syllable, an open syllable containing a long vowel, and a geminate consonant, are represented as in (3).

(3) a. open light   b. closed   c. long vowel   d. geminate

```
     t                    t    k           t                     t         k
     |                    |    |           |                     |        /\
     C  V                 C  V C V          C  V C  V             C  V C  V C  V
        |                    |   |             \ /                   |         |
        a                    a   ø             a                    a         i

     [ta]                 [tak]              [taa]                 [takki]
```
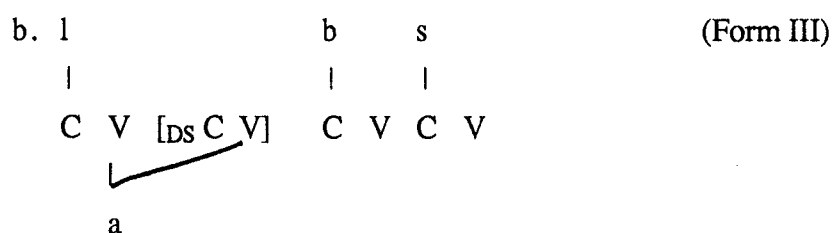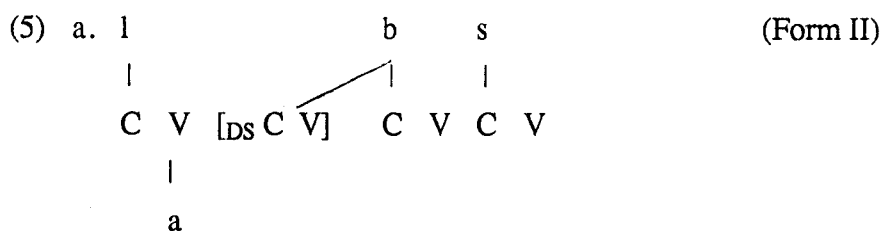
The second observation concerns the status of the syllable identified as [DS C V] (derivational syllable). That position is the seat of all operations of a nonconcatenative nature. To see this, consider the association of a triliteral root like lbs 'wear' with the template in (2).

(4) l   b   s
     | | |
     C V [DS C V] C V C V
        |
        a

Identification of DS by segmental material amounts to derivation. Thus, given (4), exactly two options are available: (i) The medial root consonant identifies DS (strictly speaking C of DS), and (ii) The vowel identifies DS (strictly speaking V of DS). These operations yield the following

3

structures, that correspond respectively to the output of Forms II and III, that is <u>labbas</u> and <u>laabas</u>.[2]

(5) a. l   b   s   (Form II)
          | ____/| |
          C V [DS C V]   C V C V
          |
          a

    b. l   b   s   (Form III)
          | | |
          C V [DS C V]   C V C V
          |____/
          a

Besides C-spread, as in (5a), and V-spread, as in (5b), there is yet a third potential derivation. The root may directly identify DS. Strictly speaking, the first radical consonant identifies the consonantal position of DS, yielding the output corresponding to Form IV, namely <u>albas</u>, as indicated in (6).

(6)   l   b   s   (Form IV)
                     | | |
          C V [DS C V]   C V C V
          |
          a
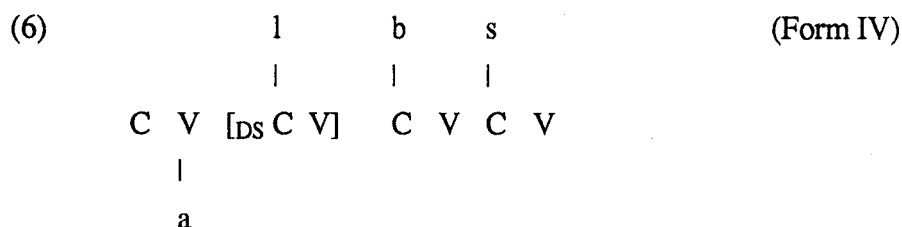
Although there are no particular morphemes signaling particular derived patterns, we take each of the three operations to act as the morphological head in each derived structure. That is, the head in (5a) is to be understood as the C-spread operation, in (5b) it is the V-spread operation, and in (6) it is the identification of DS by the root.

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[2]We assume for the moment that the vowel melody consists basically of the vowel [a], which is associated with the first vocalic position. Although not indicated in (5), we assume that the vowel [a] spreads eventually to the penultimate vowel of the template, for purely phonological reasons. For details on spreading, see Guerssel and Lowenstamm (in preparation).

Given the template in (2) there is a fourth possible derivational pattern, one where the DS is simply not identified. We claim that that is the source of Form I verbs. The input to Form I is thus the structure in (4). The immediate question that arises is that of the headedness of such forms, given that the derivational syllable is not identified. Before answering this question, it is worth noting that Form I triliteral verbs exhibit a property that sets them apart from all the other conjugation Forms. They exhibit a thematic vowel in the penultimate vowel of the template, the quality of which is an expression of verbal diathesis. Some examples appear in (7).

(7)   root   derived verb

a. kbr   kabur   'to be big'
    jsm   jasum   'to be huge'
    qrb   qarub   'to be near'
    lbq   labuq   'to be slick'

b. ktb   katab   'to write'
    qtl   qatal   'to kill'
    skr   sakar   'to lock'
    mzj   mazaj   'to mix'

c. lbs   labis   'to wear'
    slm   salim   'to be secure'
    rkb   rakib   'to ride'
    lhf   lahif   'to sigh'

In (7b) are verbs whose thematic vowel [u] expresses stativity. Verbs that exhibit the vowel [a] are typically pure agentives (involving affected objects), and those exhibiting [i] are generally considered to be "middle agentives", to use Fleisch's terminology, where it is the subject that is affected. Now if we assume that the thematic vowel acts as the head in each verbal structure, then it is no accident that the nonidentification of DS, makes it possible for the thematic vowel of the verb to surface (cf. Guerssel and Lowenstamm (in preparation) for fuller discussion). The structure of a Form I verb is thus as in (8). For the sake of exposition, the structure in (8) is a composite structure consisting of three roots corresponding to the root types in (7). Each of the three thematic vowels in the penultimate syllable is associated with a particular root type.

(8)

```
k                       b    r        [kabur]        (Form I)
|                       |    |
C  V  [DS C  V]    C    V    C    V
   |                         |
   a                         u
```

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k                       t    b        [katab]        (Form I)
|                       |    |
C  V  [DS C  V]    C    V    C    V
   |                         |
   a                         a
```

```
s                       l    m        [salim]        (Form I)
|                       |    |
C  V  [DS C  V]    C    V    C    V
   |                         |
   a                        {u}
                            {a}
                            {i}
```

It should be noted here that the derivational syllable is not identified, precisely because the head of the structure is the thematic vowel. The base form of the patterns called Forms I, II, III, and IV is the template in (2), to which a head is assigned. The head may be in the form of C-spread, V-spread, the identification of DS by the root, or in the form of the thematic vowel when DS is not identified. The following hypothetical strings will thus be ruled out as possible derived verbs in Classical Arabic, for the simple reason that they involve a single base with more than one.

(9) a. *labbis
     b. *laabis
     c. *albis
     d. *lababas
     e. *lababis

In (9a) the DS is identified by C-spread and the thematic vowel is present. Similarly (9b) involves both V-spread and the thematic vowel. In (9c) DS is identified by the root and the thematic vowel is also present. (9d) is illformed because the derivational position is identified by both the consonant and the vowel. Finally, in (9e) C-spread and V-spread have taken place, and the thematic vowel is also present. The forms in (8) are indeed not attested. We attribute their illfortmedness to the fact that a single base may not be associated with more than one head.

So far, the derived patterns we have examined involve a triliteral root and a given template. In each case there are as many root consonants as there are consonantal positions in the template. An immediate question that arises is what happens when there are fewer root consonants than consonantal positions in the template. Such a situation is obtained when a root consists of only two consonants. One such root is ms 'to touch'. Form I of this root is as follows.

(10)   m   s   [masas]   (Form I)
          | /\
          C V [DS C V]   C   V C V
          | |
   a   {a}
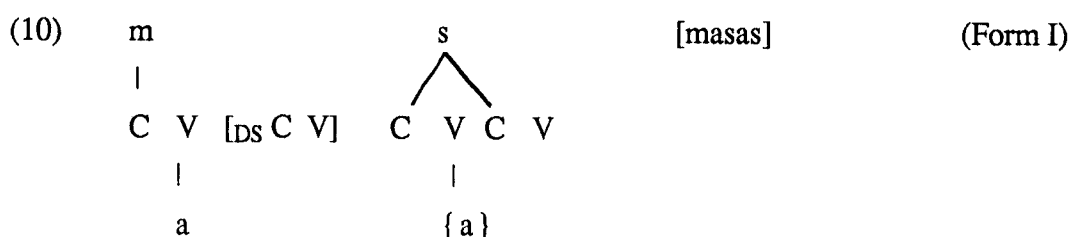
What (10) shows is that all the nonderivational C's of the template must be identified. If this were not the case then there would be no way of explaining why the final root consonant identifies two C-positions. We therefore conclude that all the root consonants of a template must be identified, where a root consonant is defined as a consonant position that is not derivational in nature.

We now turn to another facet of derivation, namely affixation. Affixation involves the prefixation to the basic template of an affixal position, [Aff C V], as shown in (11).

(11) [Aff C V] C V [C V] C V C V

Activating [Aff C V] does not amount to the construction of a complex base consisting of the binyan together with the affixal position. Rather, the affixal position is an integral part of the template. The structure in (11) is thus a single base. Prefixation, just like the operations described earlier, involves the assignment of a morphological head to the base. Thus, the derivation of the inchoative Form VII, exemplified with the root ksr 'break', is as follows.

(12)   n   k   s   r
       | | | |
    [Aff C V] C   V [C V] C _V C   V   [nkasar]
               |_ _ _ _ _ - - - ´
            a
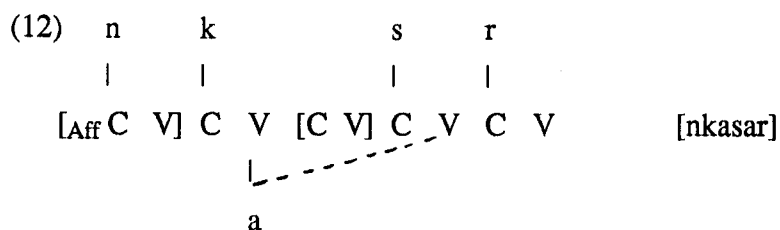
The prefix n̲, associated with the affixal position, acts as the head of the derived structure. Since the input represented in (11) is a single base, any additional operation, as for instance consonantal spreading onto the derivational syllable, will lead to illformedness. This is a nontrivial result, as students of Classical Arabic have long wondered about the reason for the ungrammaticality of a form like *nkassar. Indeed such a form would be viable from a semantic point of view. That is, since kasar 'he broke' has the corresponding intensive kassar 'he shattered', there is no reason why nkasar 'it broke' would not have the intensive counterpart *nkassar, i.e. 'it shattered'. But as noted, *nkassar is illformed. There is a simple explanation for this illformedness: *nkassar involves a single base with two morphological heads.

The affixal position in (11) may also be identified by the root. Such identification yields Form IX, as shown below with the root swd 'become black'

(13)   s   w   d   (Form IX)
       | | / \
    [Aff C V] C   V [C V] C _V_ C   V   [swadad]   'to become black'
               |_ _ _ _ _ - - - ´
            a
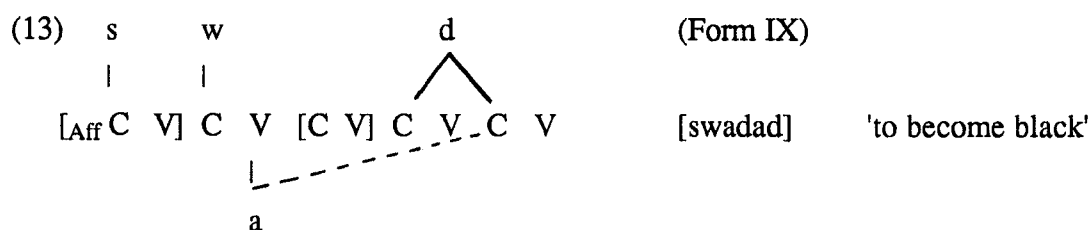
Inasmuch as the root serves as the head of the construction, the strategy involved here is nothing but the analog of the derived pattern yielding Form IV, a form that is illustrated in (6). Again we see, as in (10), that the final root consonant identifies two C-positions, for the reason that the nonderivational positions of the template must be identified.

In Guerssel and Lowenstamm (in preparation), it is argued that the template in (11) may be reflexive or nonreflexive. In all the examples examined so far, the base is nonreflexive. What imparts the reflexive reading to the base is the morpheme [t]. This morpheme is associated with the first post-affixal consonant of the base. The reflexive analog of the base in (11) is thus as follows.

8

(14)   [Aff C V] C   V [C ˈV] C   V   C   V

                | |

                | a   ---------------------------- vowel melody tier

                t   ---------------------------------- reflexive tier

The morpheme [t] is not a derivational affix. It is to be understood as a feature of the base, and simply marks that base as [+reflexive]. There are two derived reflexives in Classical Arabic, a simple reflexive, and a causative reflexive. In the simple reflexive, the root directly identifies the affixal position. In the causative reflexive, the affixal position is identified by the causative marker [s]. The two reflexives are Forms VIII and X, as illustrated below with the root nhd 'rise'.

(15)   a. n   h   d   (Form VII)

            | | |

        [Aff C V] C   V [C V] C   V   C   V   [ntahad]   'to rise'

            | |

            | a

            t

        b. s   n   h   d   (Form X)

            | | | |

        [Aff C V] C   V [C V] C   V   C   V   [stanhad]   'to awaken'

            | |

            | a

            t

In (15a) the internal DS is not identified, exactly as expected. In this respect, (15a) is analogous to the forms in (12) and (13) which are also based on the template in (11). In all three cases, the internal derivational syllable is not identified. There is no identification of that syllable because it is not the locus of morphological derivation. The identification of the prefixal position is what stands for morphological derivation. A question now arises with respect to the structure in (15b). Here the internal derivational syllable is identified in spite of the fact that the head of the construction is the causative reflexive morpheme [s]. Why should this be the case? A comparison of (15b), where the derivational syllable is identified, and (12) and (13), where the derivational syllable is not identified, reveals an important difference between the two types of structures. Now if we use the term Root-C as an appellation for those consonant slots in the template that never serve as the

9

site of morphological heads, we see that in one case, namely (12) and (13), all the root consonants may be accommodated by the available Root-C's of the template. In (15b) this is not possible. There are three root consonants, but only two Root-C's. Hence, the first root consonant is associated with the derivational syllable. But since the head of the structure is the prefix phonetically realized as [s], the internal derivational syllable does not act as a head. These observations may be recorded as follows.

(16)   a. All Root-C's must be identified.
   b. All root consonants must be realized.

We have already seen that (16a) is instrumental in the derivation of the form types in (10) and (13). In each case, the last root consonant spreads onto two consonantal positions in order to satisfy (16a). Likewise, (16b) is instrumental in accounting for a structure like that exhibited in (15b). When not acting as the morphological head of a structure, the internal derivational syllable is identified by a root consonant only when there are not enough Root-C's to accommodate all the consonants of the root.[3]

Except for Forms IV and V, we have so far shown how the derivation of all the forms in (1) is obtained. In Guerssel and Lowenstamm (in preparation) it is argued that the verbal derivational morphology of Classical Arabic exhibits cases of purely concatenative morphology as well. Forms IV and V (e.g. takattab and takaatab, based on the root ktb) are examples of such a process. They involve straightforward, extra-templatic concatenation of a prefix and a base. The base to which the prefix ta attaches are the derived Forms II and III, as for example kattab and kaatab. These examples consequently require no special comment.

Finally, a word should be said about the location of inflectional prefixes. Inflectional prefixes are found only in the imperfective aspect. They are t (second person), y (third person), n (first person plural). There is no overt morpheme for the first person singular. In Guerssel and Lowenstamm (in preparation), it is shown that these prefixes appear within the template, provided the root consonants are also accommodated by the template, otherwise they appear outside the template. There are exactly three environments in which an inflection prefix appears: (i) within the

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[3]In spite of (16) a question still needs to be answered. What exactly is the mechanism that leads to an unambiguous association of root consonants to consonantal positions in the template? Such a mechanism is provided in Guerssel and Lowenstamm (in preparation). Its introduction would lead us too far afield. For this reason, we will simply assume the correctness of the structures given in the text. At any rate, templatic association of root consonants has no consequence for the main topic of this paper, namely the vowel alternations relating different conjugation types.

basic template given in (2), (ii) in the affixal position of the template, and (iii) outside the template. The environment in which the inflectional prefix appears is determined by the particular derivational pattern with which it is associated. The first case is instantiated by Form I. Using the third person marker y as an illustration together with the root ktb 'write', the imperfective of Form I is represented as follows.

(16) y   k   t   b
      | | \   \
      C   V [DS C V]   C   V C   V
          |
          a
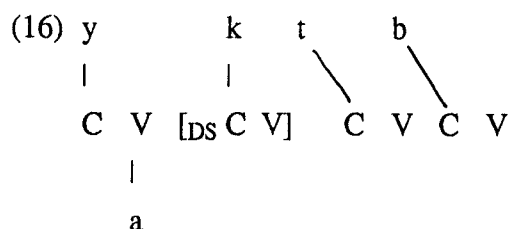
In Forms II, III, and IV, where none of the consonantal slots are available, the prefix appears in the only position available, namely the position in the templatic prefix, as in Form II for instance.

(17) y   k   t   b
      | | /\ |
      [Aff C V] C   V [C V] C   V C   V
                  |
                  a
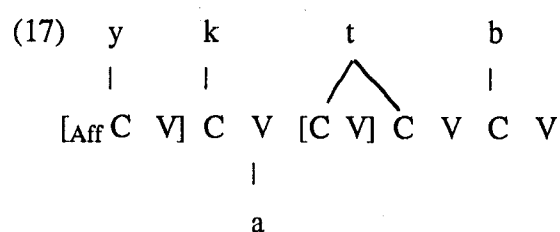
In case the prefixal position is the site of the head of a morphological structure, as in Forms VII through X, then the prefix lies outside the template, as in Form VII given below.

(18) y   n   k   t   b
      | | | | |
      C V   [Aff C V] C   V [C V] C   V C   V
                        |
                        a
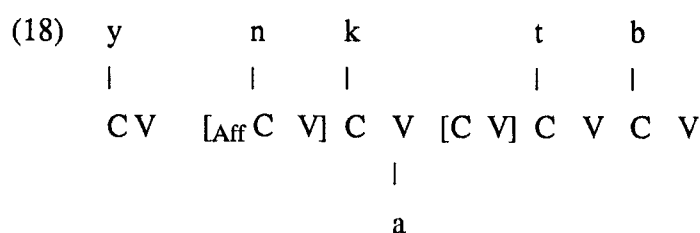
It goes without saying that in Forms V and VI, which involve pure concatenation, the inflectional prefix will lie outside the template, since these forms involve prefixes that are outside the template. The relevance of the location of the inflectional prefixes will become crucial when we address the issues concerning the apophonic system of Classic Arabic.

We are now in a position to address the issue of the apophonic system of Classical Arabic, namely the vocalic alternations that relate the two forms of aspect (perfective and imperfective), the two forms of voice (active and passive), as well as the combination of aspect and voice, for all conjugation types. The full set of a triconsonantal root appearing in all ten conjugations, where both apsect and voice are represented appears in (19).[4]

(19) Triliteral roots

	Perfective		Imperfective	
	Active	Passive	Active	Passive
I	katab	kutib	aktub	uktab
	darab	durib	adrib	udrab
	labis	lubis	albas	ulbas
	kabur	___	akbur	___
II	kattab	kuttib	ukattib	ukattab
III	kaatab	kuutib	ukaatib	ukaatab
IV	?aktab	?uktib	u?aktib	u?aktab
V	takattab	tukuttib	atakattab	utakattab
VI	takaatab	tukuutib	atakaatab	utakaatab
VII	nkatab	nkutib	ankatib	unkatab
VIII	ktatab	ktutib	aktatib	uktatab
IX	ktabab	___	aktabib	___
X	staktab	stuktib	astaktib	ustaktab

A number of observations concerning the above sets are in order. Comparing the perfective active and the imperfective active we notice that, except for Form I, the vowel melody is [a] in the perfective, but [u, i] in the passive. In Form I, the vocalism of the active depends on the root, as already noted (cf. (8) and relevant discussion), but in the passive it is uniquely [u, i] as in the rest of the forms.

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[4]The glottal stop in Form IV is epenthetic. An empty slot signifies a verb type that may not be passivized, such as a stative verb.

Comparing the perfective active and the imperfective active, we again see that Form I has a special status. Although the first vowel is uniquely [a], the second vowel may be [a], [u] or [i]. And furthermore, there are two root types that exhibit the vowel [u]. In one case the [u] is matched by [a] in the perfective, in the other it is matched by [u]. In the rest of the forms, we see that the vowel melody of the imperfective active is [u, a, i], as in Forms II, III, and IV. In Forms V and VI it is [a], and in the rest of the forms it is [a, i]. The question as to why some of the vowels are instantiated more than once must be raised. This question arises with the imperfective passives as well. There we see that the vowel melody is uniquely [u, a]. But in some cases the second vowel is instantiated more than once.

We are now in a position to procced and answer the questions raised in the foregoing, with the ultimate goal of providing a coherent analysis of the vocal system of the verbal derivational morphology of Classical Arabic.

2.   The apophonic classes of CA

In this introductory section, we will go through the essentials of the evidence, indicating, as we proceed, the issues we intend to confront, and, for the sake of a more flowing presentation, progressively filling in blanks in the verbal chart.[1]

2.1 One system or two systems ?

We start our discussion with the standard initial observations regarding vocalization. In Form I, Active forms, both Perfective and Imperfective, the full range of options i, u, a, seems to be available for the vocalization of C_2. This is not to say that the choice of vowel is free. Rather, each verb idiosyncratically requires a certain vowel, much as if the pairing of a particular root and a particular vowel, say √lbs and i for the Perfective (labis), a for the Imperfective (yalbas), were specified in the lexicon. This can be seen in (20).
(20)

	Perfective		Imperfective	
	Active	Passive	Active	Passive
I	labis		ya+lbas	
	katab		ya+ktub	
	Darab		ya+Drib	
	kabur		ya+kbur	

The reader can verify that all of i, u, a (underscored) are possible vocalizations of C_2, either in the Perfective or the Imperfective. On the other hand, not all imaginable matches are realized. Just as an example, consider the class displaying u in both the Perfective and the Imperfective, exemplified by kabur/yakbur in (20). No corresponding class exists exhibiting i or a in both aspects.[2] As well, there is no class in which Perfective u would be matched by Imperfective i.

The fairly limited set of alternations in (20) whereby a given vowel in one aspect must be matched by a given vowel in the other aspect constitutes the apophonic system of CA, as evidenced in Form I.

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[1]   Each time new information is adduced, it appears in bold in the chart.

[2]   For sure, there is a handful of cases such as Hasiba/yaHsibu, na9ima/yan9imu, yabisa/yaybisu, etc. The exceptional status of these forms was recognized early on. Thus, Bohas & Guillaume report in their important contribution (Bohas & Guillaume, 1984), the position of 13th century Arabic scholar Ibn Ya9i:sʰ : verbs such as Hasiba/yaHsibu are rare exceptions; moreover, along with the forms just mentioned, they all evidence "regular" Imperfectives, as well: yaHsabu, yan9amu, yaybasu.

Such restricted, presumably lexical, freedom of vocalization does not extend beyond Form I. Indeed, from Form II on, all verbs are vocalized alike. Thus, the 2nd forms of labis, kabur are not *labbis, *kabbur. Rather, they fall under the uniform pattern $C_1 aC_2 C_2 aC_3$: labbas, kabbar, kattab, etc. Similarly, to take just another example, the inchoatives of the same verbs uniformly fall under Class VII pattern $nC_1 aC_2 aC_3$: nlabas (not *nlabis), nkabar (not *nkabur), nkatab, etc. Accordingly, from Form II on, one verb only appears in our charts.

(21)

	Perfective		Imperfective	
	Active	Passive	Active	Passive
I	labis			
	katab			
	Darab			
	kabur			
II	kattab			
III	ka:tab			
IV	?aktab			
V	takattab			
VI	taka:tab			
VII	nkatab			
VIII	ktatab			
IX	ktabab			
X	staktab			

Similarly, the corresponding Imperfectives all fall under uniform pattern $yuC_1 aC_2 C_2 iC_3$, in Form II, irrespective of which vowel accompanied C_2 in the Imperfective of Form I of the same verb, hence yuDarrib, yukattib, yulabbis, irrespective of yaDrib, yaktub, yalbas. In the same way, the inchoatives are all of type $yanC_1 aC_2 iC_3$, thus yankatib (not *yankatub), yanlabis (not *yanlabas), etc.

(22)

	Perfective		Imperfective	
	Active	Passive	Active	Passive
I	labis		ya+lbas	
	katab		ya+ktub	
	Darab		ya+Drib	
	kabur		ya+kbur	
II	kattab		yu+kattib	
III	ka:tab		yu+ka:tib	
IV	?aktab		yu+ktib	
V	takattab		ya+takattab	
VI	taka:tab		ya+taka:tab	
VII	nkatab		ya+nkatib	
VIII	ktatab		ya+ktatib	
IX	ktabab		ya+ktabib	
X	staktab		ya+staktib	

Not only, is this range of options limited to Form I, it is, in fact, restricted to the **Actives** of Form I. Indeed, the Passives, Perfective as well as Imperfective, of Form I are all alike: they display a uniform melody, [u - i] in the Perfective and [u - a] in the Imperfective, regardless of the corresponding vowels in the matching Active forms. This is shown in (23).

(23)

	Perfective		Imperfective	
	Active	Passive	Active	Passive
I	labis	lubis	ya+lbas	yu+lbas
	katab	kutib	ya+ktub	yu+ktab
	Darab	Durib	ya+Drib	yu+Drab
	kabur		ya+kbur	
melodic status:	variable	[u-i]	variable	[u-a]

Moreover, whereas the variability in the vocalization of C_2 is restricted to Form I Actives, as we just saw, the predictability of Passive vocalization extends to the entirety of the conjugation. Accordingly, whereas *labbis is not the correct Form II equivalent of labis, lubbis, but also lu:bis, nlubis, ?ulbis, etc. are melodically similar to lubis. This is true of Imperfective Passives, too: yuka:tab, yuktab, yunkatab, etc. are all melodically similar to Form I yulbas, yuDrab, etc.

(24)

	Perfective		Imperfective	
	Active	Passive	Active	Passive
I	labis	lubis	ya+lbas	yu+lbas
	katab	kutib	ya+ktub	yu+ktab
	Darab	Durib	ya+Drib	yu+Drab
	kabur		ya+kbur	
II	kattab	kuttib	yu+kattib	yu+kattab
III	ka:tab	ku:tib	yu+ka:tib	yu+ka:tab
IV	?aktab	?uktib	yu+ktib	yu+ktab
V	takattab	tukuttib	ya+takattab	yu+takattab
VI	taka:tab	tuku:tib	ya+taka:tab	yu+taka:tab
VII	nkatab	nkutib	ya+nkatib	yu+nkatab
VIII	ktatab	ktutib	ya+ktatib	yu+ktatab
IX	ktabab		ya+ktabib	yu+ktabab
X	staktab	stuktib	ya+staktib	yu+staktab

Thus, a double dichotomy seems to obtain. The first, horizontal one pits Form I against all others; the other, vertical dichotomy opposes the melodic rigidity of all Passives (including those of Form I) against the more varied Active forms.

In short, the alternations relating Form I Active forms are, at least in part, lexically controlled inasmuch as the identity of any

particular verb will determine what apophonic class it falls into. The rest of the alternations, because they bring all verbs under similar patterns, seem to owe nothing to the lexicon, as if the vowel changes were the mere phonetic vehicle of derivational operations relating morphological classes. Whether these two apparently distinct systems have anything in common is one of the most vexed issues in Semitic linguistics. Whether or not authors explicitly raise that particular problem, it hovers over every discussion of apophony. This is one of the issues we will address. We will argue that all alternations proceed from one and the same system. For the time being, we merely illustrate the problem with the two questions of (25) and a comment on a prerequisite to answering such questions:

(25)

i. Consider the i ~ a alternation holding of **labis** and its Imperfective, **yalbas**. Is the relationship of the same nature as that holding of a Form II Active Imperfective, say **yukattib** and its Passive **yakattab** ?

ii. Or, still confining ourselves to cases of vocalization of C_2, is the a ~ i alternation between **Darab** and its Imperfective **yaDrib** of the same nature as that between **kattab** and its Passive **kuttib** ?

Clearly a meaningful answer to such questions crucially presupposes taking a position on the two issues stated in (26).

(26)

i. are the members of the pairs of forms mentioned in (25) related, at all ? If so, are they related in the same way ? To what module of grammar does such a relationship pertain ? Phonology, derivational morphology ? Such questions are far from trivial, as one must ask what link there can possibly be between a relationship cross-aspectually relating two active forms (labis <——> yalbas) and that relating an Active and a Passive within the Imperfective system (yukattib <——> yukattab) ?

ii. what is the directionality of the putative processes relating the verbal forms under discussion ? Indeed, the first question, for instance, makes sense only in case either, a) **yalbas** is derived from **labis** AND **yukattab** is derived from **yukattib**, or b) **labis** is derived from **yalbas** AND **yukattib** is derived from **yukattab**.

We turn to our next question, another puzzle of Arabic morphophonemics.

2.2. The vocalization of Imperfective prefixes

A glance at Table (24) reveals that the Imperfective prefix is yu for all Passive forms, whereas it alternates between yu and ya in the Active. We are prepared to consider the two possibilities indicated in (27), below:

(27)

a. the vocalization of the Imperfective prefix is controlled by apophony.

b. the vocalization of the Imperfective prefix is lexical.

Under either alternative certain questions inescapably arise:

(28)

    i.   if the vocalization of the prefix is the result of apophony, why is it so remarkably stable in Passive forms ? If it is to be stable for any reason, why as yu, rather than, say, ya ? By contradistinction, the ya/yu alternation in Active forms is certainly suggestive of an apophonic effect at least in part of the paradigm. In that case what underlies the discrepancy between those prefixes that apophonize and those that do not ?

    ii. if Imperfective vocalization is lexical, /yu/ is probably the underlying representation of the Passive prefix, as it is always realized as [yu]; but, what is the underlying representation of the Active prefix ? /ya/ sometimes realized as [yu], sometimes as [ya] ? Or, alternatively /yu/ sometimes realized as [yu], sometimes as [ya] ? And, in either case, what controls the observed allomorphy ?

    While we are not in a position to answer any of these questions at this expository stage, we still want to indicate what our ultimate stance will be: we will argue that apophony controls all aspects of prefix vocalization.

2.3 Problematic arrangements of melodic elements

    The proposals of McCarthy (1979, 1981) to extend the framework of Autosegmental Phonology to the treatment of nonconcatenative morphological systems have met with considerable success, affording solutions to an impressive range of, sometimes age old problems. Somehow, though, vocalic melodies notoriously resist the same sort of elegant, stipulation free treatment as consonantal melodies. Consider, for instance the Active Imperfectives of Forms VII, VIII, IX, X displayed in (29).

(29)

VII	yankatib
VIII	yaktatib
IX	yaktab(i)b
X	yastaktib

The offending feature of such forms is the double occurence of a melodic element, a, at the left margin of the form in violation of well-motivated conventions of association. Such forms are all the more puzzling when one compares them with their Passive counterparts, (30).

(30)

VII	yunkatab
VIII	yuktatab
IX	yuktab(a)b
X	yustaktab

    This time, the melodies are perfectly well-behaved with a double occurence of a melodic element at the right margin of the domain of association, as predicted by the conventions. Short of crediting the

lawful arrangement of vowels in (30) to an accident, one would not want to argue that the association conventions are inoperative when it comes to vowels.

2.4 What has to be learned ?

It should be clear from what precedes that our intention is to give maximal credit to apophony for most of the major aspects of the vocalization of the verbal forms of CA. Ultimately, we will propose a fairly simple picture of a seemingly highly intricate and opaque surface system. Naturally, we will take on the burden of stating exactly what is the nature and amount of evidence necessary for the speaker to perform the task of projecting the apophonic grammar of CA. It will turn out that precious little has to be learned. Based on our results regarding CA apophony, we will put forth a universal hypothesis about the parameters of a viable apophonic system.

We now turn to an analysis of the first putative subsystem of apophony discussed above, viz. the lexically controlled correspondences between Form I Actives.

3. Form I Actives
3.1 Facts

Illustrative examples of the situation encountered with Form I appear in (31).

(31)

	Perfective	Imperfective
1.	labis	ya+lbas+u
2.	kabur	ya+kbur+u
3a.	katab	ya+ktub+u
3b.	Darab	ya+Drib+u

Within the system of Form I forms, the following sound correspondences solely affecting the vowel of the root medial consonant, obtain:

(32)
1. If i is the vowel of the middle radical in the Perfective Active, the Imperfective has a.
2. If u is the vowel of the middle radical in the Perfective Active, the Imperfective also has u.
3. If a is the vowel of the middle radical in the Perfective Active, the Imperfective has u or i.

The form of these statements does not reflect our position on the the actual directionality of the alternations. (33) would be an equally adequate description of the facts.

19

(33)

1. If <u>i</u> is the vowel of the middle radical in the Imperfective Active, the Perfective has <u>a</u>.

2. If <u>u</u> is the vowel of the middle radical in the Imperfective Active, the Perfective also has <u>u</u> or <u>a</u>.

3. If <u>a</u> is the vowel of the middle radical in the Imperfective Active, the Perfective has <u>i</u>.

These correspondences are summed up in table (34), along with matching examples.

(34)

	Perfective	Imperfective	
1.	i	a	lab<u>i</u>s˜ya+lb<u>a</u>s+u
2.	a	u	kat<u>a</u>b˜ya+kt<u>u</u>b+u
3.	a	i	D<u>a</u>rab˜ya+Dr<u>i</u>b+u
4.	u	u	kab<u>u</u>r˜ya+kb<u>u</u>r+u

For the sake of clarity, we give the non-attested classes of cross-aspectual correspondences in (35).[3]

(35)

	Perfective	Imperfective
	*u————————i	
	*u————————a	
	*i————————u	
	*i————————i	
	*a————————a	

The system of sound correspondences under discussion displays interesting characteristics which we now review under three headings: unnaturalness, opacity, polarity.

3.2 Unnaturalness

First, the sound correspondences in (34) do not easily fit into standard categories of phonological processes. Let us open a parenthesis to illustrate in roundabout fashion what we have in mind by means of a brief discussion of one type of example.

Consider the data in (36), Active forms of verbs from roots including a guttural in initial position (36a), medial position (36b), final position (36c), and a control set (36d) whose relevance will become clear shortly.

_____

3   This is not to say that verbs evidencing such alternations cannot occasionally be found. Indeed such verbs exist, e.g. watiqa ˜ yatiqu "to rely on", but in such limited number that they must be viewed as exceptions, not as representing classes.

(36)

a. √GC₂C₃

   √?kl   ?akal/ya?kul "eat
   √9md   9amad/ya9mid "support"

b. √C₁GC₃

   √s?l   sa?al/yas?al "ask"
   √nHr   naHar/yanHar "slaughter"

c. √C₁C₂G

   √qr?   qara?/yaqra? "read"
   √ql9   qala9/yaqla9 "rip"

d.   fariH/yafraH "rejoice"
                     ta9ib/yat9ab "get tired"

Verbs from guttural-initial roots allow the full range of options for Imperfective vocalization. Thus, ?akal/ya?kul patterns like katab-/yaktub, whereas 9amad/ya9mid patterns like Darab/yaDrib. On the other hand, if the root includes a guttural in second or third position (36b,c, resp.), a only, can appear in the Imperfective, hence: yanHar (not *yanHir, or yanHur) is the Imperfective of naHar, yaqla9 (not *yaqli9, or *yaqlu9) is the Imperfective of qala9. This a clear departure from the general pattern since, as we saw, Perfective a is regularly matched by a high vowel, i or u, as the case may be, in the Imperfective. While we do not wish to engage in a full discussion of these data, three things are clear: a) the conditions under which Imperfective a appears, are well defined in terms of the nature of the root, b) there is a possible phonetic rationale for the phenomenon in terms of a lowering imposed by a guttural on an adjacent vowel within the stem, c) there is a prosodic difference between the forms where this putative lowering is enforced and others where a high vowel is allowed to survive in the vicinity of a guttural, viz. lowering takes place if the preceding vocalic position is empty. This prosodic difference distinguishes the Perfectives of (36d), where a high vowel can be observed and the Imperfectives of (36b,c), where a must occur.

Clearly, these data bear the hallmark of a possible phonological phenomenon in the sense that a synchronic sound change occurs in systematic correlation with definable properties of the environment.

Consider, now, the vocalic change relating Darab and ya+Drib. One could suppose that in the characteristic prosodic environment of the Imperfective, ya+C₁ØC₂_C₃, a high vowel is a more suitable vocalic realization than a, hence a ——> i mapping underlying yaDrab into yaDrib. Under such a view, one would then expect that the vocalization of a verb already displaying a high vowel following C₂ will remain unaltered, viz. labis ——> *yalbis. Yet, of all possibilities, a, a low vowel, appears in that position. Worse yet, vocalic changes occur in the absence of any

concomitant modification of any other aspect of the form whatsoever, hence minimal pairs such as kattab/kuttib, or yukattib/yukattab. If these sound correspondences were to be construed as phonological rules, they would have to be viewed as context-free rules, the most unnatural kind of such processes under any version of phonological naturalness.

3.3 Opacity

Second, the facts at hand involve a fair measure of neutralization shown in (37). Since we are not, yet, in a position to assess directionality, we present the situation obtaining under both possibilities. In (37a), Perfective vocalization is represented as basic, whereas Imperfective vocalization is displayed as basic in (37b).

(37)

<pre>
                       a.   b.

Input: i   a   u   Input: u   i   a
Perfective | |\ | Imperfective |\ | |
                | | \ | | \ | |
                | | \ | | \ | |
Output: | | \| Output: | \| |
Imperfective   a   i   u   Perfective   u   a   i
</pre>

The reader will recall that neutralization stems from the fact that two a's appear in the set of Perfective forms, Darab and katab, and two u's in the set of Imperfective forms, yaktub and yakbur. As expected, the picture of neutralization varies depending on the assumed directionality. Thus, in one case a is the source of opacity, as in (37a), whereas u is, in the other case, represented in (37b). Along with these substantive differences, the level of opacity itself varies, too: the evidence leading to the retrieval of a in (37a), viz. [i] and [u], with [u] also expressing /u/, is more fuzzy than that leading to the identification of u in (37b), namely [u] and [a] with [a] expressing /i/. We do not wish to impose a priori limitations on the amount of opacity beyond which a system ceases to be viable. We merely assume that the learnability of a system, hence its diachronic stability, directly relates to its transparency. Thus, we do not rule out the possibility that a grammar can sustain a measure of opacity due to neutralization, possibly including absolute neutralization. We are equally unprejudiced w. respect to context-free rules. Yet, under the view just stated, the facts at hand seem to exemplify the most unfavorable situation, mutual neutralization of context-free processes. Everything being equal an analysis disentangling this intricate surface evidence would be more highly valued.

3.4 Partial Polarity

Consider pairs such as labis~yalbas and Darab~yaDrib. Whether one supposes that the Perfective, or the Imperfective vowel is basic, either version of directionality will include both a statement to the effect that i ---> a, and another statement to the effect that a ---> i. This can be seen more clearly in the chart below, (38), where under (38a) we

22

have represented the situation obtaining when the Imperfective melody is ablauted from the Perfective, whereas (38b) shows the opposite.[4]

(38)

	a.			b.	
Input:	labis	Darab	Input:	yaDrib	yalbas
Perfective				Imperfective		
	i>a	a>i		i>a	a>i
Output:			Output:		
Imperfective	yalbas	yaDrib	Perfective	Darab	labis

A few processes seemingly bringing about "polarity" on the surface have been reported. Although their number is very small and their status poorly understood, one might be tempted to invoke "polarity", here. We note, though, that the alleged polarity only partially characterizes the surface evidence. Indeed, u remains outside of such a relation. Thus, for lack of a better term, we call this characteristic relationship holding of i and a, to the exclusion of u, the "partial polarity" effect.

Derivational operations are essentially directional. When confronted with a set of facts such as (38), supposedly expressing a process of that type, we cannot expect it to bear its analysis on its sleeve, i.e. we cannot expect that the directionality of the process it signals will be readily readable off the facts. On the other hand, it is difficult to believe that if a —> i is the manifestation of a process unidirectionally relating A and B, a — >i obtains regardless of whether A —> B or B —-> A ! Our reluctance can only increase in the case at hand as not only would a —> i be the case regardless of directionality; rather a —> i **and** i —> a would have to be true in either case. Indeed, we want to suggest that partial polarity is not a possible property of a system supporting derivation.

We have 3 reasons to want to gain deeper insight into the underlying state of affairs which we discussed in order of increasing obnoxiousness: unnaturalness, excessive opacity and "partial polarity".

3.5 An alternative to Partial Polarity

Suppose for a moment that the conundrum represented in (37) results from the presence of a fourth element, responsible for input ambiguity. Let us call it x for the time being. There are four possibilities as to the place x could occupy in a system free of ambiguity. In (39a,b) we have represented the 2 possibilities corresponding to Perfective —> Imperfective directionality. In (40a,b) we have represented the 2 possibilities under the reverse directionality. For easier reference, we

---

[4] We leave out the subset of phenomena characteristic of roots including gutturals

have indicated the verb types involved to the right of each chart.

(39)   a.   b.

```
Input:   i    a    x   {u}      i    x    a    u1.Darab~yaDrib
Perf.    |    |    |    |        |    |    |    |2.katab~yaktub
         3    1    2   |        3    1    2    |3.labis~yalbas
         |    |    |    |        |    |    |    |4.kabur~yakbur
Output:  |    |    |    |        |    |    |    |
Imperf.  a    i    u   {u}      a    i    u    u
```

(40)   a.   b.

```
Input:  {u}   x    i    a      {x}   u    i    a1.Darab~yaDrib
Imperf.  |    |    |    |        |    |    |    |2.katab~yaktub
         4    2    1    3        4    2    1    33.labis~yalbas
         |    |    |    |        |    |    |    |4.kabur~yakbur
Output:  |    |    |    |        |    |    |    |
Perf.   {u}   a    a    i      {u}   a    a    i
```

Two things are clear. First, a sufficiently convincing case has to be made for the identity of x. On the other hand, granted the first point, there can be no doubt that a more favorable picture now obtains under any of the four above possibilities. A measure of ambiguity subsists inasmuch as two different input segments may apophonize into the same surface segment, but there is no longer any question as to what any given underlying segment apophonizes into.

Before choosing between any of (39a,b) and (40a,b) we want to point out that any such decision will have a double consequence.

One, it will commit us to the specific directionality embodied in each of these four hypotheses. Thus, choosing, say (39a) implies endorsing Perfective—>Imperfective directionality, whereas the choice of (40b) means opting for Imperfective ——> Perfective directionality, etc.

Two, it will lead to the identification of the verb type "carrying" x. Indeed, under (39) where the burden of ambiguity is laid on the the two types of "a-Perfective" verbs, either the fa9al~yaf9ul[5] verb (39a), or the fa9al~yaf9ilu verb (39b) will be singled out; whereas, under (40) where ambiguity is blamed on the existence of two "u-Imperfective" verbs, the yaf9ul~fa9al verb (40a), or the yaf9ul~fa9ul verb (40b) will be seen as the culprit. While several properties of the systems described in (39) and (40) would warrant comment, one feature of (39b) clearly recommends it over the other three possibilities: it is the only case not displaying the "partial polarity" effect. Indeed, under (39b), it is no longer the case that both a —> i and i —> a. For that reason, we choose to further explore the implications of (39b) and to disregard the alternatives.

As already pointed out, (39b) embodies two claims. We list them below in (41).

---

[5]   Occasionally, root √f9l is used to illustrate a verbal form, as in traditional Arabic grammar.

(41)

a. apophony maps the Perfective melody into that of the Imperfective.
b. Darab~yaDrib is the verb type "bearing" x, viz. Dar(x)ba~yaDrib.

Thus, **Darab** and **katab** with apparently identical vocalism differ, according to our claim, as follows: **katab** involves genuine a and manifests the a —> u apophonic relation, whereas **Darab** involves (x), manifesting, as such, the (x) —> i apophony.

Since the underlying difference between Darab and katab gets neutralized, we put forth our proposal regarding the identity of x: we propose that it is the null element ∅. That null element is identified by propagation from the vowel to its left moving rightward, thus bringing about the surface identity between **Darab** and **katab**, as shown below.[6]

(42)
<center>a.   b.</center>

```
      D        r   b                      k        t   b
     /          \   \                    /          \   \
  C V [ᴅₛC V] C V C V              C V [ᴅₛC V] C V C V
     \         /                       \         /
      a————> ∅                          a        a


  [Darab] < /Dar∅ba/                    [katab]
```
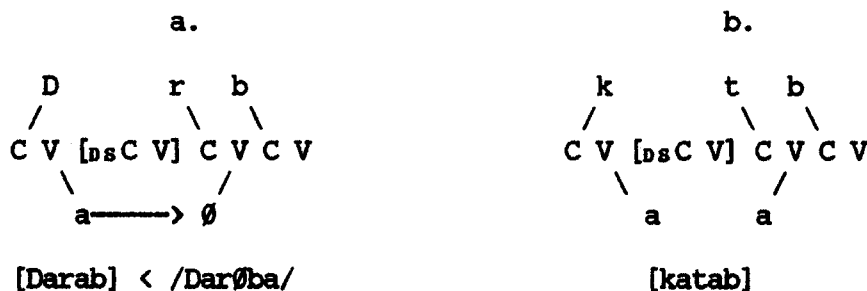
Thus, the following sound correspondences obtain:

(43)
<center>

∅ ——> i   Dar∅b~yaDrib

i ——> a   labis~yalbas

a ——> u   katab~yaktub

u ——> u   kabur~yakbur

</center>

From (43), we extract what we will refer to, from now on, as the apophonic formula, (44).

(44)
<center>∅ ——> i ——> a ——> u ——> u</center>

Moreover, it is clear from (43) that all verbs except for Darab exhibit their own "thematic" vowel. We can thus identify the melody underlying Darab, [a — ∅], as the basic underlying melody.

---

[6]   The view just sketched out calls for a comment. In early generative work, the distinction between the a of **Darab** and the a of **katab**, resp. the one that apophonizes into i and the one apophonizing into u, might have been captured by postulating two kinds of a's, say a₁ and a₂. We are proposing nothing of the kind. Rather, the phonetic interpretation of a null melodic element by propagation from a neighboring position falls well within the inventory of legitimate descriptive devices of autosegmental theory. It is amply documented in and outside of noncatenative morphological systems, as well as in tonal phonology.

4. Apophony
4.1 Preliminary observations

Based on the results of the previous section, we established that the apophony formula is $\emptyset$ --> i --> a --> u --> u. Moreover, we proposed that the basic melody is [a -- $\emptyset$]. We now turn to the fundamental question of this paper. Can the apophonic system cross-aspectually relating the Actives of Form I be extended to the treatment of derivation ?

An initial attempt at implementing such a program, i.e. the integration of the results of section II into a comprehensive picture, is greeted by a mixed signal, as we now demonstrate.

Passive Perfective melodies display with perfect regularity the same two melodic elements, [u - i], an encouraging result, as [u - i] is precisely what we expect the apophonic formula to derive when acting upon the assumed underlying melody [a - /]. Indeed, the change relating the initial vowels of the forms under discussion, Darab~Durib merely mirrors the change relating katab~yaktub, whereas the change relating the second vowels, Darab (underlyingly /Dar$\emptyset$b/)~Durib is nothing but that relating $\emptyset$ and i in Darab (underlyingly /Dar$\emptyset$b/)~yaDrib. This is shown in (45) with the derivation of Durib from Darab.
(45)

```
        D    rb                        D    rb
       /   | \                        /   | \
      /    |  \                      /    |  \
     C V C V C V C V                C V C V C V C V
       |     |                          |     |
       a     ∅                          u     i
       |_____|                          |_____|
       |     |_____|
       |_____|
```
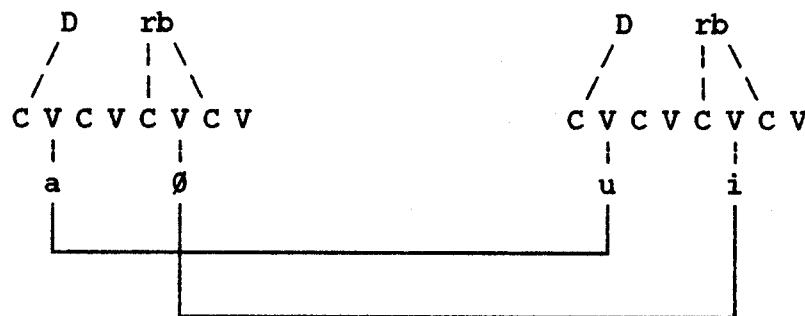
Everything being equal, the corresponding Imperfective should be yuDrib, with both Perfective Passive and Active Imperfective displaying identical derived [u - i] melodies. However, yaDrib is the correct form, much as if the derivation proceeded as shown in (46), with the initial melodic element resisting apophony.
(46)

```
        D    rb                        y    Drb
       /   | \                        /   / | \
      /    |  \                      /   / |  \
     C V C V C V C V                C V C V C V C V
       |     |                          |     |
       a     ∅                          a     i
       |_____|____resists apophony____|     |
       |_____observes apophony_____|
```

26
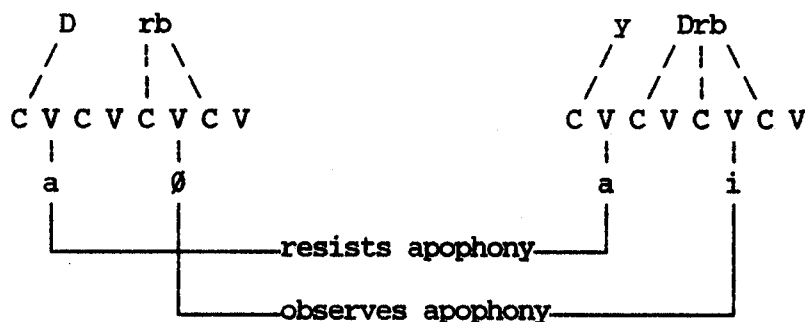
Thus, we run into the following paradox, (47).

(47)

i.   The change introduced in the derivation of the Passive melody entirely abides by the posited apophonic statements.

ii.   The very set of forms from which we extracted the apophonic formula itself, Form I Actives, only evidences a reluctant implementation of the system; specifically, the initial vowel seems to resist apophony.

Indeed, the changes relating Form I Actives involve the vocalization of C_2 __exclusively__, viz. __Darab˘yaDrib__, __labis˘yalbas__, __katab˘yaktub__, __kabur˘yakbur__. Until now, we have not dwelt upon this aspect of apophony, as the data did not suggest that we should. However, in the face of the Passive evidence just adduced, the issue can no longer be ignored: why is it that the scope of apophony encompasses the entirety of the Passive melody, whereas it only partially controls the derivation of Imperfectives ?

While we maintain our version of the apophonic changes themselves, we submit that the differential behavior just described lies in the fact that the input to apophony is not exactly the same in the two cases under discussion, viz. the Passive and the Imperfective. We will momentarily put forth the specifics of our proposal as to what such a difference might be, arguing that it accounts for the immunity of the first vowel of Form I Active Imperfectives to apophony.

In the meantime we want to bring up two other pieces of evidence strongly suggestive of a basic difference between Passives and Actives.

Observation I. As we noted in the introductory section, from Form II on, all Actives, Perfective as well as Imperfectives, fall under uniform patterns regardless of the characteristic vowel lexically associated with the root from which they are derived. Form I Active forms on the other hand, owing to the non-identification of the DS make it possible for that vowel to surface, indeed to assume the role of head of the construction. Concretely, a verb such as labis will have labbas, ?albas in Forms II and IV, resp., not *labbis, *?albis, resp. The significant observation is that, in sharp contrast, Passives, __including those of Form I__, remain uniform, __regardless of what may take place in the sub-system relating Actives to each other__. Thus, lubis for Form I, and lubbis and ?ulbis for Forms II and IV, resp., this time with no outstanding behavior on the part of Form I.

Clearly, there must be a crucial ingredient of the derivation of Actives to which that of Passives remains totally oblivious, hence must be absent from their representation.

Observation II. Our second reason to suspect the presence of a major difference between Actives and Passives comes from a consideration of forms displaying three different vowels such as yukattib and yuka:tib. The problem is that the number of vowels in those forms is in excess of the generative potential of the input melody $/a - \emptyset/$. Indeed, more generally, apophony of a two-element input melody, $/\alpha - \beta/$ will yield a derived melody $/\alpha' - \beta'/$ with no increase of the number of elements. If

the number of positions to be interpreted phonetically in the output structure is in excess of the number of melodic elements, spreading is expected to take place, as sketched out in (48).

(48)

a.   b.

```
        k       t    b              y      k       t     b
       / \     /\     \             |     / \     /\      \
      /   \   /  \     \            |    /   \   /  \      \
   C V [ɒsC V] C V  C V          C V +C V [ɒsC V]  C V  C V
       \      /                        \         /
        α    β                          α'    ...β'...
        |____|_____>___|     |_____|
             |_____>_____|
```
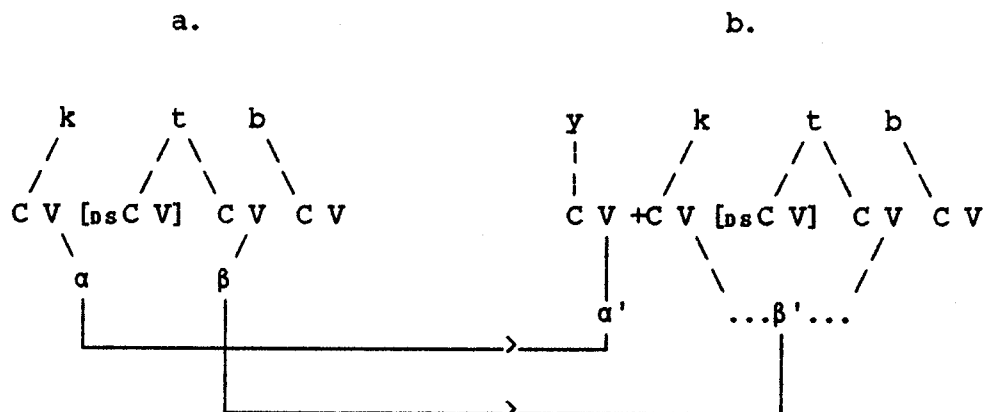
A comparison of the problematic three-voweled Actives yukattib and yuka:tib with their respective Passives yukattab and yuka:tab is revealing: Passives rigorously exemplify the pattern described in (48), displaying two vowels, u and a, with a double occurence of the second melodic element, a, at the right margin, as expected. This discrepancy between the Actives and Passives of Form II and III Imperfectives further strengthens our hunch that a basic difference in their morphophonological makeup distinguishes Actives from Passives, in general.

4.2 Actives vs. Passives: the marking of Voice

We propose that the difference is as in (50).

(50)

a.   b.

Active   Passive

```
C V [ɒsC V] C V C V                        C V [ɒsC V] C V C V
    |
    |
    |
    a
```

That is, every template supporting the realization of an Active form is positively marked as indicated above. The place of the mark, the initial syllable of the binyan, is fixed. The mark is absent from Passive templates, as shown in (50b).

In (51) we show a representation combining the template, the basic melody and the Active marker, a.

28

(51)

```
         C  V  [ᴅs C  V]  C  V  C  V
                 |
                 |
melody tier    a |            Ø
                 |
Voice μ          a
```
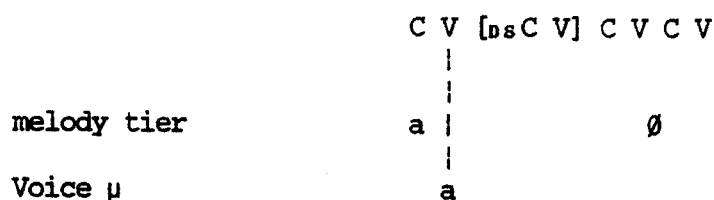
The Voice marker, being distinct from the melody, resides on its own tier. The association of such a representation with any one of our four types of root along with their lexically associated vowels, appears in (52).

$$\sqrt{Drb} = \emptyset$$
$$\sqrt{lbs} = i$$
$$\sqrt{ktb} = a$$
$$\sqrt{kbr} = u$$

```
         C  V  [ᴅs C  V]  C  V  C  V
                 |
                 |
melody tier    a |            Ø
                 |
Voice μ          a
```
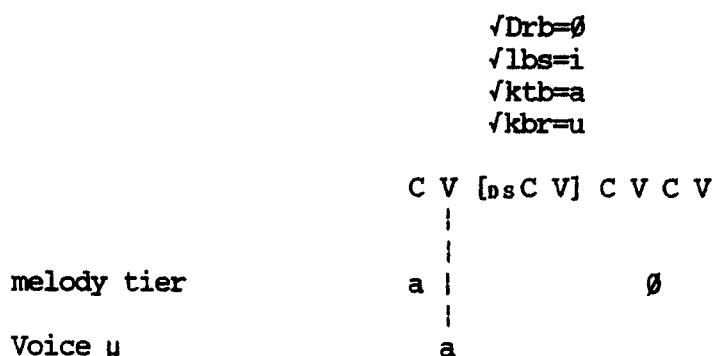
We now demonstrate how the representation in (52) combined with a lexical root forms the basis of apophonic derivations, starting with Form I.

4.3 Form I

The reader will recall that Form I is characterized by the non-identification of its derivational syllable; moreover, its derivation involves no affix. This relative bareness makes it possible for the vowel lexically associated with the root to be involved in the vocalism of the form. This, we represent in (53), where the root now appears under a generic form, and the range of possible vocalizations shows on the melodic tier.

(5)

$$\sqrt{C_1 C_2 C_3}$$

```
         C  V  [ᴅs C  V]  C  V  C  V
                 |
                 |
melody tier    a |          {Ø/i/a/u}
                 |
                 |
                 |
Voice μ          a
```

29
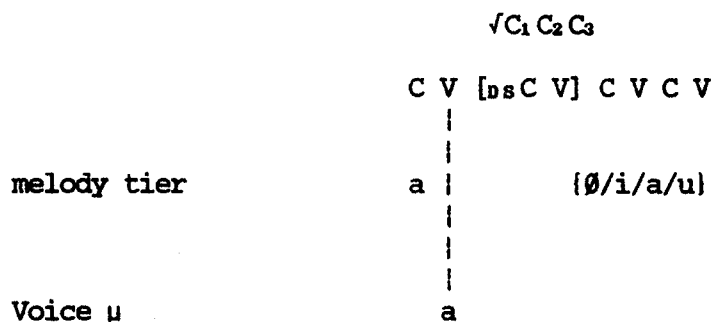
Apophony will map the vowels appearing on the melody tier according to (44). The voice marker, on the other hand, represented on its own tier, as shown in (52) does not participate in apophony. Let us now demonstrate how The Active Imperfective of Form I is derived from its corresponding Perfective.

(54)

melody tier   a   {∅/i/a/u}   u   {i/a/u/u}

Voice μ   a   a

          [fa9{∅/i/a/u}l]   [yaf{i/a/u}l]
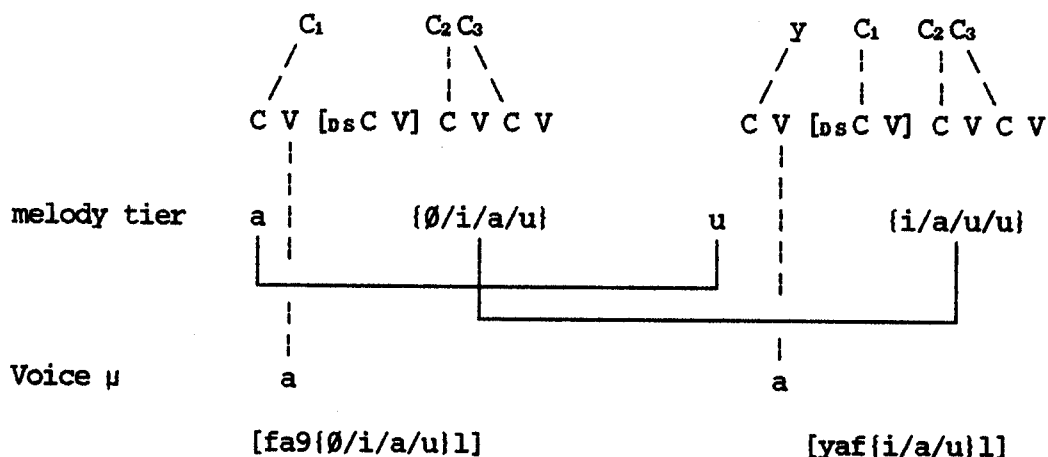
Both forms, being Actives appear equipped with their Active marker in its specified place. In the introductory section of this paper, we discussed the location of inflectional prefixes. In this case, the prefix appears within the binyan. Apophony operates as stated. However, the Active marker occupying the leftmost position both in the input and the output structure, apophony of the leftmost melodic element, a, remains virtual. On the other hand, the rightmost portion of the melody undergoes apophony mapping ∅ into i, i into a, a into u, and u (vacuously) into u. Thus, the reason why Form I Active Imperfective prefixes, ya, are vocalized with a is not due to a failure of apophony to take place, as was tentatively suggested in (46). Rather, again, the a of the prefix is the Active marker, not an element of the vocalic melody.

Up to this point, the posited interplay between "melodic" a and "Active" a allows us to rationalize the apparent resistance of the prefixal vowel to apophony. Shortly, we will see that the discussion of Form II affords an opportunity to observe both vowels in the flesh.

For the time being, we pursue our analysis of Form I forms with a demonstration of how Passives are derived, starting with Perfective Passive. In (55a), we have reproduced the representation of the Active Perfective, with its basic melody and its Active mark. In (55b), the ingredients of the Passive Perfective are represented. Of course, no mark of the Active is present; as well, the melodic tier is entirely bare.

(55)

a.

```
        C₁          C₂ C₃
       /            | \
      /             |  \
   C V [ᴅsC V] C V C V
     |
     |
a    |       Ø
     |
     |
a
```

melody tier a

Voice μ   a

b.

```
        C₁          C₂ C₃
       /            | \
      /             |  \
   C V [ᴅsC V] C V C V
```

(56) shows the operation of apophony. a is mapped into u and Ø into i, as expected. This time, in contradistinction with what we observed in (54), the absence of an Active mark in the representation of the Passive structure, makes it possible for u to be realized. Thus, a generic form fu9il (Durib, kutib, lubis) is derived.

(56)

a.

```
        C₁          C₂ C₃
       /            | \
      /             |  \
   C V [ᴅsC V] C V C V
     |
     |
```

melody tier a   Ø   u   i

Voice μ   a

[fa9al]   [fu9il]

We complete the picture of the system of Form I with the derivation of the Passive Imperfective. The source of that form is the Passive Perfective, much as the source of the Active Imperfective was its corresponding Perfective, an assumption for which evidence will be adduced in the context of the derivation of Form VII.

Both forms, the source with its melody, the one we just derived, and its target with no melody of its own appear in (57). Neither, of course, bears the Active marker. The arrangement of prefix and root is as in (57b).

31

(57)

a.   b.

```
        C₁        C₂C₃                    y   C₁    C₂C₃
       /         | \                     /   |     | \
      /          |  \                   /    |     |  \
     C V [ᴅsC V] C V C V               C V [ᴅsC V] C V C V
```

melody tier   u   i

Voice μ

    Apophony proceeds, as per (44): u̱ is vacuously mapped into u̱, and i̱
is turned into a̱.

(58)

a.   b.

```
        C₁        C₂C₃                    y   C₁    C₂C₃
       /         | \                     /   |     | \
      /          |  \                   /    |     |  \
     C V [ᴅsC V] C V C V               C V [ᴅsC V] C V C V
```

melody tier   u   i   u   a

Voice μ

[fu9il]   [yuf9al]
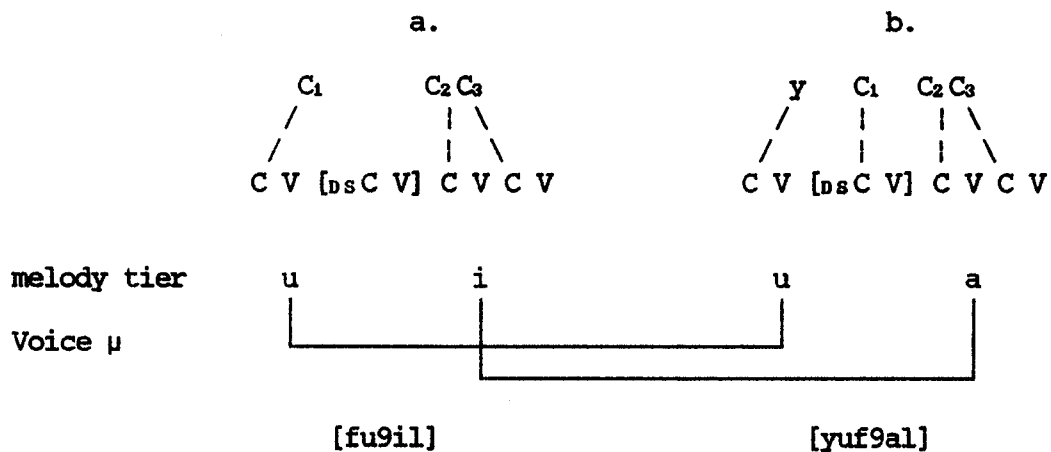
4.4 Form II

    We now derive the Imperfective Active yufa99il from its correspond-
ing Perfective, fa99al. The relevant structures are as in (59). Again,
the source structure bears the basic melody and the host structure,
(59b), the one to be provided with vocalism via apophony, is melodically
bare.
()

a.   b.

```
        C₁        C₂  C₃                  y    C₁      C₂  C₃
       /         /\   \                   |   /       /\   \
      /         / \    \                  |  /       / \    \
     C V [ᴅsC V] C V C V                C V C V [ᴅsC V] C V C V
       |                                       |
       |                                       |
melody tier  a |            Ø                  |
       |                                       |
Voice μ       a                                a
```

32
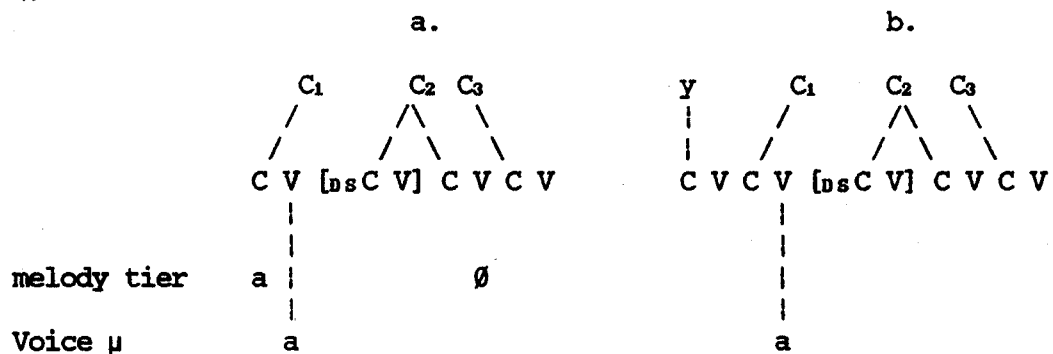
Of course, the expansion of the template supporting the realization of the Imperfective in (59b) is longer than its Perfective counterpart (59a). This is due to the need to accommodate the inflectional suffix of the Imperfective, y. The location of that extra syllable can be precisely identified with respect to the rest of the configuration: both forms display the root medial gemination characteristic of Form II. In both cases gemination straddles the C of the derivational syllable and the C to the right of DS. Immediately to the left of DS, appears the site of realization of the Active marker in both forms. Thus, the template expansion required for the derivation of the Imperfective is exactly one syllable longer than its Perfective counterpart; the extra syllable appears at the left margin of the representation. It is nothing but the unactivated affixal position discussed in section I. This is shown in (60), with the extra syllable underscored.

(60)

Perfective template: C V [DsC V] C V C V

Imperfective template: [AffC V]C V [DsC V] C V C V

With these preliminary comments on the structures involved out of the way, we can see that apophony operates in the usual fashion: "Active" a remains outside of apophony whereas "melodic" a is changed into u, and Ø is changed into i, thus deriving yufa99il.

(61)

                a.   b.

                 [fa99al]   [yufa99il]
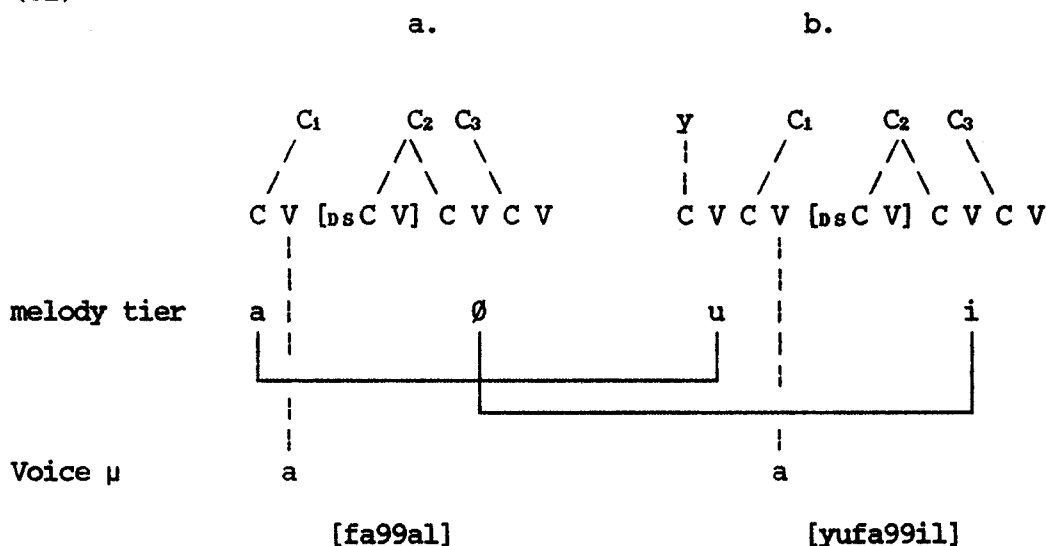
The interesting feature of this derivation comes out best out of a comparison with the derivation of Form I Active Imperfective which we repeat here for convenience as (62).

33

(62)

```
            C₁        C₂C₃                    y   C₁    C₂C₃
           /         |  \                    /   |     |  \
          /          |   \                  /    |     |   \
        C V [ᴅsC V] C V C V              C V [ᴅsC V] C V C V
            |                                     |
            |                                     |
melody tier a |        {∅/i/a/u}        u       |       {i/a/u/u}
            |                                     |
          |__|                      |_____|
            |                 |_____|      |
            |                 |                   |
Voice μ     a                                     a
```
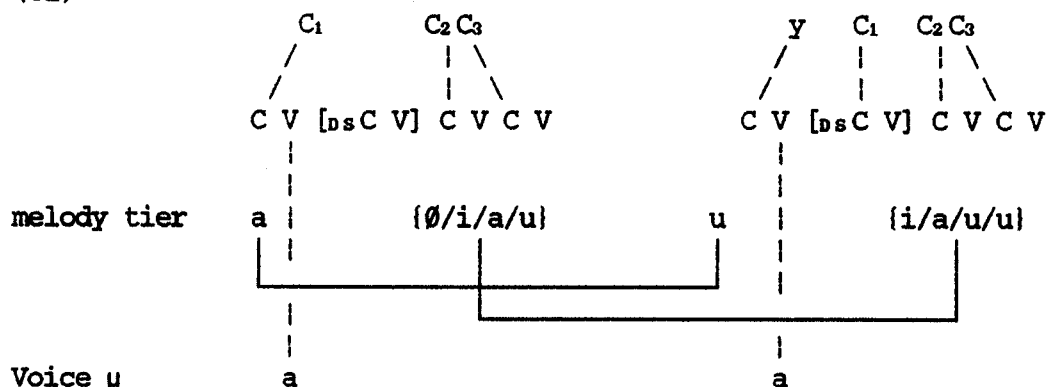
We argued earlier that the vocalization of Form I Active Imperfective prefixes, **ya**, results from the peculiar location of the prefix, i.e. within the short expansion of the binyan, hence immediately to the left of "Active" **a**. Apophony, we claimed, operated in usual fashion, but lack of space made its effect on the initial melodic element undiscernable. A clear prediction was being made: if an other Active Imperfective differed from that of Form I in being just one syllable longer at the left margin, it would make it possible for the expected **u** to surface. This is precisely what takes place in Form II.

The derivation of Passives is unproblematic. For the sake of completeness we provide the derivations. Perfective Passive **fu99il** is derived from Perfective Active **fa99al** much as Form I **fu9il** was derived from **fa9al**. Again, the target structure (69b) contains no mark for Voice. Its vocalism reflects the apophonized version of the basic melody.

(63)

            a.   **b.**

```
            C₁        C₂C₃                      C₁        C₂    C₃
           /         /\  \                     /         /\     \
          /         / \   \                   /         / \      \
        C V [ᴅsC V] C V C V                 C V [ᴅsC V] C V C V
            |                                   |
            |                                   |
melody tier a |        ∅           u          a |        u             i
            |                                   |
          |__|                |_____|   |__|                |_____|
            |           |_____|          |          |_____|
            |           |                                  |
Voice μ     a                                   a
```
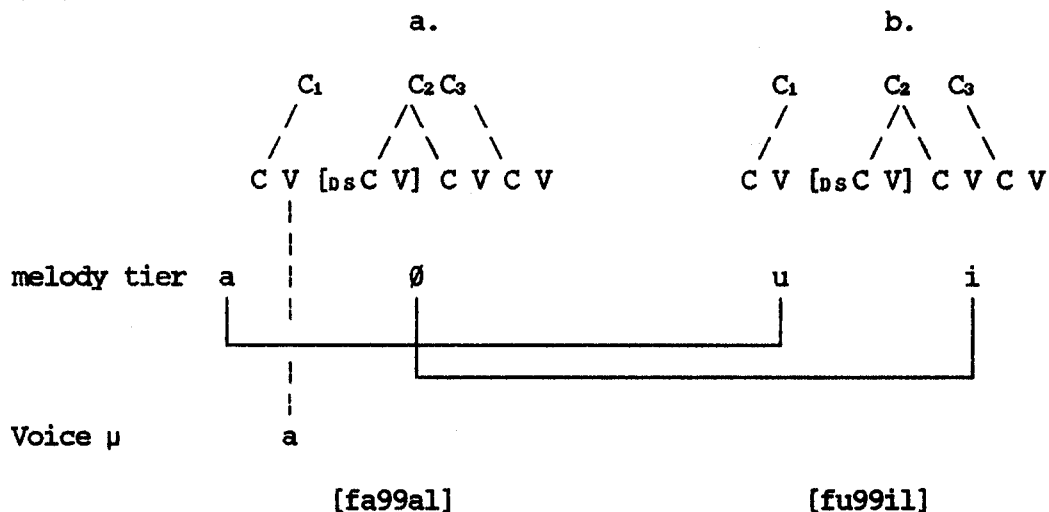
          [fa99al]   **[fu99il]**

Similarly, the derivation of Imperfective Passive **yufa99al** from Perfective Passive **fu99il** merely repeats that of Form I **yuf9al** from **fu9il**, the only noticeable difference being the spreading of the rightmost derived melodic element in (64b).

(64)

a.   b.

```
       k      t   b                        y     k      t   b
      / \    /\   \                         |    / \    /\   \
     /   \  /  \   \                        |   /   \  /  \   \
    C V [ʊsC V]  C V  C V                   C V +C V [ʊsC V]  C V  C V
      \      /                                \      \      /
       u    i                                  u      ...a...
```

[fu99il]   [yufa99al]
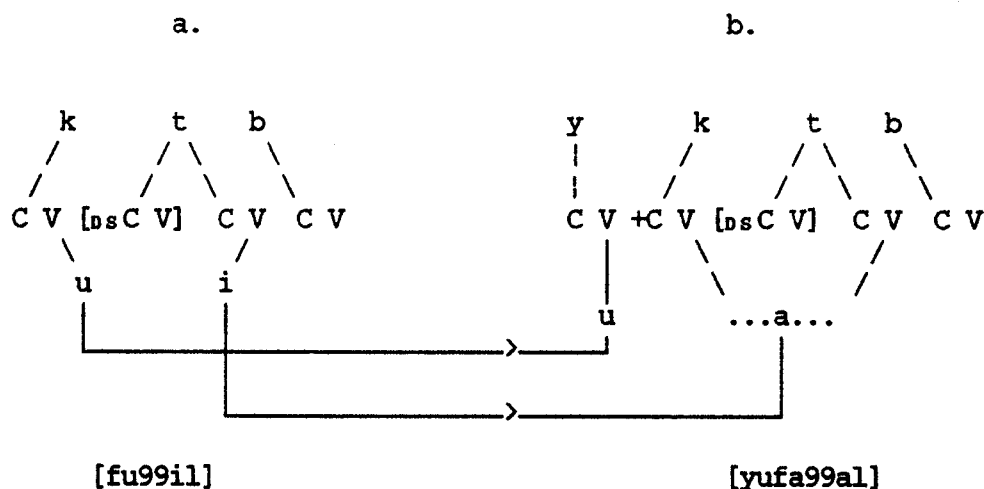
Let us turn to the derivation of forms involving derivational
prefixes.

4.5 Form VII

In order to get a sense of the problem these forms raise, let us
compare them with the cases we have already analyzed. In Table (65), Form
II stands as the representative of the group including Form II and Form
II, and Form VII for the group including Forms VII, VIII, IX and X.

	Form I		Form II		Form VII	
	Perf.	Imperf.	Perf.	Imperf.	Perf.	Imperf.
Act.	katab	yaktub	kattab	yukattib	nkatab	yankatib
Pass.	kutib	yuktab	kuttib	yukattab	nkutib	yunkatab

Judging from Table (65), it is clear that the only unexpected
feature of Form VII is the vocalization of its Active Imperfective prefix
(underscored in Table (65)). Why does an u not appear as the prefixal
vowel of these forms ? That is, *yunkatib would be expected by analogy
with yukattib. The reason why ya+nkatib and yu+kattib differ in the
vocalization of their prefix is far from obvious. Both forms belong to
the same paradigm, both have the same number of surface segments, both
include a surface heavy syllable. Moreover, the rest of the melody of the
same form, a, i is as in yukattib. The Passives of Form VII, both
Perfective and Imperfective, are melodically identical to those of Form I
and II. Why this one single difference should be observable at that par-
ticular place is the question we now turn to.

We address this question by backtracking a little bit to the topic
of section I, viz. the morphological makeup of the forms under discussion
in (66).

35

Form VII involves a prefix, n̲. As such, its structure is as in (12), repeated, here, for convenience as (66a).

(66)

```
            a.                                        b.

     n       k     sr                    y    n       k     sr
     |      /     | \                    /    |      /     | \
     |     /      |  \                   /     |     /      |  \
   [AffC V] C V [C V] C V C V         C V+[AffC V] C V [C V] C V C V
            |                                       |
            |                                       |
μ-tier     a                                       a
```
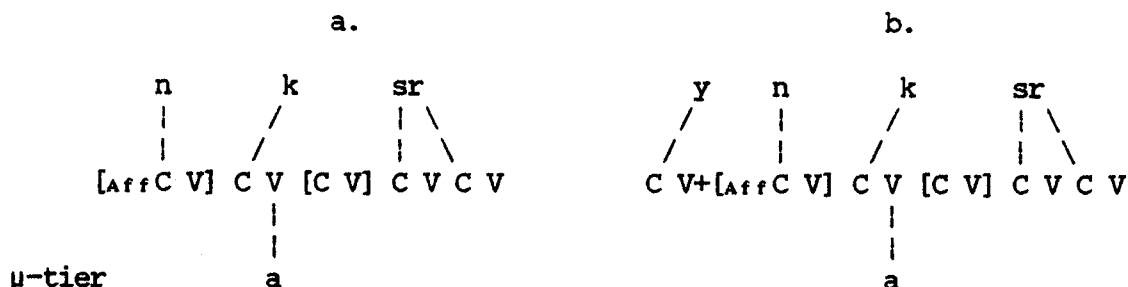
As discussed in section I, prefixal n̲ occupies the affixal position of the base, [AffC V], with deactivation of the derivational syllable, [DsC V] as a consequence.[7] The important point, here, is that n̲, or any other morpheme, identifying [AffC V] sits at the very leftmost position of the binyan. To put it differently, identification of [AffC V] inescapably results in a saturated binyan. Such additional material as may be required by the morphology will, of necessity, have to be binyan-external. This is precisely what happens when the inflexional prefixes of the Imperfective are appended. In (66b), the syllable accommodating the inflectional Imperfective prefix is concatenated with the binyan. Its extra-binyanic nature is the cornerstone of our analysis of apophony in those forms.

In (67) we have represented the operation of the phase of apophony deriving the vocalization of the Imperfective Active from its corresponding Perfective.

(67)

```
            a.                                        b.

     n       k     sr                    y    n       k     sr
     |      /     | \                    /    |      /     | \
     |     /      |  \                   /     |     /      |  \
   [AffC V] C V [C V] C V C V         C V+[AffC V] C V [C V] C V C V
            |                                       |
melody   a  |      Ø                        a       |       i
         *  |                               *       |
         **************|** no apophony **            |
            |                                       |
            |                                       |
            |                                       |
μ-tier      a                                       a

        [nkasar]                            [yankasir]
```

---
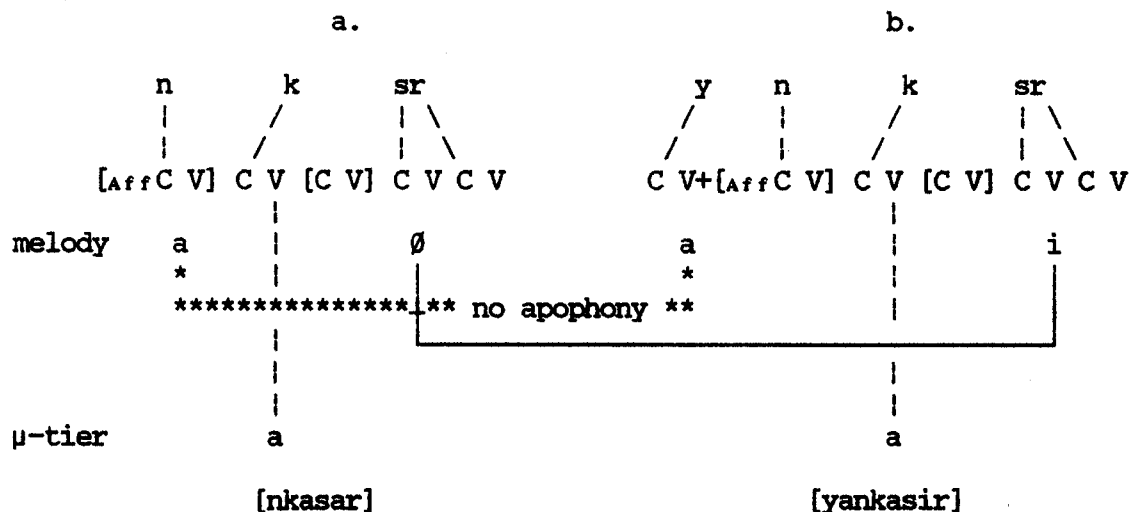
[7] For easier identification of its site we have left the square brackets around the deactivated [DsC V], the deactivation being itself signalled by the absence of label on the bracketing.

36

The striking feature of this derivation is the fact that the first part of the input melody, a, fails to undergo apophony, whereas the second part, ∅, changes into i, as expected. In order to gain insight into this differential behavior, we compare the derivation in (67) with one in which <u>the entire melody</u> undergoes the expected change, that of Form II Active Imperfective, repeated as (68) for convenience.[8]
(68)

a.   b.

```
        k       t b                 y       k       t b
       /       /\ \                 |      /       /\ \
      /       / \ \                 |     /       / \ \
     C V [DsC V] C V C V       [C V]C V [DsC V] C V C V
     |                              |
     |                              |
melody tier  a |        ∅        u |              i
          |__|_____|      |              |
             |              |_____|   |
             |                              |
Voice μ      a                              a
```

[kattab]   [yukattib]
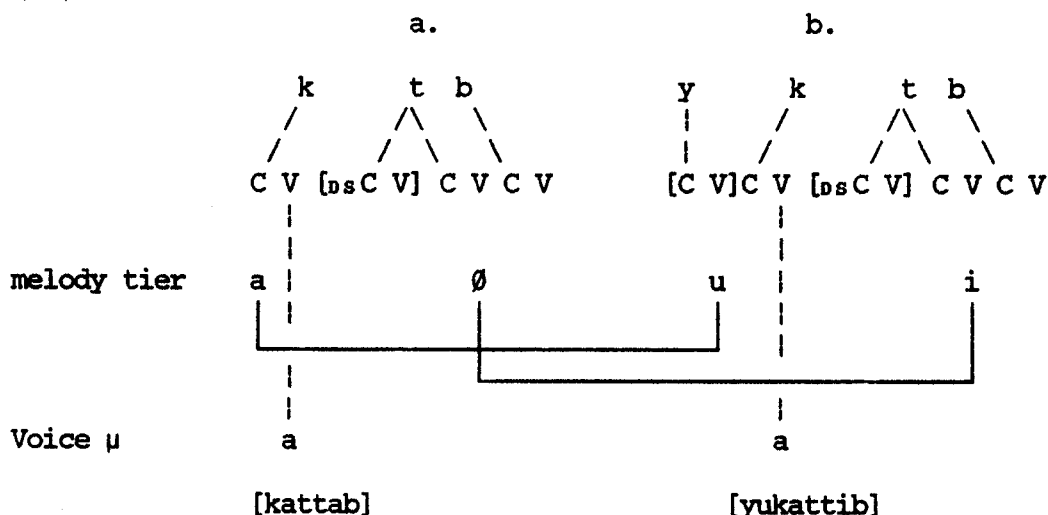
The difference between (67) and (68) emerges clearly. In (68) the prefixal vowel is intra-binyanic; in (67), it is extra-binyanic. In this light, the corresponding behavior of apophony becomes transparent: the factor to which it is sensitive is the position of the target vowel with respect to the binyan. When the target (the site of realization of the vowel) is internal, apophony takes place; when the target is external, apophony does not take place. We formulate this result as in (69).
(69)
The binyan IS the domain of apophony

We note that (69) constitutes very strong independant evidence for the posited internal structure of the binyan, an entity arrived at based on considerations altogether foreign to the workings of apophony, cf. Guerssel & Lowenstamm (in preparation).

The derivation of the Perfective Passive from the Perfective Active in (70) is uneventful. We merely note in the light of the previous comments that the very same melody, the initial part of which resisted apophony when its site of realization was to be extra-binyanic in (67), smoothly produces an [u - i] melody when it can be accommodated within the binyan, as in the case at hand, below.

---

8   In () [DsC V] being the seat of realization of the morphological head of the construction, [AffC V] remains unactivated. Its location is indicated by unlabeled square brackets.

(70)

```
            a.                                      b.

       n     k    sr                         n   k     sr
       |    /     | \                         \ /   /  | \
       |   /      |  \                         / \ /   |  \
   [AffC V] C V [C V] C V C V          [AffC V] C V [C V] C V C V
                  |
melody   a        |      Ø                         u          i
         ┌────────┼──────┐                  ┌──────────────┐
         |        |      └────────────────┐ |              |
         |        |                        └─┼──────────────┼──────┐
         |        |
μ-tier            a
```

                    [nkasar]   [nkusir]

More interesting is the case of the derivation of Form VII Imper-
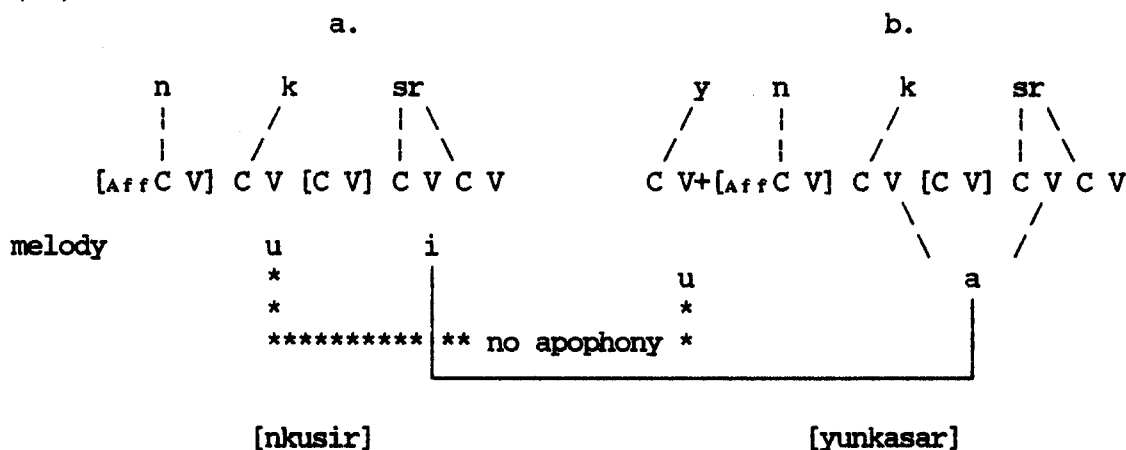fective Passive, [yunkasar] as usual from the Perfective Passive,
[nkusir] in this instance.

When discussing the vocalization of the prefix of Form VII Imperfec-
tive Active, _yankatib_ , we noted how it constrats with that of Form II
Imperfective _yukattib_, and we explained the difference in terms of the
location of the target of apophony in the two respective constructions.
Now, a challenging question arises as to whether a similar difference
should be observed in the corresponding Passives. As it turns out, the
Imperfective Passives prefixes of Form II and VII fail to reproduce a
similar differential behavior. Rather, they are vocalized alike, viz. _yu_
(_yukattab_, _yunkatab)_.

In fact, this effect is precisely what we expect. To see why,
consider the derivation relating _nkusir_ and _yunkasar_.
(71)

```
            a.                                      b.

       n     k    sr                    y    n    k     sr
       |    /     | \                    /    |   /    | \
       |   /      |  \                   /    |  /     |  \
   [AffC V] C V [C V] C V C V        C V+[AffC V] C V [C V] C V C V
                                                          \    /
melody   u         i                                       \  /
         *         |                          u             a
         *         |
       **********|  ** no apophony *
                 └──────────────────────────────────────┘
```

                    [nkusir]   [yunkasar]

For the same reason as the "melodic" _a_ of _nkatab_ failed to
apophonize into _u_, indeed remained _a_ in the derivation of _yankatib_, the
extra-binyanic location of the prefix, the initial _u_ of _nkusir_ fails to
"apophonize" into _u_, and merely remains... _u_ !

We now have all the elements to answer one of the questions we set out to address, the puzzling stability of Imperfective Passive prefixes as opposed to the wavering between ya/yu in the Perfective Active. In all cases, Imperfective prefixes result from apophony. In the case of Actives, the source melodic element, a will or will not be mapped into u, depending on the position of the target. The same is true of Passives, but because of the peculiar form of the apophonic statement affecting u (u --> u), the phonetic result is uniformly u whether apophony is allowed to take place, or not.

The analysis of Form VII just put forth provides us with the opportunity to make another point, one relating to the hypothesized directionality of the operation of apophony.

4.6 Directionality

Up to this point, we have assumed without much discussion that the directionality of apophony was as in (72a). The alternative (72b), involving derivation of the Imperfective Passive from its corresponding Active (as opposed to deriving it from its corresponding Perfective, as we claim is the case) is not entirely implausible, in view of the set of Form II forms, as we now demonstrate.
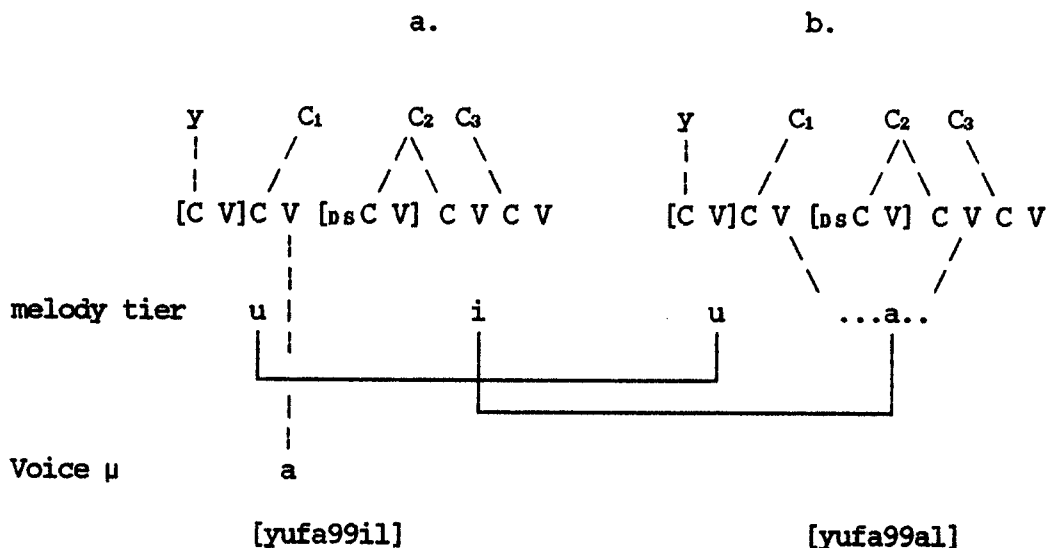
(72)

	a. Perf.		Imperf.		b. Perf.		Imperf.
Active	A	---->	B		A	---->	B
	↓				↓		↓
Passive	C	---->	D		C		D

We are going to refute the scenario in (72b) in two steps. First, we show that (72b) would be as viable as (72a) for Form II. Then, we show how (72b) fails with Form VII.

The only difference between the two schemes is that D is derived from C in (72a), as we claim, whereas D is derived from B in (72b), the alternative. Consequently, we merely illustrate how yufa99al could be derived from yufa99il (step I).
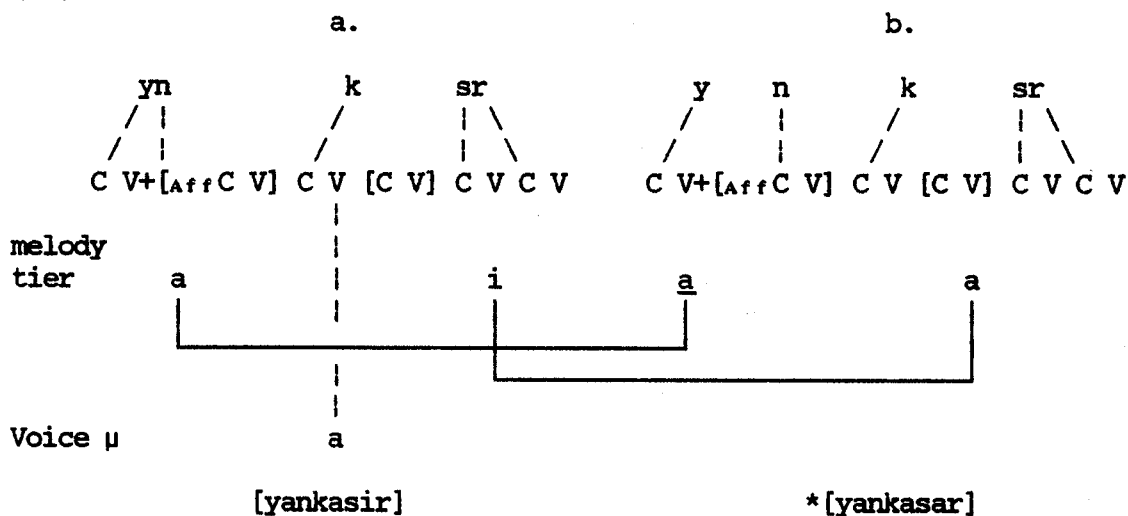
39

(73)

a.

```
    y        C₁        C₂ C₃
    |       /         /\  \
    |      /         / \   \
[C V]C  V  [DsC V]  C  V  C  V
        |
        |
melody tier  u |              i              u        ...a..
           |
           ----
           |
           |
Voice μ    a
```

[yufa99il]   [yufa99al]

The target in (73b) includes no mark for Voice. Apophony straight-forwardly maps input [u – i] into [u – a]. Thus, it appears that our machinery makes it possible for [yufa99al] to be derived from [yufa99il].

We now complete step II of our demonstration by showing that the same derivational path will not allow for a derivation of [yunkatab] from [yankatib]. This is shown in (74).

(74)

a.

```
     yn         k      sr              y  n        k      sr
    / |        /      | \             /  |        /      | \
   /  |       /       |  \           /   |       /       |  \
C V+[AffC V] C V [C V] C V C V    C V+[AffC V] C V [C V] C V C V

melody
tier  a         |         i      a                      a
              |
              ---
              |
              |
Voice μ       a
```

[yankasir]   *[yankasar]

This time, the derivation clearly fails. The initial melodic element, a in (74a) will not go to u, as it must vocalize an extra-binyanic position. Hence, it remains a (underscored in (74b)), deriving the ill-formed [yankasar].

The alternative, of course, runs into no such problem. Again, the source of the vocalization of all Imperfective Passives, the Perfective Passive, contains an initial u. This u, in its apophonized, or un-apophonized form, will inevitably surface as u.
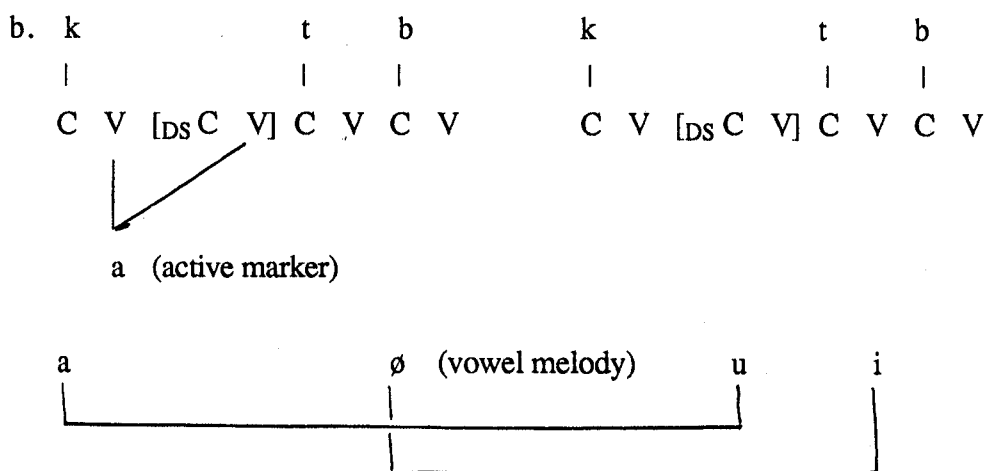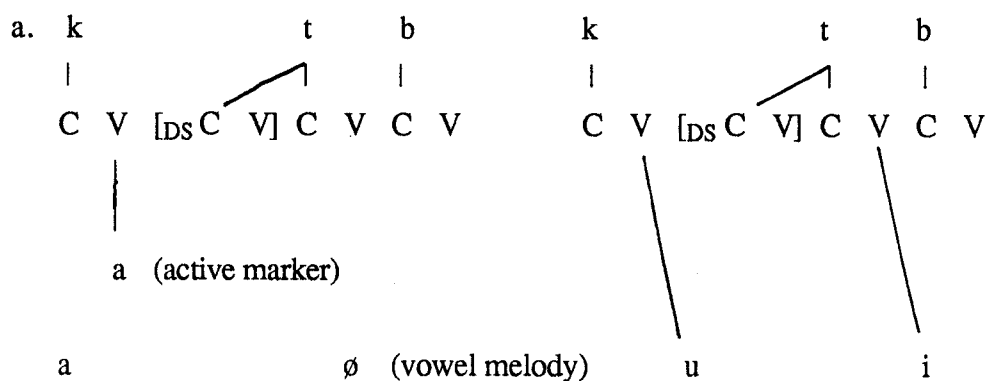
We conclude to the validation of the assumed derivational path, (72a).

44

4.7 Apophony and morphological concatenation

As mentioned in section 1, two verbal patterns are argued in Guerssel and Lowenstamm (in preparation) to be derived from other patterns, by affixation. Forms V and VI are assumed to be nontemplatic but rather the result of the concatenation of the reflexive prefix ṯ with the derived Forms II and III. This fact has an important consequence for the vocalism of these forms. Before we examine how the vocalism of such forms differs from that of the various other patterns, we look at the vocalism of Forms II and III, which are the derivational sources of Forms V and VI. Using the root ktb as an example, the perfectvive active and perfective passive of Forms II and III are as follows.
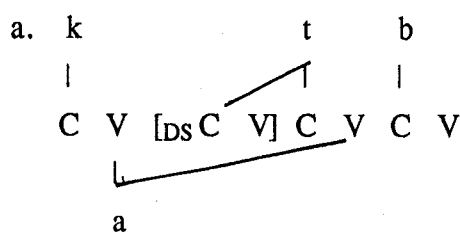
(75)   Active Perfective   Passive Perfective

a.   k   t   b   k   t   b
     | ^| | | ^| |
     C V [DS C V] C V C V   C V [DS C V] C V C V
           | \   \
           | \   \
           a (active marker)   \   \

     a   ø (vowel melody)   u   i

b.   k   t   b   k   t   b
     | | | | | |
     C V [DS C V] C V C V   C V [DS C V] C V C V
          └──────/
          a (active marker)

     a   ø (vowel melody)   u   i
     └────────────────────┘   └────────────┘
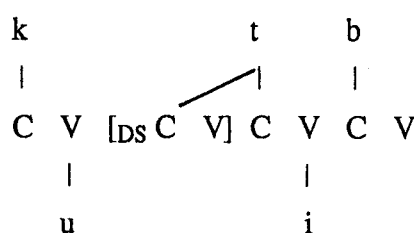   └──────────────────────────────────┘

41

In (75a), the derivational operation C-spread takes place, and in (75b) it is V-spread that is implemented. In the active, the first element of the vowel melody has no anchoring site since the active marker occupies the initial vowel position. The penultimate vowel position remains empty since the value of the second member of the vowel melody is [ø]. As already shown, this position is eventually identified by the material of the active morpheme. In the passive, where there is no active morpheme, apophony applies and the vocalism indicated is obtained. These operations yield the following derived verbs.
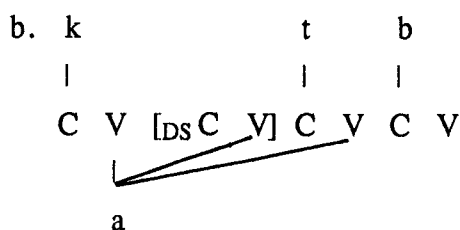
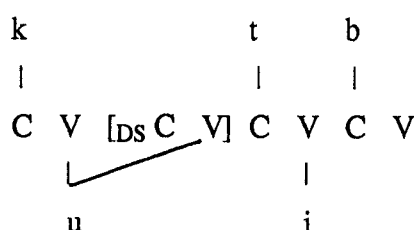(76)   Active Perfective   Passive Perfective

a.   k   t   b   k   t   b
     | | | |
     C V [DS C V] C V C V   C V [DS C V] C V C V
        L_____| | |
        a   u   i

     [kattab]   [kuttib]

b.   k   t   b   k   t   b
     | | | | | |
     C V [DS C V] C V C V   C V [DS C V] C V C V
        L_____| L_____| |
        a   u   i
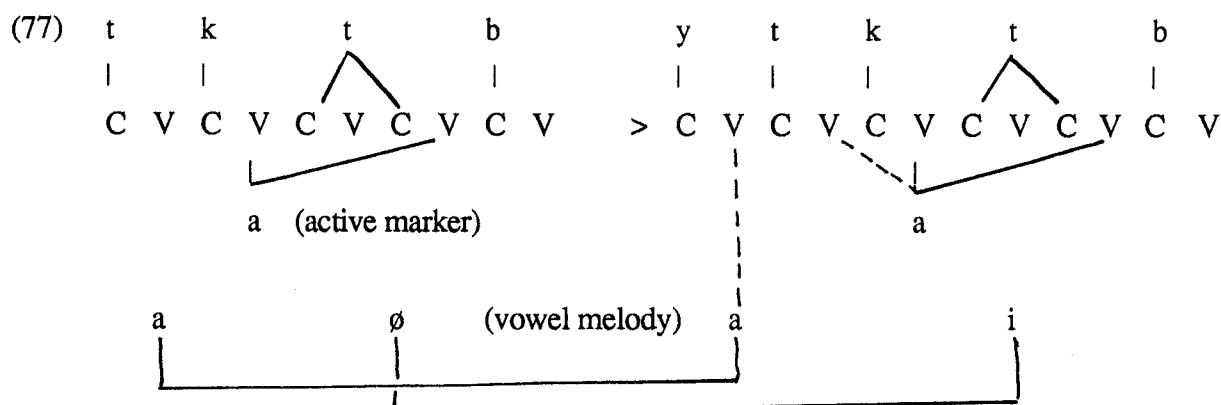
     [kaatab]   [kuutib]
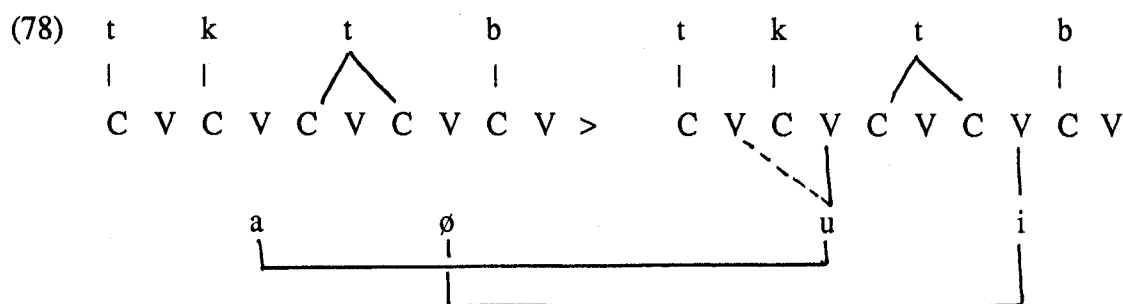

Forms V and VI are the result of the concatenation of the reflexive prefix t with the structures in (76), yielding ta-kattab, tu-kuttib, ta-kaatab, tu-kuutib, respectively. The prefix comes with a CV syllable, the nucleus of which is identified by spreading from an adjacent vowel. So far the above forms behave exactly as expected within the overall system proposed. The forms that do not seem to follow the pattern predicted by the proposed apophonic alternation are the imperfectives of Forms V and VI. In all the derived imperfective actives of Forms II through X, the second member of the vowel melody is uniquely [i], except in Forms V and VI where it appears as [a]. Why should this be the case? If, as assumed, Forms V and VI are derived from

42

Forms II and III, their imperfective active forms must indeed exhibit the shapes that they exhibit, as shown directly. The imperfective active of Form V will be derived as follows.

(77)

```
      t      k         t         b              y    t      k         t         b
      |      |         /\        |              |    |      |         /\        |
  C V C V C V C V C V          >  C V C V C V C V C V C V
          |__/                               |        \__|      \__/
          a  (active marker)                 |         a
                                             |
      a              ø   (vowel melody)      a                   i
      |__            |_____|                       |
         |_____|_____                       |
                     |_____|
```
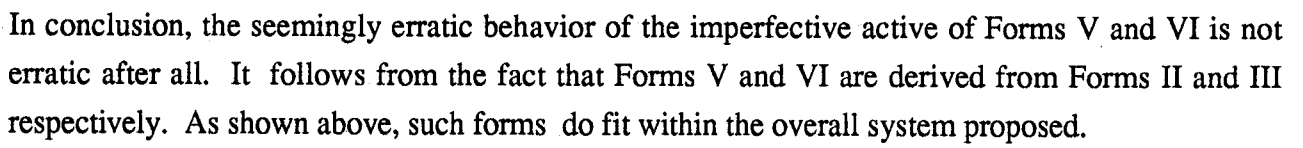
The initial [a] of the vowel melody is realized as [a] in the imperfective since the position is extra-templatic. The second member of the melody remains floating since the position it would normally be associated with is occupied by the active marker, as a result of spreading in the derivation of Form II. The final output is thus the correct [yatakattab], not [*yatakattib]. FormVI is derived in an anlogous fashion. Here also, the final output is [yatakaatab], not [*yatakaatib].

In the passive, where there is no mark other than the vowel melody, apophony is implemented in the usual manner. The source of the perfective passive is the perfective active without the active marker, as is always the case. This is represented in (78).

(78)

```
      t      k         t         b              t      k         t         b
      |      |         /\        |              |      |         /\        |
  C V C V C V C V C V  >          C V C V C V C V C V
                                        \__|      |
          a          ø                  u         i
          |__        |_____|         |
             |_____|_____         |
                     |_____|
```

The source of the imperfective passive is the output represented in (78), to which apophony applies, resulting in the following representation.

(79)

```
      t     k        t        b           y    t     k        t        b
      |     |       /\        |           |    |     |       /\        |
   C  V  C  V  C  V  C  V  C  V   >   C  V  C  V  C  V  C  V  C  V  C  V
            |        |                         |              |
            u        i           u            a
```

In conclusion, the seemingly erratic behavior of the imperfective active of Forms V and VI is not erratic after all. It follows from the fact that Forms V and VI are derived from Forms II and III respectively. As shown above, such forms do fit within the overall system proposed.

5. The ideal system

The account of apophony we have provided includes two ingredients: the apophonic mechanisms themselves and the basic melody they act upon. The rest follows with no need for stipulations of any kind, from our view of CA verbal morphology. In this section, we attempt to further reduce lexical specification. The question we ask is: is there any relationship between the substantive changes performed by apophony and the composition of the basic melody [a - Ø] ? For the sake of clarity, we repeat the apophonic statements in (80) below.

(80)

1. Ø ——> i
2. i ——> a
3. a ——> u
4. u ——> u

We choose to gain insight into the issue just raised by asking the following question: given the nature of the apophonic statements, could the underlying melody have been anything other than [a - Ø] ? In order to answer this question, we examine the properties of the systems generated when the actual apophonic statements of CA, as identified by us modify all possible underlying melodies, viz. [a - Ø], [a - i], [a - u], [u-Ø], [u - i], [u - a], [i - Ø], [i - a], [i - u], [Ø - a], [Ø - i], [Ø-u], [a - a], [u - u], [i - i], [Ø - Ø].

(81)

1.	2.	3.	4.	5.	6.
a - Ø	a - i	a - u	u - Ø	u - i	u - a
↓ ↓	↓ ↓	↓ ↓	↓ ↓	↓ ↓	↓ ↓
u - i	u - a	u - u	u - i	u - a	u - u
↓ ↓	↓ ↓	↓ ↓	↓ ↓	↓ ↓	↓ ↓
u - a	u - u	u - u	u - a	u - u	u - u

7.	8.	9.	10.	11.	12.
i - Ø	i - a	i - u	Ø - a	Ø - i	Ø - u
↓ ↓	↓ ↓	↓ ↓	↓ ↓	↓ ↓	↓ ↓
a - i	a - u	a - u	i - u	i - a	i - u
↓ ↓	↓ ↓	↓ ↓	↓ ↓	↓ ↓	↓ ↓
u - a	u - u	u - u	a - u	a - u	a - u

45

Each candidate melody constitutes a different input to the set of apophonic statements. What recommends 1., the actual underlying melody of CA as against all other imaginable possibilities ? A rapid survey of (1-12) reveals that [a - ∅] is the only melody providing each apophonic statement which a chance to be illustrated once, and once only. In order to appreciate this, compare (1,7 and 9) repeated below for convenience. (82)

```
1.              7.              9.
a - ∅           i - ∅           i - u
|   |           |   |           |   |
3   1           2   1           2   4
|   |           |   |           |   |
v   v           v   v           v   v
u - i           a - i           a - u
|   |           |   |           |   |
4   2           3   2           3   4
|   |           |   |           |   |
v   v           v   v           v   v
u - a           u - a           u - u
```

In (82.7), 4 does not occur at all, while 2 occurs twice. On the other hand, 1 never occurs in (82.9), whereas 4 occurs twice. By contradistinction, 1, 2, 3, 4 all occur, and once only in (82.1).

For the sake of completeness, we have tabulated the number of times each apophonic statement (upper horizontal row) is illustrated under any version of the underlying melody (leftmost vertical column). (83)

	1.	2.	3.	4.
[a - ∅]	1	1	1	1
[a - i]	0	1	2	1
[a - u]	0	0	1	3
[u - ∅]	1	1	0	2
[u - i]	0	1	1	2
[u - a]	0	0	1	3
[i - ∅]	1	2	1	0
[i - a]	0	1	2	1
[i - u]	0	1	1	2
[∅ - a]	1	1	1	1
[∅ - i]	1	2	1	0
[∅ - u]	1	1	0	2
[a - a]	0	0	2	2
[u - u]	0	0	0	4
[i - i]	0	2	2	0
[∅ - ∅]	2	2	0	0

It is perfectly clear that [a - ∅] is the underlying melody affording maximal transparency of the operation of apophony in the sense just defined. This property of CA cannot possibly be accidental. Rather, we submit that the following law is at work.

(84) Law of Perfect Apophony

When apophony runs its full course,
each statement is illustrated once.

From (84) we can derive the following theorem.

(85)

if n_a is the number of "apophonees" and n_{op} the number of operations involved in the longest derivational sequence, n_a/n_{op} is the number of "apophonees" appearing in the makeup of the input melody.

Thus if a language has six apophonic statements to manifest in three operations, the input melody contains two items, etc.

Consider now the set of morphological operations with which apophony is associated in CA. Verbal derivation implies the generation of four categories, say A,B,C,D, defined by the cross-classification of voice and aspect, as shown in (86).
(86)

	Perfective	Imperfective
Active	A	B
Passive	C	D

The two possibilities appear in (87a) and (87b), below, the former representing the actual state of affairs in CA, the latter the logical alternative.
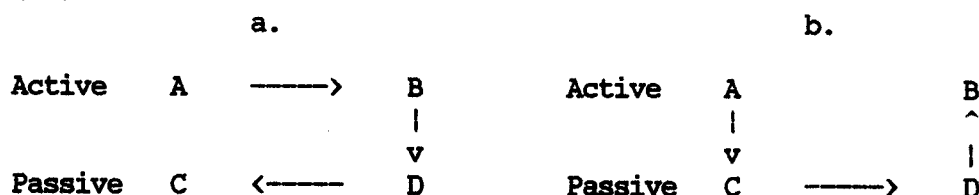
(87)

```
              a.                              b.

Active   A  ——→  B          Active   A  ——→  B
         |                           |        |
         v                           v        v
Passive  C  ——→  D          Passive  C        D
```

Any other (longer) path would entail the derivation of an Active from a Passive (D —> B), in contradiction with a previous move

47

(A --> C), as shown below in (88b), or the derivation of a Perfective from an Imperfective (D --> C), as in (88a) in contradiction with the reverse operation (A --> B).

(88)

```
                a.                                    b.

Active    A  ------->  B          Active    A                  B
          |            v                     |                  ^
          v                                  v                  |
Passive   C  <------   D          Passive    C   ------->       D
```

Thus, the longest possible derivational sequence in CA is 2. It follows from our theorem that the input melody must exhibit 2 elements.

We now know two things about the basic melody: 1) it comprises two items, 2) it has to allow for a full display of the apophonic chain in two shots. This entirely determines what these two items are: it has to be ∅ and a, the two elements which, each initiate one half of the chain. A question arises as to the order in which a and ∅ appear. Is it [a - ∅] or [∅ - a] ? A quick glance at (83) reveals that a 1 appears in each box showing that the Law of Perfect Apophony will be satisfied under either arrangement. This apparent looseness in our theory is, in fact, a welcome effect. Indeed, it is not for a theory of apophony to settle this issue. Rather, the answer pertains to the theory of autosegmental representations: under rightward spreading, there would be no possible phonetic interpretation of [∅ - a]. Thus, [a - ∅] is the only viable possibility. The nature of the underlying melody requires no specification. As the need for stipulation recedes even further, it appears that 2 things need to be figured out for the speaker to have a handle on apophony, the substance of apophony (say, i --> a rather than i --> u) and the set of categories to be derived.

6. Conclusion

In this paper we have provided a unified account of the vowel correspondences observable in the verbal system of Classical Arabic. The device we have proposed, an apophonic mechanism reapplying on its own output, drastically reduces the role of the lexicon. The ingredients of apophony are identified, as well as its domain, the binyan.

This definition of the domain of apophony, is arrived at based on considerations entirely distinct from apophony, viz. the attempt summarily sketched out in Section I to understand why Classical Arabic displays all and only the forms it does. As already pointed out, this attempt rests on the idealization that one single binyan forms the basis of all derivations. That the workings of apophony should be sensitive to the posited internal structure of the binyan constitutes in itself an extremely strong argument in favor of such a construction. However, this effect goes well beyond the sort of uninterpreted happy coincidence usually labeled "independant evidence". Indeed, we argued that apophony is the vehicle of a set of morphological, indeed derivational operations. Thus, there is nothing accidental in the fact that the domain over which apophony is operative turns out to be precisely the matrix out of which all stems are generated

48

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