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This paper will present evidence first, that certain phonetic
facts of Cairene Arabic require that syllable structure be represented
in the grammar of the language; second, that the rules of syllable
structure assignment formulated to account for these facts will also
explain the facts of word juncture in Cairene Arabic; and third, that
a class of mistakes in perception and production of word juncture con-
sistently made by English speakers learning Cairene Arabic can be
explained as an attempt to apply English syllable structure rules
to Cairene Arabic strings.

1.The evidence of the need for the syllable in a description of
Cairene Arabic involves the phenomenon of emphasis, which is associ-
ated acoustically with a lowered second formant (Obrecht 1963) and
articulatorily with a constriction in the pharyngeal cavity caused by
retraction of the tongue root (Ali and Daniloff 1972). The presence
or absence of emphasis (pharyngealization) may distinguish otherwise
identical lexical items, as the following pairs illustrate. C =
emphatic C, and vv = long v:

1) baat   'he spent the night'
   baat   'armpit'

2) tiin   'figs'
   tiin   'mud'

The facts concerning the distribution of emphasis in the Cairene dialect
are as follows: first, any segment may occur with emphatic articulation.[1]
However, any word which in isolation is pronounced with emphasis con-
tains at least one of the so-called "independent" emphatics /t,d,s,z,l,r/.
Second, emphasis never occurs as the feature of a single
segment; its minimal domain is CV.

These facts may be accounted for by the assumption that only the
"independent" emphatics are underlyingly emphatic, and that the
occurrence of emphatic articulation in other segments results from
a rule or rules spreading emphasis across some specified domain.
Thus in the following pairs the segments which display alternations
are not underlyingly emphatic:

2) a.latiif/latiifa   'pleasant m/f'   f/f

   b.fasl/faslu   'term/his term'   l/l

   c.raagil/ragleen   'man/two men'   g/g

In each word, the consonant to the left of the alternating consonant--
/ṭ/, /ṣ/, and /ṛ/, 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 pre-
cedes 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 coin-
cides 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:
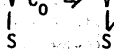
4) CA Rule I: [+syll] $\Rightarrow$ [+syll]
$$\qquad\qquad\qquad\qquad\qquad\quad |$$
$$\qquad\qquad\qquad\qquad\qquad\quad S$$

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

5) CA Rule IIa: $C^1\ V \Rightarrow C^1 V$ (Where C^1 means no more than one
$$\qquad\qquad\qquad\ \ |\qquad \searrow \qquad\quad \text{consonant})$$
$$\qquad\qquad\qquad\ \ S\qquad\ S$$

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

6) CA Rule IIb: $V\ C_0 \Rightarrow V\ C_0$ (where C_0 is not previously
$$\qquad\qquad\qquad\ \ |\qquad\quad \swarrow \qquad\ \text{connected to any S})$$
$$\qquad\qquad\qquad\ \ S\qquad\ S$$

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)   latịif   latịifa   faṣl   faṣlu   raagil   ragleen

In each case the domain of emphasis coincides with a syllable. The
underlying forms /laṭiif/, /faṣl/, 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 articu-
lation 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 sylla-
ble 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' # nkbiira la biggirl! is indistinguishable in normal rate speech
from the first three syllables of bintik # biiha '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 # lilwalad   '(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 # kbiira   bintik # biiha   faddal # ilwalad   fadda # lilwalad

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) ?asadza # ktiir   'many professors'

    dakatra # 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.[2] order to have

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   b. a pall/appall
        a name/an aim   hock it/Hockett
        gray day/grade A
        a pall, appall/up all $V\#C\acute{V} = VC\breve{V}$
        $V(\#)C\acute{V} \neq VC\#\acute{V}$ $VC\#\breve{V} = VC\breve{V}$ ($\breve{V}$=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 assign-
ment 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, all 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___V́ 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 $\Rightarrow$ C_0 V   Where C_0 equals the maximal possible
           | | syllable-initial cluster; a cluster is
           S   S   possible syllable-initially iff it is
   possible word-initially

Rule IIb: V C_0 $\Rightarrow$ V C_0 Where C_0 equals the maximal possible
        | | syllable-final cluster, and C_0 is
        S   S   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 V̆ $\Rightarrow$ V C V̆   (V̆ = unstressed V)
            | | | |
            S S   S S

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

18) output of Rules I,II,III:

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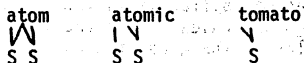
The syllable structure provided by I,II,III both accords with native speaker intuitions that the /t/ of atom can't be assigned exclusively to either syllable of the word and allows for a simple statement of t-aspiration:

19) $t \rightarrow t^h$ / _____ (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 intervocalically 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__V̆   atom (vs. atomic)

        / V#__V   at Amanda's, at Annie's

Furthermore, the identical pronunciation of atom and at Am(anda's) indicates that the /t/ of at Amanda'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

            S   S   S S   (by Rules I,II,V)

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

22) t→ D / V ___ V

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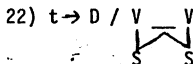
These four rules of syllable structure assignment explain the
relationship between word juncture and pronunciation in English as
a function of syllable structure. The forms Hockett and hock it
are assigned the same syllable structure, the first by the word-
level rules I,II,III and the second by Rules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

23)   Hockett   hock it

   S S   S S

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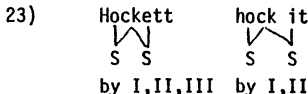
Rules I and II are the only rules which can apply to appall and
a pall, since the stressed vowel of appall blocks the application
of Rule III; thus they have identical syllable structures. The fact
that they're pronounced differently from the first two words of the
phrase up all the stairs is accounted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

24)   appall   a pall   up all

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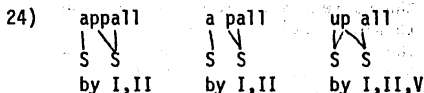
Since Rule V is the only rule to provide cross-word syllabic linkages,
and since it applies only to word-final consonants, it is not
applicable to a pall.

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:
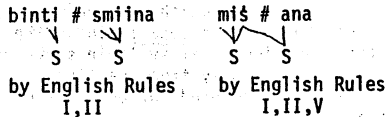
25)   V C # V

     S   S
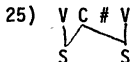
None of the cross-word linkages found in Cairene Arabic have this
sort of structure. Rule V could not apply to the strings binti #
kbiira or binti # smiina (which is comparable in segment structure
to English the stall but in syllable structure to English this tall).
Rule V could apply to miš # ana, 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:

binti # smiina   miš # ana

S   S   S   S

b.English syllable structure:

binti # smiina   miš # ana

S   S   S   S
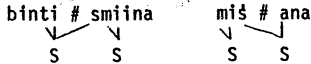
by English Rules   by English Rules
   I,II   I,II,V

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 /š/ 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 phono-
logical rules (Emphasis Spread in Cairene Arabic, t-allophonic
rules in English). The syllable structure assignment rules formu-
lated 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 /ħ/ and
/9/; 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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