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## Word Juncture and Syllable Structure

Item Type	Article
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Download date	2026-03-14 10:19:38
Link to Item	<a href="https://hdl.handle.net/20.500.14394/37116">https://hdl.handle.net/20.500.14394/37116</a>



In each word, the consonant to the left of the alternating consonant-- /t/, /s/, and /r/, respectively-- is a member of the set of "independent" or underlying emphatics. The alternating consonant is emphatic when it precedes a consonant or word boundary, non-emphatic when it precedes a vowel. Thus the alternations in (2) can be accounted for by the assumptions that

- 3) a. The only emphatic phonemes are the independent emphatics.
- b. The rule of Emphasis Spread distributes emphasis throughout any syllable containing an emphatic phoneme.
- c. A syllable begins with one and only one consonant.

If these assumptions are correct, the domain of emphasis always coincides with the syllable in Cairene Arabic. Rules of syllable structure assignment can be written to assign the proper syllable structure to the words of (2), using the notation developed by Kahn (1976). These rules factor a word into trees which correspond to syllables. The first rule assigns the node S (syllable) to each [+syllabic] segment:

- 4) CA Rule I: [+syll]  $\Rightarrow$  [S]

The second rule assigns any consonant which precedes a vowel to the S node which that vowel dominates:

- 5) CA Rule IIa:  $C^1 V \Rightarrow C^1 \begin{matrix} V \\ | \\ S \end{matrix}$  (Where  $C^1$  means no more than one consonant)

The third rule assigns any previously unconnected consonants to the S node of the vowel which precedes them:

- 6) CA Rule IIb:  $V C_0 \Rightarrow V \begin{matrix} C_0 \\ | \\ S \end{matrix}$  (where  $C_0$  is not previously connected to any S)

Since there are no three-consonant clusters in Cairene Arabic, Rule IIb will affect at most two consonants. These rules will assign the structures shown below:

- 7)  $\begin{matrix} \text{latiif} & \text{latiifa} & \text{fasl} & \text{faslu} & \text{raagil} & \text{ragleen} \\ \downarrow \downarrow & \downarrow \downarrow \downarrow & \downarrow & \downarrow \downarrow & \downarrow \downarrow & \downarrow \downarrow \\ S & S & S & S & S & S \end{matrix}$

In each case the domain of emphasis coincides with a syllable. The underlying forms /latiif/, /fasl/, and /raagil/, along with a rule

distributing emphasis to every segment in a syllable which contains an emphatic phoneme, will account for the alternations of (2). Thus the facts of emphasis are handled quite simply with reference to the syllable; a rule spelling out Emphasis Spread in terms of segments, on the other hand, would be extremely cumbersome, since a syllable may have any one of the shapes CV, CVC, or CVCC, and an emphatic phoneme in any of the three consonant positions will produce emphatic articulation throughout the entire syllable. Considerations of simplicity aside, however, the generalization that the domain of emphasis is the syllable would be obscured in a grammar not making reference to syllable structure.

2. These facts alone constitute a strong argument for including a means of referring to syllable structure in the grammar of Cairene Arabic. Additional evidence is provided by the facts of word juncture. The Cairene pronunciation of the first three syllables of the string: binti # kbifra 'a big girl' is indistinguishable in normal rate speech from the first three syllables of bintik # biha 'your daughter is on it'. Similarly, (8a) and (8b) are pronounced identically:

- 8) a. faddal # ilwalad 'he preferred the boy' (cf. faddal 'he preferred')  
 b. (idda) # fadda # ilwalad '(he gave) silver to the boy'  
 (cf. fadda 'silver')

The syllable structure assignment rules motivated to account for the distribution of emphasis will handle these facts as well if they are permitted to apply without regard for word boundaries. In this case, they will assign identical syllable structures to the phonetically identical strings:

- 9) binti # kbifra    bintik # biha    faddal # ilwalad    fadda # ilwalad  
 ↓ ↓    ↓ ↓    ↓ ↓    ↓ ↓    ↓ ↓    ↓ ↓    ↓ ↓    ↓ ↓    ↓ ↓  
 S S    S S    S S    S S    S S    S S    S S    S S    S S

The hypothesis that Cairene Arabic syllable structure assignment rules are not restricted to the domain of the word is confirmed by the distribution of emphasis in phrases. The domain of emphasis is the syllable; therefore if syllables may span word boundaries, one would expect to find emphasis spreading across word boundaries. This is in fact the case:

- 10) ʔasadza # ktiir 'many professors'  
ɖaktra # ktiir 'many doctors'

Similarly, the spread of emphasis to a word-final consonant may be blocked when the following word begins with a vowel, as in faddal

vs. faddal # ilwalad.

Thus the domain of the syllable structure assignment rules in Cairene Arabic is the phrase; in practical terms this means that word boundaries are not necessarily associated with syllable boundaries.

3. It's now possible to explain one of the major problems encountered by English speakers learning Cairene Arabic. English speakers tend to both misperceive and mispronounce certain sorts of phrases in Cairene Arabic; for example, the sentence

11) binti # kbiira (V # CC) 'a big girl'

will on first pass be analyzed as consisting of the two words

12) \*bintik # biira (VC # C)

although no such word as \*biira exists in fact. This error is common even among students who are familiar with the actual words of (11) and regardless of their degree of linguistic sophistication and conscious awareness of this pitfall. Similarly, the pronunciation of (11) by English speakers will be judged non-native by Egyptians, and this judgement will be attributed to the failure to produce /ti#k/ as a unit. This problem arises even in phrases like binti # smiina 'a fat girl', which is heard as \*bintis # miina, even though /sm/ is a possible word-initial cluster in English.

The same sort of problem arises with sentences like (13a), which is wrongly perceived by English speakers as (13b)

13) a. miš # ana (VC # V) 'not I'

b. \*mi # šana (V # CV)

though again no such words as those in (13b) exist. Both these problems are universal to beginning English-speaking students, and are mentioned by every grammar as an aspect of Cairene Arabic which the student must master.

The mispronunciation and misanalysis of these strings by speakers of English can be traced to the difference between English and Cairene Arabic syllable structure assignment rules. To see the relation between word juncture and syllable structure in English, consider the following:

14) a. see Mabel/seem able  
a name/an aim  
gray day/grade A  
a pall, appall/up all  
 $V(\#)C\acute{V} \neq VC\acute{V}$

b. a pall/appall  
hock it/Hockett  
 $V\#C\acute{V} = VC\acute{V}$   
 $VC\acute{V} = VC\acute{V}$  (V=unstressed V)

The pairs in (14a) are pronounced differently, although they consist of the same strings of segments; Lehiste (1960) has studied the acoustic differences between the members of these sets. The sets in (14b), however, are pronounced identically, even though they differ in the position or presence of word juncture. The rules for assignment of syllable structure in English proposed by Kahn (1976) account for these facts on the basis of the syllable structure of the strings involved. I'll briefly review Kahn's rules for English syllable structure, and then compare these rules to the Cairene Arabic rules. For ease of exposition, certain strings containing consonant clusters have been omitted from consideration; thus these rules represent a simplified version of Kahn's rules.

The English syllable structure rules can be motivated most easily by reference to the phonetic effects of the position of syllable boundary on English /t/. The environment for aspiration of /t/ is generally described as

- 15)  $t \rightarrow t^h / \# \_$  *Tom, tomato* stressed vowel:  
 $/ V \_ \check{V}$  atomic (vs. atom)

These two environments appear to have nothing in common; it is Kahn's contention, however, that in fact /t/ is aspirated just when it is syllable-initial, and that rules of syllabication must capture this fact. The first rule of English syllable structure assignment is identical to Cairene Arabic Rule I; it assigns the node S to any [+syllabic] segment. Rule II is as follows:

- 16) Rule IIa:  $C_0 V \Rightarrow \begin{array}{c} C_0 V \\ | \quad \diagdown \\ S \quad S \end{array}$  Where  $C_0$  equals the maximal possible syllable-initial cluster; a cluster is possible syllable-initially iff it is possible word-initially

- Rule IIb:  $V C_0 \Rightarrow \begin{array}{c} V C_0 \\ | \quad \diagup \\ S \quad S \end{array}$  Where  $C_0$  equals the maximal possible syllable-final cluster, and  $C_0$  is not already connected to some S

These are the only syllable structure assignment rules to apply to *atomic* and *tomato*, and /t/ is aspirated in each word. Another rule, however, applies to *atom*:

- 17) Rule III:  $V C \check{V} \Rightarrow \begin{array}{c} V C \check{V} \\ | \quad \diagdown \quad \diagup \\ S \quad S \quad S \end{array}$  ( $\check{V}$  = unstressed V)

Rule III makes a consonant ambisyllabic only when the vowel following it is unstressed.

## 18) output of Rules I,II,III:

atom	atomic	tomato
/ \	/ \	/ \
S S	S S	S

The syllable structure provided by I,II,III both accords with native speaker intuitions that the /t/ of atom can't be assigned exclusively to either syllable of the word and allows for a simple statement of t-aspiration:

19)  $t \rightarrow t^h / \begin{array}{c} \text{---} \\ \diagdown \quad \diagup \\ x \quad S \end{array}$  (where x indicates that /t/ is not connected to any S node on the left)

Because Rule III is restricted to the domain of the word, it will not apply to make the first /t/ of the phrase a tomato ambisyllabic, even though /t/ precedes an unstressed vowel; thus /t/ will be aspirated.

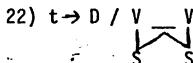
Reference to syllable structure also allows a uniform description of the environments in which flapping of /t/ takes place. As in atom, /t/ is flapped intervocally and only before an unstressed vowel; however, when /t/ is word-final and followed by a vowel-initial word, it is generally flapped regardless of the stress of the following vowel. The environment for t-flapping, stated in these terms, is extremely clumsy:

20)  $t \rightarrow D / V \_ \check{V}$  atom (vs. atomic)  
 $/ V \# \_ \check{V}$  at Amanda's, at Annie's

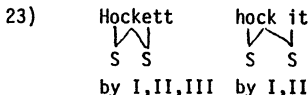
Furthermore, the identical pronunciation of atom and at Am(anda's) indicates that the /t/ of at Am(anda's), like the /t/ of atom, is ambisyllabic. A rule connecting a word-final consonant to the syllable of a following (word-initial) vowel, regardless of the stress of that vowel, serves two functions: it allows a simple statement of t-flapping, and it explains the identity of such pairs as atom/at Am(anda's) and Hockett/hock it. These functions are served by Kahn's Rule V, which is the only rule to apply on a domain larger than the word:

21) Rule V:  $C V \Rightarrow C V$  at Annie's  
 $\begin{array}{c} | \quad \diagdown \\ S \quad S \end{array}$   $\begin{array}{c} / \quad \diagdown \\ S \quad S \end{array}$  (by Rules I,II,V)

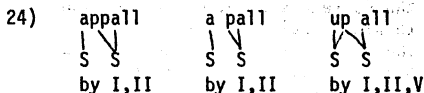
The relationship between the two cases of t-flapping is now clear; /t/ is flapped when it is ambisyllabic:



These four rules of syllable structure assignment explain the relationship between word juncture and pronunciation in English as a function of syllable structure. The forms Hockett and hock it are assigned the same syllable structure, the first by the word-level rules I,II,III and the second by Rules I,II, and V:

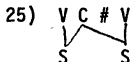


Rules I and II are the only rules which can apply to appall and a pall, since the stressed vowel of appall blocks the application of Rule III; thus they have identical syllable structures. The fact that they're pronounced differently from the first two words of the phrase up all the stairs is accounted for by the fact that Rule V applies to this phrase:



Since Rule V is the only rule to provide cross-word syllabic linkages, and since it applies only to word-final consonants, it is not applicable to a pall.

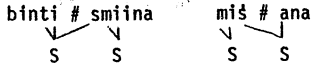
4. The differences between English and Cairene Arabic word juncture and the errors made by English speakers learning Cairene Arabic may now be accounted for by a comparison of the syllable structure assignment rules of the two languages. The only cross-word linkages in English are those produced by Rule V, of the sort shown below:



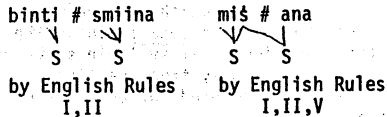
None of the cross-word linkages found in Cairene Arabic have this sort of structure. Rule V could not apply to the strings binti # kbiira or binti # smiina (which is comparable in segment structure to English the stall but in syllable structure to English this tall). Rule V could apply to miš # ana, but only to make the /š/ ambi-syllabic, since English Rule II, operating on the domain of the word, would have connected /š/ to the syllable of the vowel preceding it. In the Cairene pronunciation, however, /š/ belongs to only one

syllable, that of the vowel which begins the following word. The syllable structures assigned by the Cairene Arabic rules are compared below with those which would be assigned to the Arabic strings by the English syllabication rules:

26) a. Cairene Arabic syllable structure:



b. English syllable structure:



The mispronunciation of the Cairene strings by the English-speaking student can now be seen to be a result of applying the English rules to the Cairene strings; the student fails to make the cross-word syllable linkage required in the native pronunciation of binti # smiina, and makes the /s/ of miš # ana ambisyllabic rather than assigning it exclusively to the second syllable of the phrase. The misperception of these phrases, which tends to persist even after correct pronunciation has been mastered, is also seen to be a result of the attempt to analyze the string in terms of the English syllable structure assignment rules. The English speaker hears the syllable structure correctly, but proceeds to factor the string into words on the assumption that a word boundary must be associated with a syllable boundary except in one sort of case, that in which English Rule V has applied. In this sort of case, exemplified by hock it, a word-final consonant is a member both of the final syllable of its own word and of the initial syllable of the word which follows it. Neither of the strings in (26a) has this sort of syllable structure.

The facts of English and of Cairene Arabic show, then, that the syllable plays a role in both production and perception of speech. Syllables provide the conditioning environment for certain phonological rules (Emphasis Spread in Cairene Arabic, t-allophonic rules in English). The syllable structure assignment rules formulated to account for the operation of these phonological rules also account for the relationship between word juncture and

pronunciation, and explain the ways in which English and Cairene Arabic differ in this respect. The above analysis demonstrates that one way in which languages may differ is in the domain of their syllable structure assignment rules: while the domain of most English syllabication rules is the word, the Cairene Arabic syllabication rules apply on the phrase.

#### NOTES

1. I've omitted from the discussion the primary pharyngeals /ʔ/ and /ʕ/; these sounds, being produced with pharyngeal constriction, do not participate in the emphatic/non-emphatic alternation.
2. For example: Abdel-Massih, page 21; Lehn and Abboud, pages 5, 270; Mitchell, page 12.

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