Emergence of iambs in Eastern Arabic: Metrical iambicity dominating optimal nonfinality

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*This paper presents a relatively novel metrical and constraint-based analysis of stress patterns in Bedouin Arabic as spoken by Zalabiah and Zawaideh subtribes in southern Jordan. Different from Eastern Arabic variety, the dialect under investigation exhibits stress patterns which are basically controlled by an iambic foot. In terms of metrical parameters, final foot extrametricality is proposed where it does not violate non-exhaustivity and peripherality; extrasyllabicity is also proposed for the analysis of a final consonant in a superheavy syllable. Extrametricality is better analysed, in constraint-based terms, via the constraint NONFINALITY. Examining the domain hierarchy in Optimality Theory, the argumentation then explores how the metrical parameter 'iambicity' struggles with the optimal constraint 'nonfinality' as well as with other constraints to generate the more harmonic stress patterns. In terms of dominance hierarchy, the constraints IAMB and WEIGHT-BY-POSITION are ranked higher than the constraints NONFINALITY and *FINAL-C-μ, supporting that stress patterns in the dialect of Zalabiah and Zawaideh are mainly controlled by the iambic foot. Contrary to previous literature, this work provides evidence that not all Eastern Arabic dialects necessarily fit into trochaic foot-type.*

Keywords: *Arabic Word Stress, Metrical Model, Optimality Theory, Iamb*

1. Introduction

All modern Arabic dialects, including Jordanian Arabic, have a regular word stress which does not serve to distinguish meaning. Phonetically, stressed syllables in Arabic varieties are louder, longer and of noticeably higher/different pitch levels than unstressed syllables (Al-Ani 1992; Mashaqba 2015).

From the early stages of modern phonological theory, serious theoretical work has been devoted to Arabic word stress, within different theoretical approaches: the pregenerative approach, with reference to the nature of the syllable (Mitchell 1956, 1960; Harrell 1957; Wright 1971); the generative approach, where stress is distinctively represented by the feature [+/-stress] (Abdo 1969; Brame 1970, 1973, 1974; Broselow 1976; Johnson 1979; Weldon 1980); the metrical approach, where the syllable is weight based, rather than segment-based (McCarthy 1979a, 1980; Angoujard 1990; Hayes 1981, 1995; Watson 2002; Huneety & Mashaqba 2016); and the constraint-based approach of Optimality Theory (Kager 1999; McCarthy 2008; Rakheia 2009; Al-Jarrah 2002, 2011).

This great deal of attention to stress in modern Arabic dialects relates to a variety of factors including: (i) the significant variation among the dialects of stress patterns though they share some patterns in common;[1] (ii) the relevance and applicability of stress patterns to

[1] This variation is based on (i) the difference in the distribution of syllable types (Watson 2011), (ii) being 'differential' where only unstressed high vowels are subject to syncope interaction of stress or 'non-differential' where all unstressed vowels are subject to syncope (Cantineau 1939), (iii) long vowels shortening in open unstressed syllables (Younes 1995), (iv) interaction of stress, syncope and epenthesis, (v) and the lexical information (cf. Kiparsky 2003; Kager 2009; Watson 2011).

metrical theory parameters (cf. Hayes 1995), and (iii) the great interaction of stress, syllabification patterns, and phonological processes (especially epenthesis and syncope). (cf. Broselow 1982; Kenstowicz 1983; Kiparsky 2002); (for more details, see Kager 2009.)

Stress patterns in Eastern Arabic dialects are apparently indistinguishable from one another. Stress placement is subject to 'quantity-sensitivity', i.e., it is sensitive to syllable weight (light, heavy, or superheavy); it also has the *demarcative* property where the position of the main stress is limited to the last three syllables of the word and never exceeds the antepenult window. Eastern Arabic dialects (exclusively Levantine) share the following rules: (i) a superheavy ultimate syllable always triggers the main stress, as in *ʕæ:.la.ˈme:n* 'two worlds' (Younes 1995: 163); (ii) otherwise, assign the main stress to a heavy penult, as in *mos.ˈtaʃ.fa* 'hospital' (Johnson 1979:154); (iii) otherwise, stress the antepenult, as in *ḥæ:.ˈra.ba.to* 'she fought him' (Younes 1995:163). (iv). In disyllabic words ending in -CV or -CVC, stress falls on the first syllable, as in *ˈḍarab* 'he hit', *ˈbana* 'he built' (Watson 2011: 3011).

Metrically, this analysis produces three main aspects to generate stress assignment: (i) parse the word from left to right into moraic trochees to assign a foot; (ii) a foot is rendered extrametrical at the right edge of the word; and (iii) feet are grouped into a right-headed word constituent. The antepenult (rule iii mentioned in the paragraph above) is active by rendering the final syllable extrametrical, and constructing a quantity-sensitive trochee at the right edge (cf. Kenstowicz 1983). On the other hand, Eastern Arabic dialects show a few internal differences (ambiguity) between a right-to-left analysis with syllable extrametricality, or a left-to-right analysis with moraic trochees and foot extrametricality. For example in LLLL structures, Palestinian variety assigns stress to the fourth syllable from the right-edge (i.e., ˈLLLL),[2] but Beirut/Damascene assign stress to the third from the right edge (i.e., LˈLLL). This variation is attributed to a difference of parsing direction (left-to-right in Palestinian but right-to-left in Beirut/Damascene), and a difference in extrametricality (with foot extrametricality in Palestinian but with syllable extrametricality in Beirut/Damascene) (cf. Halle & Kenstowicz 1991).

As for Jordanian Arabic (henceforth JA) dialects, stress has also been discussed in detail in a number of studies over the last few decades (e.g., Yasin 1980; Irshied 1984; Sakarna 1999, 2002; Palva 1976, 1980, 1986, 1991; Rakhieh 2009; Hérin 2010). Among the others, Abu-Abbas (2003), Rakhieh (2009), Al-Jarrah (2011), Mashaqba (2015), and Huneety (2015) have theoretically accounted for stress patterns of selected JA dialects primarily based on Optimality Theory and/or metrical approach. The core analysis of the earlier studies (except for Mashaqba 2015) leads the reader to conclude that (similar to the Levantine) all JA varieties exhibit (moraic) trochaic foot, and that JA dialects share the same metrification directionality and the level of extrametricality with other Levantine varieties.[3] However, we will see that the spoken dialect by Zalabiah and Zawaideh subtribes in Wæ:di Ramm southern Jordan, the target of the present work, has a different foot type, namely an iambic foot – a step that may promote the idea to have a serious revision of the literature on Eastern Arabic

[2] Palestinian dialect does not have words comprising a sequence of four light syllables (LLLL) due to processes of syncope and epenthesis. But the attested examples in the literature are actually selected Classical Arabic words that show how Palestinian speakers stress Classical Arabic words containing a sequence of four light syllables as in *ˈʃadʒaratun* 'a tree' and *ʃadʒaˈratuhu* 'his tree' (Kenstowicz 1981).

[3] Based on examples from Hung (1995), Al-Jarrah (2002) makes specific reference to Bedouin Jordanian dialects being iambic but he does not expand this important criterion significantly.

dialects. For simplification, this dialect is referred to as Wæ:di Ramm Arabic (henceforth WRA).

2. Material and methodology

To examine stress patterns in WRA, the researchers recruited 30 participants, 15 males and 15 females. According to a metadata sheet, data were collected from participants of various ages ranging between 40–72 years covering the Zalabiah and the Zawaideh subtribes. The average age is 55 years old. None of the participants live outside the region (Ramm and Ad-Di:sih) nor did they travel outside the country. The spoken variety they produce is not affected by modern life aspects which change some of the linguistic features of the speech of young generations. Participants' level of education ranges from primary education (14 participants) to secondary education (16 participants). The participants have no speech impediments and were willing to answer all questions that serve this study. A consent form was filled in by each participant; they were additionally informed verbally about the purpose of the research and the way the material would be saved in order to guarantee the protection of the participants' confidentiality. At the end of the investigation, data relating to two participants were destroyed based on their wishes.

Data collection started in 2012 and the list of words collected was repeatedly updated until February 2013. A second fieldwork took place over two weeks in mid-December 2015, where many new participants and new words were retrieved and added to the corpus of this study. The second round revision leads to correcting few patterns that have been set in the first trip (as will be seen in data containing final closed syllables). The list included monosyllabic and polysyllabic words that comprise all possible syllable types in the dialect under investigation. The words pronounced were also double-checked with the participants themselves and with a language consultant, a researcher who is a native speaker of the variety under investigation. It has also been decided NOT to include rule-based analysis entirely since far fewer people are working in a rule-based framework these days.

3. Metrical stress-based model (moraic model)

This entry examines the stress patterns of WRA starting with a metrical model, followed by an Optimality-Theoretic model in Section 4. The Appendix includes a table with examples specific to WRA, organized according to syllable structure of all types and combinations attested (Monosyllabic, disyllabic, trisyllabic all combinations, etc.).

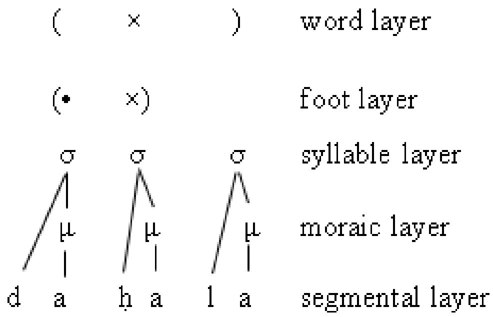
WRA is a quantity sensitive dialect which distinguishes three types of syllables: light (CV and CCV), heavy (CVV, CVC, and CCVV), and superheavy (CVVC and CVCC). To account for the aspects of stress in WRA, this section draws on metrical theory advanced in Liberman & Prince (1977), Selkirk (1980), McCarthy (1979a), and Hayes (1995) as follows: A CV syllable counts as a light syllable and is assigned one mora; CVV counts as a heavy syllable and is assigned two moras; CVC counts as a heavy syllable and is assigned two moras, with the final C assigned a mora through the WEIGHT-BY-POSITION constraint (Hayes 1995; Watson 2002). The word-final CVC in WRA is a heavy syllable, so the word-final C counts to the syllable weight and is assigned a mora. Geminate consonants are assigned one mora underlyingly (cf. Mashaqba 2015). More specifically, applying the bimoraic parameter, light syllables are monomoraic; heavy and superheavy syllables are bimoraic. Superheavy syllables are rendered bimoraic (NOT trimoraic) by presuming the final C to be extrasyllabic in WRA as will be shown later on in this section.

Three major parameters can be captured in terms of the present theory to establish stress patterns of WRA and to differentiate between its stress patterns and the other Arabic dialects, namely: (i) foot type (trochee or iamb), (ii) metrification directionality (left-to-right or right-to-left), and (iii) type of extrametricality (consonant, mora, syllable, or foot). (See Rosenthall & Van Der Hulst 1999; Kager 2009; Hyde 2007, 2011.)

Foot in WRA is iambic, binary, bounded (of a fixed size) and right-headed, and feet are parsed from left-to-right (Mashaqba 2015). The basic foot inventory in WRA comprises two consecutive light syllables (L'L), a light syllable followed by a heavy syllable (L'H), or a single heavy syllable ('H). Feet follow right-headed constituents through application of End Rule Right (ERR) (cf. Hayes 1995).

The structure (HL) or an odd number of syllables (e.g., LLL) raises a problem to syllable parsing because it may produce a leftover light syllable unfooted. WRA belongs to those dialects which impose a ban on degenerate feet.[4] In a word like *da'ḥala* ‘dune’, the light syllables (da.ḥa) are successfully parsed into a foot, but the peripheral light syllable (la) fails to be parsed into a foot as it does not satisfy the bimoraicity condition, and thus is left stranded, as shown in the metrical grid in (1):[5] The foot parses left-to-right to produce a right-headed foot over the syllables (da) and (ḥa) in (1). The rightmost syllable (la) is monomoraic and left unfooted because it cannot constitute/support a foot. Dictated by the End Rule Right (ERR) principle, stress is assigned to the head of the rightmost visible foot, *ḥa* in (1).

(1)



However, WRA imposes weak prohibition on degenerate feet (see type b in footnote 4 below) as the final C in word-final CVC syllables counts to be moraic in monosyllabic words. This factor can be supported via a number of content words that must count as monomoraic if the final consonant is rendered extrametrical, as in '*xuð* ‘take!’ '*kul* ‘eat!’, '*gil* ‘say!’, '*tam*

[4] These sub-minimal elements may be stressed as in some languages degenerate feet (Hayes 1995: 87). In others, unparsed syllables remain unfooted and unstressed. Three different levels of prohibition on degenerate feet are proposed (Hayes 1995: 87 in Mashaqba 2015: 114):

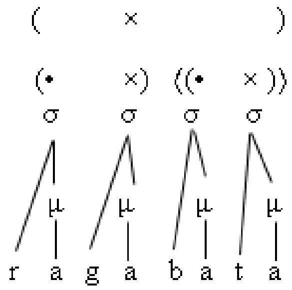
a) strong prohibition	absolutely disallowed
b) weak prohibition	allowed only in strong position, i.e., when dominated by another grid mark
c) non-prohibition	degenerate feet are freely allowed.

[5] The stressed head of a foot is marked by (×), and the weak/non-stressed element of the foot is marked by (•).

‘done’ *'ʔax* ‘brother’, *'ʔam* ‘mother’ *maj* ‘water’.[6] Such words surface as they are without resorting to a final consonant gemination or vowel lengthening, i.e., the final consonant is moraic. This may promote the idea of deactivation of extrametricality at the consonant level but its applicability at higher prosodic levels in this dialect.

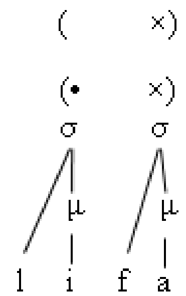
Extrametricality applies to a final unfooted light syllable, and to a final foot if it does not violate the non-exhaustivity condition. The inability of penultimate light syllables in four light-syllable words, such as *ra'gabata* ‘his neck’ in (2), presumes that the rightmost ‘peripheral’ foot counts extrametrical (not a degenerate foot, given that WRA imposes a weak prohibition on a degenerate foot) as it ‘does not exhaust the domain of the word’ (Hayes 1995: 58).[7, 8]

(2)



If the word comprises only one foot, foot extrametricality is blocked and the head of the only (peripheral) foot is stressed, as in *li.'fa* ‘to come’ in (3):

(3)



Motivated by the ban on trimoraic syllables, the behaviour of superheavy syllables CVVC and CVCC word-medially and finally poses challenges to the maximal bimoraic constraint of syllables as proposed in OT and pre-OT models that dealt with stress and syllabification patterns in Arabic varieties (e.g. Broselow 1992; Watson 2002; Kiparsky 2003; Al-Jarrah 2011). On the one hand, some argue that the final consonant falls outside the domain of the syllable and renders it *extrasyllabic* which is directly linked to a degenerate syllable (Hayes 1995: 106–107; Kager 1995: 376; Kenstowicz 1994: 274).[9] Hayes (1982: 229) proposes that

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6 For those familiar with Levantine Arabic, the claiming that CVC syllables do not undergo ‘final consonant gemination’ or ‘vowel lengthening’ is not convincing without some phonetic evidence. This is a long debated issue that cannot simply be brushed away with an unsupported statement.

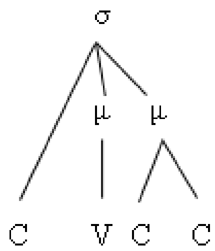
7 Foot extrametricality has been demonstrated in many trochaic and iambic Arabic varieties (cf. Hayes 1995: 227 ff. for Negev Bedouin; Watson 2002 for SanՙSani).

8 Angled brackets are used to denote extrasyllabic consonants or extrametrical foot.

9 To avoid violating NONFINAL and FT-BIN, Crowhurst (1996: 416, cited in Al-Jarrah 2011), following McCarthy (1979b), ‘argues for treating final Cs in trimoraic’ sequences ‘as degenerate feet – as a repair

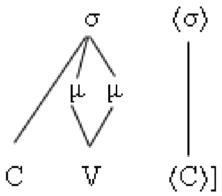
word-final superheavy syllables count as heavy, and heavy syllables count as light. On the other hand, Farwaneh (1995: 66–70) and McCarthy (2007a: 147–148) suggest that the final two consonants may share a mora, as in (4):

(4)

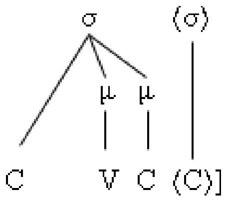


Drawing on (Hayes 1995: 106–107; Kager 1995: 376; Watson 2002: 92–94), the authors of the present paper assume that the final consonant in an ultimate superheavy syllable is extrasyllabic and is not integrated into the adjacent syllable in WRA, i.e., the ultimate superheavy syllable is mapped as a bimoraic syllable plus a degenerate syllabic consonant, as in (5a) and (5b).

(5) (a)

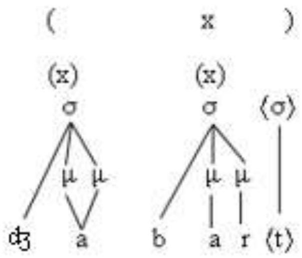


(b)



Peripherality condition also blocks foot extrametricality. That is, in words ending with a final superheavy syllable CVCC or CVVC, the final consonant is extrasyllabic and therefore intervenes between the syllable and the right edge of the word and therefore the syllable is no more in a peripheral position (Hayes 1995: 106–107). The extrasyllabic consonant will be immediately mapped to a separate syllable node. Take as an example, *ʤæ:.'bart* ‘I condoled’ and *ʤan'zi:r* ‘chain’ in (6) and (7):

(6)



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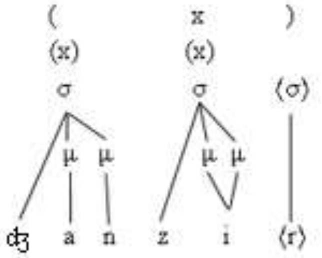
mechanism’. Kiparsky (2003: 157) argues that ‘the final C is weightless, and thus NONFINAL(C) is undominated’.

(7)



Each of the leftmost bimoraic syllables *ʤæ:* in (6) and *ʤan.* in (7) constitutes a foot. Each of the rightmost syllables *.bart* and *.zi:r* is eligible to construct a second foot plus an extrasyllabic consonant. The rightmost foot escapes peripherality by the presence of the extrasyllabic ⟨t⟩ and ⟨r⟩ consonants which intervene between the rightmost foot and the end of the prosodic word. Stress is therefore assigned to the head of the rightmost visible foot by ERR.

Accordingly, the behaviour of stress system in WRA can be reformulated in (8) below: (cf. Mashaqba 2015: 116 after Hayes 1995; Watson 2002).

(8)	(i)	Syllable Weight	CVC, CVV = /–/, CV = /˘/. Word final C = syllable when after C or VV.[10]
	(ii)	Foot Construction	Form iambs from left to right. Degenerate feet are not permitted.
	(iii)	Foot Extrametricality	Foot → ⟨Foot⟩/___]word
	(iv)	Word Layer Construction	End Rule Right

4. Constraint-based model (OT)

Previous rule-based phonological theories have elaborated a variety of complex blocking and triggering constraints. A number of these works produce rule-less phonology because they only trace universal grammar. The rules of the widespread universal grammar, however, did not account for every language all of the time (cf. McCarthy 2007b). On the other hand, as a new approach to language, OT puts forward significant reliance on language-specific rules. The general premise of OT is that constraints are universal and the ranking is language-specific. The present section is intended to sketch constraint interaction on the output of the grammar of stress patterns in WRA. Data are examined to elaborate well-defined output constraints that block (ban) a syllable from receiving the main stress, and output constraints that trigger special syllables that satisfy main stress constraint, a necessary step to demonstrate the constraint hierarchy that accounts for all stress patterns in the dialect under investigation.

4.1 *Monosyllabic words*

For monosyllabic words, recall that a lexical word must be minimally bimoraic to be able to receive stress. The requirement of prosodic word-minimality can be achieved by the constraint *PrWdµ, as represented in (9) below.[11]

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[10] This means that word-final C is syllabified in CVCC, CVVC.

(9) *PrWdμ: A prosodic word is minimally bimoraic (cf. Prince & Smolensky 1993/2004).

The constraint indicates that words must be footed and constraints on foot militate that words have at least two moras; this does not hold for CVC words in the other JA dialects where CVC counts as a light syllable word-finally (cf. § 3, data 2). Because a prosodic word must minimally have a single head foot and a foot must be bimoraic, FOOT BINARITY (which requires feet to be bimoraic) is a closely related constraint (cf. Selkirk 1984, 1995).

(10) FOOT-BINARITY (FT-BIN): Feet are binary at a moraic or syllabic level (Hayes 1995; Prince & Smolensky 1993/2004).

The metrical parameter that requires coda consonants to be moraic (Hyman 1985; Hayes 1989, 1995) is translated into OT's WEIGHT-BY-POSITION (WBP). Given that word-final consonants in absolute final domain are moraless, a monosyllabic word should end in a long vowel or in a cluster to be able to receive stress. This is translated into the constraint *FINAL-C-u which requires word-final consonants to be weightless. These two constraints are given in (11) and (12) below:

(11) WEIGHT-BY-POSITION (WBP): Coda consonants are moraic (cf. Hayes 1989).

(12) *FINAL-C-μ: A word-final consonant is weightless (Prince & Smolensky 1993/2004: 49; Kager 1999).

Recall that word-final consonants in CVC syllables are moraic in WRA as WRA imposes a weak prohibition on degenerate feet (cf. data in 2 above and footnote 4). Establishing the dominance hierarchy of these constraints, we can account for monosyllabic words of different forms. For example, the underlying form *xuð* 'take!' is rendered bimoraic by satisfying the higher ranked constraints *PrWdμ, FT-BIN, and WBP (see Table 1). Violating *FINAL-C-μ does not prevent the optimal candidate from being the most harmonic output, hence demotion of *FINAL-C-μ below the three constraints *PrWdμ, FT-BIN and WBP.[12]

Table 1: *PrWdμ, FTBIN, WBP >>*Final-C-u

/xuð/	*PrWdμ	FT-BIN	WBP	*FINAL-C-μ
(a) ☞ (xuð)				*
(b)(xu)<ð>	*	*	*	
(c)(xu)<ð>			*	
(d) xuð	*			

Table (1) shows that candidate (1b) satisfies *FINAL-C-μ but incurs a violation of the three higher ranked constraints *PrWdμ, FBIN, and WBP and thus ruled out. Candidates (1c) loses by violating WBP. Circumventing FTBIN by the null parse in (d) is not enough to win and

[11]The literature has well-established constraints that can replace the ad hoc *PrWdμ such as HEADNESS (a prosodic word contains a foot) (cf. Kager 1994), but we get stick to this constraint in harmony with the recent literature on Arabic dialects.

[12] Because *Final-C-μ and *PrWdμ are undominated in WRA, they will not be presented in the other tables.

thus it is penalised by *PrWdμ. This analysis shows crucial characteristics that distinguish WRA from other Eastern Arabic dialects: WBP outranks *FINAL-C-μ in the former; whereas *FINAL-C-μ outranks WBP in the latter.

To account for monosyllabic words of the form CVVC and CVCC (i.e., superheavy syllables), the final C is rendered extrasyllabic to satisfy FT-BIN. So FT-BIN and *PrWdμ will rank over WBP which ranks over *Final-C-u. Consider Tables 2 and 3 which establish the constraint ranking of these four constraints:

Table 2: *PrWdμ, FTBIN>> WBP >> *Final-C-u

/ṣæ:d/	*PrWdμ	FT-BIN	WBP	*FINAL-C-μ
(a) ☞ (ṣæ:)<d>			*	
(b) (ṣæ:d)		*		*
(c) ṣæ:d	*			

Table 3: *PrWdμ, FTBIN>> WBP >>*Final-C-u

/gamḥ/	*PrWdμ	FT-BIN	WBP	*FINAL-C-μ
(a) ☞ (gam)<ḥ>			*	
(b) (gamḥ)		*		*
(c) gamḥ	*			

Recall that WBP necessitates codas and semisyllables be moraic. Violating WBP does not deprive the winning candidates (2a) and (3a) from being the optimal output as long as they satisfy the higher ranked constraint FT-BIN. By way of contrast, satisfying WBP by (2b) and (3b) is not enough to win the competition. The null parse in (2c) and (3c) helps to satisfy FT-BIN but is penalised by *PrWdμ and thus ruled out.[13]

4.2 *Polysyllabic words*

The argumentation to be considered here is that extrametricality in the stress system of WRA can be better analysed, in constraint-based terms, via the constraint NONFINALITY. This constraint imposes a ban on a final mora from being parsed into the next higher prosodic level (syllable), a ban on parsing the final syllable into the foot structure of the word, followed by a ban on parsing the final foot into the prosodic word, and therefore banning final syllables from receiving the main stress. To deal with foot and syllable extrametricality principle, the constraint NONFINALITY is proposed against word-final stress unless other higher ranked constraints militate against that. For simplification, this constraint is presented as follows:

(13) NONFINALITY (NONFIN): No head of PW is final in PW (Prince & Smolensky 1993/2004: 56)

[13] For minimality, rendering FT-BIN higher than WBP in the dominance hierarchy is better than proposing a new constraint for word-final coda in CVCC/CVVC (say for example *SH-FINAL- μ) because this is tacitly indicated by the constraint *FINAL-C-μ.

4.2.1 *Words including light syllables*

WRA allows a sequence of up to four light syllables. Recall that feet in WRA have final prominence, so the constraint IAMB (in 14) ensures that the final member of bimoraic feet is prominent. In disyllabic words, stressing the second member (the right-most syllable) proves that foot is iambic-oriented. To control 'directionality' which requires feet to have left-to-right alignment in the prosodic word, we need the constraint ALIGN-LEFT (15):[14]

(14) IAMB: Feet are iambic (cf. Hayes 1995).[15]

(15) ALIGN-LEFT (ALIGN-L): Every prosodic word begins with a foot (Kager 1999: 169)

The constraint in (15) does not guarantee LR footing. All it does is make sure a single foot, of indeterminate size, occurs on the left edge of a word. As dictated by FT-BIN, light syllables cannot construct feet on their own, but each two light syllables are grouped together to make a binary foot. FT-BIN is proposed to rule out candidates which include degenerate feet (cf. data in 1 above).

Where we have two light-syllable words, as in *sa'ʕa* 'to intend', FT-BIN necessitates parsing both syllables violating NONFIN, in order not to avoid (L'L) structure. According to the IAMB constraint, stress falls on the second light syllable. So the constraint hierarchy will be: FT-BIN, IAMB, ALIGN-L >> NONFIN:

Table 4: FT-BIN, IAMB, ALIGN-L >> NONFIN

/saʕa/	FT-BIN	IAMB	ALIGN-L	NONFIN
(a)☞ (sa_{μ}'$ʕa_{\mu}$)				*
(b) ('$sa_{\mu}ʕa_{\mu}$)		*!		*
(c)sa_{μ} ('$ʕa_{\mu}$)	*!	*	*	*
(d) ('sa_{μ}) $ʕa_{\mu}$	*!	*		

Table (4) demonstrates how the alignment constraints interact with each other in order to obtain the optimal output. Stress falls on the second light syllable according to IAMB, and the first syllable is parsed to obey FT-BIN and ALIGN-L. The output (sa_{μ}'$ʕa_{\mu}$) wins because it satisfies the top three ranked constraints. Candidate (4b) is eliminated as it has a trochaic foot with stress on the first syllable, candidate (4c) loses by it violating FTB-IN and ALIGN-L, while candidate (4d) loses because of violating FT-BIN.

Light trisyllabic words, as in *ʔa'ʕama* 'blind' are accounted for in the same way. The first two light syllables are parsed together to construct a bimoraic iamb, and the rightmost syllable is left unfooted (stranded). This satisfies the constraint hierarchy: FT-BIN, IAMB, ALIGN-L >> NONFIN. Table (5) demonstrates the interaction of these constraints:

[14] ALIGN-L translates Ito's (1989) 'directionality' that requires syllables to be aligned with the left edge of the prosodic word in coda dialects to ensure that the epenthetic vowel lands to the left of the stranded consonant (e.g., the stranded .t. in /ka.tab.t.ha/ 'I wrote it' > *ka.ta.bit.ha* rather than *ka.tab. ti.ha*).

[15] IAMB replaces McCarthy & Prince's (1993) ALIGN (Hd-σ, Ft, R): Align the head syllable with the right edge of the foot.

Table 5: FT-BIN, IAMB, ALIGN-L >> NONFIN

/ʔaʕama/	FT-BIN	IAMB	ALIGN-L	NONFIN
(a)☞ (ʔa$_\mu$'ʕa$_\mu$) ma$_\mu$				
(b)('ʔa$_\mu$ʕa$_\mu$) ma$_\mu$		*		
(c)(ʔa$_\mu$ʕa$_\mu$) ('ma$_\mu$)	*!	*		*
(d)ʔa$_\mu$ (ʕa$_\mu$'ma$_\mu$)			*	*

In light syllable words, LL and LLL, FT-BIN dominates the NONFIN to optimize the desired output (L'L) and (L'L)L, respectively. Candidates (5c) and (5d) lose as mono-moraic (σμ) and light bi-moraic (σμμ) syllables are invisible to stress word-finally by violating NONFIN. Incorporating ALIGN-L into the constraint hierarchy eliminates candidate (5d) in favour of the three other candidates. Though candidate (5d) satisfies iambicity, the first syllable cannot construct a foot on its own as it would violate FT-BIN. This specification supports the argumentation that this syllable (leftmost syllable) needs to be footed. We need the constraint ALIGN-LEFT, which requires the left edge to be aligned with a foot in WRA. Candidate (5d) fails to align its left edge with a foot violating ALIGN-L. Four-light-syllable words will be argued for later on (cf. Table 14).

At this point, strictly speaking, a reader may impressionistically understand that what is needed to prove that the system is one word: (e.g., *sa'ʕa* ‘to intend’). To this end, one might ask this legitimate question: in what sense do iambs emerge? i.e., WRA would be an iambic by fiat since it has a high-ranking IAMB constraint. Assuming the stress patterns are correct, we will see that this dialect (which belongs to Eastern Arabic) differs from all other eastern dialects (which are trochaic) insofar as it lacks final consonant extrametricality. Going a little further, data like *ʔa.'ʕa.ma* ‘blind’ show that another analysis (i.e. that stress is always final) is not necessarily true. Subsequently, as weight is forced in, adequate data is accounted for in the next sections to provide evidence for all the claims about weight relationships.

4.2.2 *Words including heavy syllables*

To account for words of heavy syllables, a new constraint should be proposed. Being a weight sensitive language entails WEIGHT-TO-STRESS Principle (WSP) which requires heavy syllables to be stressed (Prince 1990) (see data in 16). Two heavy syllables may occur within the stress window which entails that one of them receives the main stress. The pre-OT ERR, which requires the head of the prosodic word be aligned with the right edge of the word (Hayes 1995), is also replaced by the constraint RIGHTMOST (see 17), which forces the rightmost visible foot to bear main stress wherever more than one heavy syllable is attested:

(16) WEIGHT-TO-STRESS Principle (WSP): Heavy syllables are prominent in foot structure and on the grid (Prince & Smolensky 1993/2004).

(17) RIGTHMOST: the rightmost foot of the word is the head (Prince & Smolensky 1993/2004; Al-Jarrah 2002).

4.2.2.1 *Disyllable word stress*

The fact that a heavy syllable in final position receives stress violating NONFIN entails that WSP also dominates NONFIN. Recall that the final heavy syllable lacks final consonant extrametricality. With heavy disyllabic words, many possibilities are suggested, of which one optimal output is accepted: ('H)(H), (H)('H), ('H)H, H('H). The last two possibilities violate WSP; ('H)(H) satisfies WSP but violates RIGTHMOST; (H)('H), the optimal candidate, satisfies WSP and RIGTHMOST but violates NONFIN. RIGTHMOST and WSP are supposed to outrank NONFIN in WRA because violating NONFIN is superior to leaving the heavy syllable unfooted. To rule out candidates like ('H)(H), we should propose that RIGHTMOST outranks WSP as well. One aspect still needs to be solved: the optimal footing of words is to assign every heavy syllable a foot. In line with Rakhieh (2009) and Abu Guba (2016), heavy syllables always receive stress (being primary or secondary). This is evident from acoustic analysis and gemination (for details see Abu Guba 2016: 248). Seemingly, the existence of two or more adjacent prominent (stressed) syllables violates the constraint *CLASH which forces restrictions against two adjacent stressed (heavy) syllables (*CLASH: Adjacent prominent syllables are prohibited, cf. Kager 1999). There are potential problems by including this constraint. Specifically, *CLASH should dominate WSP since a heavy syllable adjacent to another heavy syllable needs to be stressless in violation of WSP. In line with many analyses of the Arabic dialects, we state that heavy syllables behave like secondary stresses, but are not marked as such; hence, *CLASH is irrelevant.

The dominance hierarchy is formulated as follows: RIGHTMOST, FT-BIN, ALIGN-L >> WSP >> NONFIN. Consider Table 6 of the word *mas'ʤid* ‘mosque’.

Table 6: RIGTHMOST >> WSP >> NONFIN

/masʤid/	RIGTHMOST	WSP	NONFIN
(a) ☞ (ma$_\mu$s$_\mu$)('ʤi$_\mu$d$_\mu$)			*
(b) ('ma$_\mu$s$_\mu$)(ʤi$_\mu$d$_\mu$)	*!		
(c) ('ma$_\mu$s$_\mu$) ʤi$_\mu$d$_\mu$		*!	
(d) ma$_\mu$s$_\mu$('ʤi$_\mu$d$_\mu$)		*!	*

Heavy syllables surface stressed in final position by having WSP and RIGTHMOST dominate NONFIN. Violating NONFIN is more harmonic than violating WSP; hence WSP dominates NONFIN. Under evaluation, violating the dominated constraint NONFIN does not prevent the candidate (ma$_\mu$s$_\mu$)('ʤi$_\mu$d$_\mu$) from being the optimal output as long as it satisfies the undominated constraints WSP and RIGTHMOST. Satisfying WSP in (6b) is not enough to win the competition which confirms that RIGHTMOST >> WSP. The last heavy syllable receives the main stress violating the NONFIN constraint. Leaving a heavy syllable unfooted (as in 6d) would result in a fatal violation of the WSP constraint.

To account for stress assignment in disyllabic words comprising heavy and superheavy syllables, five main constraints are competing with each other in order to rule out the less optimal candidates. Recall that ALIGN -L and FT-BIN do not exhibit dominance ranking. Recall also that the word-final C in a superheavy syllable is extrasyllabic since the higher ranked FT-BIN requires final Cs in superheavy syllables to be weightless (extrasyllabic/extrametrical) in order to avoid trimoraicity (cf. Watson 2007), as Table 7.

Table 7: RIGHTMOST, FT-BIN, ALIGN-L >> WSP >> NONFIN

/mirjæ:ʕ/	RIGHTMOST	FT-BIN	ALIGN-L	WSP	NONFIN
(a) ☞ (mi$_{\mu}$r$_{\mu}$).('ja$_{\mu\mu}$)<ʕ$_{\mu}$>					*
(b) (mi$_{\mu}$r$_{\mu}$).('ja$_{\mu\mu}$ʕ$_{\mu}$)		*!			*
(c) ('mi$_{\mu}$r$_{\mu}$).(ja$_{\mu\mu}$) ʕμ	*!				
(d) mi$_{\mu}$r$_{\mu}$.('ja$_{\mu\mu}$ʕ$_{\mu}$)		*!	*	*!	*

Both heavy syllables satisfy WSP, and thus EVAL is decided by other constraints. NONFIN prefers the candidate with stress on the initial syllable yielding ('mir)(jæ:)<ʕ>. However, the more harmonic winner is (mir)('jæ:)<ʕ>, where the final syllable is assigned the stress. This requires a constraint hierarchy that selects the main stressed syllable be the rightmost syllable, which proves that RIGHTMOST dominates NONFIN and WSP.

4.2.2.2 *Multisyllabic word stress*

With words comprising heavy and light syllables, PARSE-σ is required which indicates that syllables must be parsed into metrical feet.

(18) PARSE-σ: All syllables must be parsed into feet. (Prince & Smolensky 1993/2004)

Earlier, we demonstrated that FT-BIN dominates NONFIN in light syllable words of the shape LL and LLL, and WSP dominates NONFIN in heavy syllable words. On the other hand, NONFIN dominates PARSE-σ as NONFIN militates against footing final syllables especially when we consider words of the shape HLL, as in Table 8:

Table 8: WSP >>NONFIN >> Parse-σ

/jax.ti.ʃi/	WSP	NONFIN	PARSE-σ
(a) ☞ ('ja$_{\mu}$x$_{\mu}$) ti$_{\mu}$ʃi$_{\mu}$			**
(b) (ja$_{\mu}$x$_{\mu}$) ('ti$_{\mu}$ʃi$_{\mu}$)		*!	
(c) jax ('tiʃi)	*!	*	*

Table 8 shows that NONFIN dominates PARSE-σ; otherwise, candidate (b) would win the competition. Parsing the syllables (ti.ʃi) into a foot suggests that candidate (8b) should be the winner as it satisfies the highly ranked constraint RIGHTMOST. Since the last two syllables (ti.ʃi) were not parsed into a foot, (jax) is the rightmost visible syllable that bears the main stress.

In words comprising HHH structure, as in: *mitʕaʃji:n* 'they have eaten' (see Table 9), Candidate (9a) wins the competition to be the optimal output simply because it satisfies all the higher ranked constraints. Candidate (9b) fares worse on RIGHTMOST though it avoids violating NONFIN, WSP, and FT-BIN. Candidates (9c) and (9d) fall victim to RIGHTMOST and thus lose out to candidate (9a). Candidate (9e) falls victim to ALIGN-L, WSP, and NONFINAL.

Table 9: RIGHTMOST, FT-BIN, ALIGN-L >> WSP >> NONFIN

/mitʕaʃji:n/	RIGHTMOST	FT-BIN	ALIGN-L	WSP	NONFIN
(a) ☞ (mi$_{\mu}$t$_{\mu}$)(ʕa$_{\mu}$ʃ$_{\mu}$)('ji$_{\mu\mu}$)n					
(b) (mi$_{\mu}$t$_{\mu}$) ('ʕa$_{\mu}$ʃ$_{\mu}$) (ji$_{\mu\mu}$)n	*!				
(c) (mi$_{\mu}$t$_{\mu}$) ('ʕa$_{\mu}$ʃ$_{\mu}$) (ji$_{\mu\mu}$n$_{u}$)	*!	*!			
(d) ('mi$_{\mu}$t$_{\mu}$) (ʕa$_{\mu}$ʃ$_{\mu}$) (ji$_{\mu\mu}$) n	*!				
(e) mi$_{\mu}$t$_{\mu}$ʕa$_{\mu}$ʃ$_{\mu}$ ('ji$_{\mu\mu}$)<n>			**	**!	*

In words comprising HLHH structure, as in: *jaʃtiri:hin* 'he buys them' (see Table 10), the optimal candidate is metrified as (jaʃ)(tiri:)('hin) with a LH iamb which insures that the dialect has a quantity-sensitive iamb.

Table 10: FTBIN, RIGHTMOST >> WSP >> NONFIN >> PARSE-σ

/jaʃ.ti.ri:.hin/	FT-BIN	RIGHTMOST	ALIGN-L	WSP	NONFIN	PARSE-σ
(a) ☞(jaʃ)(tiri:)('hin)					*	
(b) ('jaʃ)ti(ri:) (hin)		*				*
(c) (jaʃti) (ri:) ('hin)	*				*	
(d) (jaʃ) (ti) ('ri:) hin	*			*!	*	*
(e) jaʃ (ti) ('ri:) hin	*		*!	**!	*	**

In Table 10, candidate (10b) fails to parse the adjacent syllables into feet where the second syllable *.ti*. is left unfooted. The constraints hierarchy prefers (H)(LH)('H) over (HL)('H)(H). The result is that heads of binary feet are stressed and the rightmost visible foot receives the main stress.

In quadrisyllabic words comprising the HLLH structure, such as *maktabate:n* 'two libraries', parsing results as (mak)(taba)('te:)<n> forming three bimoraic feet. This means that among the possible parsing of syllables into feet as in: (H)(LL)(H), *H(LL)(H), *(H)LL(H), the optimal candidate should be (H)(LL)(H). The constraints hierarchy can be presented as follows: FT-BIN, RIGHTMOST, ALIGN-L >> WSP >> NONFIN >> PARSE-σ. This hierarchy can be manifested in examples like *maktabate:n* 'two libraries', as in Table 11:

Table 11: FTBIN, RIGHTMOST, ALIGN-L >> WSP >> NONFIN >> PARSE-σ

/maktabate:n/	FT-BIN	RIGHT MOST	ALIGN-L	WSP	NONFIN	PARSE-σ
(a) ☞(ma$_{\mu}$k$_{\mu}$) (ta$_{\mu}$ba$_{\mu}$)('te$_{\mu\mu}$) <n>					*	
(b) ma$_{\mu}$k$_{\mu}$ta$_{\mu}$ba$_{\mu}$ ('te$_{\mu\mu}$) <n>			**!	*!	*	***
(c) ('ma$_{\mu}$k$_{\mu}$) ta$_{\mu}$ba$_{\mu}$ (te$_{\mu\mu}$) <n>		*!				**
(d) (ma$_{\mu}$k$_{\mu}$) ('ta$_{\mu}$ba$_{\mu}$) te$_{\mu\mu}$n$_{\mu}$		*!		*!		*
(e) ma$_{\mu}$k$_{\mu}$(ta$_{\mu}$ba$_{\mu}$) ('te$_{\mu\mu}$) <n>			*!	*!	*	*

In (maμkμ)(ta$_{\mu}$ba$_{\mu}$)('te$_{\mu\mu}$) <n>, the ultimate receives stress by virtue of minimally violating the constraint hierarchy. Violating NONFINAL is more harmonic since it does not prevent candidate (11a) from winning the competition as long as it satisfies the higher ranked constraints FT-BIN, RIGHTMOST, and ALIGN-L.

Knowing that pre-antepenult syllables and heavy syllables do not always receive stress (cf. data in (2) and Tables 12 and 13 below), the present proposal is able to account for stress patterns in words comprising LLLL structure, as in: *na'ʕaʤata* 'his ewe' or HLLL structure, as in: *jista'hadi* 'to find (SG.M)' without the WINDOW constraint, which dictates that stress is confined to the last three syllables of a word (Kager 2012; Abu Guba 2016). Satisfying the higher ranked constraint RIGHTMOST is enough for candidate (12a) to win the competition over candidate (12b). Consider Table (12):

Table 12: FTBIN, RIGHTMOST, IAMB, ALIGN-L >> WSP >> NONFIN >> PARSE-σ

/yistahadi/	FT-BIN	RIGHT MOST	IAMB	ALIGN -L	WSP	NON FIN	PARSE -σ
(a) ☞(jis).(ta 'ha)di					*		*
(b) ('jis).tahadi							***
(c) jis.('ta ha) di			*	*	*!		**
(d) (jis). ta (ha 'di)						*!	*

The constraint hierarchy prefers (H)(LL)L over (H)LLL, H(LL)L, and (H)L(LL) and the other candidates. Stress falls on the penult light syllable violating WSP; the pre-antepenult *.jis*. does not trigger stress though it is a heavy syllable. A heavy syllable loses out to a light syllable in WRA where the constraint RIGHTMOST outranks WSP and guarantees that stress is not triggered by the heavy syllable in the pre-antepenult.

In four light syllable words, different parsings of such forms are possible: (L'L)(LL), (LL)(L'L), (L'LLL), LL(L'L), (L'L)LL, L(L'L)L, and (LL'L)L. The failure of stress of penultimate light syllables in LLLL structures, as in: *naʕaʤata* 'his ewe',[16] presumes that the rightmost foot is rendered extrametrical if peripherality does not exhaust the domain of the word (Hayes 1995: 58, *see* footnote 5). The pre-antepenult syllable is invisible to the main stress; consider Table (13).

Table 13: FT-BIN, RIGHTMOST, IAMB, ALIGN-L >> NONFIN

/naʕaʤata/	FT-BIN	RIGHTMOST	IAMB	ALIGN-L	NONFIN
(a) ☞ (na_{μ}'$ʕa_{\mu}$) $ʤa_{\mu}$ ta_{μ}					*
(b) ('naʕa)(ʤata)		*	*		
(c) na('ʕaʤa)ta			*	*	*

We argue that the parsing (L'L)LL[17] is the most harmonic structure in WRA. Recall that FT-BIN, RIGHTMOST, and IAMB dominate NONFIN in the hierarchy. To yield such a parsing, RIGHTMOST is not violated by the optimal output (13a) whenever the peripheral foot <*ʤa.ta*> counts as extrametrical because it does not exhaust the domain of the word and thus is invisible to the main stress. Candidate (13b) does not satisfy the undominated constraints RIGHTMOST and IAMB so that the pre-antepenult fails to win; ALIGN-L eliminates candidate (13c) as it ensures that the word starts with a foot erected at the left edge. RIGHTMOST and IAMB assign stress to the rightmost visible foot yielding (L'L) LL.

[16] Such forms are always subject to epenthesis in WRA, e.g., *naʕja* 'ewe' > *naʕaʤa*.

[17] Here extrametrical foot is not marked in the candidates nor in the input since it is a consequence of the constraint ranking.

5. Concluding remarks

The present work has examined stress patterns in WRA adopting moraic analysis within an OT framework. The analysis confirms that stress in WRA is fairly regular. As expected, foot extrametricality is blocked when it is the only foot in the word or when the rightmost foot is non-peripheral. For final superheavy syllables (CVVC, CVCC), the final C is unsyllabified until the stress rules apply, and thus prevents the rightmost foot from being peripheral, i.e., the unsyllabified final C blocks the rightmost foot from being extrametrical, which allows it to receive the main stress.

By contrast to Eastern Arabic dialects, WRA, a JA variety has an iambic foot in which the right head is assigned the main stress. Applying metrical parameters, WRA shows accentual parallels with Negev Bedouin (Blanc 1970); they share foot type, foot extrametricality, and stress assignment according to ERR. This entails that a future serious revision of the literature of JA dialects should be carried out.

Recognizing that the foot is iambic in WRA, the stress rules outlined in this study are able to account for all stress patterns in WRA. The study has concluded with a limited and economic number of universal constraints that cover all the possible patterns of stress in WRA. Heavy syllables in quantity sensitive languages (including WRA) attract stress assignment. WRA imposes a weak prohibition on degenerate feet as the final C in word-final CVC syllables counts to be moraic supported by a number of CVC content words that surface as they are, without resorting to a final consonant gemination or vowel lengthening.

Examining words of different syllable types (CV.CVC, CV.CV.CV, CVC.CVVC, CVC.CVV.CVVC, CVC.CV.CV.CV), the study has come up with this simplified minimal dominance hierarchy: *PrWdμ, IAMB, RIGHTMOST, ALIGN-L, FT-BIN >> WBP, WSP >> *FINAL-C-μ, >> NONFIN >> PARSE-σ. The proposed dominance hierarchy has introduced a new constraint namely ALIGN-L which was ignored in the literature of JA varieties.[18] This constraint necessitates a prosodic word to be left-aligned with a foot. This constraint hierarchy proposed its ability to account for all possible structures without resorting to WINDOW constraint which ensures that stress is assigned within the three syllable window. The study has shown how metrical *iambicity* parameter struggles with optimal *nonfinality* constraint as well as with other parameters/constraints to generate the optimal stress output. WBP also competes with *FINAL-C-μ. Contrary to Eastern Arabic varieties, WBP is ranked higher than*FINAL-C-μ in the dominance hierarchy.

Further research would be interesting as well as promising to answer why stress patterns in WRA are different from the other neighbouring dialects and most of the Eastern Arabic varieties such as Bani Hassan Bedouin and Ahl Al-Jabal Bedouin (Mashaqba & Huneety 2017). Would it be possible that it once had the stress patterns found in other Eastern Arabic dialects (moraic trochaic), and underwent a shift to an iamb? If so, what parameters and processes that are involved to capture such outcomes? Is it by Move X (cf. Hayes 1995: 34-37)? We here leave the answer for future serious research. Additionally, future research may be suggested to investigate opaque stress patterns in JA, if any, which involve interaction with syncope, epenthesis or vowel quality.

[18] This constraint is new in the way it is incorporated in the constraint hierarchy of Arabic stress patterns.

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Appendix

Example words in WRA with special focus on syllable types and stress patterns

Monosyllabic words		
CV	['hu]	‘he’
CVC	['lak]	‘yours m.s.’
CVVC	['læ:ʃ]	‘not a good man’
CVCC	['ʃadd]	‘to tie’
CCVCC	['bṣall]	‘onions’
CCVVC	['ʃdæ:d]	‘saddle and blanket on camel’
Bisyllabic words		
CV.CV	[li.'fa]	‘to come’
CV.CVC	[la.'ḥam]	‘meat’
CVV.CV	['kæ:.fi]	‘enough’
CV.CVCC	[ʃi.'ribt]	‘I drank’
CVC.CVVC	[mir.'jæ:ʕ]	‘ram leading the herd’
CVC.CV	['ḥaf.li]	‘party’
CVV.CVC	[næ:.'gil]	‘newly pregnant’
CVV.CVCC	[ḥæ:.'babt]	‘I kissed’
CCVCC.CVVC	[mʕazz.'bi:n]	‘guests (M)’
Trisyllabic words		
CV.CV.CV	[fa.'ru.na]	‘our fur’
CV.CV.CVC	[ʔa.ḥa.'mar]	‘red’

CVC.CV.CVCC	[ʔaʃ.ta.'ʁalt]	'I worked'
CVC.CVCC.CVVC	[mit.waʤʤ.'hi:n]	'heading to (PL, M)'
CVC.CVV.CVVC	[ḥaṭ.ṭæ:.'bæ:t]	'women preparing firewood'
CVC.CV.CVC	[jax.ti.'riʕ]	'to frightened'
CV.CVV.CV	[ʔa.'xu:.na]	'our brother'
CV.CVC.CV	[ʤi.'mal.ha]	'her camel'
Polysyllabic words		
CV.CV.CVC.CVC	[ji.ti.gaṭ.'ṭam]	'to break down'
CVC.CV.CVCC.CV	[miʕ.ni.'gij.ji]	'pure-bred horse'
CVC.CVC.CVV.CV	[ʔim. ʕaʃ.'ʃæ:.ha]	'its pasture'
CV.CVC.CVC.CVC	[ʔin.daʤ.'ʤin.ha]	'we domesticate it (F)'
CV.CVC.CV.CVVC	[mu.ʤam.ma.'ʕæ:t]	'bus stations'
CV.CV.CVV.CVVC	[ta.la.fo:.'næ:t]	'telephones'
CVC.CV.CVC.CVC.CVC	[miʕ.na.gij.jit.'hum]	'their (M) horse'

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