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Representation of quantity-sensitivity in a CV-only framework: a study of Cairo Arabic word-stress[1]

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0 Introduction

This paper explores possible answers to the following question: 'how can quantity sensitivity be represented in a phonological framework in which no constituents may branch?' The question arises thus: in some languages stress is attracted to heavy syllables, both CVC and CVV, a generalisation which has been successfully identified as sensitivity to branching 'within the rhyme'; at the same time, some languages exist whose morphology encourages us to posit a theory of representation in which no constituents may branch. If these two sets of languages intersect at any point it would appear that we have a problem. They do intersect, and Arabic is in the subset of languages which are both quantity sensitive and yield best to a CV-only interpretation.

The present study therefore examines alternative ways of capturing the same generalisation in skeletal theory, and does so in the context of the colloquial spoken form of a particular dialect of Arabic, Cairo Arabic (CA); this allows the interaction of stress assignment with other vocalic processes such as epenthesis, syncope and vowel shortening to be examined. Discussion of previous treatments of the same question - Yoshida (1993, 1999) and Szigetvari (1999) - is followed by a new analysis, and the strengths, weaknesses and implications of all three potential solutions are examined. The general framework adhered to is that of Government Phonology (GP), and whilst the study assumes a CV-only analysis for Arabic in view of its templatic morphology, this should not be construed as adoption neither of any particular version of CV-only theory nor of its application to all languages. Nonetheless the issues raised in this paper will hopefully be of interest to others working in CV-only frameworks on non-templatic languages.

Section 1 presents the theoretical background to the question under consideration: §1.1 motivates adoption of a CV-only analysis for Arabic and the theoretical implications of this choice in GP; §1.2 gives a brief overview of metrical stress theories and of representation of quantity sensitivity in particular; §1.3 presents the facts of stress assignment and vocalic processes in CA. Section 2 discusses in detail three possible answers: §2.1 reviews use of left-headed Proper Government to account for both stress assignment and inter-vocalic relations in CA by Yoshida (1999); §2.2 discusses a method of stress assignment in CV-only which counts 'CV pairs' as proposed by Yoshida (1993) and Szigetvári (1999); §2.3 offers a third, new analysis of stress in CA, based on a notion of licensing first proposed by Lowenstamm (1996).

Standard IPA transcriptions are used for the more unusual Arabic segments; emphatic (velarized) consonants are marked with a diacritic: t ð s d. Surface forms are given in square brackets: [katbiin]. Assumed underlying forms, where given, are between slashes: /kaatibiin/. Glosses are provided between inverted commas: 'they are writing m.pl.'. To indicate stress, the vowel(s) of the stressed syllable is marked in bold type: [**a**rabik].

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1 Theoretical background

1.1 The syllable structure of Arabic

Successful autosegmental analysis of the non-concatenative or discontinuous morphology of Arabic was a decisive factor in the development of an autosegmental representation for all languages. Whilst it had been demonstrated that tones and vowel harmony operated independently of their position in the phonological string, McCarthy's 1979 study of Arabic root-template morphology (McCarthy 1982) showed clearly that vocalic and consonantal segments in Arabic similarly operated on separate morphologically defined tiers. For example the word [kuutib] "it was being written" combines three distinct lexically-specified components - a tri-radical consonantal root and a vocalic melody are mapped to a CV template:

{1}
```
  k     t   b          "write"
  |     |   |
  C V   V   C V C      "participative"
    \ /     |
    u       i          "passive"      (Kenstowicz 1994:398)
```

A key piece of empirical evidence for this analysis is the fact that in Arabic geminate roots are commonly found in which C_2 and C_3 are identical, whereas roots in which C_1 and C_2 are identical are never found. Given the Obligatory Contour Principle (OCP): "in a given autosegmental tier, adjacent identical autosegments are prohibited" (McCarthy 1982:131), a geminate root such as [smm] must in fact be underlyingly bi-radical: [sm]. This asymmetry in the Arabic lexicon falls out naturally if we assume that autosegments are mapped to the template from left-to-right (McCarthy 1982:146-7):

{2}
```
  C V C V C
    \   \ /
    s   m          [samm] "he poisoned"
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Whilst at first glance Arabic would appear to be a language in which rhymes may branch but onsets may not, given the high frequency of medial or final consonant clusters and the absence of word-initial clusters[2], Lowenstamm (1996:422) claims that the templatic properties of Arabic that we have just examined in fact demonstrate that Arabic is formed of CV 'syllables' (onset-rhyme sequences) only, without branching of constituents. As evidence he shows that in a CV-only approach the differing behaviour of tri-radical and bi-radical roots in the first 'binyan' (verbal template) can now be represented without recourse to resyllabification[3] and by means of a single verbal template (see {3} below). In Lowenstamm's analysis of Arabic spreading of melodic material to form geminate consonants and long vowels is motivated by a

[2] Some North African dialects differ in that word-initial clusters are found.
[3] Resyllabification is formally excluded in GP under the Projection Principle "Governing relations are defined at the level of lexical representation and remain constant throughout a phonological derivation" KLV (1990:221).

requirement that at least one member of each CV pair be 'identified' by being associated with melodic material (see Idrissi 1997):

{3}
```
  k a t a b        y a k   t u b      /ktb/ "write"
  | | | | |        | | |   | | |      [katab]/[yaktub]
  C V C V C V      C V C V C V C V
  | |   \ /        | | | |   \ /      /jr/ "pull, drag sth."
  j a   r          y a j u     r      [jarr]/[yajurr]

  perfect 3rd m.s.   imperfect 3rd m.s.
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(after Lowenstamm 1996:422-3)

Many authors have proposed a Strict-CV model for all languages; in this paper I adopt a CV-only framework for Arabic in view of the persuasive arguments arising from its templatic morphology, without here engaging the question of its applicability to non-templatic languages[4].

A further argument offered by Lowenstamm against the existence of closed syllables in templatic languages arises from the distribution of segments found in surface consonant clusters: if both the surface cluster C_x C_y and its mirror C_y C_x are found in a language, these cannot both be instances of a rhyme-onset sequence, given the strict substantive conditions on inter-constituent government whereby an inter-constituent governor must be at least equal in complexity to its governee[5]; such mirror surface clusters are however commonplace in Arabic. In a CV-only analysis of Arabic therefore all surface consonant clusters, including geminates, are analysed as a sequence of two onset positions with an intervening nucleus. Long vowels are similarly analysed as a sequence of two nuclei with an intervening empty onset (see Lowenstamm 1996:423-7).

The possibility of 'null nuclei' being present in the string in order to preserve licit syllable structure has been proposed in analyses of Arabic in non-GP frameworks also[6]. In GP the phonetic realisation of such empty categories is however strictly regulated under the Empty Category Principle (ECP) which states that only "a p-licensed (empty) category receives no phonetic interpretation". An empty category can be 'p-licensed' either: domain-finally, in languages which (parametrically) license domain-final empty nuclei, by being properly-governed, by falling within an inter-onset or inter-nuclear governing domain, or by being magically licensed[7].

Many accounts of stress open with an inventory of syllable shapes found in the language under discussion. Kenstowicz (1980), for Cairo Arabic, is a case in point, listing five basic syllable types: "CV (light), CVC and CVV (heavy), CVCC and CVVC (extra-heavy)" Kenstowicz (1980:39). In a CV-only framework: "the distribution of empty nuclei subsumes observations collected under the label 'syllable inventory of a language'" Lowenstamm (1996:420 n2). The 'syllable shapes' of a particular language arise as a direct result of whether and which p-licensing operations are employed by that language to regulate realisation of empty categories. A language

[4] However see Lowenstamm (1996) for an initial discussion.
[5] Harris (1994).
[6] Kenstowicz (1980:50-1) and Selkirk (1981:215 ff.)
[7] Charette (1990); magic licensing arises in sibilant + consonant sequences, see Kaye (1991).

which permits no p-licensing of empty nuclei will be CV-only on the surface; a language which permits p-licensing will display surface clusters.

As outlined in the ECP a range of possible p-licensing strategies are available. Proper government (PG) is a relationship between two nuclei in which a nuclear position which is itself neither p-licensed nor a government licenser may properly govern an adjacent nucleus on the nuclear projection[8]. PG is generally thought to be right-headed although it has been shown to operate both from the right edge of the domain (eg French, Polish and Yawelmani; Charette (1991)) and from the left edge (eg Tonkawa; Yoshida (1990)). An empty nucleus may also be p-licensed parametrically if it is domain-final, or by falling within an inter-onset governing (IOG) domain subject to substantive constraints akin to those on inter-constituent government (Heo 1994). It has been observed that proper government is blocked in some languages by an intervening consonant cluster. Under the Government Licensing Principle, for a governing relation to hold between a non-nuclear head and its complement, the head must be licensed to govern by its (following) nucleus. The blocking effect arises in languages which restrict the licensing roles of nuclei - they may either properly govern or government license, but not both[9]. It has also been proposed that nuclear heads, in a long vowel, may require a government licence in some languages (Yoshida 1993).

To understand the forces which result in construction of well-formed 'syllables' therefore, in a CV-only framework, we must discover what strategies a particular language or dialect employs to regulate realisation of empty categories. We turn now to the forces that govern the grammaticality of stress assignment.

1.2 Metrical theory

The fundamental insight of early metrical theory, in contrast to previous linear analyses, was that stress patterns do not reflect a feature or property of individual vowels but rather relative prominence relations between vowels. Liberman & Prince (1977) (as discussed in Hogg & McCully 1987:64ff) represented this by means of a tree diagram; any pair of sister nodes are labelled either weak/strong or strong/weak. Sister vowels in a tree can never be labelled *weak/weak or *strong/strong; the relative prominence of one to the other is directly encoded in the fact of their being sisters. The stress assignment rules of a particular language determine which of any two sisters is assigned prominence. Relative prominence has also been successfully represented by means of a metrical grid, in which pairs or groups of grid marks are said to be governed by a 'head' mark within that group. The stress assignment rules of a language determine, for example, how close to the group boundary the head of a metrical grouping is required to be, and whether it is terminal or initial within the group (Halle & Vergnaud 1987:9-10).

A further major development within metrical theory was the recognition that the stress patterns of the world's languages in fact vary within an unexpectedly small range. Hayes (1981) drew on descriptive sources for a large number of languages to formulate a theory of parametric variation in the assignment of stress. Using a tree-diagram representation, his theory posited rules of foot construction (the foot being a

[8] Charette (2000); PG of non-nuclear positions has also been proposed, see Charette (1991:91-4).
[9] This is an example of principle ranking in GP; see Charette (1991:113 ff.) for a full discussion, and Rowicka (1999:26-9) for a summary of alternative CV-only analyses.

metrical constituent grouping) and of word-tree construction whereby languages may build either binary or unbounded feet and word-trees, and may construct these from either the left or the right edge of the word. The notions of extrametricality (a word-peripheral element which is 'invisible' for the purposes of stress assignment) and of labelling rules (which distinguish between branching and non-branching nodes in the assignment of 'strong' status) allowed Hayes to handle a wide range of complex cases within a restricted theory. In his more recent theory (Hayes 1995) attempts to restrict the range of parametric variation further by proposing an inventory of only three possible foot structures:

{4}	(x .) σ σ			syllabic trochee (strong-weak over syllables)
	(x .) ∪ ∪	or	(x) –	moraic trochee (strong-weak over moras)
	(. x) ∪ σ	or	(x) –	iamb (weak-strong)

(Hayes 1995:71)

Optimality Theory metrical constraints resemble the parameters used in metrical stress theory in many cases, concerning size of feet or their alignment within the word for example (Kager 1999b:142ff.).

One way in which languages are uncontroversially attested to vary is whether they make a distinction made between 'heavy' and 'light' syllables or not, described as quantity-sensitive and quantity-insensitive systems, respectively. English uses a quantity sensitive system in that stress is attracted to either a closed syllable (CVC) or a long vowel (CVV), as in the words "expensive" and "conducive" compared to "primitive" (Hayes 1981:153). Some languages differ as to what constitutes a heavy syllable, making the distinction between long and short vowels only, with closed syllables not attracting stress[10].

Stress assignment is clearly closely tied to syllabic structure therefore, and any theory of syllabic structure must presumably offer a way to express the parallel between CVV and CVC 'syllables'. In skeletal theory, which recognises sub-syllabic constituents, it has been captured under the generalisation that both involve branching within the rhyme; a closed syllable is a branching rhyme and a long vowel is a branching nucleus[11]. Hayes (1981) and Halle & Vergnaud (1987) for example both propose that metrical structure in quantity sensitive languages is built on some kind of 'rhyme projection'. Moraic theory however states that metrical processes are sensitive to the number of moras. Mora assignment is language-specific and a quantity sensitive language is one in which an 'extra' mora is assigned to a coda consonant or to the second member of a long vowel by a Weight By Position rule. Equally a language may accord one mora to a closed syllable but two to a long vowel resulting in sensitivity to long vs. short vowels. One argument in favour of moraic theory is the

[10] For example, St Lawrence Island Yupik (Hayes 1995:240ff.), Ydinin', and Tiberian Hebrew (McCarthy 1979a:455); also Ojibwa, see below.
[11] Usually attributed to McCarthy (1979, 1982) following Vergnaud & Halle (1978).

claim that a skeletal analysis has no way to explain why onsets do not contribute weight but rhymes do.

In standard GP the concept of branching within the rhyme is a natural one since the rhyme is a constituent of the theory. Analyses of stress have successfully combined a GP theory of syllabification with a Hayes(1981)-style set of foot and word-tree construction rules by stating that metrical structure is built on a nuclear projection (eg Charette 1991 for French and Segundo 1994 for the Natal dialect of Brazilian Portuguese, both quantity insensitive languages). Kaye (1989:140-145) offers a similar style of analysis for Ojibwa, a Canadian language in which long vowels attract stress (but closed syllables do not - see Hayes 1995:216). Kaye formulates the stress-attracting property of long vowels in terms of the ineligibility of long vowels to be the weak member of a foot (feet are binary in Ojibwa); if a long vowel occurs in a position where it might otherwise be assigned weak member status it rejects this to form a degenerate foot alone, and so receives stress.

Recent work in CV-only theory has sought to resolve how quantity sensitivity may be encoded in a CV-only string where the rhyme no longer features as a constituent. One hypothesis is that metrical structure results directly from the same set of nuclear relations that produce segmental phenomena such as vowel syncope and epenthesis. In the context of this hypothesis it is claimed that the generalisation between CVV and CVC heavy 'syllables' can be captured without the concept of branching within the rhyme, by drawing a parallel between a left-headed proper government relation and left-headed feet (Yoshida 1999). In contrast Yoshida (1993) for Palestinian Arabic, and Szigetvári (1999) for English and Latin (both quantity sensitive languages) suggest that CVV and CVC 'heavy syllables' contrast with CV 'light syllables' in a CV-only string simply by virtue of comprising a sequence of two pronounced CV pairs. Both of these analyses will be described in detail in §2 below.

1.3 *Cairo Arabic word-stress patterns and vocalic processes*

The dialect of Arabic spoken in Cairo assigns primary word-stress as follows[12] (data and generalisations from Langendoen 1968):

{5} a) a final 'superheavy' syllable (CVCC or CVVC) is stressed; darabt
ʔaʕmaal

b) a penultimate heavy syllable (CVV or CVC) is stressed; katabta
kitaaba

c) if both final and antepenult are light syllables then either the penult or the antepenult is stressed, whichever is an even number of syllables from the first heavy syllable in the word or, if there are no heavy syllables in the word, from the beginning of the word. maktaba
kataba

d) in disyllables the penult is stressed unless the final syllable is 'superheavy'. raʕaa
qaalat

The generalisation made by Langendoen in (c) is seen most clearly in the Cairo pronunciation of Classical Arabic words, which have long sequences of light syllables:

[12] Welden (1980) is one of few authors to suggest that regular secondary word-stress occurs in CA.

{6} ʔadwiyatuhu 'his medicine' šajaratun 'tree' (stress on the penult)
ʔinkasara 'it broke' šajaratuhu 'his tree' (stress on the antepenult)
(Langendoen 1968:102)

However the colloquial CA version of these words lose word-final case and verbal markers resulting in shorter sequences of light syllables, and may also undergo vowel syncope producing 'new' heavy syllables, which attract stress:

{7} ʔadwiyatu 'his medicine' šagara 'tree'
ʔinkasar 'it broke' šagartu 'his tree'(elicited from CA speaker)

Nonetheless, as McCarthy (1979:446) points out, even in CA colloquial pronunciation the operation of (c) above means that a heavy antepenult does not automatically attract stress, as it would in other dialects of Arabic:

{8} madrasa 'school' CA madrasa 'school' Palestinian Arabic[13]

In CA the phonological domain is the word, thus all of the data to be examined in CA constitute a single phonological domain. In GP terms this means that all affixes in CA are non-analytic (in traditional generative terms one could say that in CA stress rules are cyclic). We can demonstrate this briefly here by comparing CA to Palestinian Arabic (PA) again, in which (in at least some analyses) possessive and object suffixes are analytic:

{9}	bagara 'cow' CA [bagara(t)]	ba?ara 'cow' [ba?ara(t)]	PA[14]
cf.	bagartak 'your cow' CA [bagarøtak]	ba?artak 'your cow' [[ba?arø(t)]ak]	PA

CA stress patterns have been widely and variously analysed. McCarthy (1979:449-58) posits a tree structure in which binary feet are assigned from left-to-right in pairs of light syllables, ignoring any heavy syllables, then a right-branching word-tree gathers up all feet and stray syllables into the word; the whole structure is then labelled according to the principle that a right node is strong if and only if it branches (see overleaf)[15]. Hayes (1981:115-117), also using tree structure, proposes a foot-construction rule that assigns right dominant binary feet left-to-right on the rhyme projection, a right-branching word-layer tree and a labelling rule that labels dominant nodes strong iff they branch. Word-final rhymes are marked extrametrical, and word-final 'superheavy' syllables are stipulated to consist of two rhymes, thus assuring them stressed status:

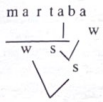
[13] Abu Salim (1983:96).

[14] Abu Salim (1983:94); note here that the final [t] in the innermost bracketed form is part of the feminine marker 'ta-marbuta' and is unpronounced when not linked to a following genitive; Hayes (1995:125-130) has a non-cyclic analysis of PA.

[15] McCarthy represents final 'superheavy' syllables as comprising two syllable nodes, a branching foot structure, and thus stress-attracting; word-final CVC syllables are immune because the labelling rule is claimed to be insensitive to branching below the level of the foot.

{10}

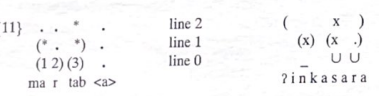
McCarthy (1979:450)



Hayes (1981: 117)

In grid notation, Halle & Vergnaud (1987:60-63) assign 'line 0' asterisks to both the head and the 'rhyme phoneme' in heavy syllables, so that metrical structure is effectively built on a rhyme projection. The head of a branching rhyme is assigned a 'line 1' asterisk by rule, promoting heavy syllables, and word-final segments are marked extrametrical. Left-headed binary constituents are constructed left-to-right on 'line 0', then an unbounded right-headed constituent is constructed on 'line 1'. Hayes (1995:67-71) assigns CA the moraic trochee as its basic foot template. A moraic trochee consists of either two light syllables of which the first is strong, or a single heavy syllable. Hayes invokes consonant extrametricality[16], foot construction is left-to-right in moraic trochees and word-layer construction follows 'End Rule Right', a right-headed unbounded word-layer constituent. He states that CA has a total ban on degenerate feet which means that a single light syllable remaining at the right edge of the word after foot-construction has taken place is not assigned foot status alone

{11}



Halle & Vergnaud (1987:63) Hayes (1995:70)

These different analyses have much in common, reflecting the basic empirical facts that any successful analysis of CA stress patterns must capture: attraction of stress to heavy syllables word-medially but not word-finally, attraction of stress to word-final superheavy syllables, and the characteristic CA displacement of stress from a heavy antepenult when it is followed by two light syllables.

It should be noted that most of these analyses have as their stated goal a single account for both CA colloquial stress patterns and the CA pronunciation of Classical Arabic. Interestingly however, all of the analyses described so far use data for the CA pronunciation of Classical Arabic from a single source: Mitchell (1960, reprinted 1975)[17]. Holes (1995:51) similarly notes that the CA pronunciation of Classical Arabic follows CA stress rules rather than those of Modern Standard Arabic but claims a much simpler stress rule for CA, namely that the syllable immediately after a heavy syllable is stressed; thus for /muhtawayaatahu/ the Langendoen pattern predicts

[16] He also states that *if* final long vowels are pronounced long in CA then mora extrametricality is also required to account for their not attracting stress; in fact final long vowels are only pronounced long in CA in a few exceptional cases.

[17] Kenstowicz (1980) provides some alternative CA Classical data, obtained from informants, which conform to the Langendoen pattern.

[muhtawayaatuhu] but Holes quotes the CA form as [muhtawayaatuhu]. When checking data with a speaker of CA I found that the pattern produced for Classical words sometimes matched the Langendoen pattern, but just as often did not[18]. In this study I therefore focus on CA colloquial pronunciation because I believe that a meaningful study of CA Classical pronunciations should first verify whether these have genuinely altered since Mitchell's 1960 work. In fact the interaction of stress assignment with other vocalic phenomena is perhaps just as great a challenge to any analysis of CA; these are processes such as vowel syncope, epenthesis and shortening, which Classical Arabic does not display.

The context for syncope of high vowels [i] and [u] is: VC_CV, word-internally and in limited phrase-internal contexts (Kenstowicz 1980:42). An epenthetic vowel, usually [i], appears in CA to break up any sequence of three consonants: VCC_CV (Kenstowicz 1980:49-50). Vowel shortening occurs when a long vowel falls in a word-medial 'closed syllable', ie before a consonant cluster:

{12} syncope

nizil	'he went down'	nizlu	*nizilu 'they went down'
katab	'he wrote'	*katbu	katabu 'they wrote'

epenthesis

bint	'daughter'	bintina	*bintna 'our daughter'

shortening

šaaf	'he saw'	kaatib 'he is writing'
šafna	'he saw us'	katbiin 'they are writing'

(Yoshida 1999:380, 388; Kenstowicz 1980:50)

As we have seen, in GP, and particularly a CV-only version of GP, both syncope and epenthesis must be accounted for under the ECP as the regulated interpretation or non-interpretation of empty nuclei always present in the string. In contrast to 'closed-syllable shortening' accounts, the standard GP analysis of vowel length alternations has been that a lexically long vowel shortens when followed by a licensed empty nucleus, in languages which require the head of a long vowel to be licensed by a following nucleus to govern its complement. If in such a language a word-internal licensed empty nucleus is not a government licenser then a nuclear head followed by a word-internal licensed empty nucleus receives no licence to govern and the lexically long vowel shortens (Yoshida 1992, 1993; Kaye 1995:299-300). It is syncope and shortening effects in particular that will be the test of the various analyses in section 2, whilst epenthesis will be examined only briefly in the concluding remarks in section 3.

2 Alternative proposals for representing quantity sensitivity in CV-only

2.1 Using left-headed proper government - Yoshida (1999)

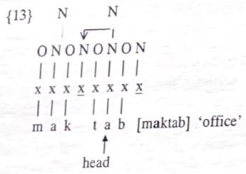
Yoshida (1999) proposes the use of left-headed proper government (PG) to capture the inter-nuclear relations that result in the formation of both CVC and CVV syllables

[18] In fact my colleague expressed frustration at being asked to pronounce words that were both alien to him and, in his opinion, extremely rare.

in CA. If we assume with Yoshida that the relations that assign stress in words are in fact the same inter-nuclear relations that govern audibility of empty nuclei, for example, then the proposal falls out naturally. Recall that we are trying to equate the inter-nuclear relation that forms a long vowel with some relation that results in the formation of a closed syllable; to capture the CVV/CVC generalisation, we want stress to be attracted to the 'head' of the relation in both cases.

Assuming that only unlicensed nuclei project to higher levels of nuclear projection and participate in the formation of metrical relations, let us propose that the empty nucleus following the 'coda' consonant of a closed syllable is licensed by right-headed PG. In this case the CVV/CVC equivalence is immediately lost as the head of the relation which creates the 'closed syllable', to which stress should be attracted, is now outside it:

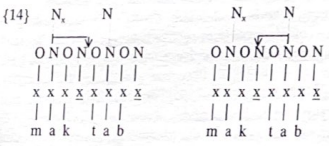
{13}



[maktab] 'office'

An alternative would be to propose that the empty nucleus after the coda consonant is instead licensed via inter-onset government (IOG)[19], either head-initial or head-final. In this case, our nucleus within the 'closed syllable' will project and participate in stress assignment, but we have to explain in what way it is distinct from the nucleus of a light or open syllable, which would also project. Why should stress assignment treat the projected nucleus within a 'closed syllable' (N_x below) differently from the projected nucleus of a light syllable?:

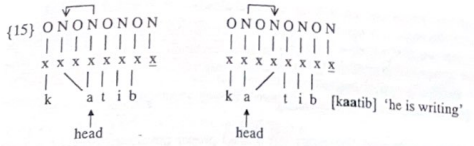
{14}



Looking at the relation that results in long vowels we might suggest that this inter-nuclear governing relation is perhaps head-final (leaving aside the question of directionality of melodic spreading); however we still do not capture the symmetry between long vowel and closed syllable relations - the head of the relation that *results* in the CVV 'syllable' is outside it:

[19] Or, a 'burial domain' (Szigetvári 1999).

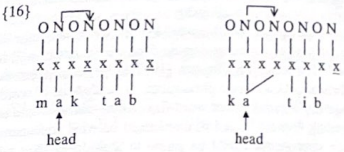
{15}



[kaatib] 'he is writing'

To capture the CVC/CVV generalisation then, the only remaining alternative is to posit a left-headed relation to create 'closed syllables'; in doing so it seems that Yoshida has indeed found a way of formulating the generalisation between CVV and CVC syllables:

{16}



Yoshida proposes this left-headed inter-nuclear relation therefore for both long vowels[20] and closed syllables (termed a level 0 binary constituent) in the context of a ranking of possible constituent relations that may form at level 0:

{17} A licenses B where:
i) B is a word-internal empty nucleus, overriding any other licensing duty of A;
ii) B is a word-final empty nucleus *unless* A is the head of a long vowel (see iii);
iii) B is the complement of A in a long vowel;
iv) A and B form none of the other possible relations described in i) ii) or iii).
(summarised from Yoshida 1999:389)

To account for syncope of lexical vowels in CA he proposes that elements (I) or (U) are de-linked from any nucleus which is p-licensed at level 0 (Yoshida 1999:391). Note how he equates heavy syllables (CVV/CVC) with binary feet formed over a sequence of two light syllables, this being the relation formed as a default by condition (iv) in his system. This equivalence, along with higher levels of grid-mark assignment rules, neatly captures the characteristic CA pulling of stress off a heavy antepenult when followed by two light syllables (shown in Yoshida's grid notation):

[20] Yoshida in fact retains branching of nuclei based on evidence of re-articulation of a long vowel into two short vowels before a geminate in Classical Arabic but not in CA, thereby losing the strength of the CV-only analysis in capturing the templatic behaviour of Arabic; for this reason I here evaluate the value of his proposal as if it were in strictly CV-only terms.

{18}
```
      *          *)    2  right-headed constituents form from right-to-left
   (* *    (* *        1  left-headed constituents form from right-to-left
(* (* *  (* (*  *  0  left-headed constituents form from left-to-right
m u k a a t i b a h ø
```
[mukaatiba] 'she is corresponding'[21] Yoshida (1999:394)

In standard Government Phonology left-headed proper government (PG) has rarely been proposed. Kaye et al. state that governing relations at the skeletal level are subject to "strict directionality", whilst those at projection levels are subject to "directionality" only (KLV 1990:198, 219). Kaye (1990b:145) discusses the possibility that proper government may, like metrical foot construction, be of two types, binary and unbounded, and, as Rowicka (1999:16) points out, implicit in Kaye's argument is the possibility that proper government may, like metrical foot construction rules, parametrically vary in its directionality.

Most authors who consider the option of left-headed PG in a given language do so on the assumption that the parameter licensing domain-final empty nuclei will in such languages be set to 'off'. For example Charette (1991:137-9) associates the theoretical possibility of left-headed PG with two phenomena: i) an absence of word-final clusters in such a language (left-headed PG of word-final empty nuclei would be blocked by the cluster, a governing domain[22]); and ii) restrictions on what consonants may appear word-finally (such consonants would be prone to lenition as they fall within a proper government domain). Gibb (1993) proposes left-headed PG in Finnish under the assumption that the word-final parameter is 'off'; as independent evidence for this parameter setting she offers both the severely restricted range of consonants that can appear in word-final position (coronals only) and the fact that no word-final consonant clusters are found. For her this is consistent with an absence of domain-final licensing and she proposes that left-headed PG licenses the few word-final empty nuclei that do appear.[23] (Gibb 1993:133-138). If we look in Arabic for similar evidence we find that there are no restrictions on the distribution of word-final consonants since C_3 in a tri-radical root can be filled by any consonantal segment (Greenberg 1950:166) and word-final consonant clusters are common, particularly in CA. This suggests that in Arabic the parameter is in fact 'on'.

In contrast Yoshida (1999) allows for two ways in which a domain-final empty nucleus may be p-licensed, either parametrically or by left-headed PG. In his analysis if a potential proper governor exists to the left of a domain-final empty nucleus then a relation forms; if no such proper governor exists or if the potential proper governor is head of a long vowel then the parameter is invoked. Switching on and off of a parameter is an unwelcome move yet Yoshida relies on these mechanisms to account for a number of facts in CA.

[21] Note that Yoshida's analysis depends on an underlying representation of the feminine ending [-ah] as comprising two CV pairs; I analyse the same suffix as involving a floating segment (see Hellmuth unpublished).
[22] These facts could equally be ascribed to the government licensing potential of word-final empty nuclei in these languages, in a right-headed PG scenario.
[23] The analysis also includes a condition on onset licensing in Finnish such that licensed empty nuclei can only license coronals to appear in an onset (Gibb 1993:139).

In [nizil] below N_2 is available to license the domain-final empty nucleus so this relation forms, taking precedence over the potential relation that might otherwise form between N_1 and N_2 and which would result in syncope of N_2. Without retaining the parameter Yoshida would have no way to explain the difference between a word like [nizil] 'he went down' in which the penultimate nucleus is lexically filled and one where it is underlyingly empty, [nahər] 'river' [24]:

{19}
```
O N1O N2O N3        O N1O N2O N3
| | | | | |        | | | | | |
x x x x x x̲        x x x x x x̲
| | | | |          | | |   |
n i z i l          n a h   r
```
[nizil] 'he went down' [nahr] 'river'

Yoshida's account of the absence of vowel shortening before word-final consonants also requires the parameter to be 'on'. In [šaaf] N_3 is licensed parametrically leaving N_1 free to govern its 'complement' N_2 and form a long vowel; compare [šafna] in which the need to properly govern a word-internal empty nucleus takes precedence over formation of the 'long vowel' relation:

{20}
```
O N1O N2O N3          O N1O N2ON3O N4
| | | | | |          | | | | | | | |
x x x x x x̲          x x x x x x̲ x x
| |  /  |            | |  /  |  | |
š a    f             š a    f  n a
```
[šaaf] [šafna]

Finally, in Yoshida's stress assignment system a parametrically licensed nucleus is assigned a level 0 grid-mark as a kind of 'degenerate constituent'; this mechanism means that a level 1 constituent is formed at the right edge of the word, resulting in stress assignment to final superheavy syllables, for example. However when a word-final empty nucleus is licensed under proper government it is not assigned a level 0 gridmark (resulting in 'extrametricality'):

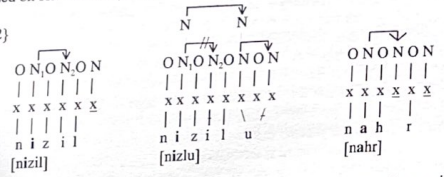
{21}
```
*          *)        2
(*    * (*   *       1    (*   *
(*    * (* * (*      0    (* * (* *
k a a t i b i i n ø       k a a t i b ø
/kaatibiin/              /kaatib/
[katbiin][25]            [kaatib]
'they are writing'       'he is writing'  (Yoshida 1999:394)
```

[24] This is pointed out by Rowicka who associates a left-headed 'trochaic' PG analysis with an 'off' setting for the word-final parameter; for her the difference between [nizil], a verb, and [nahr], a noun, arises because noun & verb classes in CA have different stress alignment rules (Rowicka 1999:77-79).
[25] Yoshida's analysis only explicitly predicts shortening when a following nucleus is underlyingly empty yet his representation of [katbiin] /kaatibiin/ as reproduced here suggests that the initial nuclear head here fails to govern its complement because it instead forms a relation to license the following lexically filled short vowel. In order to explain why this option does not take place in the alternant [kaatib] Yoshida would presumably again invoke operation of the domain-final parameter as shown.

Variable operation of the parameter is therefore integral to Yoshida's analysis. Now if we choose to retain left-headed PG so as to maintain Yoshida's generalisation between CVV and CVC 'syllables' but decide to reject the use of proper government to license domain-final empty nuclei, to maintain the domain-final parameter 'on' (in keeping with the empirical facts regarding distribution of word-final consonants and word-initial clusters in Arabic), can we still account for the facts of [nizil] vs. [nahr], and [katbiin] vs. [kaatib]?

In the case of [nizil] vs.[nahr] we must alter our analysis of syncope. Instead of Yoshida's proposal that (I) is delinked from nuclei licensed at level 0, one might propose an account based on reduction in a weak metrical position, a form of licensing inheritance[26]. Let us suppose that in CA a vowel whose licenser has other licensing responsibilities to perform has reduced a-licensing power, by analogy with syncope in English in the weak position of a 'superfoot'[27]. Like Yoshida we might propose that such a position is able to a-license (A) but not (I) or (U). In [nizil] (below) a binary relation forms between N_1 and N_2 but left-headed proper government is not in itself enough to delink (I) from N_2. In its alternant [nizlu] the same relation forms but N_2 finds itself in a metrically weak position where its licenser N_1 also has other licensing responsibilities (licensing N_3 at a higher level); the a-licensing power of N_2 is reduced and the melodic material is de-linked. In [nahr] left-headed proper government of underlyingly empty N_2 results in it being phonetically uninterpreted as we expect (only unlicensed nuclei project and inter-nuclear relations are represented using arrows rather than grid-marks for clarity; an alternative set of metrical rules based on Kenstowicz (1980) are used[28]):

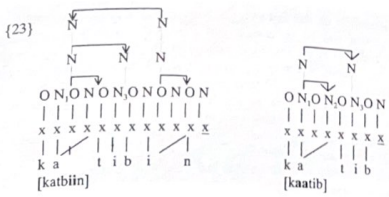
{22}



As shown below, in [katbiin] vs. [kaatib] the new stress mechanism assigns stress correctly in both cases, without switching the parameter 'on' and 'off'(setting aside for the moment analysis of shortening). However recall that we have changed our account of syncope of lexically filled positions; it is no longer under proper government only but occurs under licensing inheritance. In [katbiin] therefore we have to say that the a-licensing power of N_3 is reduced because its licenser (N_1) is itself licensed:

[26] The Licensing Inheritance Principle states that "a prosodically licensed position inherits its autosegmental licensing potential from its licenser" (Harris:1994:206).
[27] Harris (1994:182-183) notes that the central position of a ternary 'super-foot' (Selkirk 1980) is weak and an empty nucleus in this position may be subject to syncope eg "reference" [refrəns].
[28] Binary feet are assigned left to right along the string and then a word tree is built from right to left in which the right node is strong iff it branches (see Kenstowicz 1980:40)

{23}



Unfortunately we now have two contexts in which reduction occurs; one where a licenser has other licensing responsibilities to perform, [nizlu], and one where a licenser is itself licensed, [katbiin] (this latter more properly resembling licensing inheritance as proposed in Harris 1994). The existence of two entirely complementary contexts makes prediction of syncope virtually impossible. If we keep left-headed PG to account for stress assignment (equating CVV to CVC) it seems that we lose the ability to predict syncope.

Note that a right-headed PG account, in contrast, predicts syncope uniformly:

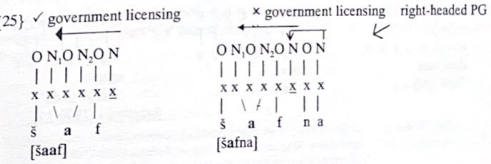
{24}

šaaf	šafna
kaatib	katbiin
laabis	labsa
makaatib	makatbu

Syncope is clearly triggered when a suffix is added to the word, and under a right-headed PG analysis this has a quite simple explanation - a suitable proper governor is now available to p-license the preceding vowel.

Interestingly this insight also allows us to capture vowel shortening patterns if we follow Yoshida (1993) and say that a nuclear head in CA requires a government license from a following nucleus. The newly syncopated word-internal nucleus, being licensed under proper government is not a government licenser, whereas a word-final parametrically licensed empty nucleus is:

{25}



Lowenstamm (1996) proposes an alternative analysis of shortening in which for melodic content to spread and form a long vowel: "the target of spreading must be licensed; a properly governed vocalic position is licensed" Lowenstamm (1996:431).

Implicit in this statement is the fact that a vocalic position whose proper governor is in turn properly governed will be unlicensed, and may not play host to spreading melodic material. However if we apply this version of the analysis to long vowels before word-final consonants, which as we have seen in CA do not shorten, then his interpretation appears to require domain-final parametrically licensed empty nuclei to be proper governors, conflicting with all standard readings of the ECP; this is a problem to which we shall return. Yoshida's original (1993) analysis here captures the same facts in terms of the varying government licensing potential of word-internal and word-final licensed empty nuclei, a distinction independently motivated by differing government licensing potential of word-internal and word-final licensed empty nuclei in other languages (see Charette 1992).

2.2 Counting CV pairs - Yoshida (1993) and Szigetvári (1999)

Earlier work by Yoshida (1993) proposed an alternative way of formulating stress assignment in Arabic in CV-only, taking account of the presence of empty nuclei in the string. In his analysis of Palestinian Arabic (PA), whose stress assignment rules differ slightly from those of CA, Yoshida suggested that stress is in fact assigned to the antepenultimate CV pair:

{26}	ka.ta.bø.ti	'you (f.s.) write'
	ma.kø.**tu**.øu.bø	'letter'
	ka.ta.bi.tø	'I/you (m.s.) wrote'
	ka.ta.bø	'he wrote'
	ka.ta.bu	'they wrote'
	ma.kø.**ta**.ba.to	'his library'

Yoshida (1993:157)

Yoshida compares this approach to that of Charette (1991) and Segundo (1994) in that inclusion of empty nuclei in the analysis facilitates a correct result. However whilst Charette and Segundo do both include empty nuclei in their metrical analysis (of French and Brazilian Natal Portuguese, respectively) they do so by means of foot/word-tree construction rules[29]. Yoshida is instead appealing to a mechanism which counts from one edge of the word to select a CV pair which will bear stress.

A similar mechanism is suggested by Szigetvári (1999:32-34) for English and Latin (both quantity sensitive languages). For Latin he proposes that, again, stress is applied to the antepenultimate CV pair in the string:

{27}	C V **C V** C V C V	C V **C V** C V C V	C V **C V** C V C V
	d o m i n i k a	a r i n a	a g e n d a
	dominica	arena	agenda
	'lord' (adj. f.)	'sand'	'things to do'

Szigetvári (1999:33)

[29] Both authors specify that licensed or licensor nuclei are ineligible in certain metrical positions. For example in French Charette proposes that in a foot an empty nucleus cannot be head and only a licensed empty nucleus may occupy the weak position (Charette 1991:146 ff.).

Szigetvári claims that in CV-only a heavy syllable (surface CVV, CVC or VC) is distinguished from a light syllable (surface CV or V) purely in that it consists of two CV pairs rather than a single CV pair. This, he claims, provides a simple explanation as to why onsets do not contribute to syllable weight: in this analysis neither the rhyme nor the onset contribute weight and the apparent asymmetry between the two surface positions is lost.

However, as Szigetvári acknowledges, the 'counting' analysis fails in some cases: when the selected (antepenultimate) CV pair contains an empty nucleus stress in falls one pair further left (on the ante-antepenult, or 4th from last CV pair); certain word-final CV pairs appear to be skipped over, in that word-final long vowels count as short and word-final consonants do not count:

{28}	C V **C V** C V C V	C V **C V** C V C V	C V **C V** C V C V
	f o r m u l a	f a k i j o	a s i d u s
	formula	facio	acidus
	'rule'	'make'	'sour'
	A	B	C

Szigetvári (1999:33 fn. 35)

To account for these apparent failures one might propose that the counting mechanism is sensitive to the licensed status of nuclei: a parametrically licensed domain-final nucleus is invisible to the system (extrametrical) and hence any final CV pair in which the final V position is empty is skipped (B & C above); if the counting mechanism selects a candidate for stress whose V position is empty (licensed) then stress migrates one position further to the left. These are stipulations[30], but they produce the correct results (licensed nuclear positions are shown underlined):

{29}	←		
	C V **C V** C V C V	**C V** C V C V<C V>	**C V** C V C V<C V>
	f o r m u l a	f a k i j o	a s i d u s
	formula	facio	acidus

Equipped with these additions to the counting mechanism can we now account for the facts of CA?[31] The mechanism appears to assign stress accurately to heavy syllables in antepenult and penult position, and to di-syllables provided we state that stress is assigned to the leftmost CV pair if there are less than three 'visible' CV pairs in a string:

[30] Szigetvári derives final consonant extrametricality by re-partitioning the string into VC pairs Szigetvári (1999:97-98) but acknowledges that in so doing he would have to find an alternative analysis for languages in which word-final consonants are not extrametrical.

[31] The data given above appear to suggest that PA does not display final consonant extrametricality (ka.ta.bi.tø).However as we saw briefly in §1.3, PA suffixes are analytic, so these forms may in fact be morphologically complex; we know CA suffixes to be non-analytic so these provide an easier context to test the counting mechanism.

{30} C V **C V** C V C V<C V>
m u d a r i s
[mudarris]
'teacher'

C V **C V** C V C V<C V>
m a k a t i b
[makaatib]
'office'

C V C V<C V>
k a t a b
[katab]
'he wrote' (m.s.)

However in cases where CA assigns stress to a final superheavy syllable or a light penult (when first in a sequence of two light syllables - recall pattern (c) in {4} above) then the counting analysis fails to predict stress accurately:

{31} C V **C V** C V C V
m a k t a b a t
*[maktaba]
correct: [maktaba]
'library'

C V C V **C V** C V C V <C V>
k a t b i n
*[katbiin]
correct: [katbiin]
'they are writing'

The cases where the counting mechanism fails are exactly those where in traditional analyses the facts are explained in terms of foot formation; in CA a binary relation forms over two light syllables and such a constituent in penult or antepenult position is as eligible to be stressed as a 'heavy syllable'; a surface final superheavy syllable usually analysed as a foot formed over a heavy syllable adjacent to the final extrametrical consonant. A mechanism that can only 'count' CV pairs has no way to account for this behaviour. Indeed the fact that the analysis relies on the notion of counting is in itself a reason to reject it, given the widely held view that in order to constrain a theory its processes should involve binary relations only, based on the notion of adjacency. Szigetvári himself appears to be uncomfortable with the notion of counting since he describes another analysis, that of minimal word constraints, in which he is 'forced to count' (Szigetvári 1999:34)[32].

The counting notion could perhaps be replaced by means of a binary or at least ternary constituent that is formed over sequences of CV pairs. What is not clear however is quite how such a metrical structure could sense that a particular CVCV sequence represents a surface CVC or CVV heavy syllable so assign stress to it; how does it differ from a CVCV sequence which is heard as CVCV or VCV? Stress assignment cannot simply be sensitive to the number of CV pairs but rather to the fact that a particular sequence of pairs are in some way linked - a relation of some kind exists between the two. This notion is exactly that of a foot, and in CA a theory must capture the fact that a relation of some kind forms between a sequence of two CV pairs which are heard as CVCV, as well as between pairs heard as CVC or CVV.

Both of the analyses discussed so far have tried to account for stress behaviour within the bounds of segmental processes: Yoshida (1999) sought to associate metrical stress assignment with segmental inter-nuclear relations; Szigetvári (1999) suggests that stress assignment is a function of the configuration of the skeleton itself. The next section proposes a mechanism whereby an independent metrical assignment system could be sensitive to the contours of a CV only skeleton.

[32] He reanalyses this in a re-partitioned VC skeleton without counting CV pairs, as being sensitive to the presence of at least one non-peripheral element (Szigetvári 1999:100).

2.3 Sensitivity of foot construction rules to licensing of nuclei

Charette (1991) suggests that languages may place restrictions on what status a nucleus may or must have if it is to hold a certain position in metrical structure. For example Charette proposed that in French the weak member of a foot must be a licensed empty nucleus (including one which is parametrically licensed due to its domain final position). Let us assume then that a similar restriction applies in CA: the weak member of a (maximally binary left dominant) foot must be a licensed empty nucleus. A foot would form over a closed syllable as shown (a CV skeleton is used and feet are represented in tree notation):

{32} s w
C V C V_2 C V C V
m a k t a b a t
[maktaba] 'library'

How can we extend this analysis to capture formation of a foot in CA over a heavy syllable consisting of a long vowel? Recall Lowenstamm's proposal, noted at the end of §2.1, that in a long vowel "the target of spreading must be licensed" (Lowenstamm 1996:431). If we adopt this notion of how the spreading of melodic material in a long vowel is licensed, then in a CVCV sequence which is heard on the surface as a long vowel, V_2 is also a licensed empty nucleus, and metrical structure will consider it a suitable candidate to be the weak member of a foot:

{33} s w
C V C V_2 C V C V
k a t i b
[kaatib] 'he is writing'

By combining these two notions (following Charette and Lowenstamm) we capture the generalisation that surface CVV and CVC both count as heavy in CA. However we should re-examine how V_2 is licensed in these cases. In the case of a closed syllable, for example in { }a), V_2 is licensed under proper government from its right as we have seen. In the case of a long vowel,{ }b), Lowenstamm would say that V_2 is also licensed under proper government from its right: "a properly governed vocalic position is licensed" (Lowenstamm 1996:431):

{34} s w

a) C V C V_2 C V C V
m a k t a b a t
[maktaba] 'library'

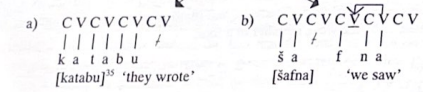
b) s w
C V_1 C V_2 C V C V
k a t i b
[kaatib] 'he is writing'

However, as Szigetvári (1999:147) asks, why in a) does proper government result in V_2 being silenced, whilst in b) proper government results in V_2 being heard? The

answer lies in the make-up of the CV pair in which V_2 is found. In both a) and b) V is empty and requires some kind of licensing, for example under proper government, if it is to remain uninterpreted. However in b) C_2 is also empty. As outlined in s1.1 Lowenstamm (with Guerssel) has proposed that at least one member of every CV pair must be identified (associated with melodic material and heard) thus capturing gemination of bi-radical roots in Arabic as we have seen (see {3} above). In other words C_2 also requires licensing, and V_2, its potential licensor, cannot do the job being itself licensed; one of either C_2 or V_2 must be phonetically interpreted. Arabic has the option of providing phonetic interpretation through spreading of melodic material (rather than through a default vowel such as the [ə] schwa of French); the nearest melodic material to C_2 and V_2 is that linked to V_1; the material therefore spreads to V_2 rather than C_2 and we hear a long vowel[33]. This explanation of the spreading behaviour will have implications for other parts of the analysis so it is a point to which we shall return.

Lowenstamm's notion of vowel length predicts a short vowel when no suitable proper governor exists to the right of V_2 in a CV_1CV_2 surface long vowel sequence. We see two instances of this in CA: the absence of word-final long vowels[34], where there is no following vowel at all, and 'closed syllable shortening' in word-internal sites, where the following vocalic position is itself licensed:

{35} has no suitable proper governor



Note that in both cases the failure of melodic spreading leaves an unassociated CV pair (the second pair in the CVCV long vowel sequence). This breach of the requirement for association is inherent to Lowenstamm's new analysis of vowel length, but is one that CA appears to tolerate.

In CA we also see counterexamples to the prediction made by Lowestamm's shortening account. Where a long vowel occurs before a word-final consonant it does not shorten; here V_3 is licensed parametrically and should not be able to properly govern V_2, yet spreading takes place:

{36} C V C V C V₃
š a f
[šaaf] 'he saw'

[33] In theory of course the element (A) could equally be associated to the consonantal position resulting in something akin to *[kartib]. I have at present no means of formally excluding this alternative.
[34] Word-final vowels do occur in certain loanwords eg [gatoo] 'cake' (Kenstowicz 1980:).
[35] This final vowel is known to be underlyingly long from alternations with eg the negation particles [m-][-š]: [katabu] 'they wrote'/[makatabuuš] 'they didn't write'.

Following the argument through we must assume that here V_2 is in fact licensed in some way; ie that a parametrically licensed empty nucleus can properly govern a vocalic position to its left.

In the case of word-final geminates, similarly a parametrically licensed nucleus appears to properly govern the nucleus to its left. The final CV pair being unidentified, the phonology seeks to create an association through spreading of melodic material if at all possible. The nearest available material is consonantal, and spreads to the C position:

{37} C V C V C V
s a m
[samm] 'he poisoned'

If we accept that word-final licensed nuclei in CA may have this property then we also have a solution for the problem of how the vocalic position within word-final consonant clusters in CA, which display no phonotactic constraints, are licensed. In [nahr] V_3, a parametrically licensed word-final empty nucleus properly governs V_2:

{38} C V C V C V
n a h r
[nahr] 'river'

The shortening facts indicate that CA makes a distinction between word-final and word-internal licensed empty positions with regard to how they are licensed rather than whether they are licensed; thus a word-final (parametrically) licensed empty nucleus can properly govern but a word-internal licensed empty nucleus cannot, because its licensing is under proper government. Is there any other evidence to suggest that CA is sensitive to how a vocalic position is licensed? Recall the case of underlyingly long vowels in word-final position, which do not lengthen. CA does not consider the parametrically licensed nucleus a suitable target for spreading, whereas a properly governed empty nucleus is a suitable target:

{39} C V C V C V C V
k a t a b u
[katabu] 'they wrote'

C V C V C V C V
k a t i b
[kaatib] 'he is writing'

In foot formation also CA makes the distinction; a word-final parametrically licensed vocalic nucleus is ineligible to be the weak member in a foot. In recognising this distinction between parametrically licensed and properly governed nuclei we derive the effect usually known as 'final consonant extrametricality' in CA:

{40} s w
* C V C V C V C V
k a t a b i t
*[katabit] 'she wrote'

In CA therefore properly governed positions are weak positions and may be the target of melodic spreading or the weak member of a foot. Parametrically licensed positions are not weak, such that they not only resist melodic spreading and status as weak member of a foot, they can also act as proper governors. Note however that they do not hold the same status as a lexically filled full vowel. As we have seen, a filled vocalic position in CA may properly govern a lexically filled vocalic position resulting in delinking of the elements (I) or (U); if a parametrically licensed word-final nucleus is the proper governor for such a filled position de-linking does not occur:

{41} C V C V̲ C V C V̲

f i h m u

[fihmu] 'they understood'

C V C V C V̲ C V̲

k a t a b i t

[katabit] 'she wrote'

At present it is not clear whether this is because the licensed word-final nucleus does not have sufficient power to reduce a-licensing potential or in fact that it only has sufficient governing potential to properly govern empty positions, but this point will be clarified in our examination of stress behaviour below.

Having identified the distinctions that CA makes between the licensed or (properly) governed status of a nucleus let us now apply this to an analysis of stress assignment and vocalic processes in CA. For the purposes of stress assignment we will again use an existing analysis, following Kenstowicz 1980 (and similar to Hayes 1981), since the aim of the present study is not to find a new analysis of stress assignment but rather to identify how stress assignment can be shown to be sensitive to the contours of a CV-only string.

In CA then a foot construction rule assigns left-dominant binary feet, left-to-right along the string, in which the weak member of the foot must be a properly governed position. If no suitable site for foot construction is found, no feet are assigned, rather than assigning 'degenerate' feet. Construction of all other metrical relations is undertaken by the word tree construction rule which builds right dominant binary relations right-to-left along the string, gathering in both feet and any nuclear positions not yet incorporated into the structure. In the word tree node a right node is assigned strong status iff it branches, otherwise the left node is strong (see Kenstowicz 1980:40). In the notation used below feet and word tree nodes are separated by a horizontal line.

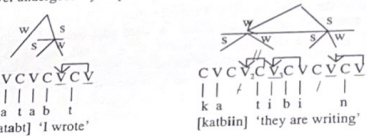
Some questions will require resolution: note that proper government of a position reduces the a-licensing potential of that position. Elements (I) and (U) in such a position will become de-linked and the position will not be interpreted, whereas the element (A) remains in such positions[36]. A vocalic position linked to (A) may therefore be properly governed and yet remain audible; will CA still treat it as a weak position and therefore suitable to be the weak member of a foot? Similarly such a position, being interpreted, may act as a proper governor itself; if it fulfils this function will CA then still consider it as weak? My analysis of 'shortening' effects

[36] The element (U) in such position is sometimes de-linked and sometimes not - see { } [ʕaalamuh]; further investigation would be required to clarify this point and it is not central to the present argument.

will follow Lowenstamm 1996 as amended above such that the target of spreading in CA must be properly governed. In CA a word-final licensed position is a proper governor (possibly of empty positions only); word-internal licensed nuclei are not proper governors.

Turning to the data we can see how the analysis works; first, stress assigned to a final 'superheavy'. Note how in [katbiin] V_2 is not properly governed and so is neither a suitable target for spreading (hence 'shortening') nor to be weak member of a foot. Weak member status of the initial foot is instead assigned to V_3, which is eligible to be weak member of a foot, being properly governed. The element (I) is de-linked and the vowel undergoes 'syncope':

{42}



C V C V C V̲ C V̲

k a t a b t

[katabt] 'I wrote'

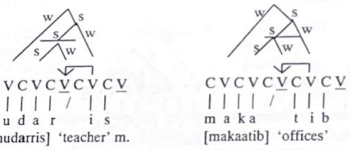
C V C V̲ C V̲ C V C V̲ C V

k a t i b i n

[katbiin] 'they are writing'

In the case of a heavy penult stress is drawn to either a closed syllable or a long vowel equally:

{43}



C V C V C V̲ C V C V

m u d a r i s

[mudarris] 'teacher' m.

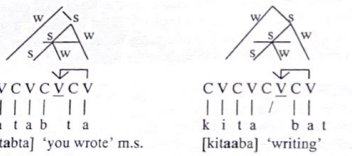
C V C V C V̲ C V C V

m a k a t i b

[makaatib] 'offices'

Compare also cases with a final filled vowel:

{44}



C V C V C V̲ C V

k a t a b t a

[katabta] 'you wrote' m.s.

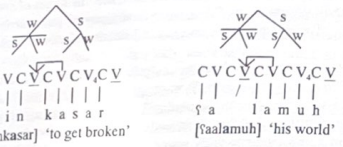
C V C V C V̲ C V

k i t a b a t

[kitaaba] 'writing'

The test of the analysis is how it handles cases where the final two syllables are light and stress falls on the penult or antepenult (whichever is an even number of syllables form the first heavy syllable in the word or the beginning of the word - see {4} above):

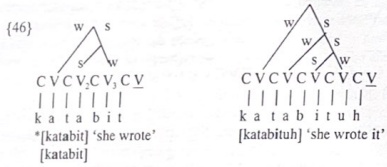
{45}



In both of the examples above only one foot is assigned, to the word-initial CVCV sequence, heard on the surface as either a closed syllable or a long vowel. Note also that in neither case is V_4 properly governed - a word-final licensed empty nucleus cannot properly govern a lexically filled vowel, so V_4 is not eligible to be weak member of a foot. However the word-tree assignment rules of CA assigns a binary relation between V_4 and V_5 in which, since the right member does not branch, strong status is assigned to the left member. This analysis suggests that dialects of Arabic which display a different stress pattern in these cases must have a different word-tree assignment rule.

There is however a class of potential counterexamples to the analysis - words in which there are no properly governed nuclei. As it is, the analysis will form no feet and stress will be assigned by the word-tree only, which gives a wrong result in some cases and a correct result in others:

{46}



Note that in [katabit] above, we also see some indication that word-final empty nuclei properly govern empty positions only, and not lexically filled positions; if this latter were the case, even though syncope does not take place because the proper governor is not a full vowel, we should expect a foot to form at the right edge of the word and it does not.

With some notable exceptions therefore, the analysis demonstrates an alternative way, in a CV-only framework, of capturing the generalisation that both CVV and CVC syllables attract stress in CA. It also has a number of conceptual flaws.

The notion that parametrically licensed empty nuclei can act as proper governors is a potentially significant weakening of the theory. However in CV-only we have no other way to account for the unrestricted distribution of consonant combinations in word-final clusters in CA so the notion is thus independently required for this dialect; it is perhaps an advantage that we see other effects of this unusual behaviour. Investigation of other dialects of Arabic in which restrictions on the distribution of consonants in word-final clusters are found therefore may yield

interesting results which would have a bearing on the present study and its conclusions.

Similarly we cannot simply ignore the fact that Lowenstamm's shortening analysis introduces a quite novel understanding of the effects of proper government; the explanation that spreading occurs in order to provide association for otherwise unidentified CV pairs is plausible, yet the analysis in fact creates contexts in which CV pairs are left entirely unidentified (recall the examples in {35} above).

3 Conclusions

The aim of this paper was to tackle to the challenge of accounting for quantity sensitive stress assignment in a CV only analysis of Cairo Arabic. It has offered three different potential solutions to this problem and all three offer a plausible account of stress assignment yet each has conceptual flaws. By virtue of appealing to very different theoretical equipment to re-capture the equivalence of CVV and CVC 'syllables' in CA the three analyses also make very different predictions as to what we might expect to find in other dialects of Arabic.

Yoshida's (1999) analysis using left-headed proper government appears to predict that all dialects of Arabic will employ a left-headed relation, since all display quantity sensitive stress assignment of one kind or another. There is one area of data where this can be tested: epenthesis. The facts are that CA will resolve any C_C_C context by inserting a vowel in the second empty position: C_CVC (rather than in the first: CVC_V). Hence:

{47} /makatabøtøš/	is realised as:	[makatabøtiš]
/binøtøna/		[binøtina]
/katabøtøluh/		[katabøtiluh]
/katabøtøløhaa/		[katabøtiløha]

A left-headed analysis correctly predicts an epenthetic vowel in exactly these contexts, since it is always the leftmost empty nucleus which is successfully licensed; a second empty nucleus, being without a proper governor to its left is interpreted. It would seem that left-headed PG has an advantage over the other analyses therefore. However the facts of epenthesis in other dialects of Arabic are in fact different, since Palestinian Arabic (PA) for example resolves a C_C_C context by inserting a vowel in the first empty position: C_CVC[37]; a position which we might claim to be consistent with right-headed PG, favouring either of the other two analyses, so the picture is not so simple.

Switching 'on' and 'off' of the domain-final parameter was inherent to Yoshida's left-headed analysis. Note however that the new 'governed nuclei' analysis also relied to some degree on a novel and somewhat stipulative understanding of the role of word-final empty nuclei - namely that they can act as proper governors but of empty nuclei only. This notion predicts that whenever a word-final empty nucleus is preceded by an empty nucleus a proper governing relation will result and a foot will be formed at the right edge of the word; this produces the exact same result as Yoshida's concept that whenever there is an empty nucleus to the left of a word-final empty nucleus (ie it is without a left-headed proper governor) it will play a role in

[37] Kenstowicz (1980:50).

stress assignment. In this respect the choice between the two analyses may well be theoretical only.

The new analysis predicts that dialects which do not allow word-final licensed empty nuclei to be proper governors will have different stress patterns, a fact borne out in the brief comparisons that have been made in this paper between CA and PA. However only further investigation will confirm whether this first impression is correct.

Szigetvári's 'counting' analysis makes no particular predictions for other dialects, unless we assume that all dialects in a particular language family will choose the same CV pair in the linear sequence to assign stress to, penultimate, antepenultimate. In the case of CA whilst an 'antepenult CV pair' setting is often accurate in picking out the correct nucleus to bear main stress, as we saw it is in the cases where stress is pulled towards the right edge of the word where the analysis fails. These are the very cases where the 'left-headed proper government' analysis and the 'governed nuclei' are successful - because they introduce some new understanding of the behaviour of word-final empty nuclei in CA.

At present therefore I believe that it is one of these two analyses - either Yoshida 1999 or the present new analysis - which will bear the most fruit in future research. The unrestricted distribution of word-final consonants in CA leads me still to favour an analysis in which the word-final parameter in CA is always in operation. Whilst the study has provided only a partial answer to the question it set out to tackle, it has in the process revealed the important fact that any analysis of CA stress must incorporate an analysis of the role of word-final empty nuclei.

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