A prosodic account of syncope and epenthesis in Sudanese Colloquial Arabic

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In this paper I propose a theory of phrasing of P-Phrases in Sudanese Colloquial Arabic (SCA). In doing so, I show that complicated conditions on the application of the rule of syncope, proposed in previous analyses, are unnecessary. I argue that what has been previously analyzed as two types of syncope is in fact one process the asymmetrical nature of which is explained in terms of its interaction with the process of resyllabification. I consider the predictions of this analysis with regard to the process of epenthesis and show that a prosodic approach accounts for both processes in a unified way.

0.1 Introduction

In this paper, I propose a prosodic account for the processes of syncope and epenthesis in Sudanese Colloquial Arabic (SCA). I begin by examining Hamid’s (1984) account of syncope in SCA. He describes two rules of syncope that apply in opposite directions deleting high unstressed vowels. While right-hand syncope applies whenever its environment is met, left-hand syncope is a phrasal rule which is sensitive to the syntactic relation between the two words involved in its application; namely, the left-hand word must govern the right-hand one. In this paper I argue that syncope is in fact one process whose target is the underlined vowel in the sequence (V C V C V). This process applies at the levels of word, Phonological (P)-Phrase and Intonational (I)-Phrase.

In the first section of the paper I propose a rule of P-Phrase formation in SCA. I show that this rule accurately characterizes the domain of left-hand syncope, i.e., I show that LHS applies up to the P-Phrase level and not beyond. I provide further evidence for the significance of the P-Phrase as a domain of phonological processes by examining the behaviour of the degemination process. Furthermore, I consider the factors of rate of speech and weight of phonological material and propose a restructuring rule to account for cases where these factors affect the parsing of the P-Phrase. In the second section I show that RHS applies up to the I-Phrase level.

In the third section I account for the asymmetry in the domain of application of syncope in terms of the (re)syllabification process that occurs at the prosodic levels of word, P-Phrase, and I-Phrase. Specifically, I argue that as a consequence of the resyllabification process, the nucleus of an open syllable is deleted when its Onset is resyllabified as a Coda of the preceding syllable. Then I consider the prediction this analysis makes with regard to the behaviour of epenthesis. In section four, I consider the two types of epenthesis reported in the literature. The first one, discussed in
Broselow (1992), inserts a vowel to the right of a VCC# sequence. The second one, discussed in Kenstowicz (1986, 1994) and Hamid (1984), is argued to insert a vowel to the left of a #CCV sequence. I show that while the former does account for phonological alternation facts, the facts on which the latter is based are best explained in terms other than those of epenthesis. Accordingly, I conclude that the vowels this analysis deals with are in fact present underlingly. Finally, I modify the account of the asymmetry in the domain of application of syncope to accommodate the epenthesis facts as well.

0.2 Hamid's (1984) analysis of syncope

Hamid (1984) describes two rules of syncope in SCA which apply across a word boundary. The rules apply in two opposite directions (left-to-right and right-to-left) deleting high unstressed vowels. He defines the level at which these rules apply as phrasal.¹ Noting that they do not delete final or initial vowels of words, Hamid proposes the rule in (1) below to represent the two types of syncope (p. 122):

(1) \[
\begin{array}{c}
\text{+high} \\
\text{-stress} \\
\text{+syll}
\end{array} \quad \rightarrow \quad \emptyset / V (\#) C \rightarrow C (\#) V
\]

He notes that the rule, when applying from right-to-left, is "merely phonological in nature [operating] automatically whenever its phonological condition is met" (p. 116). When it applies in the opposite direction, however, "it seems to be sensitive, to some extent, to a certain syntactic relationship between the relevant elements" (pp. 117-18). Following are some of the examples he uses to illustrate the process.²

(2) Right-hand syncope (V#C __ CV)

a. V + Obj
   kåtabu kätåb
   wrote-they (a) book
   'They wrote a book'.

b. S + V-Obj
   Såli Sjriña
   Ali knew-us
   'Ali knew us'.

c. N + N
   dawa kybär
   medicine (of) adults
   'medicine for adults'

¹It is important to note that such a statement implies that the rules apply at the same level. I will return to this point later.
²Direction is defined with respect to the word containing the syncopated vowel. By right-to-left, he means that the syncopated vowel is in the right-hand word; left-to-right syncope affects the left-hand word.
d. N + Adj  
```
d. N + Adj  karāasi    kytāar     --> karāasi ktaar
         chairs     many
          'many chairs'
```

e. Prep + N  
```
e. Prep + N  mfā    ktyāb     --> mfā ktaab
             with      (a) book
              'with a book'
```

(3) Left-hand syncope (VC _ C#V)³

a. V + Obj  
```
a. V + Obj  jirb    al-gahwa  --> jirb al-gahwa
           (he) drank   the-coffee
             'He drank the coffee'.
```

b. S + V  
```
b. S + V  al-kalib    akal     --> al-kalib akal
           the-dog      he-ate       cf.*al-kalb akal
              'The dog ate'.
```

c. N + Rel. clause  
```
c. N + Rel. clause  al-kalib    al-akalu   --> al-kalb al-akalu
                   the-dog      that-ate-3sg
                      'the dog that ate it'
```

d. N + N  
```
d. N + N  juyul     ammad     --> juyl ammad
          work (of)   Ahmed
             'Ahmed's work'
```

e. N + Adj  
```
e. N + Adj  at-taadjr  as-suudani --> at-taadjr es-suudani
           the-merchant the-Suadanese
              'the Sudanese merchant'
```

f. N + Pred  
```
f. N + Pred  at-taadjr  amlin    --> at-taadjr amlin
             the-merchant (is) honest  cf.*at-taadjr amlin
                'The merchant is honest'.
```

Based on examples such as the above, Hamid (1984) argues that LHS is sensitive to the syntactic relation between the two words triggering its application. He claims that this rule applies only when the left-hand word governs the right-hand one. This point is illustrated by the structures of (3. e & f) in (4. a & b), respectively.

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³ Italics are used to indicate cases where the rule fails to apply.
Accordingly, he proposes the following syntactic constraint to be observed "upon the application of phrasal syncope" (p. 121):

(5) In phrase structure where one of the two adjacent words triggers the application of syncope to the other, syncope applies to the right-hand word once its phonological condition is met, regardless of the syntactic relation between the two, and applies to the left-hand word if the left-hand word governs the right-hand one. 4

Thus, he concludes that the rule stated in (1) above, together with the constraint in (5), accounts for the behavior of syncope in SCA.

Three points regarding Hamid's (1984) analysis of syncope are relevant to the goal of the present paper. First, the analysis proposes that two rules of syncope that apply in opposite directions exist in SCA. Second, these two rules are analyzed uniformly as applying at the same level. Third, the syntactic constraint on the rule, as stated in (5), makes the implicit assumption that phonological processes have direct access to syntax and syntactic relations. The analysis makes no reference to prosodic levels. In doing so, it fails to provide an adequate account of syncope, a point that will be demonstrated in the sections to follow. Appealing to prosodic levels, I will argue that the two rules of syncope described by Hamid are in fact instantiations of one process that applies at two different prosodic levels. While the domain of LHS is the P-Phrase, RHS applies at the level of the I-Phrase.

1.0 P-Phrase: The domain of left-hand syncope

The standard diagnostic of a prosodic level is the existence of phonological processes the domain of which is that prosodic level. In this section I provide evidence for the existence of a P-Phrase in SCA in terms of the domain of application of the phonological rules of syncope and degemination. I propose a basic rule of P-Phrase formation along the lines of the Designated Category (DC) Parameter and the End Parameter hypotheses as stated in Hale and Selkirk (1987) 5. As a working hypothesis I assume that the DC that is relevant to defining the domain of the P-Phrase in SCA is X\text{max}. I further assume that the end of the DC that is relevant to the formation of the P-

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4Hamid (1984) defines government in terms of the head-complement relation. That is "the head of a phrase ... governs its complement" (Footnote (3) p. 131).

5The hypotheses state that 1) only one DC\text{max} or X\text{head} is relevant to defining the prosodic level PL\text{max} and 2) only one end of DC\text{max} (right or left) is relevant to the formation of PL\text{max}. 

Phrase is the right end. Accordingly, I propose the rule of P-Phrase formation in (6) below.

(6) P-Phrase Formation:
Form a P-Phrase boundary at the right end of every $X_{\text{max}}$ in the input.

Assuming that LHS applies at the P-Phrase, I will now show that the rule in (6) accurately defines the domain of its application. Consider (7) below, where LHS applies, deleting the underlined vowel of the verb.

(7)

The rule in (6) states that the end relevant to P-Phrase formation is the right end of $X_{\text{max}}$. It is evident from example (7) that the relevant DC is not $X_{\text{head}}$. If that were the case, the right end of the rule domain should be the right end of V, and the rule should fail to apply. It should also fail to apply if the relevant end were the left one. In this case, the left end of the domain would be the left end of N. It is reasonable, therefore, to conclude that the relevant DC is $X_{\text{max}}$. The relevant end of $X_{\text{max}}$ cannot be the left end. The rule, then, would fail to apply since the left end of its domain would be the left end of NP. Thus, the rule in (6) accurately predicts the domain of LHS in example (7). I will now provide further evidence for the accuracy of rule (6) by considering cases where the rule is blocked. Consider (8) below.
The rule fails to apply to delete the high vowel of the first NP. This can be accounted for if the end relevant to P-Phrase formation is the right end of $X^{\text{max}}$ (in this case it is the right end of NP). Further evidence for this analysis comes from (9) where the rule applies in one environment and fails to do so in another.

As predicted by rule (6) syncope fails to apply to delete the high vowel of the first NP since the right end of its domain is the right end of that NP. However, since the next right end of $X^{\text{max}}$ is that of the second NP, the rule applies deleting the vowel of the verb.
Based on the discussion of examples (7-9) above, rule (6) accurately defines the P-Phrase in SCA, which is the domain of application of LHS. I will now demonstrate how this rule is consistent with the behavior of LHS in examples similar to those discussed in Hamid (1984). Consider the structures of (3. e & b), repeated as (10) and (11) respectively.

(10)

```
NP
  N
  al-taadjr
' the-merchant'
  AP
  al-suudaani
' the-Sudanese'
```

By rule (6), this structure consists of only one P-Phrase, in which case syncope is expected to apply and, in fact, it does. Now compare (10) to (11) below.

(11)

```
S
  NP
  al-taadjr
' the-merchant'
    A
    amin
    X_{max}
  AP
  X_{max}
  amin
' The merchant is honest.'
```

Although in (10) and (11) the same phonological environment triggers the application of syncope, the latter consists of two P-Phrases. This is consistent with the fact that syncope is blocked in (11) since the right end of its domain is that of NP.

Now compare (8), where the rule is blocked, to (12) below.
According to rule (6) only two P-Phrases can be formed in (12). Once again, this is consistent with the fact that syncope applies to delete the high vowel of the first NP and that it fails to do so with respect to the second NP.

Finally, consider (13. a & b) below.

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6It is worth mentioning here that (12) in fact consists of three P-Phrases. I will demonstrate in section (1.3) that factors such as rate of speech and weight of phonological material may influence P-Phrase formation, parsing an utterance into a number of P-Phrases greater than that allowed by rule (6). What is relevant at this point is the fact that although in (8) and (12) the phonological (i.e., segmental) environment triggering the application of syncope is met, the rule is blocked in the former and not in the latter.
Once again, these examples demonstrate that LHS consistently applies within the P-Phrase as defined by rule (6). It operates in (13.a) where the two words triggering its application are in the same P-Phrase and it is blocked in (13.b) where the relevant two words are in separate P-Phrases.

To conclude, in this section I have provided an account of LHS in terms of a theory of phrasing of P-Phrases. I have demonstrated that this process applies at the P-Phrase level and not beyond and that the P-Phrase, as stated in rule (6), is formed with reference to the right end of x^max. Clearly, the syntactic-government-based analysis proposed by Hamid (1984) equally accounts for the facts discussed thus far. However, in the following section I show that the P-Phrase is the domain of rules other than LHS, i.e., it is not specific to the latter. I then introduce facts that demonstrate that the phrasing analysis is more adequate than the syntactic government analysis.

1.1 P-Phrase: The domain of degemination

Hamid (1984) describes a rule of degemination that applies at the word level. In SCA the final consonant of forms that are underlyingly CVC, C is deleted by stray-
erasure unless the form is followed by a suffix of the shape VC. In this environment the second C in the geminate is syllabified as an onset of the following syllable. This is illustrated in (14) below.

(14) a. bitt + ik → bit.tik
girl + your (f. sg.)'your daughter'

b. umm + ik → um.mik
mother + your (f. sg.)'your mother'

Examples (15) and (16) below demonstrate that the P-Phrase is also the domain of application of this rule above the word level.

(15)

(16)

Stray erasure is blocked in (15) and it applies in both cases in (16). This is to be expected since the relevant two words in the former are in the same P-Phrase while in both cases in the latter they are in separate P-Phrases.

In conclusion, the phonological process of degemination discussed in this section provides further evidence for the significance of the P-Phrase as a domain of
phonological processes in SCA. In the following section, I examine the factors of rate of speech and weight of phonological material insofar as they affect P-Phrase formation.

1.2 Factors affecting P-Phrase formation

Further investigation of SCA data reveals that P-Phrase formation is affected by rate of speech and the number of phonological words to be parsed in a P-Phrase. Having demonstrated that LHS applies in the P-Phrase, I will consider cases where the rule is blocked to illustrate the exact effect of these factors on P-Phrase formation. Accounting for these facts provides strong support for the present analysis over that of Hamid (1984). The latter analysis predicts that syncope applies whenever the syntactic condition required for its application is met. Consider (17) below which has the same structure as that of (13a).

(17) kutb al-kaatib al-gadiim

'the old writer's books'

Normal/Fast rate: 

a. (kutb al-kaatib) (al-gadiim) (WW) (W)

b. (kutb) (al-kaatb al-gadiim) (W) (W W)

c. * (kutb al-kaatb al-gadiim) * (W W W)

Slow rate:

d. (kutb) (al-kaatb) (al-gadiim) (W) (W) (W)

According to P-Phrase formation, (17) consists of only one phonological phrase. The fact that a double application of syncope is blocked in (17.c), however, suggests that the rule of P-Phrase Formation in (6) is sensitive to rate of speech and the number of phonological words in a P-Phrase. With respect to rate of speech, there is no difference in phrasing. In both cases the P-Phrase consists of either one or two words with no restriction on ordering of phrases with respect to weight. Although the phonological phrase may consist of only one word in slow speech, it may not consist of more than two words regardless of the rate of speech (cf. (17.c & d). Thus, it seems that there is a restriction on P-Phrase weight irrespective of its distribution. To test the validity of this statement, consider the more complex example (18) below.
According to P-Phrase formation in (6), (18) consists of two phrases. Relevant to our present discussion is the first P-Phrase which is demarcated by the right end of NP. Consider the restructuring this phrase undergoes in (19) below.

The validity of the statement regarding the sensitivity of the P-Phrase Formation rule to rate of speech and phonological weight is supported by the phrasing of (18). The only factor that phrasing is sensitive to is the weight of the P-Phrase. Furthermore, there is no restriction on the distribution of phonological phrases with respect to weight.\(^7\)

Based on the discussion above, it is reasonable to conclude that the output of P-Phrase formation (6) is subject to a phrasing process whereby primitive phonological

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\(^7\)In this respect SCA is different from Italian. Chini (1993) shows that the distribution of phonological phrases in Italian is affected by the weight of phonological material.
phrases are parsed with respect to weight yielding P-Phrases that consist maximally of two words each. Accordingly, I propose the modified rule of P-Phrase formation (20).

(20) P-Phrase Formation:
   a. Form a P-Phrase boundary at the right end of each and every $X^{max}$ in the input.
   b. Parse the output of (a) into finer P-Phrases that consist maximally of two words each.

Thus stated, the rule in (20) provides an adequate account for the phrasing facts stated above.

In the following section, I will return to the phonological process of RHS. I provide evidence against Hamid’s (1984) assumption that this process applies at the same level as LHS. I show that RHS applies up to the level of the Intonational Phrase (I-Phrase) and not beyond.

2. Right-hand syncope

The observation made by Hamid (1984), that RHS applies whenever its phonological environment is met, indicates that it applies at a level higher than the P-Phrase (the domain of LHS). However, although it is true that the rule applies at a level higher than the P-Phrase, it is not exactly an accurate statement to say that it applies whenever its phonological environment is met. I provide evidence below that the rule applies at the I-Phrase level and that it is blocked when the two words triggering its application occur in two adjacent I-Phrases.

Consider how (21) is parsed into I-Phrases depending on the rate of speech.

(21) *lamma* *wasiina* *al-hilla* *ligiina* *al-nas* *rahalu*

when (we) arrived the-village (we) found the-people left

'When we arrived at the village we found that the people had already left.'

Fast rate: (lamma wasiina al-hilla ligiina annas rahalu)
Normal rate: (lamma wasiina al-hilla) (ligiina annas rahalu)

In fast speech (21) has one intonational contour, i.e. it forms one intonational phrase. The rule applies throughout the I-Phrase deleting the high vowels in both verbs. In normal speech, however, (21) is divided into two I-Phrases and the rule is blocked since the second word triggering its application is in the second I-Phrase.

Based on the behavior of RHS in (21) above, it is reasonable to conclude that this rule applies at the level of I-Phrase.

To conclude, in the previous sections I have proposed a theory of phrasing of P-Phrases for SCA. Then, I have demonstrated that while LHS applies up to the level of the P-Phrase, RHS applies up to the level of the I-Phrase. In the following section I explain this asymmetry in the domain of application in terms of the interaction of syncope with the process of resyllabification.
3. The interaction between syncope and resyllabification

We have observed that right-hand syncope (RHS) applies everywhere up to the level of I, but LHS applies only up to the P-phrase. But why should this be the case? It is apparent that RHS and LHS are essentially the same process, differing only in the position of the word divisions. I believe the answer lies in the relation between syncope and syllabification, or resyllabification. Notice that syncope minimally has the effect of resyllabifying the onset of the syncopated vowel, shown in (22.a), into the preceding coda (22.b).

(22) Effects of syncope
a. Before syncope: V.CV.CV
b. After syncope: VC. Ø CV

Indeed, if this C is not able to immediately resyllabify in this way, the syncope is blocked. This is the significance of the left-hand context VC of the rule. The right-hand context is there to ensure that the C following the syncopated vowel will end up in the onset of the next syllable, if not already there.

To simplify the discussion, I will assume that resyllabification precedes syncope: i.e. I will assume that vowels which are capable of being syncopated are weak in a sense that needs to be made precise. Stressed vowels and long vowels cannot be weak. Also, a weak vowel is strengthened if supported by a coda. Effectively, then, a weak vowel in SCA is an unstressed short high vowel. I assume also that weak vowels do not retain their onsets if they can rather syllabify as codas. I call this Onset Defection, shown in (23) (by ‘weak’ I mean here also that there is no coda).

(23) Onset Defection
V. Cv --> VC. v where v is weak.

Then, syncope applies to a weak vowel that is alone in its syllable:

(24) Revised syncope
.v. --> Ø

Viewed this way, restrictions on syncope where the linear conditions appear to be met must be due to some restrictions on resyllabification.

Let us then turn to LHS. The rule applies within a P-phrase. Assuming that syllabification occurs first at the word-level, the output of the word-level phonology of a typical example would appear as in (25.a). Syncope cannot occur at the word level, because the final C of the first word has nowhere to go, so the onset of the potentially weak vowel cannot defect. At the P-phrase level, however, the final C of the first word can syllabify as an onset. This permits the onset to defect, triggering syncope.

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8 An earlier version of this section was written in collaboration with B. Elan Dresher.
Turning now to RHS at the phrase level, we observe that the derivation is as with LHS, except that there is no need for resyllabification into onset. Rather, Onset Defection occurs across the word boundary, and syncope occurs as before, as shown in (26).

Let us now consider why LHS is blocked when the two words are not in the same P-phrase.

In (27) the two words are in different P-phrases (the W-level is not shown). We know that syllabification into onset can occur across a P: it is audible in the surface syllabification of this phrase; nevertheless, syncope cannot occur. The problem must then be with Onset Defection. As a first approximation, then, I propose that Onset Defection is blocked after the P-phrase level. This constraint needs to be refined, however, since RHS can occur across a P-phrase, as shown in (28).

As is evident, Onset Defection is not blocked in (28 b). There is a crucial difference in the domain of application of Onset Defection in LHS and RHS, however: in RHS, Onset Defection applies across the P boundary, in a derived environment. In (27), Onset Defection, if it were to apply, would be applying wholly within the domain of the left-hand word. This is allowed within a P-phrase, as we have seen. Our proposal, then, is that resyllabification is free, being no more restricted than initial syllabification, up to the level of the P-phrase. After the P-phrase, within I, resyllabification may occur in derived environments, i.e. environments that do not exist until the I-phrase level. This
is why resyllabification to Onset is permitted in all cases, and why Onset Defection is permitted only with RHS.

Further evidence that the P-phrase is a significant level for syllabification in SCA is provided by the rule of degemination: recall that the final consonant of a word ending in a geminate is subject to stray erasure unless it can be resyllabified within the P-phrase; this is shown in (29).

(29) **W-final geminate syllabified at P**

a. **W:** Syllabification: (al. bit. ū.) w(al. ka. bī. ra) w
   
b. **P:** Syllabify into Onset: ((al. bit. ū)(al. ka. bī .ra)) p

The important point here is that the underlined stray C may not be erased at the word level, even though it is not properly syllabified. If the stray C cannot be syllabified within the P-phrase, however, it is erased.

(30) **W-final geminate not syllabified at P**

a. **P:** Syllabification: (a. lūm. m.) (in. na)
   
b. **P:** Stray Erasure: (a. lūm. Ø) (in. na)
   
c. **I:** Syllabify into Onset: (a. lū. m)(in. na)

We can conclude from these facts that syllabification remains freely in progress until the P-phrase level. By this I mean that no restrictions are placed on resyllabification up to the P-Phrase level. At the end of the P-phrase level, however, basic syllabification is fixed and all segments must be properly syllabified. Further alterations to this syllable structure are possible at the I-Phrase level, but only in derived environments.

In the previous sections, I have shown that syncope in SCA is a single rule which applies in the phrasal phonology. I have argued that the phonological phrase is derived from the syntax by the algorithm in (20). I have accounted for the asymmetry between left-hand and right-hand syncope in terms of the restriction on syllabification when it must apply above the phonological phrase. Specifically, I have concluded that no restrictions are placed on resyllabification until the P-Phrase level and that at the end of this level basic syllabification is fixed. At the I-Phrase level, alterations to this syllable structure are possible only in derived environments. Thus stated, this account of the asymmetry facts might lead one to conclude that degenerate syllables in SCA are tolerated up to the P-Phrase level. Such a conclusion would, in turn, make certain predictions with regard to the behaviour of the process of epenthesis in SCA. I explain this point below.

Consider the underlined consonants in the sequences CVCC and CCVC. Conceivably a number of processes, functioning as strategies of repairing degenerate syllables such as these, may be available to the language. Relevant to the present discussion, however, are two such processes. The first one is epenthesis which may operate at the word level creating a new syllable by inserting a vowel after the underlined consonant in the first sequence and before it in the second one. This is shown in (31) below.
The second one is the resyllabification process which is available at the P-Phrase level. Given the appropriate environment, this process may incorporate the underlined C into the edge of an adjacent syllable. This is illustrated in (32) below.

The word following the underlined consonant in (32.a) begins with a vowel. This allows the C to be resyllabified as an onset of the following syllable at the P-Phrase level. Similarly, the word preceding the underlined consonant in (32.b) ends with a vowel. Again, this makes it possible for the C to be syllabified as a coda of the preceding syllable at the P-Phrase level. The conclusion that degenerate syllables are tolerated up to the P-Phrase level (where they can be repaired through the resyllabification process), predicts that the process of epenthesis ought to apply only at the P-Phrase level. In other words, it ought to apply only in the absence of the environments necessary for incorporating the underlined C into the edge of an adjacent syllable; specifically, when a word-final degenerate syllable is followed by a word that begins with a consonant and when a word-initial degenerate syllable is preceded by a word that ends with a consonant. This is illustrated in (33.a and b), respectively.

However, we shall see later that this prediction is inaccurate. In order to demonstrate this point, I will first examine the two types of epenthesis reported in the literature.

4.0 Epenthesis in SCA

The literature on the phonology of SCA reports two types of epenthesis. The first one, discussed in Broselow (1991), inserts a vowel to the right of a VCC# sequence (henceforth left-to-right epenthesis). The second one, discussed in Kenstowicz (1986 & 1994) and Hamid (1984), is argued to insert a vowel to the left of a #CCV sequence (henceforth right-to-left epenthesis). In this section, I consider the nature of the sound alternations that these processes are argued to account for. I briefly review the former and show that it deals with sound alternations that can only be explained in terms of the process of epenthesis. Then, I consider the arguments on which the latter is based and demonstrate that these are problematic in various ways. I argue that the facts on which they are based are best explained in terms other than those of the process of epenthesis, and that the vowels this analysis deals with are in fact present underlyingly. Accordingly, I conclude that there is only one type of epenthesis in SCA rather than two.
4.1 Left-to-right epenthesis

Broselow (1991) proposes a unified account of the processes of epenthesis and syncope in the Cairene, Makkan, Sudanese, and Iraqi dialects of Arabic. She argues that these processes are motivated by a constraint that requires syllables be "maximally and optimally bimoraic" (p. 5). It is beyond the scope of this paper to discuss Broselow's theoretical claims and the accounts she provides for these processes. Relevant to the task at hand, however, is the nature of the vowels she treats as epenthetic in SCA.

Broselow merely notes that, in this language, an epenthetic vowel a is inserted to the right of an underlying VCC sequence creating, thereby, a new syllable the onset of which is the second consonant in the sequence. In the following section, I provide arguments for the existence of this process.

One such argument is based on the variation in the form of the first person singular subject suffix. This is illustrated in (34) below.

(34)  

\begin{tabular}{lll}  
  i & ii &  \\
  katab-ta & 'I wrote' & mafee-t & 'I went' \\
  darab-ta & 'I hit' & 2addee-t & 'I gave' \\
  2akal-ta & 'I ate' & ligii-t & 'I found' \\
  2akan-ta & 'I lived' & bigii-t & 'I became' \\
\end{tabular}

The subject suffix has two forms, -ta in (34.i) and -t in (34.ii). Thus, either the vowel is present underlingly and is deleted in the latter, or it is epenthetic in the former. A deletion analysis would fail to account for the behaviour of other subject suffixes. For instance, the vowel of the first person plural suffix na appears with both types of verbs in (34) (cf. katab-na 'we wrote' and mafee-na 'we went'). Note that while verbs in (34.i) end in a consonant, verbs in (34.ii) end in a vowel. Accordingly, we can reasonably assume that the underlying form of the first person singular suffix is -t. Adding the suffix to verbs that end in a consonant, such as those in (34.i), results in a VCC# sequence. It is this environment that triggers the application of epenthesis, resulting in a new syllable the onset of which is the second consonant in the sequence. As such, the motivation of this process is justifiably explained in terms of a constraint on syllable structure in SCA that disfavors complex codas.9 I demonstrate below that this explanation is supported by the highly restricted distribution of superheavy syllables of the form CVCC (the only form that consists of a complex coda).

Superheavy syllables of the form CVCC occur in final position in only two types of words, borrowed words (e.g., bank 'bank', half 'valve') and roots that end in a geminate (e.g., mahall 'place', damm 'blood'). In fact, the former type represents the only case where the complex coda actually appears on the surface. As mentioned earlier, the final consonant of forms that are underlyingly CVC\_Ci is deleted by a degemination process unless the form is followed by a word that begins with a vowel. In this

9Since it is not the object of the present paper to provide a theoretical account of the process of epenthesis, I will not give a formal representation of this constraint. Instead, I will merely show that syllables with complex codas are highly disfavoured in SCA, a fact that explains phonological processes such as epenthesis and degemination.
environment, the second consonant of the geminate is resyllabified as an onset of the following syllable. This is illustrated in (35) below.

\[(35)\]
\[\begin{align*}
a. \text{ ma.hall } & \text{ fa.ti.ma } \rightarrow \text{ ma.hal.fa.ti.ma} \\
& \text{ place Fatima} \\
& \text{ 'Fatima's Place'} \\
b. \text{ ma.hall } & \text{ ah.med } \rightarrow \text{ ma.hal.lah.med} \\
& \text{ place Ahmed} \\
& \text{ 'Ahmed's place'}
\end{align*}\]

Thus, in (35.a) where the second word begins with a consonant, degemination applies deleting the second consonant of the geminate. In (35.b), where the second word begins with a vowel, the second consonant of the geminate is resyllabified as an onset of the following syllable. In either case, the result is a syllable with one consonant in the coda position. This clearly demonstrates that the degemination process in (35.a) is motivated by some sort of a constraint banning complex codas.

Now turning to epenthesis, examining the behavior of roots with final geminates at the word level reveals that the constraint on complex codas also motivates this process. Consider the examples in (36) below.\(^{10}\)

\[(36)\]
\[\begin{align*}
a. \text{ ma.hall+ak } & \rightarrow \text{ ma.hal.lak} \\
& \text{ place-2msg.poss.} \\
& \text{ 'your place'} \\
b. \text{ ma.hall+ik } & \rightarrow \text{ ma.hal.lik} \\
& \text{ place-2fsg.poss.} \\
& \text{ 'your place'} \\
c. \text{ ma.hall+na } & \rightarrow \text{ mahal.la.na} \\
& \text{ place-1pl.poss.} \\
& \text{ 'our place'} \\
d. \text{ ma.hall+kum } & \rightarrow \text{ mahal.la.kum} \\
& \text{ place-2pl.poss.} \\
& \text{ 'your place'}
\end{align*}\]

In (36.a&b), where the root is followed by a suffix that starts with a vowel, the second consonant of the geminate is resyllabified as an onset of the following syllable. However, in (36.c&d) where the suffix starts with a consonant, an epenthetic vowel is inserted between the root and the suffix resulting in a new syllable the onset of which is the second consonant of the geminate. Once again, in either case, the result is a syllable

\(^{10}\)Based on forms such as \textit{galam-ak} 'your (m.sg) pen', \textit{galam-ik} 'your (f.sg) pen', \textit{galam-na} 'our pen', and \textit{galam-kum} 'your (pl.) pen', the underlying forms of the possessive suffixes are \textit{-ak}, \textit{-ik}, \textit{-na}, and \textit{-kum}, respectively.
with only one consonant in the coda position. More importantly though, the alternation in the forms of the possessive suffixes between -na/-ana and -kum/-akum can only be explained in terms of epenthesis.

In conclusion, the above discussion provides evidence for the existence of the epenthesis process noted in Broselow (1992). It has been demonstrated that the alternation in the forms of the subject and possessive suffixes can only be accounted for in terms of this process. Furthermore, it has been shown that the process of epenthesis itself is motivated by a constraint on syllable structure that disfavors complex codas. In the following section, I discuss the second type of epenthesis proposed in Kenstowicz (1986, 1994) and Hamid (1984). I show that the facts on which their analyses are based are better explained in terms other than those of epenthesis and, consequently, that the vowels they consider are in fact present underlingly.

4.2.0 Right-to-left epenthesis

Kenstowicz (1986) proposes an account for the alternation of i with  in Levantine, Bani-Hassan and Sudanese dialects of Arabic on the basis of a theory that restricts the core syllables of Arabic to those maximally consisting of two elements in the rime position, i.e., syllables of the forms CV, CVV, CVC which are derived by the three rules in (37) below (p. 105).

(37)  i. V → V  ii. C → C / V  iii. V → C
      \ |   \ |   / \ |   / R  O   R

He argues that the superheavy syllables CVVC/CVCC are constructed postlexically. These syllables are analyzed as consisting of an extrasyllabic consonant which is assigned to a rime position (R). A word whose underlying form consists of a superheavy syllable is, then, assumed to motivate one of two possible processes. The first process merges the rime of the extrasyllabic consonant with that of the preceding element in the skeletal tier. Kenstowicz assumes that this process is subject to the falling sonority condition which states that the extrasyllabic consonant must be lower in the sonority scale than the preceding element. As such, since vowels have greater sonority than consonants, the rime assigned to the extrasyllabic consonant in a CVVC syllable will always be merged with the rime of the core syllable. Superheavy syllables of the form CVCC, on the other hand, may result in a situation where the second consonant has greater sonority than the first one violating the falling sonority condition. These cases motivate the application of two rules. The first one inserts a V slot on the skeletal tier to the left of the extrasyllabic consonant. The second process associates the V slot with a default i in the segmental tier. This is illustrated by the derivation of the Lebanese noun himil 'load' in (38) below.
Kenstowicz argues that this analysis accounts for the behavior of the vowel of the passive prefix in in SCA. Following Hamid (1984), Kenstowicz assumes that the underlying form of the passive prefix is $n$. Thus, the underlying form of $\text{inkatal} \ 'was killed'$ is $/nkatal/$. The prefix vowel is assumed to be inserted by the default rule described in (38) above. Kenstowicz provides two arguments for this analysis. First, he notes that this vowel is not present in the surface when preceded by a word that ends in a vowel. Kenstowicz gives the examples in (39) below (pp. 117-18).

(39) a. $\text{al-walad in-katal} \rightarrow \text{al-wala.din.ka.tal}$
    the-boy Pass-killed
    ‘the boy was killed’

b. $\text{walad-u n-katal} \rightarrow \text{wala.dun.ka.tal}$
    boy-his Pass-killed
    ‘his boy was killed’

In cases such as (39 b), he argues that the vowel is never inserted. Rather the rime projected by the consonant of the passive prefix is merged with that of the preceding vowel.

The second argument he provides is based on the fact that the prefix vowel never receives stress even when it is the nucleus of the only heavy syllable in the word.

Although Kenstowicz’s theory of syllable structure may be consistent with the epenthesis facts in Levantine and Bani-Hassan dialects of Arabic, there are several problematic points regarding the arguments he provides for the analysis of the vowel of the passive prefix in SCA. I consider this issue below and show that the vowel of the prefix is in fact present underlyingly.

4.2.1 The first argument: $\emptyset/i$ alternation

As mentioned above, Kenstowicz’s first argument for the epenthesis analysis is based on his observation that the prefix vowel is not present when the preceding word ends in a vowel. However, this observation is not completely accurate. Further examination of SCA data shows that the presence and/or absence of the prefix vowel depends on the quality of the vowel preceding it. To illustrate this point, consider (40) below.

(40) $\text{fa.li in.ka.tal} \rightarrow \text{fa.liin.ka.tal}$
    Ali Pass-killed-3m.sg.
    ‘Ali was killed.’
Thus, on a par with (39), where the vowel of the prefix is absent, there is (40) where the vowel is present. Note that the two examples are different in that the vowel of the preceding word in (40) is identical to that of the prefix. As such, the behavior of the prefix vowel can best be explained in terms of hiatus resolution mechanisms. In SCA, there are two possible processes that operate to resolve hiatus whenever the result of the resyllabification process is a syllable whose nucleus consists of two vowels of different qualities. One process deletes the second vowel, a fact that explains the absence of the prefix vowel in (39). The other process creates a new syllable by inserting a glottal stop between the two vowels. This is illustrated in (41) below.

(41)  
\[\text{Usaama in.kal} \rightarrow \text{Usaama in.kal} \rightarrow \text{Usaama in.kal}\]

'Usaama was killed'

Note that this same process may also apply to Kenstowicz’s example (39), yielding \(\text{wa.la.du.nin.kal}\). Evidently, the epenthesis analysis is not consistent with these facts. Since it asserts that the prefix vowel is not inserted when it is preceded by a word that ends in a vowel, it falls short of accounting for the long vowel in (40) above. For the same reason, it fails to account for the presence of the prefix vowel in (41). These facts are only explained if we assume that the vowel of the prefix is present underlingly and that it's absence in (39) is a product of the hiatus resolution mechanism that is pervasive in SCA. Further evidence for this analysis comes from examining the behavior of initial vowels of varying qualities. Consider the examples in (42-44) below.

(42)  
\[\begin{array}{l}
\text{mi.nu in.ti} \rightarrow \text{mi.nu in.ti} \rightarrow \text{mi.nu in.ti} / \text{mi.nu in.ti} \\
\text{who you-f.sg.}
\end{array}\]

'Who are you?'

\[\begin{array}{l}
\text{lee.ki in.ti} \rightarrow \text{lee.ki in.ti} \rightarrow \text{lee.ki in.ti}
\end{array}\]

'This is for you.'

(43)  
\[\begin{array}{l}
\text{in.tu ag.su du} \rightarrow \text{in.tu ag.su du} \rightarrow \text{in.tu ag.su du} / \text{in.tu ag.su du}
\text{you-pl. sit-2pl.}
\end{array}\]

'Sit!'

\[\begin{array}{l}
\text{in.tu ag.su du} \rightarrow \text{in.tu ag.su du} \rightarrow \text{in.tu ag.su du}
\text{you-m.sg. sit-2m.sg.}
\end{array}\]

'Sit!'

(44)  
\[\begin{array}{l}
\text{in.ti a.bee ti} \rightarrow \text{in.ti a.bee ti} \rightarrow \text{in.ti a.bee ti} / \text{in.ti a.bee ti}
\text{you-f.sg. refused-2f.sg.}
\end{array}\]

'You refused.'
In (42 a) the pronoun inti is preceded by a word that ends in a vowel of a different quality than that of the initial vowel of the pronoun. As indicated above, one of the two processes of hiatus resolution may apply. The initial vowel of the pronoun may either be deleted, or an epenthetic glottal stop is inserted between the two vowels, thereby creating a new syllable. In (42 b), on the other hand, the final vowel of the preceding word is identical to the initial vowel of the pronoun. As such, resyllabifying the two vowels as the nucleus of one syllable does not result in a hiatus situation. Thus, the result of the resyllabification process is a syllable whose nucleus is a long vowel. The same observations are true with respect to the behavior of the initial vowels of the verbs in (43) (44). In cases where the preceding vowel is of a quality different from that of the vowel of the verb (a-sentences), either the latter is deleted or a new syllable is created by inserting a glottal stop between the two vowels. In cases where the two vowels are of the same quality (b-sentences), they are resyllabified as the nucleus of the same syllable. 11

A crucial argument for analyzing the vowel of the passive prefix as present underlingly comes from examining the behavior of initial vowels in non-derived environments. Consider the examples in (45 & 46) below.

(45) a. is.m-u ah.mad --> is.mu.h.mad --> is.muh.mad / is.mu.ah.mad  
        name-his Ahmed  
        'His name is Ahmed.'

b. is.m-u u.saa.ma --> is.muu.saa.ma --> is.muu.saa.ma  
        name-his Usaama  
        'His name is Usaama.'

(46) a. is.m-a.ha ij.laal --> is.ma.haj. laal --> is.ma.haj. laal / is.ma.ha.2ij.laal  
        name-her Ijlaal  
        'Her name is Ijlaal.'

b. is.m-i ij. laal --> is.miij. laal --> is.miij. laal  
        name-my Ijlaal  
        'My name is Ijlaal.'

Clearly, the initial vowels of the proper names in (45 &46) behave in an identical manner to that of the vowel of the passive prefix. In the a-examples the final vowel of the preceding word is different from the initial vowel of the name. When these are

11Note that while it might be argued that the verb initial vowel is epenthetic in the imperative form agfud 'sit' in (43), the same argument cannot be made with regard to the vowel of the verb abeeet 'refused' in (44). Since the latter does not start with a consonant cluster, it is inconceivable how epentheses would be motivated.
resyllabified as the nucleus of the same syllable, either of the two hiatus resolution processes may apply. Specifically, either the initial vowel of the proper name is deleted, or a new syllable is created by inserting a glottal stop between the two vowels. In the b-examples, on the other hand, the two vowels in question are of the same quality. Thus, the resyllabification process yields a syllable whose nucleus is a long vowel.

Evidently, Kenstowicz's first argument for the epenthesis analysis is not consistent with the facts revealed by the above examples. Specifically, the vowel of the passive prefix and vowels in non-derived environments behave in an identical manner. This fact can only be explained by analyzing the former as present underlyingly. As such, the presence/absence of the vowel of the passive prefix is explained in terms of the mechanism of hiatus resolution that is pervasive in the grammar of SCA. In the following section, I address Kenstowicz's second argument for the epenthesis analysis.

4.2.2.0 The second argument: Failure of the prefix vowel to receive stress

The second argument that Kenstowicz presents in support of the epenthesis analysis is that, even when the passive prefix is the only heavy syllable in the word, the prefix vowel never receives stress. He takes this fact to mean that the vowel is not present at the level at which stress is assigned. It is relevant to mention here that Kenstowicz's argument is based on Hamid's (1984) analysis of stress in SCA. In the following section, I demonstrate that Hamid's analysis is problematic in various respects and that the analysis argued for in Ali (1994) is consistent with the facts of stress in SCA. Furthermore, I show that the fact that the vowel of the passive prefix is never stressed is predicted by the algorithm responsible for assigning stress.

4.2.2.1 Hamid's (1984) analysis of stress

Hamid (1984) describes the stress pattern of SCA (p. 37) as follows:

\[(47)\]
\[
\begin{align*}
\text{a. Stress the heavy syllable in a word that has only one heavy syllable.} \\
\text{b. In a word that has more than one heavy syllable, stress the rightmost one} \\
\text{c. Otherwise, stress the first syllable.}
\end{align*}
\]

Accordingly, he proposes that stress is assigned by a rule that 1) forms unbounded left-dominant feet iteratively and 2) forms a right-dominant word tree.

The first problematic point about Hamid's analysis is that it is observationally inadequate. According to the descriptive statement (47.a), if a word consists of one heavy syllable that syllable receives stress. Further examination of SCA data shows this not to be the case. Consider the nouns in (48) below.

\[(48)\]
\[
\begin{align*}
\text{a. } & \text{zambélak} \quad \text{cf. } *\text{zambélak} \quad \text{‘pendulum’} \\
\text{b. } & \text{manjúlk} \quad \text{cf. } *\text{manjúlk} \quad \text{‘Manjuluk’} \\
\text{c. } & \text{muntasír} \quad \text{cf. } *\text{muntasír} \quad \text{‘Muntasír’}
\end{align*}
\]

Note that final consonants are extrametrical in SCA. Hamid's rule predicts stress to be assigned to the first syllable, since it is the only heavy syllable in the word, yielding the
unacceptable forms in the second column. It is crucial to note that these are non-
derived words, a fact that rules out any derivational account (e.g., epenthesis) for the
failure of the heavy syllables to receive stress. Thus, Hamid’s analysis is empirically
inadequate, a natural consequence of the fact that it is based on partially inaccurate
observations.

Although Hamid does not discuss cases such as those in (48), he considers some
problematic data in arguing for the adequacy of his analysis of stress. I discuss some of
these below and show that his account of them is also inadequate. First consider the
verbal forms of measure VIII in (49) below where the only heavy syllable (the initial
one) is not stressed.

(49) a. iftáraa 'he lied'
    b. iftáyal 'he worked'
    c. iyttáreb 'he travelled'
    d. intázá 'he waited'

Hamid proposes to account for the failure of the only heavy syllable in each of the
examples above to receive stress by analyzing the initial vowel as being epenthetic. His
argument for such an analysis is based on the same two observations made by
Kenstowicz (1986) in relation to the passive prefix. Specifically, the initial vowel in
question is not present when the verb is preceded by a word that ends in a vowel and
that it does not receive stress. Considering these observations one at a time, the first one
cannot be interpreted as evidence for the epenthesis analysis. This is so because the
behavior of the verb initial vowel is consistent with the hiatus resolution process
described earlier. To illustrate this point consider the examples in (50) below.

(50) a. mi nu in.ta.żar --> mi.nuin.ta.żar / mi.nun.ta.żar
    who waited-3.m.sg.
    'Who waited?'

    b. in.ti in.ta.żar.ti --> in.tiin.ta.żar.ti --> in.tiin.ta.żar.ti
    you-f.sg waited-2.f.sg.
    'You waited.'

Clearly, the verb-initial vowels behave in identical manner to those discussed in section
(4.2.1). Consequently, the absence of these vowel in cases such as (50.a) cannot be used
as an argument for analyzing them as epenthetic. Such being the case, the only
remaining argument for the epenthesis analysis then is based on the fact that these
vowels never receive stress. In the following section of the paper, I provide further
evidence for the inadequacy of Hamid’s analysis of stress. Accordingly, I show that
failure of these vowels to receive stress cannot be interpreted as evidence for their
epenthetic nature. Rather, such behavior is predicted by a more adequate analysis of
stress in SCA.

Another problematic issue regarding Hamid’s (1984) analysis is his treatment of
the apparent inconsistency of the imperfect prefix with regard to stress. He claims that
this prefix has two allomorphs, ya- and yi-. The former appears in measures I and IV
before roots of the form CCVC and receives stress. The latter appears with other root forms and does not receive stress. This is illustrated in (51) below.

(51) a. ya-kṭib 'he writes'
    b. yi-ṭṭāyil 'he works'

Hamid proposes to account for these facts by lexically marking the yi- form extrametrical (p. 54).

The argument against this analysis is twofold. First, the two forms of the imperfect prefix are dialectal variants and not allomorphs. Thus, speakers of a given dialect exclusively use one or the other regardless of the root form. Moreover, these two forms behave in an identical manner with regard to stress in their respective dialects. As such, it becomes implausible to account for such behavior by appealing to the theoretical device of extrametricality. This is so because extrametricality is a property of elements that occur at the edges. The distribution of the prefix is highly restricted in that it always occurs word initially, i.e., it is never rendered word internal through affixation. As a result, if we were to maintain Hamid's analysis, we would be forced to stipulate that the prefix is extrametrical with some verbal roots while it is not with others. Clearly, this would be a highly unjustifiable and a theoretically weak position to take, particularly if it is proved, as I will demonstrate later, that the behavior of the prefix follows directly from the algorithm responsible for assigning stress in SCA.

The second shortcoming of Hamid's analysis is that it considers only the third person masculine prefix, implying that the inconsistent behavior with regard to stress is particular to this prefix. However, as the examples in (52) below show, this is not the case.

(52) i ii

a. a-kṭib a-ṭṭāyil
   1sg-write 1sg-work
   'I write' 'I work'

b. ná-kṭib na-ṭṭāyil
   1pl-write 1pl-work
   'we write' 'we work'

c. ta-kṭib ta-ṭṭāyil
   2sg-write 2sg-work
   'you write' 'you work'

---

12 The dialect spoken in urban centers in the central region consists only of yi-, whereas dialects of rural areas and of the North consist exclusively of ya-.
Thus, all imperfect prefixes behave in an identical manner with regard to stress. While they receive stress with roots of the form CCVC (52.i), they fail to do so elsewhere (52.ii). As such, extending Hamid’s account of the stress facts of the third person imperfect prefix would force us to adopt the undesirable stipulation referred to earlier. That is, all imperfect prefixes would have to be marked extrametrical with roots other than those of the form CCVC.

In conclusion, the above discussion indicates that Hamid’s analysis of stress is problematic in major ways. It has been demonstrated that the analysis is based on partially inaccurate observations. As a result, it makes empirically inadequate predictions. Moreover, maintaining this analysis entails adopting a theoretically unjustifiable stipulation, namely, elements may be arbitrarily marked extrametrical. In the following section, I show that the analysis of stress argued for in Ali (1994) overcomes these limitations. Also, I show that the behavior of the passive prefix and the verb initial vowels in (49) with regard to stress is predicted by the stress assigning algorithm posited by this analysis.

4.2.2.2 An alternative analysis of stress

The analysis of stress argued for in Ali (1994) is based on the metrical theory developed in Hayes (1985, 1987, & 1991). In this theory, which uses bracketed grids instead of trees, stress is assigned as follows. A word is parsed by the stress-assigning algorithm into feet. A word layer is formed on the output of the initial parse and its head (main stress) is assigned by a rule to either the right or left edge. This rule is subject to the Continuous Column Constraint which states that a grid containing a column with a mark on a higher layer and no mark on a lower one is illformed (Hayes 1991, p. 27).

In Ali (1994), I accounted for the stress facts in terms of an algorithm that parses words into moraic trochees. Given the issue at hand, I will not review this analysis in detail. Rather, I will briefly demonstrate that it is more adequate than Hamid’s (1984) analysis. However, it is relevant to point out here that the syllable inventory of SCA consists of light syllables of the form CV, heavy syllables of the forms CVC and CVV, and superheavy syllables of the forms CVVC and CVCC. In word final position while heavy syllables behave like light ones with regard to stress, superheavy syllables
behave like heavy ones. To account for the stress facts I argued that heavy syllables are bi-moraic while superheavy syllables project, in addition, an extrasyllabic mora.

Using the notational system proposed by Hayes to formulate stress rules, I propose the rule in (53) to account for stress assignment in SCA.

(53) a. From left to right, parse the word into moraic trochees
b. \( \mu \rightarrow <\mu> / \_D \) "Final mora is extrametrical."
c. Word layer: End Rule Right
c. Degenerate feet are not allowed.

In the space to follow, I demonstrate the consistency of this analysis with the stress facts in SCA by showing how it overcomes the shortcomings of Hamid's analysis. First consider an example of the words in (48) whose stress pattern is inaccurately predicted by Hamid's analysis.

(54)

<table>
<thead>
<tr>
<th>Word layer</th>
<th>Foot construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>(x)</td>
<td>(x) (x)</td>
</tr>
<tr>
<td>( \mu \mu \mu \mu &lt;\mu&gt; )</td>
<td></td>
</tr>
<tr>
<td>zambalak</td>
<td></td>
</tr>
<tr>
<td>'pendulum'</td>
<td></td>
</tr>
</tbody>
</table>

In contrast to Hamid's rule, the rule in (53) predicts the stress pattern of non-derived words where the initial heavy syllable fails to receive stress in a straightforward manner. Note that this is the same stress pattern of measure VIII. This is illustrated in (55) below.

(55)

<table>
<thead>
<tr>
<th>Word layer</th>
<th>Foot construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>(x)</td>
<td>(x) (x)</td>
</tr>
<tr>
<td>( \mu \mu \mu \mu &lt;\mu&gt; )</td>
<td></td>
</tr>
<tr>
<td>iyтараз</td>
<td></td>
</tr>
<tr>
<td>'he travelled'</td>
<td></td>
</tr>
</tbody>
</table>

Thus, the stress pattern provides no evidence for arguing that these vowels are epenthetic.\(^{13}\)

Returning to the issue of the seemingly inconsistent behavior of the imperfect prefixes with respect to stress, the examples in (56) below show how such behavior is predicted by the stress rule in (53).

\(^{13}\)It should be noted here that the argument for the epenthesis analysis based on the stress facts is rather circular. In other words, Hamid claims that verb initial vowels such as those in (14) are epenthetic based on the fact that they fail to receive stress. At the same time, he proposes to explain their failure to receive stress by claiming that they are epenthetic.
Thus, the behavior of the imperfect prefix follows directly from the stress assigning algorithm as specified by rule (53). This point clearly illustrates the superiority of the present analysis over that of Hamid. By accurately predicting the stress pattern of the prefixes, it eliminates the need for Hamid’s unjustifiable stipulation that they are marked extrametrical with roots other than those of the form CCVC.

Finally, let’s consider the issue of the passive prefix in SCA. Contrary to Kenstowicz’s and Hamid’s analyses, I have argued earlier that the underlying form of the prefix is in- and not n- based on the fact that the prefix vowel patterns with those in non-derived environments. Recall that Kenstowicz’s second argument for analyzing this vowel as epenthetic is based on Hamid’s analysis of stress which predicts that this vowel should receive stress, since it is the nucleus of the only heavy syllable in the word. Having established that Hamid’s analysis is both observationally and empirically inadequate, I demonstrate in (57) below how the rule in (53) accounts for the stress facts of the passive prefix vowel.

Thus, the behavior of the prefix vowel follows directly from the stress assigning algorithm in SCA.

To conclude this section, I have considered the arguments that Kenstowicz (1986) and Hamid (1984) provide for right-to-left epenthesis to account for the facts of the vowel of the passive prefix and initial vowels of measure VIII in SCA. Considering the first argument, I have shown that these vowels pattern with initial vowels in non-derived environments in that they are not present on the surface when preceded by a word that ends in a vowel. Furthermore, I have provided a unified account for this behavior in terms of a hiatus resolution mechanism. With regard to the second argument, I have demonstrated that the fact that the relevant vowels do not receive stress is predicted by an adequate analysis of stress in SCA. Accordingly, I have
concluded that there is no evidence to support a right-to-left epenthesis in SCA and, consequently, that the vowel of the passive prefix and the initial vowels of measure VIII are in fact present underlingly.

4.3 Conclusion

In the previous sections, I have considered the two types of epenthesis in SCA reported in the literature. The first one, discussed in Broselow (1992), is a left-to-right process which inserts a vowel to the right of a VCC sequence. The second one, discussed in Kenstowicz (1986 & 1994) and Hamid (1984), is argued to be a right-to-left process that inserts a vowel to the left of a CCV sequence. In section (4.1), I have provided evidence for the existence of the former. I have demonstrated that the alternations in the forms of the subject and possessive suffixes can only be accounted for in terms of this process. In section (4.2), I have considered the second type of epenthesis. I have shown that the facts on which the analysis of the relevant vowels is based are best explained in terms other than those of the process of epenthesis. Moreover, I have provided evidence that these vowels are present underlingly. Accordingly, I have conclude that there is only one process of epenthesis in SCA, namely, the right-to-left epenthesis. In the following section, I return to the issue regarding the domain of application of this process.

5. The domain of epenthesis

Recall that the conclusion that degenerate syllables are tolerated up to the P-Phrase level predicts that epenthesis may not apply at the word level. Rather, it ought to apply only at the P-Phrase level in the absence of the environment necessary for incorporating the degenerate syllable into the edge of an adjacent one through resyllabification. However, as the examples in (58) below demonstrate, this prediction is not borne out by SCA data.

(58) a. gaa.bal+.1. a.maal -> gaabal.ta.a.maal cf. *gaabal.ta.a.maal
    met-1sg. Amaal
    'I met Amaal.'

b. gaa.bal+.1. ii.maan -> gaabal.ta.ii.maan -> gaabal.ta.ii.maan cf.
    met-1sg. Imaan
    'I met Imaan.'

In each of these examples, the word following the unsyllabified consonant begins with a vowel. The conclusion that degenerate syllables are tolerated up to the P-Phrase level predicts that epenthesis may not apply in either example. Instead, the unsyllabified consonant t is expected to be resyllabified as an onset of the following syllable at the P-Phrase level. Contrary to what is predicted, however, the epenthetic vowel a is inserted after the unsyllabified t. Since the conditions for epenthesis exist at the word level, but not at the phrase level, it follows that the isertion of a occurs at the word level in both examples. As a result, the resyllabification process at the P-Phrase level yields a syllable
with a long vowel in (58.a). In (58.b), on the other hand, it results in a syllable whose nucleus consists of two vowels of different qualities. This forces the hiatus resolution mechanism discussed earlier to insert a glottal stop between the epenthetic vowel and the initial vowel of the following word thereby creating a new syllable. In fact, failure of epenthesis to apply results in the unacceptable forms in (58) where the underlined consonant is resyllabified as an onset of the following syllable. Evidently, the examples in (58) represent instances of degenerate syllables being repaired at the word level through the process of epenthesis.

This last point is not without implications on the account of the asymmetry in the domain of application of syncope proposed in section three. Given the epenthesis facts, we need to make explicit the prosodic domains of (re)syllabification. By that I mean we need to make precise the extent to which (re)syllabification is free, i.e., what unsyllabified segments, if any, are tolerated and at what level? I address this issue in the following section.

6.0 Prosodic domains of syllabification

Given the behaviour of word-final geminates discussed earlier, the conclusion that degenerate syllables are tolerated up to the P-Phrase level is not entirely inaccurate. Recall that the final consonant of a word ending in a geminate is subject to stray erasure unless it can be resyllabified within the P-Phrase. Clearly, this provides strong evidence for unsyllabified elements being tolerated up to the P-Phrase level. Such being the case, the issue to be addressed is: how can we account for examples such as those in (58), where degenerate syllables are repaired at the word level? I propose to explain this in terms of the restriction on the structure of the syllable in SCA. Specifically, the affixation of the first person subject marker in the examples in (58) yields syllables of the form CVCC. I have demonstrated in section (4.1) that syllables of this form are highly disfavoured in SCA and that they appear on the surface only in a few borrowed words. In this section I provide historical evidence for the highly restricted nature of these syllables by examining the development of tri-radicals of the form CVCC in SCA. I argue that in Classical Arabic (CA) the stem-final degenerate syllables in these forms are repaired at the word level through addition of case endings. Since case endings were lost in SCA, this repairing strategy was no longer available. Consequently, all tri-radicals of the form CVCC were reanalyzed into CVCCV. Finally, I address the consequences of these arguments for my account of the asymmetry in the domain of application of syncope.

As Hamid (1984) notes, tri-radicals of the form CVCC in CA have been reanalyzed as CVCVC in SCA. This reanalysis is a result of the loss of case endings in SCA. In CA, the degenerate syllable in a CVCC sequence is repaired at the word level

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14 See section 1.1 and the discussion of examples (29) (30).
15 I am following the fairly standard assumption that the proto-language of modern Arabic dialects, including SCA, is Classical Arabic, the contemporary variety of which is known as Standard Arabic. For further discussion of the historical development of these dialects the reader is referred to Blanc (1970), Blau (1965, 1988) and Ferguson (1959).
16 For a comprehensive list of examples of these forms see Hamid (1984) pp. 17-27.
through the addition of case endings. To illustrate this point, consider the example of the tri-radical noun in (59) below.

(59) a. kalb
   ‘dog’

   b. akala al-kalb-u —–> a.kal.kal.bu
   ate-3msg the-dog-Nom
   ‘The dog ate.’

   c. nadaha al-kalb-a —–> na.da.hal.kal.ba
   called-3msg the-dog-Acc
   ‘He called the dog:

   d. bayt-u al-kalb-i —–> bay.tul.kal.bi
   house-Nom the-dog-Gen
   ‘The dog’s house’

Clearly, the stem of the tri-radical noun in (59.a) contains a degenerate syllable (the underlined consonant b). At the word level, in (59 b, c, & d), this consonant is syllabified as an onset of the following syllable which is the case marker. In other words, the case system which is independently available in the grammar of the language provides a means of repairing degenerate syllables. Thus, we can argue that stem-final degenerate syllables in CA are tolerated since they can always be repaired at the word level. This is so because nouns must always be marked morphologically for case. Having established this point, I will now examine the development of these forms in SCA.

Through historical development, the case system of CA was replaced by a word-order-based system in SCA and case endings were entirely lost in the latter. Consequently, degenerate syllables in tri-radicals of the form CVCC could not always be repaired at the word level. Unlike in CA, in SCA such a repair strategy would only be possible at the P-Phrase level when the word following the degenerate syllable begins with a vowel. This meant that the motivation for tolerating these syllables no longer existed. Assuming that the syllable-shape inventory remained constant, in such a situation the language may choose one of the following two strategies of repairing these segments: 1) either delete the unsyllabified consonant, or 2) create a new syllable by inserting a vowel before or after the unsyllabified consonant. Alternatively, the language may somehow incorporate the unsyllabified consonant into the preceding syllable.\(^{17}\) Out of the first two strategies the language chose the second one. We can argue that the first strategy was disfavoured based on the fact that consonants carry the essential meaning of the root in Arabic. Accordingly, a repair strategy that preserves

\(^{17}\)Whether this is achieved by the mora-adjunction analysis proposed by Broselow (1991) or adjunction to the preceding syllable node along the lines argued for in McCarthy (1979) and McCarthy & Prince (1990), has no bearing on the present discussion. What is relevant is that in any case the result is a syllable of the form CVCC.
consonants would be preferred to one that does not. Likewise, we can argue that the fact that the alternative option was ruled out strongly suggests that syllables of the form CVCC are highly disfavoured in SCA. As a result, all tri-radicals of the form CVCC, with the exception of those that end in a geminate, have been reanalyzed into CVCVC in SCA.\footnote{I will not speculate here as to why tri-radicals with final geminates escaped the reanalysis process. For a full discussion of the peculiar behaviour of geminates with respect to phonological rules the reader is referred to works such as Hayes (1986); Schein and Steriade (1986); Kenstowicz and Pyle (1973); and Guerssel (1977, 1978).}

Support for the reanalysis argument is provided by approaching this issue from the the language learner’s point of view. Based on the input, the learner must posit a unique underlying representation of a tri-radical of which there are two surface variants. The first one is CVCVC, which occurs when the stem is in isolation or at the end of a phrase (e.g., kalib ‘dog’, tamur ‘dates’, etc). The second one is CVCC, which occurs when the stem is followed by a suffix that begins with a vowel (e.g., kalb-u ‘his dog’, tamr-u ‘his dates’). On positing the former as the underlying form, the learner must assume that the latter forms are derived by a rule of syncope. On positing the latter, on the other hand, an epenthesis rule must be assumed to derive the former. Faced with such a situation, the learner must look for evidence in the language for one process or the other. As for the epenthesis rule, the language provides no such evidence.\footnote{Not only the position of the vowel to be inserted is different from that of the epenthetic vowel, as we have seen in section (4.1), but also there is the issue of the quality of that vowel. This is evident from examples such as jabur ‘forcing’ and jabir ‘mending’.}

Evidence for syncope, on the other hand, is massive. We have seen earlier that syncope applies at the levels of word, P-Phrase, and I-Phrase in SCA. Thus, we can reasonably argue that the learner posits the CVCVC form as the underlying representation of these tri-radicals. The question we need to address, then, is how does the learner posit a CVCC form for those tri-radicals that end in a geminate? Following the same logic, the input provides the learner with two forms. The first one is CVC when the stem occurs in isolation or at the end of a phrase (e.g., dum ‘blood’). The second one is CVCiCi when the stem is followed by a suffix that begins with a vowel (e.g., dumm-u ‘his blood’). On the assumption that the former is the underlying form, the learner must assume a gemination rule to derive the latter from. Alternatively, assuming the latter to be the underlying form, the former can be derived by a rule of degemination. Once again the evidence that the input provides the learner with favours the second analysis. As we have seen, while the evidence for a degemination rule is abundant, there is no evidence for a gemination rule. It is reasonable, then, to argue that the learner posits a CVCiCi form for these stems.

Based on the discussion above, we can conclude that all tri-radicals of the form CVCC, with the exception of those that end in a geminate, have been reanalyzed into CVCVC in SCA. This reanalysis was motivated by the highly restricted nature of syllables of the CVCC form. As such, we expect syllables of this form to be repaired as soon as they arise as a result of affixation. This is exactly what happens in the examples in (58). Adding the subject marker to a verb that ends in a consonant results in a
syllable of the form CVCC. Consequently, an epenthetic vowel is inserted at the word level creating a new syllable the onset of which is the second consonant in the cluster.

To conclude then, the fact that epenthesis applies at the word level in examples such as those in (58) can be explained in terms of the restriction on the structure of the syllable in SCA; specifically, syllables of the form CVCC are highly disfavoured in SCA. The reanalysis of tri-radicals of the CVCC form discussed above provides strong evidence for the restricted nature of these syllables. In the following section, I consider the implications of these facts for the account of the asymmetry in the domain of application of syncope provided earlier.

6.1 Syncope and resyllabification revisited

Recall that I proposed to explain the asymmetry facts in terms of the restriction on resyllabification; specifically, no restrictions are placed on resyllabification up to the P-Phrase level. At the end of the P-Phrase level, however, basic syllabification is fixed and all segments must be properly syllabified. However, alteration to this basic syllable structure is possible at the I-Phrase level but only in derived environments. This explains why resyllabification to Onset is always permitted while Onset Defection is permitted only with RHS; while it is always possible to derive the environment required for the application of the former, the environment required for the application of the latter cannot be derived beyond the P-Phrase level. This in turn explains why LHS is blocked beyond the P-Phrase level while RHS is blocked beyond the I-Phrase level.20

Based on the discussion of epenthesis in the previous section, we can conclude that it is not exactly the case that degenerate syllables are tolerated up to the P-Phrase level. Rather, in SCA all segments, with the exception of the last consonant of a word ending in a geminate, must be properly syllabified at the word level. However, the asymmetry facts suggest that there is no restriction on resyllabification up to the P-Phrase level. Thus, my proposal is that although all segments, with the exception of the final consonant of a word ending in a geminate, must be properly syllabified at the word level, alteration to the structure of the syllable is possible up to the P-Phrase level. At the end of this level, however, basic syllabification is fixed and further alteration to the syllable structure is possible only in derived environments. As such, epenthesis is accounted for in terms of the restriction on the structure of the syllable in SCA; namely, all segments must be properly syllabified at the word level. Likewise, the behaviour of syncope follows directly from the restriction on resyllabification.

7. Conclusion

In this paper, I have proposed a prosodic account for the processes of syncope and epenthesis in SCA. I have examined Hamid's (1984) account of syncope in which he describes two rules of syncope that apply in opposite directions deleting high unstressed vowels in SCA. While right-hand syncope applies whenever its environment is met, left-hand syncope, as a phrasal rule, is sensitive to the syntactic

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20 See the discussion of examples (25-30).
relation between the two words triggering its application; namely, the left-hand word
must govern the right-hand one. I have argued that syncope is in fact one process
whose target is the underlined vowel in the sequence \( V C V C V \), and that this process
applies at the levels of word, P-Phrase and I-Phrase.

In the first section of the paper I have proposed a rule of P-Phrase formation in
SCA. I have shown that this rule accurately characterizes the domain of LHS, i.e., I have
demonstrated that LHS applies up to the P-Phrase level and not beyond. I have
provided further evidence for the significance of the P-Phrase as a domain of
phonological processes by examining the behaviour of the degemination process.
Furthermore, I have considered the factors of rate of speech and weight of phonological
material and and modified the P-Phrase Formation rule to account for cases where these
factors affect the parsing of the P-Phrase. In the second section I have shown that RHS
applies up to the I-Phrase level.

In the third section I have proposed an account of the asymmetry in the domain
of application of syncope in terms of the (re)syllabification process that occurs at the
prosodic levels of word, P-Phrase, and I-Phrase. Specifically, I have argued that as a
consequence of the resyllabification process, the nucleus of an open syllable is deleted
when its Onset is resyllabified as a Coda of the preceding syllable. Then I have
considered the prediction this analysis makes with regard to the behaviour of
epenthesis. In section four, I have considered the two types of epenthesis reported in
the literature. The first one, discussed in Broselow (1992), inserts a vowel to the right of
a VCC\# sequence. The second one, discussed in Kenstowicz (1986 &1994) and Hamid
(1984), is argued to insert a vowel to the left of a \#CCV sequence. I have shown that
while the former does account for phonological alternation facts, the facts on which the
latter is based are best explained in terms other than those of epenthesis. Accordingly, I
have concluded that the vowels this analysis deals with are in fact present underlingly.
Finally, I have modified the account for the asymmetry in the domain of application of
syncope to accommodate the epenthesis facts.

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