

Arabic stress in Strict CV, with no moras, no syllables, no feet and no extrametricality

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Abstract This paper continues the effort that began in Scheer and Szigetvari (2005) to present a compelling alternative to moraic accounts of stress systems, framed in the theory of Strict CV (Lowenstamm 1996). For this purpose, the empirical basis of the paper is a stronghold of moraic theory: stress in Palestinian Arabic, with its rich interplay of syllable structure and stress assignment, involving quantity sensitivity and a syllabically-determined stress shift. These phenomena, although recurrent cross-linguistically, remained outside the scope of Scheer and Szigetvari's work. The present paper provides an account of these patterns using the innovative grid-based notion of weight incorporation (Ulfsbjorninn 2014). The analysis is also brought to bear on Cairene Arabic, which is shown to differ from Palestinian in a single parameter setting. Significant independent support is provided by the extension of the analysis to the phenomenon of vowel shortening (both metrical and final), whose distribution and motivation are shown to follow in a straightforward manner from the general account. The paper also improves on previous analyses of meter in Strict CV, as for the first time in Strict CV metrics, a computational component is explicitly formalized. We conclude with a comparison to a moraic analysis of the phenomena discussed, and argue on principled grounds that the Strict CV account is a worthy competitor to such an analysis. Like its predecessor from 2005, the present account recognizes only one unit relevant for meter: the nucleus. No appeal is made to moras, syllables, feet or extrametricality.

1. Introduction

The stress systems of Arabic dialects have been a fertile bed for theoretical discussion of stress-assignment (see survey in Watson 2011). Moras feature prominently in most analyses. The present paper, in contrast, models stress assignment in Arabic (specifically Palestinian Arabic) without using moras at all. Instead, the only entity that is significant for stress assignment is the skeletal nucleus, which can be either filled or empty.

Replacing moras with a nucleus-only framework is a worthy goal for the following reasons. Although moras may be used to formalize syllabification in general, their existence is motivated primarily on the basis of phonological quantity and stress assignment. In contrast, in Government approaches to Phonology, such as Strict CV, nuclei (filled or empty) are an *independently-motivated* representational device that is required for the syllabification of any language (Kaye et al. 1985, 1990; Charette 1991; Harris 1994; Lowenstamm 1996; Scheer 2004).¹ They are just an 'ordinary' part of the phonological skeleton, which may or may not be considered by stress.

The idea that meter is universally projected only from nuclei was first put forth by Scheer and Szigetvari (henceforth S&S) in a paper from 2005. In that paper, the authors demonstrate how a number of systems that have traditionally been regarded as quantity-sensitive can be reanalyzed as fixed-stress systems. In these systems, *Quantity* and *Extrametricality* are in fact epiphenomenal and can be interpreted as edge effects. As we will see in the present paper, this point can also be made with respect to some patterns in Arabic dialects. However, a full account of these dialects cannot rely solely on reference to edges; the theory in S&S has to be adapted to include the concept of quantity.

The necessary plug-in was provided in Ulfsbjorninn (2014) in the form of a process of *Incorporation*, whereby the projection from an empty nucleus is incorporated into that of an adjacent contentful one. This proposal effectively derives "true" quantity directly from the skeleton, again with no appeal to moras. As will become clear, Incorporation also manages to express the weight hierarchy in a representational way, rather than by assumption, since Incorporation leads to different weights depending on the skeletal shape of the underlying forms.

Because the Arabic stress system discussed here is one with “true” quantity, Incorporation will play a central role throughout the paper.

Before we turn to an exposition of data and theoretical tools, let us survey the structure of the paper, highlighting its main argument once again. In the short Section 2 we introduce the stress facts of Palestinian Arabic. Section 3 proceeds to introduce the framework and theoretical tools mentioned above: the Strict CV model of stress and the notion of Incorporation. Section 4 then provides an analysis of the facts from Palestinian in Strict CV. After simplex and suffixed nouns are considered, the analysis proceeds to account for the related cases of stress shift in cliticized nouns and verbs in both Palestinian and Cairene. The analysis is then extended to the phenomenon of vowel shortening in Palestinian, whose distribution, it is shown, follows elegantly from the account of the basic stress facts. Section 4 also provides the *computational* process that drives projection and stress assignment in our framework. Section 5 discusses the competition: it examines Hayes’s moraic account of Palestinian Arabic, and argues that it involves much burdensome machinery that is avoided in the Strict CV account. Moreover, the moraic account does not cover the issue of vowel length nearly as neatly as its Strict CV competitor. In the conclusion, we assess our proposal. For the first time in this framework, both quantity and computation have been integrated into an analysis of stress assignment in Strict CV. But more importantly for the general public, we have devised an account of quantity-sensitive stress systems that – as we hope will have been clear at this point – is at the very least a worthy opponent of the moraic analyses. To the extent that our view can be applied to other phenomena that have hitherto been understood in terms of moras, we thus call for a reevaluation of the mora and moraic syllabification as a theoretical tool.

2. Stress in Palestinian Arabic

This paper will be concerned principally with the stress facts in one Arabic dialect, namely Palestinian Arabic (PA).² The basic facts are summarized in (2). The first of two or three light syllables is stressed (2a). But if the final syllable is a “superheavy” CV:C or CVCC (2b), or the penultimate syllable is heavy CVC or CV: (2c), then that syllable will be stressed, even if it is only the second syllable from the right edge. Note that final CVC syllables do not behave like medial CVC syllables, in that they do not attract stress. In HLL (Heavy-Light-Light) words, the antepenultimate syllable is stressed (2d). The dialect also exhibits stress shift, or a “three-syllable window” effect: when another syllable is added to an HLL word and it becomes HLLL, stress is shifted to the antepenultimate L (2e). Note that these cases involve object suffixes, which we will treat as clitics.

(2) Basic stress facts of Palestinian Arabic

a. antepenultimate in LL(L)	nísi	‘he forgot’
	kátab-u	‘they wrote’
b. stress to weight I	biḥíbb	‘he loves’
	bis‘í:r	‘he becomes’
	tarǵám-t	‘I translated’
c. stress to weight II	tarǵám-ti	‘you (f.) translated’
	ji-sá:fir	‘that he travel’
	ji-tárǵim	‘that he translate’

- d. different patterns in HLL mádras-e ‘school’
 sákkat-at ‘she silenced’
 ká:tab-at ‘she corresponded’
 e. Stress shift in HLLL sakkát-at=o ‘she silenced him’
 ka:táb-at=o ‘she corresponded with him’

It is impossible to do justice to all the literature that has been written on the topic of stress in Arabic dialects: the reader is again referred to the survey in Watson (2011). In that article, one also finds the standard moraic analysis of the facts above. We suspend the examination of that account to the comparison to the present one, which will be conducted in Section 5, and proceed directly to introducing the theoretical framework adopted in the present study.

3. Theoretical framing

3.1. *Strict CV and stress*

Strict CV (Lowenstamm 1996, Scheer 2004) is a representational framework principally concerned with syllabification. Along with autosegmental theory, Strict CV assumes that phonological representations involve multiple tiers. Of these, relevant for our discussion are the ‘segmental’ or melodic tier, which houses the features, and the skeletal tier, to which these features are associated in various ways (one-to-one, many-to-one, one-to-many). Much like Clements and Keyser (1983)’s CV phonology, the entities found on the skeletal tier are two: C and V. But in Strict CV, as its name suggests, the only skeletal *constituent* is the minimal “syllable”, i.e. the CV unit. This derives a skeleton which is made up of strictly alternating Cs and Vs.³

In Strict CV, the CV skeleton is universal. All other considerations being equal, upon lexicalization, every consonant is attributed a C-slot, which is followed by a V-slot. Assuming such an algorithm, all words end in a V-slot which is either filled or empty. The two Spanish words in (3) thus have skeletons with the same number of CV units. If the final V-slot is empty as in (3a), the word will phonetically end in a consonant; and if the final V-slot is filled with features as in (3b), the word will phonetically end in a vowel.⁴

- (3) C and V final words end in nuclei in Spanish (Harris and Gussmann 2002)

a. x	a	m	o	n		consonant-final word: [xamon] ‘ham’
b. p	a	l	o	m	a	vowel-final word: [paloma] ‘dove’
C	V ₁	C	V ₂	C	V ₃	

The phonetic interpretation of empty V-slots (such as V₃ in 3a) must be inhibited. In GP, the force that manages inhibition is called “p-licensing”. For final empty nuclei (henceforth FENs), p-licensing is dictated by the parameter setting in (4a): in some languages (such as Yoruba), FENs are not p-licensed, and therefore must be filled, while in other languages FENs are p-licensed. As can be seen in the Arabic word in (4c), FENs are p-licensed in Arabic: this parameter in Arabic is set to <yes> (4a below).

As is well known, the prevalent model of stress assignment until the present day assumes weight units called *moras*, which can be projected by either vowels or consonants, with the additional assumption that consonants can only project a mora when in coda position. The model of stress in Strict CV therefore carries a considerable formal advantage over moraic models, namely that *the only object of metrical significance is the nucleus*, empty or full. While there is

still a sense in which empty and full nuclei are not exactly the same object, they clearly have a common denominator, which is not the case for consonants and vowels.

S&S's proposal also has a typological advantage. In languages such as Spanish, default stress is assigned to the penultimate syllable in vowel-final words [palóma] 'dove' and to the final syllable in consonant-final words [xamón] 'ham'. Such systems are standardly analyzed as quantity-sensitive, assuming default stress on the penultimate syllable $[(pa_\mu)_{\sigma 1}(l\acute{o}_\mu)_{\sigma 2}(ma_\mu)_{\sigma 3}]$. This default stress assignment could be bled by right-aligned heavy syllables, which attract stress due to their moraicity: $[(xa_\mu)_{\sigma 1}(m\acute{o}_\mu n_\mu)_{\sigma 2}]$.⁶ In contrast, S&S's account reveals that such systems are not quantity-sensitive at all, but rather they have regular fixed stress. Because both words end in a V-slot, all that the algorithm has to do is identify the penultimate nucleus (V_2 in 5) and designate it as the position of stressed vowel.⁷

(5) Quantity sensitivity reassessed as fixed stress

x	a	m	ó	n		C final word: [xamón] 'ham'
p	a	l	ó	m	a	V final word: [palóma] 'dove'
C	V_1	C	V_2	C	V_3	

Thus, quantity is reanalyzed as an edge effect. Accordingly, and because it does not appeal to the additional layers of syllable or mora, the analysis is simpler and formally more elegant. The same reanalysis is shown in S&S to be applicable to other systems that were previously considered to be quantity-sensitive, such as Latin.

However, Ulfsgjorninn (2014) shows that not all quantity-sensitive stress systems can be reanalyzed in this fashion. In addition to the pseudo-quantity systems described by S&S, there are also cases of "true quantity". In Pulaar, for example, syllables of the form CVVC, CVV, CVC and CV can all occur word-medially. Stress in Pulaar is quantity-determined and can be shown to fall on the "heaviest" syllable in the word, wherever it appears in the word.⁸ The heaviest syllable of the word is determined in accordance with the weight hierarchy in (6) (Wiltshire 2006).

(6) Weight hierarchy for Pulaar

$$CVVC > CVV > CVC > CV$$

Because stress is quantity-determined and falls on any syllable in the word, a system such as Pulaar cannot be derived solely by reference to edges.

To account for true quantity systems, Ulfsgjorninn (2014) introduces two main components to the framework initiated in S&S: 1) a grid-based theory of projections and 2) Incorporation. In this metrical framework, nuclei are classified according to their projection potential. Universally, filled nuclei are stronger than empty nuclei, since the latter are empty and can never host stress. Accordingly, lexically-filled nuclei project to Line 2, while empty nuclei only project to Line 1. Long vowels are a consequence of vocalic melody spreading to a dependent V position, which also only projects to Line 1.⁹ To illustrate this, consider the representations of sequences such as [ba:l] and [bal] in (7a). Their skeletons consist of three CV units for [ba:l] and two for [bal]. In both cases, it is the first nucleus (V_1) that is the filled head

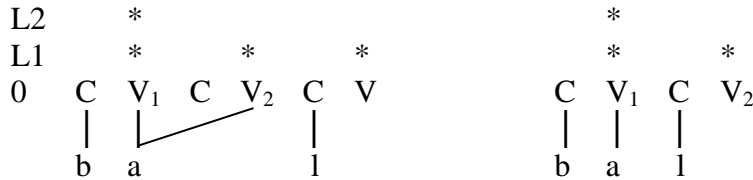
and both structures also contain an empty or dependent nucleus (V_2). In accordance with the universal projection conditions alluded to above, V_1 projects to Line 2, while the empty nuclei project only to Line 1 (7b).

(7) Projection in systems with “true” quantity

a. Underlying CVV vs. CVC



b. Projection, filled to Line 2, empty to Line 1

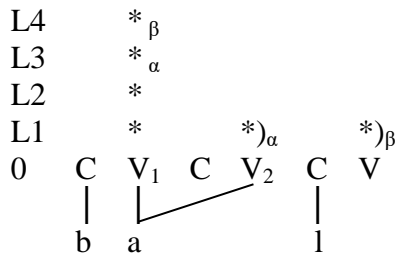


The key mechanism in Ulfsgjorninn (2014) is Incorporation, which handles the metrically projected word-medial empty nuclei (V-slots that project as far as Line 1). Incorporation consists of labeling these empty V-slots as dependents of filled nuclei; then reassigning their projective power into the projection of the head. As a result, the incorporating head gains one level of projection (promotion to Line 3).

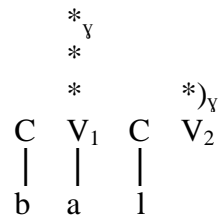
In Pulaar, as in all languages we are aware of, Incorporation runs from left to right: filled nuclei incorporate any empty nuclei to their right. In the structure in (8a) that models a CVVC ‘syllable’ ([ba:l]), the two empty nuclei of [ba:l] are incorporated into the projection of the filled nucleus to their right. Therefore, the incorporating head (V_1) gains two degrees of projection and ends up on Line 4. In the structure that models a CVC [bal] (8b), there is only one empty nucleus to incorporate and so the incorporating head can only project to Line 3.

(8) Incorporation of “true” quantity

a. CVVC [ba:l]



b. CVC [bal]



As mentioned, Pulaar stresses the leftmost heaviest syllable (cf. [6]). If the structures [bal], [ba:l], and [ba] were to form a single word [balba:lba] (CVC.CVVC.CV), then the CVVC syllable would be assigned main stress, despite CVC being a heavy syllable at the left-edge of the word. This is because the incorporating head of [ba:l] projects higher than the incorporating head of [bal].

Incorporation within Strict CV can be regarded metaphorically in the following two ways. Unlike contentful nuclei, ENs have no way of exhibiting their metrically-projected status on their own; this results in their incorporation into the head of their preceding contentful nucleus, thereby signaling their presence. Alternatively, one may say that while such ENs do have weight (since they will be realized unless they are governed), this weight must be “identified” (Faust and Torres-Tamarit 2017), and identification is achieved by the mechanism of Incorporation. Therefore, the motivation for incorporation appears to be the identification of empty but metrically-significant positions and the consequence is a gain in projection for the incorporating head.

There are several formal advantages to Ulfsgjorninn’s proposal. First, in moraic theory, weight could be contributed by either long vowels or codas. In this proposal, phonological quantity comes about only through the incorporation of empty nuclei: as in S&S, the only object of metrical significance is the nucleus. Second, and as a result, the weight hierarchy of any language does not need to be separately listed in the grammar: for instance, Pulaar’s weight hierarchy (cf. 6) is fully derived by Incorporation.¹⁰ Satisfyingly, incorporation will lead to different projection outcomes depending on the shape of the input; from this, stress can be mapped directly: the highest projecting head maps to primary stress. This way, true quantity is ultimately just another consequence of what stress always is: projection. Third, the proposal shows squarely that moras are unnecessary even for those stress systems that were left out by S&S, namely the clearly quantity-sensitive systems. Such systems can no longer constitute a valid objection to the abolition of moras in S&S.

The final advantage of this marriage between a grid theory of projections and Strict CV concerns the difference between FENs and ENs, which as we saw was *independently-motivated* in Strict CV. If this difference can be identified as a representational one regarding nuclei, it can also be parametrized for the purposes of stress-assignment. This is the starting point of the next section, where Incorporation, projection and empty nuclei feature in a non-moraic analysis of that stronghold of moraic theory that is Arabic stress.

3.2. *Projection, Incorporation and empty nuclei in Palestinian Arabic*

As we discussed in the previous section, once moraic codas are traded for empty nuclei, *consonants never count for stress purposes*. Only nuclei do. There are three types of nuclei: (i) contentful nuclei; (ii) empty nuclei, i.e. nuclei that would be realized if not for government; and (iii) FENs, i.e. nuclei that are allowed to remain unassociated even though they are not governed. Therefore, crucially, the status of final consonants and internal codas is different. Final consonants are C-slots preceding a parametrically p-licensed empty nucleus, while internal coda consonants precede a governed nucleus.

Because the distinction between FENs and ENs is one that exists in the theory independently of the discussion of stress-assignment, projection parameters can exploit this distinction with no additional cost to the theory. Reference can be made to FENs independently from medial empty nuclei and vice-versa, enforcing different conditions on the projection of

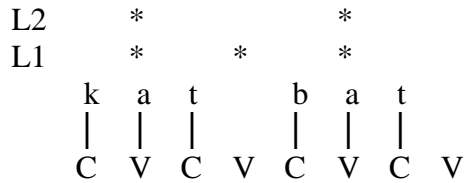
FENs and ENs. More concretely, for the calculation of stress, a language may count FENs or it may not, and it may count ENs or it may not. We propose to formalize these choices with the two parameters in (9). The setting of the parameters for Palestinian Arabic is underlined:

- (9) Proposed parameter of metrical projection and their settings for Palestinian Arabic
- a. Governed EN are metrically-significant: <yes, no>
 - b. FENs are metrically-significant: <yes, no>

We further assume that all metrically-significant nuclei project to Line 1. Accordingly, as originally proposed by Charette (1984), when the parameter in (9b) is set to <no>, this effectively produces extrametricality: if the FEN is not metrically significant, the final consonant would *seem* to be extrametrical, whereas medial coda consonants will not be affected. When this parameter is set to <yes>, one derives the cross-linguistically recurrent pattern of final stress in consonant-final words and penultimate stress in vowel-final words (e.g. regular stress in Spanish as shown in 5).

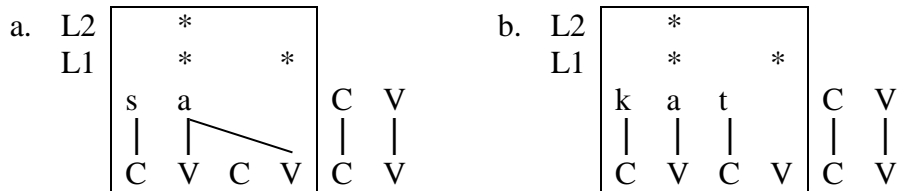
Now consider the representation of the Palestinian [katbat] ‘she wrote’ in (10). Because the parameter in (9a) is set to <yes>, the governed empty nucleus projects once (to Line 1), while contentful nuclei project twice (to Line 2). As can further be seen in (10), the FEN does not project at all, because the parameter in (9b) is set to <no> in Arabic. Again, the final consonant *seems* extrametrical, where in fact it is irrelevant for stress purposes.

- (10) The projections of ENs, FENs and contentful nuclei in a grid-based approach



Palestinian, like Pulaar, treats CVC and CVV syllables on a par (as contributing weight). And just like in Pulaar, given the parameter setting of Arabic, in both configurations there are two consecutive metrically-significant nuclei, as shown in (11).

- (11) Long vowels and closed syllables are metrically equivalent

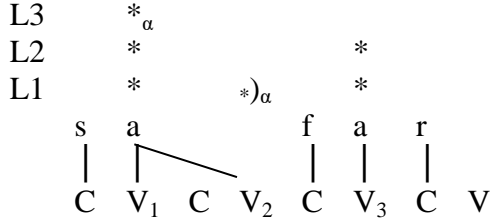


As described in the previous section, in quantity-sensitive systems, representation such as (11a,b) trigger a process of Incorporation. This is the case in most Arabic dialects. Thus, the projective power of the governed EN is incorporated into the projection of the preceding V-slot, as shown in (12). As a result, the incorporating nucleus projects again, thrice into Line 3. Note that unlike

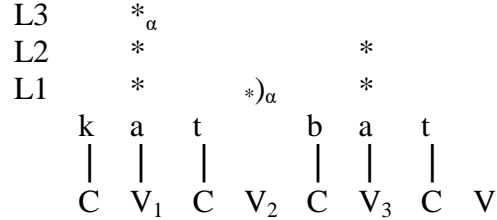
in Pulaar, FENs do not project at all (cf. parameter setting in 9b), and therefore V_1 projects higher than V_3 and attracts stress.

(12) Incorporation in Arabic

a. [sá:far] ‘he travelled’



b. [kátbat] ‘she wrote’



At this point we can already point out several merits that our approach to Arabic stress shares with previous metrical accounts in Strict CV. First, no syllables or feet are necessary. Second, our approach obtains extrametricality from an *independently necessary* distinction of the theory, namely ENs vs. FENs. Third, it has only one (non-metrical) type of phonological entity that is relevant for stress assignment, namely the nucleus (vs. both vowels and coda consonants or syllables in the traditional analysis). And most importantly, this last advantage provides motivation for the parallel between long vowels and non-final closed syllables, and may even be explanatory with respect to why such (phonetically-different) syllabic configurations (CVV, CVC) and not others (CV) are those that attract stress. The “price” of the integration of quantity into Strict CV metrics is the introduction of the tools of projection and Incorporation. We contend that this is not a high price: both projection and integration are natural extensions of the theory’s three-way distinction between contentful nuclei, ENs and FENs; moreover, weight is expressed by these notions in terms of linear dependency rather than constituency – in accordance with Strict CV’s general principles.

Having said all that, we have only seen the basic facts of Arabic stress. In the next section, a fuller analysis of the Palestinian data is provided, as well as extensions to Cairene and the phenomena of metrical and positional vowel shortening.

4. A Strict CV metrical account of Palestinian and Cairene

4.1. The basic pattern

In the previous subsection, we saw that FENs in Arabic do not project at all, whereas ENs project to Line 1 and contentful nuclei project into Line 2. We will now use these facts in order to account for the entire data set of Palestinian Arabic. We begin in this section with forms that are either unsuffixed or carry a suffix, to the exclusion of forms carrying clitics.

In the data section, we saw that Palestinian exhibited stress shift, reflecting the cross-linguistically recurrent observation of a “three-syllable window” restriction. We propose to build this requirement into the algorithm as in (13a) on the basis of Line 1 projection, effectively establishing a domain of stressability. Note that our “window” is not based on vowels, but on metrically-significant nuclei (henceforth MSN), i.e. in PA both contentful nuclei and ENs, to the exclusion of FENs. We saw further that heaviness is a result of a V slot projecting to Line 3 as a

- Define window among last three Line 1 projections.
- Establish head on a Line 3 projection
- In the absence of a Line 3 projection, projects onto Line 3 the leftmost MSN and make it head (kátabu).
- If that is an empty nucleus, stress the preceding MSN (preantepenultimate: [mádrase])

Let us now illustrate this algorithm with real examples. The three-MSN window on Line 1 is shaded in all the examples below. In (14a-c), the incorporating vowels (in bold) within the window are stressed, because they fulfill the requirement of having a Line 3 projection. In a form with no incorporating vowel, such as (14d), a projection is added to the first MSN in the window. As a result, this vowel is stressed. However, if that first MSN does not have content, as in (14e) or (14f), it cannot serve as a bearer of main stress. The solution proposed for Palestinian is to stress the preceding, preantepenultimate MSN, which already projects to L3 by Incorporation. This “repair” is depicted by the arrow; of course, it is not the only solution to the problem – we will see below that the Cairene dialect follows another path.

a. L3 L2 L1

*_α

* *

* *_α) *

k a t **a** b t i

| | | | | | |

C V C V C V C V

b. L3 L2 L1

*_α

* *

* *_α) *

b i h **i** b

| | | | |

C V C V C V C V

c. L3 L2 L1

*_α

* *

* *_α) *

s a f a r

| | | | |

C V C V C V C V

d. L3 L2 L1

*

* *

* * *

k a t a b u

| | | | |

C V C V C V C V

If so, Palestinian moves the stress to the vowel that incorporates the projection of the unstressable MSN, at the cost of exiting the window; Cairene prefers to remain within the three MSN window, at the cost of stressing an MSN which is not related to the first MSN of the window in any way.¹⁴

Additional support for the minimal difference regarding the direction of resolution is provided in the next subsection, as we move to cliticized words and the stress shift that they display.

4.3. A bi-cyclic account of cliticized words and stress shift

The phenomenon of stress shift in Palestinian was presented in (2d,e) above. As recalled in (17) below, when a syllable is added to an HLL word and it becomes HLLL, stress is shifted to the antepenultimate L (17a). This shift was presented as motivating a three syllable window. However, within the present framework, it is not an ideal case for this purpose, because the fourth MSN is an EN /sak_kat-at=o/, /ka_tab-at=o/. A better case for the three MSN window can be made by examining an LLLL word. Unfortunately, no such surface sequences are to be found. However, there are words that can be regarded as underlyingly LLLL. The word [bárak-e] ‘blessing’ in (17b) carries the feminine suffix [-e]. When followed by a possessive clitic, this suffix has an allomorph /it/. That the vowel of this allomorph is lexical can be observed in the fact that it carries stress when a C-initial clitic is added (epenthetic vowels do not attract stress, even in closed syllables, see ft. 17). When a V-initial clitic such as [=o] ‘his’ is added, one expects to find an LLL sequence [barakito]. Yet Palestinian has a rule deleting /i/ in non-final open syllables (governed nuclei in the present framework), and so the attested form is [bárakto] (For /i/ syncope see Brame 1974, Kager 1999). This form is problematic for our analysis, because the stressed vowel is the fourth, rather than the third MSN from the end [bá₄ra₃k_₂to₁].

Another problem with the three-syllable window is raised by the Cairene facts in (17c). The base [kátab-et] is well-behaved with respect to the window; but when the V-initial clitic is added, the stress moves to the penultimate, rather than the antepenultimate position, as it did in Palestinian in (17a). If the window is set to three MSNs in both languages, as we have proposed, what can explain the differences in the targets of stress shift?

(17) Shifts or lack thereof in cliticized words

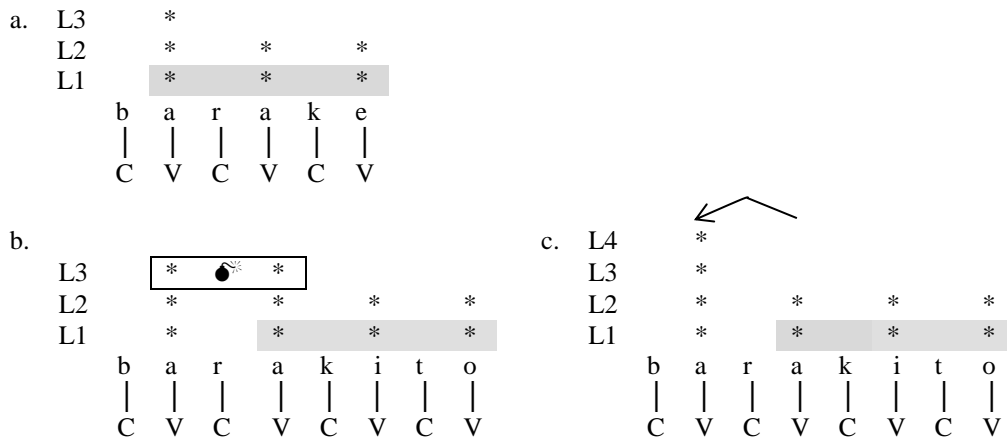
- | | | |
|------------------------------------|--------------------|-----------------------------|
| a. Palestinian V=Object clitic | | |
| sákkat-at | ‘she silenced’ | sakkát-at=o |
| ká:tab-at | ‘she corresponded’ | ka:táb-at=o |
| | | ‘she corresponded with him’ |
| b. Palestinian N=possessive clitic | | |
| bárak-e | ‘blessing’ | barak-ít=na |
| | | bárak-t=o |
| | | ‘his blessing’ |
| c. Cairene V=Object clitic | | |
| kátab-et | ‘she wrote’ | katab-ét=u |
| | | ‘she wrote it’ |

In the two previous subsections, we proposed that when a problem arises with stressing the antepenultimate MSN, Palestinian allows stress to be retracted outside the window, while

Cairene advances stress in order to keep it within the window. It will now be shown that the data in (17) in fact both corroborate that analysis and support the three-syllable window. The problem raised in (17) is only slightly different in nature from the one raised by HLL words like /madrase/, and the solution is identical.

All of the forms that challenge our analysis involve clitics. It stands to reason, therefore, that their derivation proceeds in two stages: first a word-level stage is computed, and then a phrase level one is.¹⁵ Let us examine [báarak-t-o] in this light. There is nothing special to say about the base in (18a): the third MSN is projected to L3 as expected. Now consider what happens at the stage when the clitic /=o/ is added in (18b). The antepenultimate MSN is expected to project to L3, too. Assuming (uncontroversially) that the L3 projection of the first cycle remains in the representation, the cliticization would create a clash of prominence on both sides of the window, framed in (18b) (clash is defined on L3; we assume that L2 clashes are not problematic). If so, as in the case of /mad_rase/, stressing the antepenultimate is problematic, this time because it creates a clash of prominence: two adjacent MSNs project to the same line. The solution is the same: allow stress to escape the window and be added to the preantepenultimate position, as in (18c)

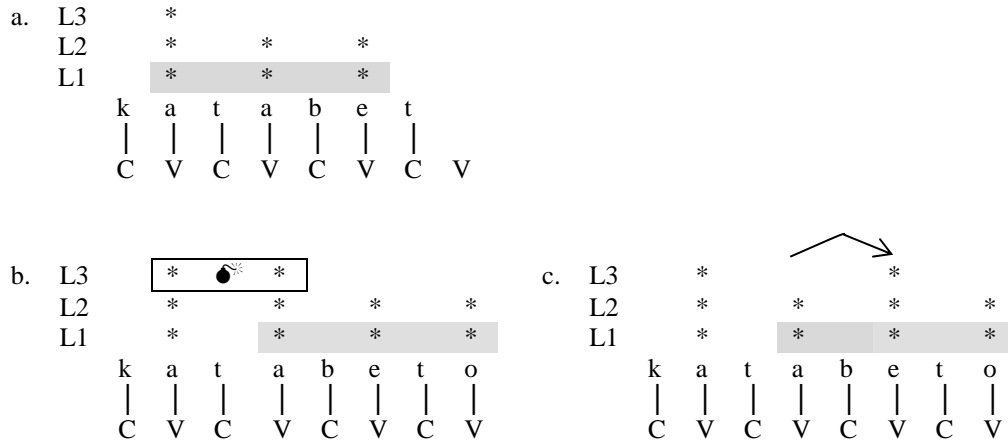
(18) Stress clash and retraction in Palestinian cliticized nouns



If we are on the right track, a prediction is made for Cairene. When clash arises, stress should be advanced rather than retracted, in order to stay within the window, just as in the /mad_rasa/ => [madrása] case.

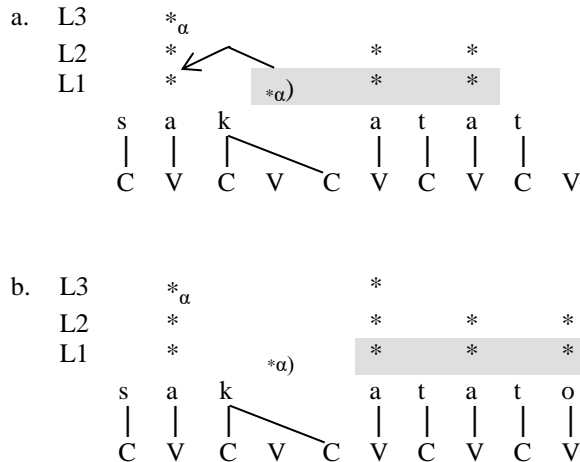
As shown below, this prediction is correct. The representations are provided in (19). In the base form the antepenultimate MSN is projected to L3 (19a). When a V-initial clitic is added, shifting stress to the antepenultimate MSN derives a clash (19b), which is resolved by protraction (19c).

(19) Stress clash and protraction in Cairene cliticized verbs



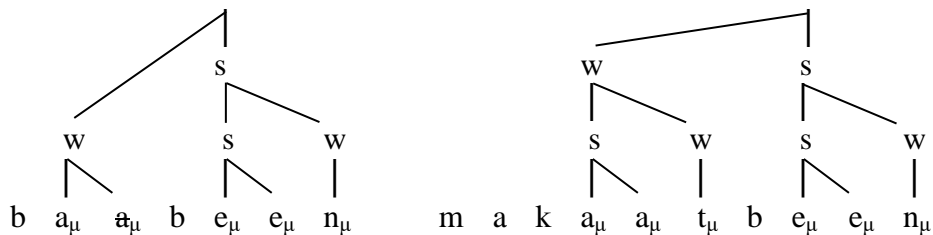
The bi-cyclic analysis also derives the correct result for the case of Palestinian [sakkat-at], [sakkát-at=o] in (17a) above. As shown in (20a), the base /sakkatat/ ‘she silenced’ is analogous to /madrase/ ‘school’: the first MSN in the window may not be stressed and so stress is retracted. Once the object marker is added, the first MSN in the window becomes eligible for stress-bearing. As a result, stress will appear to have shifted to the right, when in fact it is completely regularly placed on the first MSN in the window.¹⁶

(20) No stress clash and no stress shift in Palestinian cliticized verbs: [sákkatat] vs. [sakkátato]

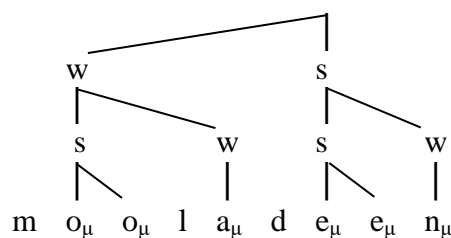


To summarize this section, we have examined three cases that appeared to be problematic for the three MSN window. Upon closer examination, however, the cases in fact corroborated not only this window, but also the proposal as to the minimal difference between Palestinian and Cairene being a simple parameter setting regarding the direction of resolution in case stress cannot be placed on the first MSN of the window. The analysis involved a bi-cyclic derivation of the forms, which is very much supported by their morphological complexity.

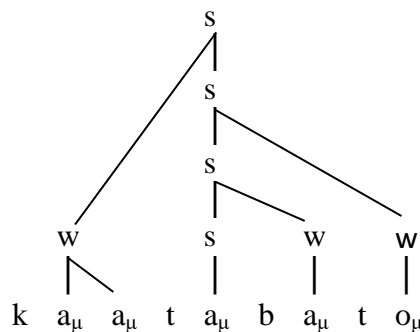
This concludes our analysis of stress assignment in Palestinian (and Cairene) Arabic.¹⁷ Before we summarize the entire analysis and compare it to the moraic analysis, we turn in the



c. /mo:lād-e:n/=>[mo:lādē:n]



d. /ka:tab-at=o/=>*[kátabato]



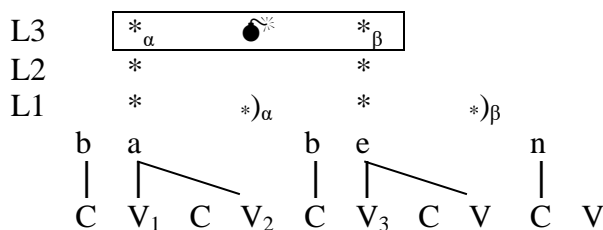
Abu-Salim is at a loss with (22d). After rejecting a cyclic analysis, he resorts to homophony avoidance: the expected *[katabato] would be identical to the underlying /katabato/ ‘she wrote it’, which undergoes syncope and is realized [katbato]. A shortened /katabato/ would also be expected to be realized [katbato]. In order to avoid this homophony, the long /a:/ is not shortened.

If homophony avoidance was ever a convincing argument, we do not consider it to be one in the present case. First, the Palestinian verbal system is full of cases of homophony that are not avoided. Second, most verbs of the Qa:TaL type instantiated by [ka:tabat] ‘she corresponded’ do not have equi-rooted parallels in the QaTaL type like /katabat/ ‘she wrote’, so the prediction is that these *should* undergo shortening. This prediction is false. Abu-Salim’s account cannot be correct.

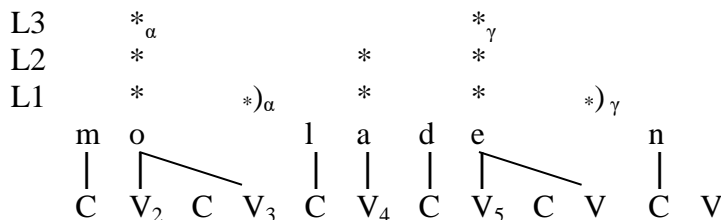
Since the publication of Abu-Salim’s paper, although Palestinian has continued to feature prominently in discussions of Arabic stress to this day, no subsequent analysis of these facts has been proposed to the best of our knowledge.²⁰ We will now present an account in our own framework.

The main insight of Abu-Salim’s account is that /ba:be:n/ ‘two doors’ is problematic because it involves equal prominence. Crucially – and this is ignored by Abu-Salim – the problem of equal prominence is determined without reference to main stress. Indeed, in the pronounced word, the final vowel would be more prominent by receiving main stress, and there would be no conflict. Consider now the representation of this word in our approach before main stress assignment (23). As can be seen by the frame, both vowels project to Line 3. We submit that this situation constitutes yet another clash (framed in 23). Again, that the intervening MSN V_2 does not prevent the clash: its only projection is incorporated in the preceding MSN.^{21,22}

(23) Vowel shortening: the problematic form as clash

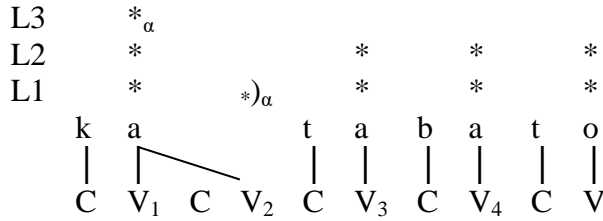


We claim that the clash in (23) is avoided by undoing the incorporation of V_2 . This undoing has a segmental effect. It appears that in Palestinian vowels can only become long by spreading into



Meanwhile, for [ka:tábato] in (27), no clash is expected between V₃, which will eventually bear stress, and V₁, since clash is crucially defined at Line 3 *before* main stress assignment:

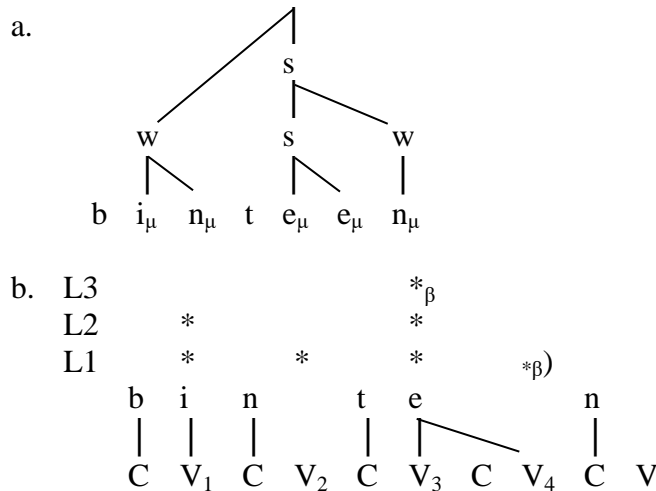
(27) Vowel shortening in Palestinian: no clash in [ka:tábato]



Finally, consider forms like /bint-e:n/ ‘two girls’, derived from /bint/ ‘girl’ and realized [binté:n] (the unsuffixed base is sometimes realized with epenthesis [bínit]). Such forms are not discussed by Abu-Salim, but in fact they pose a problem for his account. The first syllable is bi-moraic, just as in /ba:b-e:n/. In /ba:b-e:n/, Abu-Salim assumed that the first monosyllabic foot couldn’t stand under the weak branch of a higher foot. Yet as is shown for Abu-Salim’s account in (28a), this is exactly the case in [binté:n], which the phonology does not alter at all. Abu-Salim is obliged to limit the effect to monosyllabic feet created by vowels, again by brute force.

Our account does not suffer from this drawback. As shown in (28b), we predict that the incorporation of V₂ will be undone in order to prevent clash. In the case of [babé:n], the lack of incorporation correlated with the unavailability of V₂ for spreading. In contrast, in the base /bint/, spreading is not an issue. No segmental effect is predicted, and indeed none is attested.

(28) /bint-e:n/ in both accounts



To summarize, as in the case of the main body of data, an account based on Incorporation and nuclei (filled and empty) succeeds where a moraic account involves several shortcomings. Indeed, once the problem and solution are defined in our terms, the distribution of the effect follows straightforwardly. As we will see in the next subsection, besides explaining metrical vowel shortening, our account very easily extends to another case of vowel shortening, namely *final* vowel shortening.

- a.
- | | | | | | | | | |
|----|---|----------------|---|----------------|---|----------------|-----|----------------|
| L3 | * | | | | | | | |
| L2 | * | | * | | * | | | |
| L1 | * | | * | | * | | | |
| | k | a | t | a | b | u | | |
| | | | | | | | ... | |
| | C | V ₁ | C | V ₂ | C | V ₃ | C | V ₄ |
- b.
- | | | | | | | | | |
|----|---|----------------|---|----------------|---|----------------|---|----------------|
| L3 | | | | | | * _β | | |
| L2 | | * | | * | | * | | |
| L1 | | * | | * | | * | | |
| | k | a | t | a | b | u | | |
| | | | | | | | | |
| | C | V ₁ | C | V ₂ | C | V ₃ | C | V ₄ |

The Incorporation and demotion account of clash-induced vowel shortening developed in the previous subsection easily extends to final vowel shortening, providing additional support for the proposal in this paper.

In the next section, we will collect and tie together our account of syllabic structure and metrics in Palestinian. This will demonstrate how our assumptions work together procedurally, as well as the parametric difference between Palestinian and Cairene.

4.5. Computational component of stress in Palestinian and Cairene

Like its predecessors in metrical Strict CV, the analysis in this paper treated mainly the final representations of the different forms. The computational component of the grammar has not been made explicit in either S&S or Ulfsbjorninn's work. In (31) below we specify, by way of summary, the ordered processes by which the underlying representation is assigned stress in the two Arabic dialects discussed. Although the examples come from these two dialects, the model has the potential for universal scope. For those who may wish to pursue and develop this new metrical framework, it will serve as a starting point from which testable hypotheses can be extracted.

As is shown in (31), the grammar first applies the projection parameters. Subsequently, a window of three MSNs is defined. Then follows the application of Incorporation of all the ENs in the representation. If following incorporation there is a nucleus inside the window that projects high enough (minimally to Line 3), the computation can stop and stress has been assigned: [biḥíbb], [bisʕí:r], [ka.tábtí].

In PA, if after Incorporation there are *two* adjacent nuclei that both reach Line 3, this results in Clash and demotion of the left incorporation domain: /ba:be:n/ => [babé:n], /mna:fis-na/ => [mnafis-na]. That the demoted domain is the left one in PA follows straightforwardly from the right-alignment of the window: clearly there is a preference to give more prominence to the rightmost Line 3 projection. Our model therefore predicts that in a quantity-sensitive system with left-oriented stress (with or without a left-aligned window) and a parallel sensitivity to clash, the rightmost of two incorporation domains will be demoted. The Australian language Gidabal (Geytenbeek and Geytenbeek 1971) seems to confirm be such a language: in it, the first heavy syllable is stressed, and the second of two consecutive heavy ones is deleted (there seems to be no window in Gidabal).

If, however, no Incorporation has led to a Line 3 projection within the window, default stress is assigned. In Palestinian and Cairene Arabic, the default stress projects the leftmost MSN in the window to Line 3: [ká.tab], [kátabu].

If the leftmost MSN cannot be projected by the default rule because it is an empty nucleus and cannot bear stress, stress must be shifted. The direction of this stress shift is determined by the parameter at the bottom of the diagram: protraction in Cairene [sakkátat], retraction in Palestinian [sákkatat], [sá:faru].

The diagram also contains a shorthand representation of the 2nd cycle, which might bring about a clash on both sides of the window. In this case, the same resolution applies as in the 1st cycle.

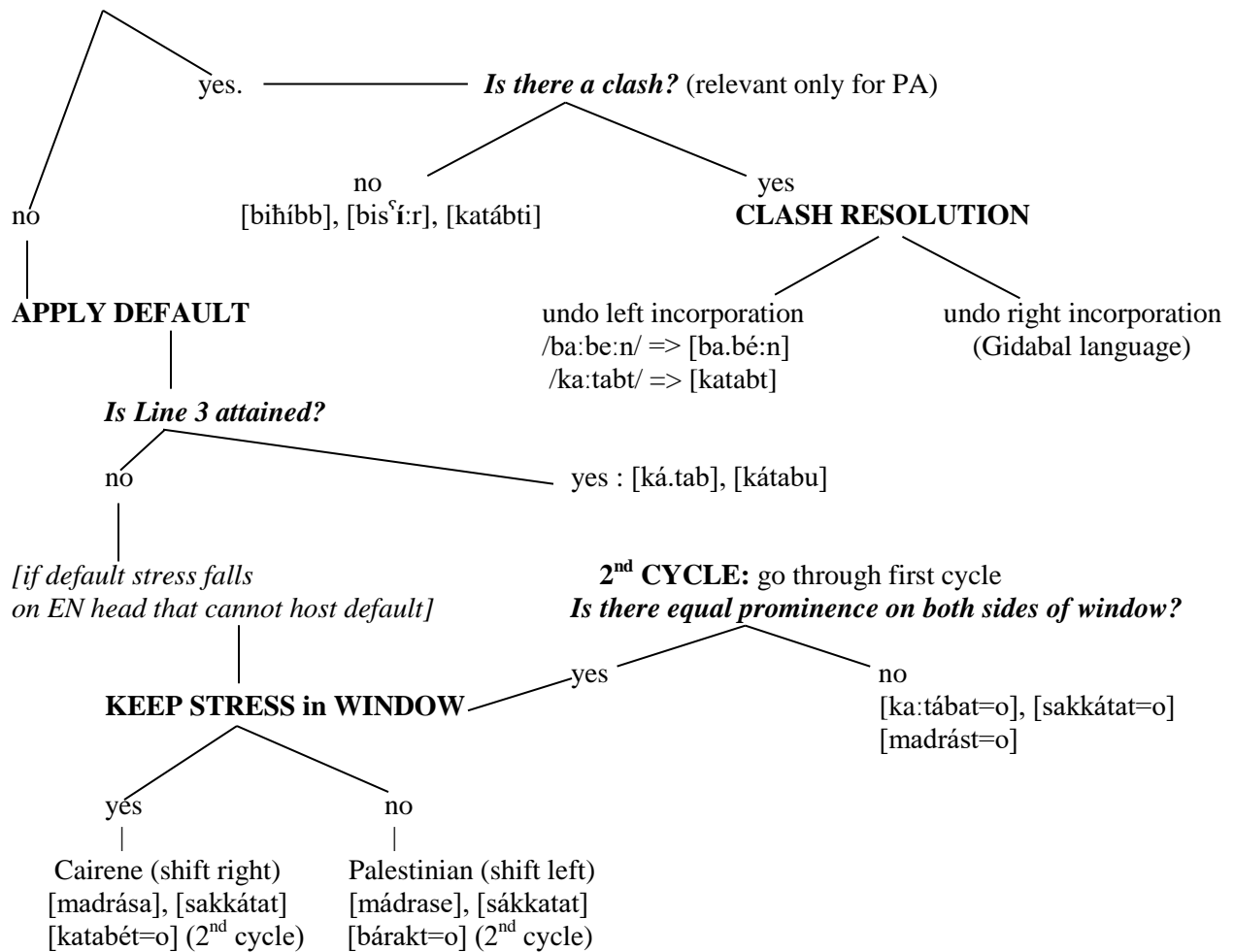
(31) Stress computation

1st Cycle PROJECT Vs [according to the projection parameters: FEN, EN]

BUILD WINDOW [for Palestinian and Cairene: last 3 MSN]

INCORPORATE

Is Line 3 attained?



To summarize this analytic section, we presented an Incorporation-based, Strict CV metrical account, which manipulates distinctions that are independently-motivated within the theory. We showed how the account extends smoothly into the matter of vowel shortening in Palestinian, whether induced by clash avoidance or by positional considerations. Finally, this subsection has made explicit what previous work in the framework has mostly tacitly assumed: a computational component that takes in a stressless underlying representation and produces a stressed

representation built directly on the skeleton. Having presented our account in full, in the next section we compare it to the more classic, mora-based account.

5. A comparison to the moraic account

In this section, we conduct a comparison between our analysis and the classic and most influential moraic account of Palestinian and Cairene stress in Hayes (1995). Our aim is to show that our account is at the very least a worthy competitor to Hayes's.

In (32), we present again the basic facts of Palestinian, for convenience.

(32) Basic stress facts of Palestinian Arabic

a. antepenultimate in LL(L)	nísi	‘he forgot’
	kátab-u	‘they wrote’
b. stress to weight I	biḥíbb	‘he loves’
	bisʿí:r	‘he becomes’
	tarzáṁ-t	‘I translated’
c. stress to weight II	tarzáṁ-ti	‘you (f.) translated’
	ji-sá:fir	‘that he travel’
	ji-tárzim	‘that he translate’
d. different patterns in HLL	mádras-e	‘school’
	sákkat-at	‘she silenced’
	ká:tab-at	‘she corresponded’
e. Stress shift in HLLL	sakkát-at=o	‘she silenced him’
	ka:táb-at=o	‘she corresponded with him’

Hayes proposes an account of these data based on moras and feet. In what follows, we will treat the data in the order they are presented in (32), comparing Hayes's proposal and ours. It is important to add before we begin that this comparison cannot be regarded as directly attacking moraic theory – much more space would be needed for this – or even more recent applications of this theory in OT. Our goal is more modest, namely to compare the two accounts and highlight what we see as the advantages of our account.

5.1. Antepenultimate stress in LL(L): [nísi], [kátabu]

Hayes assumes that all nuclei project moras. Trochaic feet are then built on top of those moras from left to right. Thus, [$\{n_i s_i\}$] involves one foot (feet in this section are marked by curly brackets). The word [$\{ka_\mu ta_\mu\} bu_\mu$] also has one foot according to Hayes: the rightmost syllable and mora remain unparsed, because there is a ban on non-binary feet. In our account, in contrast, the first MSN of the window is stressed in both [nísi] and [kátabu], and nothing else has to be added. Unlike Hayes's account, *our account does not require the distinction between parsed and unparsed entities of any sort.*

5.2. Stress to weight I: [bihibb], [bis^si:r], [tarzám-t]

For /bihibb/ and /bis^si:r/ (and also for /katab-t/ ‘I wrote’), building feet on top of projected moras gives the wrong prediction. All other things being equal, the first foot is built on top of the first two vowels. To its right, there is not enough material to build a binary foot, and so stress is expected to appear on the first vowel: *[{b_μh_μ}bb], *[{b_μs^si_μ}:r], *[{ká_μta_μ}bt].

In fact, the general assumption among practitioners of moraic theory is that feet are not built directly on moras. Rather, there is an intervening syllabic level, and it is syllables that are built directly on moras, while feet are built on top of syllables. Consider /bis^si:r/ through this prism: under the reasonable assumption that long vowels involve two moras, it is syllabified as [(bi_μ)_σ(s^si_μ:_μ)_σr] (we will return below to the reason that /r/ remains outside of the syllable according to Hayes). This syllabification explains why the first two moras cannot be grouped together under the same foot: since feet are built on syllables, a foot whose head is on the first syllable cannot directly access only the first mora of the second syllable: *[{(bi_μ)_σ(s^si_μ:_μ)_σr].

Yet this does not immediately solve the problem of *[bihibb]: all other things being equal, there are two moras in this word [bi_μh_μbb]. To explain why /hib/ behaves like /s^si:/, moraic theory makes the assumption that that coda consonants also project a mora. If this is true, then *[{(b_μ)(h_μ)b_μ}b] is also impossible. The same can be shown for [katábt]. The proposed parse for these forms is therefore [bi_μ{h_μb_μ}b], [bi_μ{s^si_μ:_μ}r], [ka{tá_μb_μ}t] (ignoring syllables).

There are three differences that should be pointed out between this account and ours. First, note that in the proposed parses the initial syllable remains unparsed. If so, not only the final syllable, but also the initial syllable may remain unparsed in the moraic account. No such exception needs to be made in our account in this case: instead, Incorporation has the relevant nuclei project to L3, in which case there is no need to create prominence elsewhere in the window. Second, the moraic account crucially relies on syllables and syllabification, which are completely absent from our account. While it can be claimed that syllables are an independently-motivated aspect of language – and this is not the place to argue against this claim – it nevertheless is remarkable that CVCC- and CVVC-final words constitute the only case in which the moraic account crucially requires the intermediary syllabic level. Our account, in contrast, does not require such a level at all.

The third, most important distinction between the two accounts is the number of entities that are relevant for the computation of stress. These can be either a vowel or a coda consonant in the moraic account, whereas in our account only nuclei are relevant. It is unclear why a coda (and moreover, only an internal one; see below) should add to the stressability of a preceding vowel. Moraic codas are a way to encode this, but they do little more than formalize the facts, as opposed to explaining them. In contrast, the apparatus that we introduced in order to account for the effects in this subsection, namely Incorporation, works only on nuclei, and functions in the same manner for [bihibb] [bis^si:r], and [katábt]. To summarize, we contend that the heaviness of CVC and CVV in the moraic account is equal by mere assumption, whereas in our account it follows from the general assumptions of CVCV Phonology and the mechanism of Incorporation.²⁶

Before we turn to the next set of words, consider the word [tarzám-t]. In our account, there is nothing special about it: the vowel /a/ projects to Line 3 by Incorporation and so attracts stress. Under the moraic view, two feet will be created [{ta_μr_μ}{zá_μm_μ}t]. It must be claimed that when there are two feet, the rightmost of the two bears main stress. Yet this cannot be the entire story, as we will see in the next two subsections.

5.3. Stress to weight II: [jisá:fir], [tárzam], and [kátab]

In the previous subsection we saw that according to the moraic account, coda consonants project a mora, and the rightmost foot is stressed. All other things being equal, one wrongly predicts *[ji{sa_μ·_μ}{fī_μr_μ}], *[{ta_μr_μ}{ʒá_μm_μ}]. In order to account for the place of stress in these forms, Hayes (1995) assumes that final consonants are extrametrical. In other words, even though they are codas, these consonants do not project a mora. This way, the parse of such words is like that of [kátabu], with the final mora remaining unparsed: [ji{sa_μ·_μ}fī_μ<r>], [{ta_μr_μ}ʒá_μ<m>]. The parse of a word like /katab/ is [{ka_μta_μ}].

Yet why is it possible for a final coda not to project a mora, while internal codas must project a mora? If both are codas, then the fact that a consonant is situated at the right edge should not be of any consequence. Final consonant extrametricality remains a formalized observation, rather than an explanation.

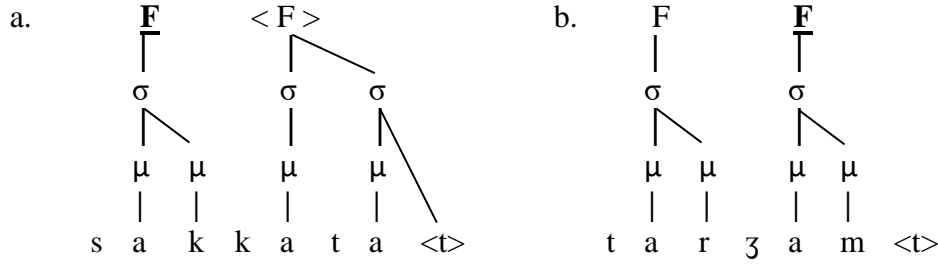
Now consider the parallel idea in our account, namely the parameter setting stating that the FEN does not project even to Line 1, and so there is nothing for the preceding nucleus to incorporate. This idea manipulates a fundamental and *independently necessary* distinction in the theory between FENs and governed ENs: only the former may remain empty even though they are not governed. By extension, the claim that there are different parameters for the two types of empty nuclei is not as ad-hoc as final consonant extrametricality. If so, while the moraic account requires the stipulation of final consonant extrametricality, our account does not require any unmotivated stipulation about extrametricality.

5.4. Different patterns in HLL: [mádrase], [sákkatat], [ká:tabat]

Hayes' account as it was presented until now does not work well for HLL words like [mádrase]. Left-to-right foot construction yields [{ma_μd_μ}{ra_μse_μ}], which is predicted to be stressed on the rightmost foot *[{ma_μd_μ}{rá_μse_μ}]. To explain these forms, Hayes proposes another type of extrametricality, which targets feet: if a foot is at the right edge of the word, it will be ignored by the rule that stresses the rightmost foot.

But rightmost foot extrametricality leads to yet another complication. Consider a word like [tarzámt], which was parsed [{ta_μr_μ}{ʒá_μm_μ}-<t>]: the rightmost foot is not extrametrical in this case. Hayes proposes that this is so because it is not at the right edge. However, the footing of [sákkatat] according to the assumptions accumulated so far also results in a foot that is not adjacent to the right edge [{sá_μk_μ}{ka_μta_μ}-<t>], yet in this word stress appears on the first foot, which means that the second foot *is* extrametrical. In order to explain the difference between [sákkatat] and [tarzámt], Hayes stipulates that a final consonant is “syllabified” with a preceding CV sequence (36a), but not with a preceding CVC sequence (33b). For this reason, the final C does not stand in the way of extrametricality in (33a), but does block it in (33b).

(33) Final C in the moraic analysis of Palestinian stress in Hayes (1995)



Whatever the reason that C behaves differently after CV and CVC sequences, for the present purpose of comparison it is important to say that our account does not require the distinction between syllabified and unsyllabified entities of any sort. With respect to final feet extrametricality, one may reiterate the final sentence of Section 5.3: our account does not require any unmotivated stipulation about extrametricality.

Having said this, the Strict CV account does carry an assumption that parallels, at least to a certain extent, foot extrametricality. Recall that cases like [mádrase] involved in our account a mechanism of stress retraction from the first nucleus in the window to a preceding nucleus, a move which does add to the complexity of the account. However, unlike foot extrametricality, which requires the complications in (33), stress retraction in our account is a *consequence* of the entire analysis, rather than an additional stipulation on our behalf. Indeed, it only occurs *because* the first position in the window, which should otherwise bear stress, cannot do so. In this sense, unlike foot extrametricality, stress retraction has a principled reason.

In the next subsection we discuss three aspects of the moraic analysis that can be claimed to be advantages over the present one, and show that they are no such thing.

5.5. Advantages of the moraic approach?

In defense of Hayes's use of final foot extrametricality, one may mention its treatment of three sets of facts: (i) Cairene [madrása] 'school', [sa:fáru] 'they travelled', [katab-ét=o] 'she wrote it'; (ii) the Palestinian facts from (33e) above (e.g. [sakkát-at=o]); and (iii) the form [báراك-t=o] 'his blessing'.

In a very elegant move, Hayes proposes that the only difference between Palestinian and Cairene is final foot extrametricality, which Cairene simply lacks. This indeed derives the correct result for $\{[ma_\mu d_\mu] \{r\acute{a}_\mu sa_\mu\}\}$. But it does even more than that: it also derives the correct result for the stress shift in Cairene $\{[ka_\mu ta_\mu] \{b\acute{e}_\mu to_\mu\}\}$ vs. $\{[k\acute{a}_\mu ta_\mu] be_\mu t\}$, with stress appearing on the penultimate vowel when, because of the addition of a clitic [=o], it can be parsed. In addition, the cases of cliticized words in Palestinian are also well-behaved under Hayes's view. For instance, $\{[sa_\mu k_\mu] \{k\acute{a}_\mu ta_\mu\} to_\mu\}$ exhibits stress on the rightmost foot because it is not final, as expected. As for /barak-i=to/ => [báراكto], Hayes assumes, much as we do, that stress assignment precedes syncope. This form is therefore parsed as $\{[ba_\mu ra_\mu] \{ki_\mu to_\mu\}\}$, and the rightmost foot is ignored because it is final. To summarize, foot extrametricality seems to make predictions which are borne out.

However, this can also be said of the notion of stress retraction in our account. Indeed, just like Hayes, we proposed a minimal difference between the two dialects: Palestinian retracts, Cairene protracts. And just like Hayes, we showed that the predictions made by this minimal difference are borne out in the analysis of forms with clitics. It can be claimed that in our analysis of cliticized forms, we appealed to a bi-cyclic derivation, whereas in Hayes's account,

no such complication is required. However, as mentioned, Arabic dialects, and cliticized words in Palestinian in particular, have featured repeatedly in discussions of cyclic effects, at least since Brame (1974). Assuming bi-cyclicity in these cases specifically can therefore hardly be regarded as a weakness of the analysis.²⁷

A final disadvantage that our account may be claimed to carry is its use of a three MSN window, which was crucial in cases like [sakkátato]. In the moraic analysis, once all of the parameters are set, no reference to a window is necessary. Our account, in turn, appears to be stipulative, as it does not derive the window from anything. However, we submit that this is an illusion: important aspects of the moraic account are just as stipulative as our proposal on this issue. In actuality, the element doing the work of the window alignment in Hayes's account is the rule designating the rightmost foot as carrying stress. This rule expresses the generalization that once all of the potential stress peaks have been established, the algorithm seeks the one that is closest to one edge rather than the other. But of course the choice of the edge does not follow from anything: it is equivalent to stating that a certain edge matters, while the other doesn't. This is exactly what the window alignment does in our analysis. If so, in both systems, an edge is arbitrarily assumed. Now, in Hayes's system, the placement of stress at a certain distance from this arbitrarily-designated edge follows from the interaction of several other stipulations, called "parameters", such as the direction of foot-building, the possibility to leave feet unparsed and the claim that feet are trochaic. But it is very unclear to us whether this is any less stipulative than simply saying "leftmost within the window of 3 MSNs".²⁸

If so, the moraic account does not fare better than the one proposed here in terms of inter-dialectal comparison or in terms of motivating stress shift/traction. It is furthermore debatable that the way that the moraic account derives the window is less costly than simply stipulating that window, as we do in our account. In the next subsection, we summarize the comparison between our account and the moraic account.

5.6. *Summary of the comparison*

In this Section, we embarked on a short comparison of our account and the moraic competitor. In this comparison, probably the first and foremost advantage of our account is the reduction of the set of metrically-significant non-metrical entities to one, the nucleus (filled or empty), as opposed to the nucleus and the consonant in a non-final coda position of the moraic account. But this is not the only advantage. Hayes's account involves no less than five types of ignored constituents: (i) consonant extrametricality; (ii) foot extrametricality; (iii) unparsed syllables, initial *and* final; (iv) unparsed moras; (v) unsyllabified consonants. In contrast, our account does not require any part of the representation to be unparsed, unsyllabified or extrametrical. The only entity that is ignored in our account is the FEN, as a result of an independently-motivated parameter setting.

The innovative tools that our account introduces, namely stress traction, Incorporation and differential projection, are consistent with the independently-motivated premise of Strict CV that empty nuclei are deficient when compared to contentful ones. In contrast, the exceptional treatment of the constituents listed above does not seem to be motivated by anything besides its success in covering the data. Even the strong points of the moraic account – inter-dialectal difference, stress shift – are equally well explained in ours. We therefore contend that our account is a worthy opponent to the moraic account. It is up to the reader to decide which model is more parsimonious.

Nevertheless, we must conclude with a repeated word of caution. This section was not an exhaustive comparison between theories, but rather a comparison of two accounts. It remains to be seen whether other strongholds of moraic theory, besides Arabic stress, can be matched by a non-moraic approach.

6. Conclusion

This paper continued the effort in Scheer and Szigetvari (2005) and Ulfsgjorninn (2014) to present a strong Strict CV alternative to moraic accounts of stress systems. Following Ulfsgjorninn (2014), it showcased the principle of Incorporation and a metrical grid introduced in order to account for true quantity within Strict CV. For the first time, this theory is applied to data that have been analyzed repeatedly using the competing moraic theory, namely the systems of Arabic dialects.

The Strict CV grid makes direct reference to the skeletal tier, independently-necessary in the representation of words, rather than to additional moraic and syllabic tiers. All metrical phenomena are parametric variations on the projection of a single phonological object: the V-slot, filled or empty. The quantity-sensitive grammars considered here do not require any idiosyncratic unit of quantity and no weight scales are needed. This is because the outputs of the computation vary only in accordance to the different shapes of the words that are fed to it: different URs give different projection outcomes. With this system in place, stress is simply mapped onto the highest projection.

With the metrical grid, Incorporation and the three MSN window in place, an account was provided of the basic data from Palestinian and Cairene which does not require moras, which are prominent in most previous accounts. In addition to matching the moraic analysis in the empirical coverage of the stress facts, the Incorporation tool was shown to be insightful regarding the issue of metrical long vowel shortening in Palestinian. This process, which received a highly-flawed mora-based analysis in Abu-Salim (1986), can be very simply handled in our framework, and moreover in a way which unifies metrically-conditioned vowel shortening with final vowel shortening. Encouragingly, this analysis was a straightforward extension of the account of the basic stress facts that we have developed (both are Incorporation-based analyses). Finally, unlike our predecessors in Strict CV metrics, we also furnish an account that is equipped with an explicit computational component.

In the previous section, we conducted a comparison between our account and the moraic predecessor. We showed that the account presented here does not require 1) moras, 2) extrametricality, 3) parsed vs. unparsed MSNs, 4) syllables, 5) syllabified vs. unsyllabified consonants, and 6) feet. All of these notions are crucial components of the traditional moraic analysis; but unlike the distinction between FENs and ENs, they do not express independently-motivated distinctions (with the possible exception of syllables). We submit that the contrast between our analysis and the moraic analysis is so marked that it constitutes grounds for phonologists to actively pursue the Strict CV approach. At the very least, reconsideration of the grammatical necessity of moras is certainly opportune.²⁹

Endnotes

¹ See Section 3 for more on the independent motivation of empty nuclei.

² By “Palestinian” we refer to the group of dialects spoken in Israel, the Gaza strip and the West Bank by traditionally sedentary populations, to the exclusion of the Bedouin dialects of the same regions. The generalizations about stress in Palestinian can be found, for instance, in Abu-Salim (1986) or Watson (2011) and references therein. For the present paper, we also worked with the excellent dictionary by Elihai from 2017.

³ The system can be described in terms of precedence: # precedes C, C precedes V, V precedes C or %.

⁴ Final empty nuclei (abbreviated as FEN) such as in (3a) were inherited into Strict CV from GP. For the empirical arguments see Kaye (1990), which discusses Moroccan Arabic, Kaye et al. (1990), Harris and Gussmann (2002).

⁵ The definitions in (4) describe the conditions accurately, though they are not the original definitions, which are framework-internal. For the original definitions see Kaye et al. (1990), Charette (1991).

⁶ Another way to derive such systems within moraic theory is with a right-aligned trochaic foot built directly on moras. However, because in the standard moraic theory of syllabification there is also a syllable layer, feet cannot be built directly on moras without violating the Strict Layering Hypothesis where each tier/domain/level is properly contained in the next (Nespor and Vogel 1986; Inkelas 1999).

⁷ Governed empty nuclei must be ignored to account for words like [álto] ‘tall’. See a very similar discussion for word-final nuclei foot dependents in Harris and Gussmann (2002), Charette (2008). The details of the Spanish stress system are more complicated than characterized in the present paper; the pattern described here, which is general for nouns, serves to illustrate the point that what looks like quantity sensitivity can be reanalyzed as fixed stress.

⁸ In cases of a tie, the leftmost syllable is stressed.

⁹ Long vowels in Strict CV are linked to two V positions: CV₁CV₂. We follow a GP representational tradition that treats the second position of a long vowel as essentially an ‘empty position’. More precisely, the second CV of long vowel structures is a dependent CV that is metrically restricted to project to Line 1. This reflects the asymmetric nature of the long vowel. In CV₁CV₂, CV₁ can contain an onset consonant and a vowel, while CV₂ must be *wholly composed* of material that is also found in CV₁. Moreover, only the V of this CV can be filled. This representational treatment of long vowels is at least as old as Goh (1997). He equates CVV and CVC syllable-types by treating CV₂ as differently ‘recessive’: CV_(full)CV_(either V or C).

¹⁰ One may claim that in the Strict CV model, a scale *would* have to be listed in the grammar if (for instance) CVV were heavy but CVC weren’t. This is in fact the case in Wolof, a language related to Pulaar. Ulfsgjorninn (2014) discusses Wolof and shows how the typology of

weight hierarchies are derived via parametric differences, without the need for listing weight scales in the grammar of each language.

¹¹ This is a principled assumption because all filled V-slots universally project to Line 2, therefore to achieve prominence over equally projected V-slots, a V-slot must minimally project to Line 3. Line 2 is then left for secondary stress. Note that Line 1 could not play that role, because even ENs project onto Line 1.

¹² Enough of our account is laid out now to mention a predecessor. Yoshida (1993) includes an appendix with a preliminary account of Palestinian stress in Strict CV. His algorithm is simply “stress the antepenultimate nucleus”, counting the FEN. But this makes the wrong prediction for /sakkatat/ => *[sakkátat]. In Cairene, where – as we will see – [sakkátat] is the correct form, the account would fail to explain [kátabet].

¹³ Our transcriptions of Cairene follow our main source of data, Fathi (2013).

¹⁴ Watson (2011) mentions several facts about Cairene that are exceptional. For instance, some LLL nominal plurals are stressed on the penult, e.g. [wazíra] ‘ministers’. A degree of lexicality is required to handle such examples under any account.

¹⁵ It is uncontroversial that Arabic has cyclic derivations in cliticized words. A famous Palestinian example is found in Brame’s (1974) discussion of /fihim-na/ => [fhímna] ‘we understood’, with /i/-deletion, vs. /[fihim]=na/ => [fhímna] ‘he understood us’, with no deletion.

¹⁶ Stress shift may also be described as the result of a pressure not to leave a long unstressed stretch at the right edge of the word. “Long” in the present framework would imply three MSNs on L1. The window both defines the problem and provides the solution: in both the original and the “shifted” cases, stress initially targets the leftmost MSN of the window.

¹⁷ This is of course not a complete account. At least since Kenstowicz and Kisseberth (1979), Palestinian has been famous for issues relating stress and epenthesis. Epenthetic vowels are ignored by stress even when they create a closed syllable. For instance, the [i] of certain verbal stems like [yí-ktib] ‘that he write’ gets syncopated before vowel-initial suffixes, leaving behind a triconsonantal cluster *[yi-ktb-u]. This is repaired by epenthesis between the first two stem consonants [yí-kitbu]. In our framework, such facts can be covered by having the stress algorithm not apply to empty nuclei that come to be non-p-licensed ENs (and *phonetically* interpreted). We do not develop the account here because in our opinion this analysis is neither an advantage nor a disadvantage of our framework as compared to competing accounts.

¹⁸ This form, like all cases of long vowels in non-final closed syllables, involves syncope of the base’s short /i/. (The behavior of ‘competitor’ is illustrated by two different bases in Abu-Salim’s work).

¹⁹ Palestinian (unlike several other Arabic dialects) exhibits long vowels in closed syllables. Note further that the representations in (22b,c) involve an uneven trochee, a representation which was later considered impossible by Hayes (1995). The facts in (21) were not treated by Hayes.

²⁰ The issue is also dealt with in Younes (1995) in an analysis that is essentially identical, although less formal.

²¹ The same clash arises before non-final CVC under our view, as in /ka:tab-t/ => [katáb-t] ‘I corresponded’. The case of /mna:fís=na/ => [mnafísna] ‘our competitor’ is identical, and shows that clash can be established and resolved in the second cycle.

²² The careful reader will have noticed that the representation of clash in (24) is seemingly identical to the representation of the shifted stress in [sakkátato] ‘she silenced him’ in (20b). However, as mentioned in the text, vowel shortening is the resolution of a clash defined crucially *before* main stress assignment and the definition of a window; stress-shift deals with clashes defined after stress assignment and having to do with equal prominence on both sides of the window. As a result, if the nucleus preceding the window is empty, as it is in [sak_katato], there is in fact no clash (and even if one were to treat this as clash, retraction is impossible because the preceding nucleus is an EN).

²³ There are some exceptions to this generalization among loans, such as [gató:] ‘cake’, and a more interesting case in the Palestinian native system involving a segmentally-null third person marker, [katabú:] ‘they wrote it’ (cf. 29a). We assume that this marker is not skeletally empty, thereby rendering the phonetically-final vowel phonologically non-final.

²⁴ For McCarthy, this generalization is expressed in the constraint hierarchy MaxV: >> FinalC >> MaxV. In prose, Arabic dialects like PA want words to end in a consonant, and will accept the total deletion of final short vowels in order to achieve that goal; but final long vowels will have to be represented by something on the surface, and so they shorten, but are not deleted. Besides the ad-hoc ordering of constraints, we find the use of FinalC problematic, since it predicts languages in which all words end in a consonant on the surface. While some Aslian languages do exhibit this pattern, it is probably motivated by stress considerations, rather than by FinalC (*pace* Blevins 2017:60): all of these languages have exceptionless final stress (see Phillips 2013 for Semai, and Burenhult 2001 for Jahai). In the main text we explain the shortening of final long vowels. As for final short vowels, Strict CV also has a way of ruling these out, while keeping final long ones: it can be claimed that all lexical representations in Arabic must end in an empty nucleus. C-final words comply with that condition, as do the words with a final underlyingly long vowel (e.g. 30); but words with final short vowel do not.

²⁵ Note that these representations introduce a final CV for final vowels. This addition has no bearing on our metrical analysis, since the V-slot of that CV does not project and will be ignored by the window.

²⁶ Moreover, the asymmetry between long vowels and coda consonants with respect to stress is especially apparent in that while there are many languages (though not Arabic) that

systematically lengthen stressed vowels, no language systematically expresses stress by coda-insertion. Gordon (2006) claims, on the basis of phonetic data, that coda consonants contribute “energy” to the rhyme. Based on this premise, one might claim that in languages where all codas are moraic, any amount of energy above that which is carried by a single vowel makes the rhyme heavy. Gordon’s approach cannot be discussed here in full; but his view of weight can hardly be mentioned as supporting moras, since the translation of the phonetic facts into moras is not at all straightforward. Indeed, why would a consonant, which carries just a little “energy”, be represented by the same entity as a vowel, i.e. the mora? We may mention here two other drawbacks to the calculation of weight based on “energy”. First, it is unclear why the energy of final consonants should be any different from that of medial ones. Second, it is hardly the case that energy groupings can be read off the spectrogram: Gordon (2006:155) must assume that the phonetic signal is first analyzed into syllables, and then weight is measured, with consonants that immediately precede vowels (i.e. onsets) not contributing their energy to anything. If so, while the notion of energy does carry interesting predictions with respect to the difference between coda sonorants and obstruents, it seems that the phonetic facts must be phonologized anyway, and so there is no competition with a phonological account (the issue is discussed briefly in S&S).

²⁷ The same can be said about the notion of clash in our account. Although clash avoidance is not necessary in the moraic account, it expresses a fundamental insight about human languages, and so comes with no cost whatsoever.

²⁸ It *can* be claimed that the maximal number three somehow follows from a need not to place stress too far away from the right edge. We further insist that a window such as the one proposed here does not require counting: it can be regarded as a template whose size is defined in terms of MSN and which is aligned to the right edge. Then, if there is no L3 projection within the window, the leftmost MSN is made to project to L3. For further discussion of a way to derive the three syllable window without feet, see Kager (2012). Interestingly, for reasons that are internal to Optimality Theory, Kager ends up rejecting the grid-based window and adopting weakly layered feet. But such ternary feet are as controversial as windows, and therefore not much better than them as a primitive of the analysis. Metrical windows remain descriptively necessary, and since we cannot find an insightful explanation/analysis (*i.e.* ternary feet), we are happy to stipulate this entity. In our system, nothing precludes the possibility of larger windows.

²⁹ To paraphrase on a catch sentence in the conclusion of Outi Bat El’s famous (1994) paper against the Semitic root hypothesis.

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