Paradoxical Non-finality:
Stress Assignment in Three Arabic Dialects

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1.0. Introduction

Non-finality, OT's successor of extramericality in derivational accounts, operates through a set of constraints evaluating the position of metrical constituent heads rather than controlling their metrification. Merely parsing a final constituent never violates any constraint on Non-finality but assigning it headedness may. This paper builds on this assumption in its endeavour to analyse the process of stress assignment in the three Arabic dialects of Palestinian, Cairene, and Hijazi. The asymmetries depicted across these stress patterns are minor, yet evaluating their candidate analyses for Non-finality encompasses the full spectrum. The argument of ruling out final head feet, final head syllables, or both will be crucial to the analysis. In particular, the issue of assigning headedness to a rhythmically footed final pair of lights and denying it footing elsewhere calls for some radical developments of a hierarchy banning such a compromise of Non-finality.

The paper is structured as follows: Section two introduces OT's formalisation of the basic stress principles of Boundedness, Headedness, Weight-sensitivity, Extrametricality, and Directionality. In section three, the analysis is divided into two subsections, quantity-sensitive and quantity-insensitive (or default) stress patterns. Finally, section four presents the concluding remarks.

2.0. Stress Assignment in OT

In standard metrical theory, stress is derived by building feet, hence the finite and very limited list of parameters. These literally are set on a language particular basis to construct the desired foot form and/or content. Ultimately, they aim to account for three basic principles of footing, viz. Boundedness, Headedness, and Weight-sensitivity. In Optimality Theory, this is basically what we expect to achieve, as far as the final output is concerned. Nevertheless, it is done rather differently. It is not a matter of a step by step derivation, but rather of a constraint-regulated evaluation leading to optimising a certain candidate output. We do not need to perform footing, a task shifted to the dummy-like function of GEN (the generator), that provides us with all the possible logical candidate analyses of a certain input, i.e., all the possible footings in this case. Consequently, the focus is on determining the active constraints and their relative ranking enabling Eval (the evaluator) to identify the optimal footing. So, in Optimality Theory, stress assignment is a mere testing of footing.

In this section, I will dwell on the three basic principles of Boundedness, Headedness, and Weight-sensitivity summarising the relevant constraints suggested in the literature. I will also discuss the effects and the evaluation of extrametricality in Optimality Theory. Lastly, I will wind up with a small note on directionality in OT.

2.1. Boundedness

The stress systems analysed in this paper are considered to be bounded. In such patterns, the distance between the constituent's head and boundaries is restricted to no more than one element (Halle and Vergnaud 1987). To formalise this optimally, some constraints are suggested in the primary literature (Prince & Smolensky

(1993/2002) and McCarthy & Prince (1993a, b)), the most important of which are FT-BIN and PARSE-SYL.

(1) Foot Binarity (FT-BIN)
Feet are binary at some level of analysis (μ, σ).
(Prince & Smolensky 1993/2002: 47)

This constraint says that the internal structure of feet is maximally and minimally binary. Therefore, a legitimate foot can only be disyllabic or bimoraic, though never monomoraic or trisyllabic. Yet, this raises the question of how to impose such a condition on foot structure throughout a given sequence of syllables. FT-BIN does not say anything about parsing syllables into feet, hence the inevitability of PARSE-SYL.

(2) PARSE-SYL
All σ must be parsed by feet.
(McCarthy & Prince 1993b: 11)

In bounded systems, where foot binarity is required, dominance of FT-BIN over PARSE-SYL is certain, to the extent that McCarthy & Prince (1993b) suggested including FT-BIN in GEN. This will eventually guarantee blocking degenerate feet, as demonstrated in the following tableaux, where the two constraints interact:

(3)(i)

Candidates	FT-BIN	PARSE-SYL
a. ☞(σσ)(σσ)		
b. (σσσσ)	*!	

(ii)

Candidates	FT-BIN	PARSE-SYL
a. ☞(σσ)(σσ)σ		*
b. (σσσσσ)	*!	
c. (σσ)(σσ)(σ)	*!	

In inputs with an even number of syllables (3 i), a candidate with the quadrisyllabic foot is avoided as it fatally violates the higher-ranked constraint FT-BIN. Also, in odd-numbered sequences, exhaustive parsing of syllables into feet (3 ii b, c) is diminished by the higher priority of (binary) boundedness. Therefore, the interaction of these two constraints will help evaluate and eventually optimise bounded parsing of syllables.

2.2. Headedness

Here, the process of assigning constituent headedness is examined to demonstrate how optimal head location is promoted to true output level. In particular, I want to consider the constraints involved in determining headedness at both foot and word levels.

As far as headedness is concerned, feet are basically of two types: left-headed or right-headed. In derivational metrical accounts, these two foot types are derived by means of parametric rules assigning headedness to either the left-most or the right-most element in the foot. The need to employ this machinery in OT is explicitly noted by Prince & Smolensky. They think that "there must be a constraint which set [*sic*] the rhythmic type at either iambic or trochaic; call this RHTYPE = I/T” (Prince & Smolensky 1993/2002: 53). This means that in languages where left-headed feet are empirically attested, the rhythm type constraint is set as RH-TYPE = T and RH-TYPE = I if the language promotes right-headedness on the foot level. Obviously, this (usually undominated) constraint provides the needed barrier to stop any proposed output with undesired flank dominance on the foot level. However, its effects may not be elevated to maintain word prominence.

As noted by McCarthy & Prince, in order “to complete the discussion of elementary stress-pattern theory, we observe that one foot must typically be picked out as the strongest, the head of the PrWd Ft´.” (McCarthy & Prince 1993b: 17). The constraint they proposed is a member of the Alignment family: ALIGN-HEAD.

(4) ALIGN-HEAD
Align (PrWd, Edge, H(PrWd), Edge)
(McCarthy & Prince 1993b: 18)

Simply, what this constraint says is that a certain edge of all prosodic words in a given language must be aligned with that of the word’s head, regardless of the dominant flank within that head.

Apparently, each of these two headedness constraints evaluates a different prosodic domain, the foot and the prosodic word, respectively. Consequently, they may not directly interact; i.e., violating one of them will not necessarily satisfy the other. Thus, no analytic argument may be presented to justify any proposed relative ranking holding between them.

2.3. Weight-sensitivity

To account for the stress patterns to be analysed later, this subsection focuses on the OT machinery for distinguishing weight-sensitive systems, where binarity is chiefly moraic. The constraint suggested in the primary literature for weight-sensitivity is WSP.

The constraint FT-BIN will positively evaluate a rather long list of different foot configurations, regardless of the head location within each. In addition, recognising headedness in all foot structures will not guarantee a cross-linguistically attested footing; there is a certain degree of markedness consistent with some. McCarthy & Prince (1986 *et seq*) and Hayes (1987 *et seq*), interpreting Hayes (1985), think that such a list will surely incorporate some unacceptable feet.

(5)

	(H)	(LĹ)	(ĹL)	(LH́)	(ĹH)	(HĹ)	(H́L)	(HH́)	(H́H)
FT-BIN	+	+	+	+	+	+	+	+	+
Unmarked	+	+	+	+	-	-	-	-	-

The constraints introduced so far are unable to rule out the latter five marked foot configurations. This means that a further constraint is needed to block these unattested FT-BIN satisfiers. Prince & Smolensky suggested this non-far fetched constraint of Prince (1990): Weight-to-Stress Principle given in (6) below.

(6) Weight-to-Stress Principle (WSP)
Heavy syllables are prominent in foot structure and on the grid.
(Prince & Smolensky 1993/2002: 53)

Simply, as noted in Prince & Smolensky (1993/2002), this constraint says that heavy syllables must be footed, and they are always stressed, i.e. assigned headedness in their feet. Therefore, as lack of stress indicates syllable lightness, this constraint helps in ruling out all the marked representations of prominence and weight relations in (5), where heavy syllables failed to be promoted.[1] This ultimately guarantees weight-sensitive moraic binary parsing, of at least Trochaic feet (the foot type to be utilised for the analysed stress patterns), and, more fundamentally, ensure that heavy syllables are assigned foot headedness and consequently receive stress.

By this, I conclude talking about the basic principles of footing and proceed to explaining OT's analytic device(S) proposed to account for final stress avoidance, a phenomenon attested in the stress patterns discussed in this paper.

2.4. *Non-final Stress*

Keeping stress off the ultima, or more generally off word final position, is a phenomenon attested in a number of languages. In a rule-based approach, extrametricality is the device developed for explanation (Hayes (1981) *et seq*). This independent tool provides the derivation with language particular rules to render the marked element (segment, syllable, foot) undetectable to the subsequent process of footing.

To yield this essential effect within OT, Prince & Smolensky (1993/2002) developed NONFINALITY. They introduced this constraint on three different levels as it assesses syllables, feet, or both domains in a final position.[2]

First, they introduced NON-FIN, as the basic form of the "constraint", to exclude stressed ultimate syllables:

(7) NON-FIN (1)
The prosodic head of the word does not fall on the word-final syllable.
(Prince & Smolensky 1993/2002: 40)

Then, they introduced the other extreme of evaluation in an attempt to realise antepenultimate stress patterns. They wanted to ensure that the head foot is not final in the PrWd.

(8) NON-FIN (2)
The head *foot* of the PrWd must not be final.
(Prince & Smolensky 1993/2002: 43)

This may help optimise the true outputs for almost all inputs in a language like Latin, for example. However, it will be detrimental with disyllabic words of the forms (LH) and (LL) that are stressed on the initial syllable. In such forms, the head foot must be final, if FT-BIN is to be satisfied (cf. 9 c below). Obviously, this incurs a violation of NON-FIN(2) regardless of the position of stress within this particular foot (on the

[1] We are left with one problem, though. Neither WSP nor any constraint introduced so far could rule out the lawful but highly marked foot configuration (H́L), where the heavy syllable is stressed and binarity is met syllabically. For this reason, Prince & Smolensky (1993/2002: 59) incorporated the constraint RH-HARM: *(H́L). However, as the discussion progresses later, a need to decompose FT-BIN (Hewitt 1994) will be justified providing a set of constraints collectively disfavouring any violation of strict binarity, hence offering a more plausible alternative to RH-HARM.

[2] Advocating a more fundamental role of NonFinality, Hyde (2002 and 2003) proposed a different formalisation allowing for broader applications beyond extrametricality.

final syllable or not). This shifts the evaluation burden to WSP that will rule out (ĹH). The following tableau demonstrates the inability of NON-FIN(2) to resolve the conflict between (ĹH) and L(H́) in favour of the former, the true output.

(9)

/LH/	FT-BIN	NON-FIN	WSP
a. ? (ĹH)		*	*!
b. ☞* L(H́)		*	
c. (Ĺ)H	*!		*

WSP, the low ranked constraint, evaluates the false output L(H́) as most harmonious. This inspired Prince & Smolensky to come up with the third and final version of NON-FIN to evaluate non-finality on both levels, syllables and feet.

(10) NON-FIN (3)
No head of PrWd is final in PrWd.
(Prince & Smolensky 1993/2002: 52)

This constraint says that NON-FIN is violated when either the head foot or the head syllable is final. Forms where the head foot is a final iamb or erected over a heavy syllable incur two violations of NON-FIN.

(11)

/LH/	FT-BIN	NON-FIN	WSP
a. ? (ĹH)		*!	*
b. L(H́)		*!*	
c. ☞*LH́	vac.	vac.	*

This shows that (ĹH) is more harmonious than L(H́). Clearly, there remains one problem, however. The unparsed LH is a better candidate analysis, as it vacuously satisfies both FT-BIN and NON-FIN. Prince & Smolensky noted this shortcoming of the so far proposed hierarchy of constraints and suggested a constraint that they put in a wider perspective to rule out completely unparsed inputs.[3] Basically, this constraint is introduced to ensure that monosyllabic words are not extramericalised for the sake of satisfying a lower ranked constraint (NON-FIN). The constraint is formalised as follows:

(12) LX ≈ PR (*MCat*)
A member of the morphological category *MCat* correspond(s) to a PrWd.
(Prince & Smolensky 1993/2002: 43)

This constraint says that lexical words must be phonologically (prosodically) realised. Obviously, such a demand will strongly motivate footing. Nevertheless, LX ≈ PR must be dominated by FT-BIN to block parsing sub-binary lexical categories into feet. Consider (13) where (11) is re-presented incorporating LX ≈ PR.

[3] One may argue for the use of the already existing constraint PARSE-SYL, which is violated twice by (11c). I would not favour this prospect as PARSE-SYL would have to be ranked lower than both FT-BIN and NON-FIN which means that violating it by (11c) is of no significance as far as the evaluation of the true output (ĹH) is concerned.

(13)

/LH/	FT-BIN	LX ≈ PR	NON-FIN	WSP
a. ☞(ĹH)			*	*
b. L(H́)			**!	
c. LH	vac.	*!		*

2.5. *Directionality*

In rule-based metrical theory, directionality effects are imposed on the process of footing by stipulating a set of rules explicitly indicating the direction of progression. However, the evaluation-based mechanism of OT constraints ensures that no such brute force is required.

The constraint ALIGN-FOOT, introduced in McCarthy & Prince (1993b), determines the preferred directionality of footing, especially in odd-numbered syllable sequences. The most harmonious candidate will be the one whose feet are closer to a designated edge, usually measuring the distance in syllables.

(14) a. Align (Ft, L, PrWd, L) left-to-right
b. Align (Ft, R, PrWd, R) right-to-left

(McCarthy & Prince 1993b: 16)

What these two constraints are saying is that the left or right edge of each and every foot, in a particular prosodic word, must be aligned with the same edge of that prosodic word. Nevertheless, this will only be perfectly satisfied by a candidate containing a single foot aligned to the nominated edge, but this is not always the case. Ranking FT-BIN over PARSE-SYL and having them dominate this alignment constraint to achieve binary bounded footing will inevitably incur violations of ALIGN-FOOT. This is not something adverse in OT. Candidates can violate some constraints and are still chosen to be optimal if the violation is kept to its minimum. So, in our particular case, the lower the number of violations of ALIGN-FOOT a certain candidate incurs the higher its potentiality of being designated as the optimal true output - *ceteris paribus*. In other words, the shorter the distance separating each foot in a certain form from the desired edge, and consequently the fewer the number of syllables accumulating after evaluating every foot, the more optimal a candidate is, as the tableau below shows:

(15) FT-BIN >> PARSE-SYL >>ALIGN-FOOT (left)

Candidates	FT-BIN	PARSE-SYL	ALIGN-FOOT (L)
a. ☞(σσ)(σσ)σ		*	**
b. (σ)(σσ)(σσ)	*!		****
c. (σσ)(σσ)(σ)	*!		******

By this, I conclude discussing directionality, and I also conclude the summary of the basic elements and factors involved in stress assessment in OT in general. In the following section, I will analyse three dialects of Arabic with similar, though not identical, stress patterns to show how OT operates the constraints and their interaction. However, as we shall see there, the set of principal constraints introduced so far will not be sufficient. The issues tackled necessitate presenting further constraints and arguments to account for the attested facts. Nonetheless, the challenge is to achieve true output optimisation assuming universality.

3.0. Three Arabic Dialects

In this section, I will analyse the stress patterns of three Arabic dialects, namely, Palestinian, Urban Hijazi, and Cairene. The three dialects exhibit very similar, though not identical, stress placement algorithms as all of them are both prominence-driven and rhythm-driven. This section endeavours to demonstrate how the depicted asymmetries are resolved through different rankings of a limited set of constraints.

3.1. The Stress Patterns

The syllable types attested in the three dialects are similar to other Arabic dialects. Consider the following inventory:

(16) a. Light.......................CV
b. Heavy.....................CVV, CVC
c. Superheavy.............CVVC, CVCC[4]

In principle, any of these syllables is stressable. The determinant factors, however, are syllable weight and syllable position. To demonstrate this, let us consider the following groups of examples to work out the stress algorithms:

(17) Palestinian[5]
Abu Salim (1980), Kenstowicz and Abdul-Karim (1980), Kenstowicz (1981), (1983), Hayes (1995), and others:

I. Stress on a Final Superheavy:

a.	da.rást	‘I studied’
b.	duk.káan	‘shop’

II. Stress on a Heavy Penult:

a.	jír.ʃi	‘he bribes’
b.	báa.rak	‘he blessed’
c.	mak.táb.na	‘our office’

III. Stress on a Heavy Antepenult:

a.	ʕál.la.mat	‘she taught’
b.	ʔíd.fa.ʕu	‘(you *pl.*) pay’

IV. Stress on a Light Penult, Antepenult, or Preantepenult:

a.	ʔá.na	‘I’
b.	ká.tab	‘he wrote’
c.	ká.ta.bu	‘they wrote’
d.	ʃá.d͡ʒa.ra.tun *msa*	‘a tree’

[4] Superheavies are not distinct syllable types. They are a combination of a heavy syllable plus a prosodified extrasyllabic consonant, i.e. one that is not syllabified but is linked to the PrWd.
[5] This stress pattern is sometimes rendered opaque by other phonological processes like high vowel deletion or long vowel shorting (Hayes 1995, Kager 1996). For an OT account of opacity, see Kager (1999), McCarthy (1999), (2002), Wee (2004), among others. However, the forms marked "*msa*" (Modern Standard Arabic), will not be affected by the colloquial processes of syncope.

e. ʃa.d͡ʒa.rá.tu.hu *msa* ‘his tree’

f. ʕal.lá.ma.to ‘she taught him’

(18) Urban Hijazi Arabic
Al-Mohanna 1998 (c.f. Jarrah 1993)

I. Stress on a Final Superheavy:

a. ka.tábt ‘I/ you *sg. ms.* wrote’

b. muf.táaħ ‘key’

II. Stress on a Heavy Penult:

a. dár.si ‘my lesson’

b. táa.d͡ʒir ‘merchant *ms.*’

c. faa.túu.rah ‘receipt’

III. Stress on a Heavy Antepenult:

a. mák.ta.bah ‘library’

b. ʔasˤ.ħáa.ba.na ‘our friends’

IV. Stress on a Light Penult or Antepenult:

a. sá.ma ‘sky’

b. fá.d͡ʒur ‘dawn’

c. ká.ta.bu ‘they wrote’

d. bá.sˤa.lah ‘an onion’

e. ba.ga.rá.ti ‘my cow’

f. dˤa.ra.bá.tak ‘she hit you *sg. ms.*’

g. ʃa.d͡ʒa.rá.tu.hu *msa* ‘his tree’

h. mak.tá.ba.ti *msa* ‘my library’

i. daħ.ra.d͡ʒa.tú.hu *msa* ‘his rolling’

(19) Cairene Arabic
Mitchell (1960), McCarthy (1979), Hayes (1981), Halle & Vergnaud (1987), Hayes (1995), and others:

I. Stress on a Final Superheavy:

a. ka.tábt ‘I/ you *sg. ms.* wrote’

b. sa.ka.kíin ‘knives’

II. Stress on a Heavy Penult:

a. bée.ti ‘my house’

b. mu.dár.ris ‘teacher *ms.*’

c. haa.ðáa.ni ‘these *dual ms.*’

III. Stress on a Light Penult or Antepenult:

a. sá.mak ‘fish’

b. bú.χa.la ‘misers’

c.	ka.ta.bí.tu	‘she wrote it *ms.*’
d.	ʃa.d͡ʒa.rá.tu.hu *msa*	‘his tree’
e.	mar.tá.ba	‘mattress’
f.	ʔin.ká.sa.ra *msa*	‘it *ms.* got broken’
g.	ʔad.wi.ja.tú.hu *msa*	‘his drugs’
h.	ʔad.wi.ja.tú.hu.ma *msa*	‘their *dual* drugs’

Examining the lists of forms above reveals a number of similarities and differences. Firstly, the three dialects agree on stressing a final superheavy syllable, and they also agree on stressing a heavy penult if the ultima is either light of heavy. In addition, Palestinian and Hijazi stress a heavy antepenult when followed by two light syllables. Add to that the fact that a light syllable is appointed as a potential stress-docking-site depending on the number of light syllables preceding it. Nonetheless, stress may not go beyond the antepenult for Hijazi and Cairene and the preantepenult for Palestinian. These facts may be formalised as follows:

(20)

	Stress Algorithm	**Palestinian**	**Hijazi**	**Cairene**
a.	Stress a *final* superheavy.	✓	✓	✓
b.	Otherwise, stress a heavy penult.	✓	✓	✓
c.	Otherwise, stress a heavy antepenult.	✓	✓	×
d.	Otherwise, stress the penult or the antepenult, whichever is separated from the first preceding heavy syllable or (if there is none) from the beginning of the word by an even number of syllables.	×	✓	✓
e.	Otherwise, stress the penult, the antepenult or the preantepenult, whichever is separated from the first preceding heavy syllable or (if there is none) from the beginning of the word by the least even number of syllables.	✓	×	×

Therefore, footing in these dialects of Arabic is, by default, rhythm-driven. The stress algorithms fundamentally say that stress is assigned to the light syllable that satisfies (20 d (or e)). Nonetheless, syllable weight plays a crucial role. For example, the appearance of a stress-attracting heavy penult, coupled with the absence of a superheavy ultima that is usually stressed, overshadows the totally rhythmic placement of stress. This implies a ternary weight opposition of syllable types (light vs. heavy vs. superheavy). In other words, there are two binary syllable weight distinctions, light and heavy vs. superheavy word-finally and light vs. heavy word-internally (McCarthy 1979 b).

In the remaining subsections, constraints and constraint settings, to which true footing may be attributed, are identified and dominantly related to one another in an overall constraint hierarchy. However, the reported facts entail that we divide the analysis into two subsections. The first discusses the quantity-sensitive stress, i.e. (20 a, b, and c), highlighting the correlation between heaviness and prominence. And, the other one tackles the rather challenging default rhythmic stress. Ultimately, a factorial typology of a limited number of constraints is formalised to explain the attested asymmetries.

3.2. Constraints and Dominance

In this subsection, the metrical principles relevant to the discussion of the examined stress patterns are rendered in the format of OT constraints. In particular, I will talk about Boundedness, Headedness, Weight sensitivity, Extrametricality, Directionality, and Exhaustivity.

The facts reported above dictate that a certain form must be parsed into bounded (binary) feet. This is because we fundamentally want to achieve the rhythmic footing required to attain the default stress. In other words, the even number of light syllables required to separate the stressed syllable from the designated edge entails some sort of rhythmic (bounded) footing. Therefore, assuming the set of basic constraints on metrification presented in section two, FT-BIN must be highly ranked, preventing ALIGN-FOOT from including all syllables in a given form under a single multi-syllabic foot.

As for headedness, we need to set two constraints to assign headhood to elements on both foot and word levels. RH-TYPE = T/I, that determines the dominant flank of a certain foot, must be set to promote left elements of binary feet, i.e. RH-TYPE = T. The justification for this claim is the desire to realise the conditioned default stress pattern where crucially an even number of light syllables is required. The other headedness constraint to set is ALIGN-HEAD, which nominates a certain foot as the head of a given form. The tendency to assign word stress to the right-most heavy syllable strongly indicates that this constraint must be set to place the head foot as close as possible to the right edge of the prosodic word: Align(PrWd, R, H(PrWd), R).

As for weight sensitivity, WSP is the main constraint to consider. However, this principle can only be enforced when considering the binary weight distinction of heavy vs. light word-medially. This is because stress can never be final, whatever that ultima's weight is (with the exception of superheavies that are treated differently in a manner that does not prejudice this claim, as we shall see below). This indicates that some kind of non-finality must be imposed and crucially ranked higher than WSP. Nevertheless, NON-FIN must not be allowed to discriminate against footed monosyllabic forms, so the standard theory's principle of non-exhaustivity of the stress domain is maintained by introducing LX $\approx$ PR, ranking it undominated. The issue to be addressed latter concerns the level where NON-FIN is enforced. In particular, we want to determine the constituent evaluated by this constraint. Is it the final syllable, the final foot, or will either affect the overall harmony of a candidate? Meanwhile, however, and at least to account for the stress pattern of Palestinian, I will assume the full version of the constraint, i.e. NON-FIN (3).

Another consequence of the default rhythmic stress is the directionality of footing. The three dialects require syllables to be parsed into feet starting with the initial syllable and going rightwards. ALIGN-FOOT, which requires all feet to appear at a certain edge, is the OT constraint that interprets this principle. Of course this requires parsing all syllables into only one foot per word. However, the interaction of ALIGN-FOOT and FT-BIN, that is ranked undominated, will produce the necessary directionality effect by optimising forms whose accumulative violations are the least, as their feet are closest to the preferred (left) edge. Consequently, ALIGN-FOOT is set as: Align (Ft, L, PrWd, L).

Finally, exhaustivity of parsing is attributed to PARSE-SYL. This constraint, along with FT-BIN and RH-TYPE = T, will ensure that all syllables are parsed into trochaic feet, unless ruled out by a higher constraint.

Thus, the following table sums up the required constraints, and the principles they maintain:

(21)

Principle	Boundedness	Headedness	Weight sensitivity	Extrametricality	Directionality	Exhaustivity
Constraints	FT-BIN	RH-TYPE = T RH-HARM ALIGN-HEAD-RIGHT	WSP	NON-FIN (Σ, σ́)	ALIGN-FOOT-LEFT	PARSE-SYL

Having determined the set of basic constraints, we now turn to the dominance relations holding between them. The interaction of such relatively related (ranked) constraints renders Eval capable of discriminating between different candidate analyses to approve attested outputs.

To optimise true outputs, Eval requires a language particular ranking of the constraints supplied by UG. In such a ranking, constraints usually belong to one of three distinct levels. Some are predominant, never violated. Others are dominant as they are only violated under duress, i.e. to satisfy a predominant constraint or a higher dominant one. And, thirdly the low ranked constraints that are violated more frequently. What appeals to us at this point are the interaction relations existing between these distinct levels and between individual constraints within each.

I will start by determining the predominant constraints that are literally never violated in true outputs in the studied stress patterns. Two essential characteristics are binarity and left-headedness, on the foot level. This means that FT-BIN and RH-TYPE = T are the two basic predominant FOOT-FORM constraints. Of course, RH-HARM is taken for granted to be represented here to discriminate against the uneven trochee. Another quite important restriction on the configuration of the stress domain is the total absence of final stress, leaving superheavies aside for the time being. As I mentioned earlier, this indicates that NON-FIN is highly ranked. But, as we saw above, NON-FIN must be always ranked lower than LX ≈ PR to avoid exhausting the whole stress domain, especially with monosyllabic forms. Also, this latter essential constraint is required to encourage footing.[6] Therefore, the only clear dominance relation holding between these constraints is the one forcing NON-FIN to be dominated by LX ≈ PR. This is clarified in the following tableau:

(22)

/σ/	FT-BIN, RH-TYPE, RH-HARM, LX=PR	NON-FIN
a. ☞(σ́)	√	**
b. < σ >	*! LX=PR	√

[6] The assumption that a PrWd must comprise a minimum of one foot, McCarthy and Prince (1986) among others, requires some type of footing to achieve the correspondence between the morphological and phonological categories.

Crucially however, NON-FIN must dominate certain lower ranked constraints to avoid optimising otherwise false outputs. The most obvious is WSP. This essential relation will guarantee stress non-finality even if the ultima is heavy. The following tableau demonstrates the dominance relations holding between these constraints (H = a heavy syllable, L = a light syllable):

(23)

/LH/	FT-BIN	NON-FIN	WSP
a. ☞ (ĹH)		*	*
b. L(H́)		**!	
c. (Ĺ)(H)	*!		

Clearly, ALIGN-HEAD, that attracts stress rightwards, is also strictly dominated by NON-FIN if the latter is operative on the foot level. This will keep the head foot off the final position, especially if erected over a final heavy syllable. Consider the following tableau:

(24)

/LLH/	NON-FIN	ALIGN-HEAD
a. ☞ (ĹL)(H)		σ
b. (LL)(H́)	*!*	∅

Another interesting dominance relation is the one that holds between WSP and PARSE-SYL. The former must be ranked higher to achieve true footing in /LHL/ forms. The following tableau clarifies this point:

(25)

/LHL/	RH-HARM	WSP	PARSE-SYL
a. ☞ L(**H**)L			**
b. (**L**H)L		*!	*
c. L(**H**L)	*!		*

The last interaction I will look into, for the time being, is the one between PARSE-SYL and ALIGN-FOOT. The former must dominate the latter to ensure exhaustive parsing of syllables into feet. Otherwise, we will end up with a single binary foot erected on the left edge of the form under consideration. However, the desired parsing must be in accordance with FT-BIN, to ensure that degenerate monomoraic feet are not created. This will consequently rank FT-BIN higher than PARSE-SYL. Consider the following tableau:

(26)

/LLLLL/	FT-BIN	PARSE-SYL	ALIGN-FOOT
a. ☞ (LL)(LL)L		*	σσ
b. (LL)LLL		**!*	∅
c. (LL)(LL)(L)	*!		σσσσσσ
d. (LLLLL)	*!		∅

The ranking in (27) below sums up the dominance relations discussed above. This constraint ranking is only tentative and is subject to further improvement as the discussion progresses.[7]

(27) FT-BIN, RH-TYPE = T, RH-HARM, LX = PR >> NON-FIN >> WSP >> PARSE-SYL >> ALIGN-FOOT, ALIGN-HEAD

The issue to consider now is the compatibility of this proposed ranking with the facts attested in the stress patterns of Palestinian, Hijazi, and Cairene. The remainder of this section is basically devoted to looking into this query.

3.3. *Quantity-sensitive Stress*

As mentioned above, the fact that heavy syllables usually attract stress demonstrates the influence of syllable weight on metrification in the three Arabic dialects under investigation. The tendency is to place stress as close as possible to, although not exactly at, the right periphery of the word. Consequently, the constraints WSP, ALIGN-HEAD, and NON-FIN are respectively motivated by quantity-sensitivity, word right headedness, and extrametricality. In this subsection, I will demonstrate how the interaction of mainly these three constraints achieves heavy penult and antepenult stress. Also, they will be sufficient to stress superheavies.

As indicated in (20 b) above, the three dialects agree on stressing heavy penults. As a non-final syllable, and potentially composing a non-final foot, a heavy penultimate syllable will invariably attract stress, in the absence of a final superheavy. Consider the following tableaux:

(28)i. /kutubhum/ → [ku.túb.hum] 'their books'

/kutubhum/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a.☞ ku(túb)(hum)							*	σσσ	σ
b. ku(tub)(húm)					*!*		*	σσσ	
c. (kú.tub)(hum)						*!		σσ	σ
d. (ku)(túb)(hum)	*!							σσσ	σ

ii. /maktabna/ → [mak.táb.na] 'our office'

/maktabna/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a.☞ (mak)(táb)na							*	σ	σ
b. (mák)(tab)na							*	σ	σσ!
c. (mák)(tab.na)			*!					σ	σσ
d. (mak)(táb)(na)	*!							σσσ	σ

iii. /maktabhum/ → [mak.táb.hum] 'their office'

/maktabhum/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a.☞(mak)(táb)(hum)								σσσ	σ
b. (mák)(tab)(hum)								σσσ	σσ!
c. (mak)(tab)(húm)					*!*			σσσ	
d. (mák.tab)(hum)						*!		σ	σ

[7] For the time being, there is no motivation for relatively ranking ALIGN-HEAD with respect to WSP, PARSE-SYL, and ALIGN-FOOT. Yet, as we shall see below, a more specific ranking is in order.

The candidate analyses with a stressed heavy penult are systematically optimised, no matter what the weight of the preceding or following syllable is (excluding superheavies for now). Any attempt to place stress on a heavy ultima is ruled out by NON-FIN (28 i b and iii c). On the other hand, ALIGN-HEAD drags stress rightwards form a heavy antepenult (28 ii b and iii b).

The other chief characteristic preserved in all three algorithms is stressing a final superheavy syllable, despite its apparent final position. This poses a challenge to the proposed constraint hierarchy. In particular, the relative predominance of NON-FIN guarantees ruling out final word prominence. Consider the following tableau:

(29) /ʕalameen/ → [(ʕa.la)(mée)n] 'two flags'

/ʕalameen/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a. ? (ʕa.la)(méen)					*!*			σσ	
b. ʕa.(lá.meen)					*!	*	*	σ	
c.☞* (ʕá.la)(meen)								σσ	σ

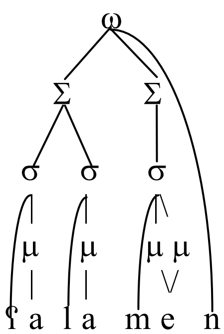
To optimise forms like (29 a) without violating NON-FIN, I will assume associating the final consonant of a superheavy syllable directly to the PrWd node (Al-Mohanna 1998). This would render the right-most foot in such a form non-final in the PrWd, as the final (extrasyllabic) consonant intervenes between any structure to its left and the right periphery.

(30)

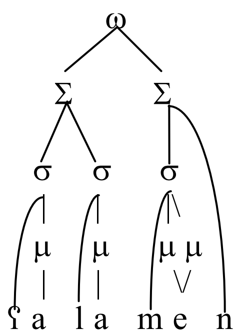
/ʕalameen/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a.☞ #(ʕa.la)(mée)n#								σσ	
b. #ʕa.(lá.mee)n#						*!	*	σ	
c. (ʕá.la)(meen)								σσ	σ!

However, we may be tempted to associate the syllabically stray consonant to the foot node, which is lower in the prosodic hierarchy and consequently more eligible to dominate that consonant. Consider the following representations:

(31) a.



b.



This demonstrates why the association to the PrWd node is favoured. Associating the final consonant to the preceding foot (31 b), renders the rightmost foot final, violating NON-FIN. On the other hand, a candidate like (31 a) separates the right peripheries of the final foot and the PrWd's by the extrasyllabic consonant. The tableau below demonstrates how the constraint hierarchy evaluates the two candidate analyses.

(32)

/ʕalameen/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a.☞#($ʕa$la$)($mée$)n#								σσ	
b. #($ʕa$la$)($mée$n)#					*!			σσ	

The third and final instance of quantity-sensitive (prominence-driven) stress assignment, excluding Cairene, is attested in an environment where a heavy antepenult is followed by two non-stress attracting syllables, including a heavy ultima, (20 c). The proposed constraint hierarchy will evaluate the candidate analysis assigning stress to that heavy antepenult as most harmonious. Consider the following tableau:

(33) /ʔistaʁfaru/ → [ʔis.táʁ.fa.ru] 'they asked for divine forgiveness'

/ʔistaʁfaru/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a.☞(ʔis)(táʁ)(fa.ru)								σσσ	σσ
b. (ʔís)(taʁ)(fa.ru)								σσσ	σσσ!
c. (ʔis.taʁ)(fa.ru)						*!		σσ	σσ
d. (ʔis)(taʁ)(fá.ru)					*!			σσσ	

The constraints WSP, NON-FIN (3), and ALIGN-HEAD conspire to optimise the true output. As a consequence of this constraint ranking, ALIGN-HEAD fails to motivate a perfect alignment of the head foot to the right periphery of the PrWd due to the NON-FIN violation incurred by a candidate such as (33 d).[8] Also, minimising the number of feet to minimise ALIGN-FOOT violations (33 c) is ruled out by WSP. And, ALIGN-HEAD denies preantepenultimate stress (33 b).

By this I conclude talking about prominence-driven stress after demonstrating that syllable weight is an essential factor in the process of footing, and consequently in stress assignment in the three stress patterns. Attracting stress leftwards, but not beyond the antepenult (for Palestinian and Hijazi), and denying absolute word final headedness are the main points analysed in this subsection.[9] In what follows, I will tackle the default rhythmic stress to examine the overall adequacy of the proposed constraint hierarchy.

3.4. Default Stress

The facts in (20) above indicate that the stress placement algorithm in the three patterns is rhythmic by default. The absence of heavy syllables in the final three-syllable window requires a systematic left-to-right pairing of light syllables into binary feet. Therefore, an even number of light syllables will separate the stressed syllable (the preantepenult (in Palestinian), the antepenult or the penult) from the first preceding heavy syllable or from the left periphery.

For the purposes of Palestinian and, to some extent, Cairene (which will only require a limited adjustment of NON-FIN), the set of constraints suggested above are adequate to optimise attested outputs as the two dialects represent the two extremes of

[8] This indicates the version of NON-FIN to be adopted later for Cairene, where finality of the head foot is tolerated.

[9] In § 3.4, the three stress patterns are discussed separately developing relatively different rankings and (in some cases) constraints. This will eventually account for the attested distinctions depicted in (20) above.

non-finality range. In Palestinian, head feet are never final unless forced by LX ≈ PR in forms with only two light syllables. On the other hand, Cairene will always assign headedness to a final foot, providing that the head syllable is non-final. However, the facts of Hijazi stress pattern appear to be more challenging; it is not always a clear cut. The appearance of a heavy antepenult will deny assigning headedness to a final foot erected, if at all, over a final pair of lights. Elsewhere, the two final light syllables constitute the head foot. In what remains of this subsection, I will demonstrate how constraints and constraint rankings can account for such discrepancies.

For Palestinian, the tableaux below show that the proposed constraints and dominance relations suffice for optimising the two attested manifestations of default (iterative) footing, i.e. antepenultimate and preantepenultimate stress.

(34) /ʃad͡ʒaratuhu/ → [ʃa.d͡ʒa.ra.tu.hu] 'his tree *msa*'

/ʃad͡ʒaratuhu/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN 3	WSP	PARSE -SYL	ALIGN-FOOT	ALIGN-HEAD
a. ☞ (ʃa.d͡ʒa)(rá.tu)hu							*	σσ	σ
b. (ʃá.d͡ʒa)(ra.tu)hu							*	σσ	σσ!σ
c. (ʃa.d͡ʒa)ra(tú.hu)					*!		*	σσσ	

(35) /ʃad͡ʒarati/ → [ʃa.d͡ʒa.ra.ti] 'my tree *msa*'

/ʃad͡ʒarati/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN 3	WSP	PARSE -SYL	ALIGN -FOOT	ALIGN -HEAD
a. ☞ (ʃá.d͡ʒa)(ra.ti)								σσ	σσ
b. ʃa(d͡ʒá.ra)ti							*!*	σ	σ
c. (ʃa.d͡ʒa)(rá.ti)					*!			σσ	

(36) /ʃad͡ʒari/ → [ʃa.d͡ʒa.ri] 'my trees *msa*'

/ʃad͡ʒarati/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN 3	WSP	PARSE -SYL	ALIGN -FOOT	ALIGN -HEAD
a. ☞ (ʃá.d͡ʒa)ri							*		σ
b. ʃa(d͡ʒá.ri)					*!		*	σ	

(37) /sama/ → [sá.ma] 'sky'

/sama/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN 3	WSP	PARSE -SYL	ALIGN -FOOT	ALIGN -HEAD
a. ☞ (sá.ma)					*				
b. sá.ma				*!					
c. (sá)ma	*!								

These tableaux show that the extreme enforcement of non-finality is satisfied in Palestinian. The constraint NON-FIN 3 denies headedness of final feet (34 c, 35 c, and 36 b) and consequently guarantees preantepenultimate stress in forms with an even number of syllables (35 a) and antepenultimate stress elsewhere (34 a and 36 a). The only exception to this generalisation is triggered by disyllabic forms. The candidate analysis (37 a) is rendered most harmonious and consequently optimal although it violates NON-FIN 3 since it is the only plausible footing that satisfies higher undominated constraints, like FT-BIN and LX ≈ PR.[10]

In contrast, the stress pattern of Cairene demands a more lenient implementation of non-finality, one that completely confines the contribution of NON-FIN to ruling out final head syllables (i.e. NON-FIN-σ́). This means that it will move up to join the undominated constraints, as final head syllables are absolutely banned. Nevertheless, if we adopt this solution, we will not be able to rule out candidates like (34 c or 36 b) unless the relative ranking of ALIGN-FOOT and ALIGN-HEAD is specified. If NON-FIN-σ́ does not evaluate final feet, ALIGN-FOOT will have to emerge not only as a constraint encouraging true directionality of footing, but as one determining the overall harmony of candidates on such basis. Therefore, ALIGN-FOOT must properly dominate ALIGN-HEAD. The tableaux below show how these alternations, in ranking and in constraint scope of evaluation, help optimise true outputs in Cairene:

(38)

/ʃad͡ʒaratuhu/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN-σ́	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a. ☞ (ʃa.d͡ʒa)(rá.tu)hu							*	σσ	σ
b. (ʃa.d͡ʒa)ra(tú.hu)							*	σσσ!	
c. ʃa(d͡ʒa.ra)(tú.hu)							*	σσσ!σ	

(39)

/ʃad͡ʒarati/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN-σ́	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a.☞(ʃa.d͡ʒa)(rá.ti)								σσ	
b. (ʃá.d͡ʒa)(ra.ti)								σσ	σ!σ
c. ʃa(d͡ʒá.ra)ti							*!*	σ	σ

(40) /ʃad͡ʒari/ → [ʃa.d͡ʒa.ri] 'my trees *msa*'

/ʃad͡ʒarati/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN-σ́	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a.☞ (ʃá.d͡ʒa)ri							*		σ
b. ʃa(d͡ʒá.ri)							*	σ!	

Therefore, NON-FIN-σ́ does not discriminate against true outputs like (39 a). On the other hand, ranking ALIGN-FOOT higher than ALIGN-HEAD renders (38 a and 40 a) most harmonious, and consequently optimal.

This analysis accounts for all instances of the rhythmically determined default stress placement in Cairene as it also holds with forms containing heavy antepenults (cf. Palestinian and Hijazi (33) above). In forms like /maktabi/, the proposed analysis will deny assigning stress to a heavy antepenultimate syllable since the hierarchy accommodates right-most head feat. Consider the following tableau:

[10] By assuming that the processes of footing and foot-level head assignment are actually separable (Crowhurst 1996), one may claim that creating headless feet is conceivable, as such processes may be attributed to two different (violable) constraints. Adopting such a view will allow for footed candidate analyses that satisfy NON-FIN 3 simply because they are not assigned headedness (sa.ma).

(41)

/maktabi/	FT-BIN	RH-TYPE	RH-HARM	LX = PR	NON-FIN-σ́	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a.☞ (mak)(tá.bi)								σ	
b. (mák)(ta.bi)								σ	σ!σ

Therefore, the only two differences in the (metrical) constraint hierarchies for Palestinian and Cairene are the level where non-finality is enforced and the relative ranking of headedness constraints:

(42) a. Palestinian: NON-FIN 3 … ≻ … ALIGN-FOOT, ALIGN-HEAD

b. Cairene: NON-FIN 1 … ≻ … ALIGN-FOOT ≻ ALIGN-HEAD

However, neither of the two hierarchies ensures true optimisation across the board in Hijazi. The issue of locating the head foot is paradoxical. In order to optimise forms like (Ĥ)(LL), final head feet must be banned. Otherwise, the constraint ALIG-HEAD will discriminate against forms whose head feet are not final. Yet, the hierarchy must allow footing a final pair of light syllables to optimise forms like (LL)(ĹL).

To overcome the difficulty sketched above, we need to draw a distinction between (L̀L)(ĹL) and (Ĥ)(L̀L). Similar true output candidates differ in their foot structural configuration. Assuming trochaic footing, a candidate like (Ĥ)(L̀L) involves a pair of clashing feet while (L̀L)(ĹL) does not. Therefore, as a first step towards ruling out a false output like (H̀)(ĹL) in Hijazi, I will introduce the constraint *CLASH (Burzio (1994), Buckley (1994, 1995 a), Kager (1995b), Green (1996), among others). This constraint, as shown below, discriminates against any candidate with adjacent stressed syllables. It is formalised as follows:

(43) *CLASH: Clashing feet (stresses on adjacent syllables) are prohibited.[11]
(Buckley 1994: 19)

This means that, in a trochaic stress system like Hijazi, any footing like (**H**)(**L**L) will inevitably violate *CLASH, as the heavy syllable and the following light are heads of their respective feet constituting a pair of adjacent stress bearers. On the other hand, the foot structure (**L**L)(**Ĺ**L) does not.

To avoid creating any clashes, *CLASH will force some sort of syllable under-footing (under-parsing), in forms containing /...HLL/ sequences, as demonstrated below:

(44)	/HLL/	*CLASH	PARSE-SYL
a.	(**H**)(**L**L)	*	√
b.	(**H**)LL	√	**
c.	H(**L**L)	√	*
d.	HLL	√	***

[11] Due to the lack of secondary stresses in Hijazi, the phrase “stresses on adjacent syllables” is interpreted as “adjacent metrically strong syllables”, indicating that in **boldface**.

Although ranking *CLASH undominated disfavours (44 a), optimising (44 b), rather than (44 c or d) is yet to be determined. The constraints WSP and LX ≈ Pr, respectively, achieve the desired effect. Consider the following tableau that incorporates *CLASH:

(45) /maktabi/ → [(mák)ta.bi] 'my office'

/maktabi/	FT-BIN, RH-TYPE, RH-HARM, LX = PR, *CLASH, NON-FINσ́	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a. (**mák**)(**ta**.bi)	*! *CLASH			σ	σσ
b. ☞ (**mák**)ta.bi			**		σσ
c. mak(**tá**.bi)		*!	*	σ	
d. mak.ta.bi	*! LX = PR	*	***		

Besides ruling out the *CLASH violating candidate (45 a), the tableau demonstrates that (45 b), the true output, is more harmonious than (45 d), which violates LX ≈ PR, another undominated constraint. Also, the tableau shows how WSP discriminates against (45 c) which fails to metrify the initial heavy syllable.

Nonetheless, introducing *CLASH as an undominated constraint, will have undesired consequences elsewhere. For example, for a quadri-syllabic input like /maktabati/ 'my library' the footing process must not metrify the initial heavy syllable and the immediately following pair of lights in two successive feet, creating two adjacent metrically strong syllables. Other candidates that satisfy *CLASH could unparse a syllable between the two feet or just metrify the initial heavy syllable. These possibilities are illustrated below:

(46) /maktabati/ → [mak(tá.ba)ti] 'my library'

/maktabati/	FT-BIN, RH-TYPE, RH-HARM, LX = PR, *CLASH, NON-FINσ́	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a. (**mak**)(**tá**.ba)ti	*! *CLASH		*	σ	σ
b. ? mak(**tá**.ba)ti		*!	**	σ	σ
c. (**mák**)ta.ba.ti			**!*		σσσ
d. ☞*(**mak**)ta(**bá**.ti)			*	σσ	

Obviously, candidates (46 b, c, and d) satisfy *CLASH, and all other undominated constraints. The problem is that candidate (46 b), the true output, is less harmonious than the other two as it incurs a violation of WSP.

Though more harmonious than the true output, (46 c) contains three successive unparsed syllables. This failure to group adjacent syllables into feet must be seen to violate a certain principle, other than merely incurring three violations of PARSE-SYL. More than one proposal is available in the OT literature. Collectively, they endeavour to interpret Selkirk's (1984) "Lapse" and/or Hayes' (1995) "Persistent Footing". I will introduce and employ Kager's (1994) PARSE-2, with some adjustment to accommodate the analysed data:[12]

[12] Green (1995) and Green and Kenstowicz (1995) attributed this banning on successive unfooted syllables (or moras) to the constraint "Lapse" that forces the separation of adjacent unstressed moras or syllables by a foot boundary (cf. Eisner's (1997) ANTILAPSE). Alderete (1995) achieves the same effect using PARSE-ADJ-SYLL

(47) PARSE-2: One of two adjacent stress units must be parsed by a foot.
(Kager 1994: 9)

This constraint, however, must assume both Syllable Integrity and Foot Binarity, when evaluating candidates. Thus, the second mora of a heavy syllable and a following light syllable's are not considered *parsable*. Also, in a system that requires strict binary moraic parsing, a sequence of a light and a heavy is not parsable into a foot.[13] Thus, the constraint must be re-formalised as follows:

(48) PARSE-2: A sequence of two tautosyllabic moras or a sequence of two mono moraic syllables should be parsed by a foot.

To rank this constraint in the proposed hierarchy, we must take into consideration the ranking of the highest constraint the true output violates. If we are to demonstrate that (46 b) is more harmonious than (46 c), PARSE-2 must at least dominate WSP. This means that underparsing a heavy syllable should be evaluated as less fatal than underparsing three successive light ones. In other words, we can avoid creating clashing feet by leaving out the two adjacent stress units (moras) of the initial heavy syllable unfooted. Although such a candidate violates PARSE-2 once, it is more harmonious than failing to metrify a sequence of three moras, in which case PARSE-2 is violated twice. In particular, it will be violated once between the first and second moras and another time between the second and third moras, [(μμ)μ] and [μ(μμ)].

Still, this will not render (46 b) optimal. The candidate (46 d) does not violate PARSE-2 nor does it violate WSP. Yet, in that candidate, there is a stray syllable intervening between the two feet. This PARSE-SYL violation should be distinguished from one incurred by a peripheral syllable. To rule out such degenerate footing configuration, I introduce the constraint FOOT-CONTIG that discriminates against word-medial syllable association to the prosodic word (cf. the Peripherality Condition Harris 1983 and Hayes 1995), ranking it undominated. It can be formalised as follows:

(49) FOOT-CONTIG:
Metrical well-formedness is enforced over contiguous strings of submetrical elements.
(cf. McCarthy and Prince 1990)

The tableaux in (50) below show the two constraints in action:

(50)(i) /maktabi/ → [(mák)ta.bi] 'my office'

/maktabi/	FT-BIN, RH-TYPE, RH-HARM, LX = PR, *CLASH, NON-FINσ́, FOOT-CONTIG	PARSE-2	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a.☞(mák)ta.bi		*		**		σσ
b. mak(tá.bi)		*	*!	*	σ	
c. (mak)(tá.bi)	*! *CLASH				σ	

[13] As we shall see below, the latter restriction will be attributed to an undominated pair of constraints decomposing FT-BIN.

(ii) /maktabati/ → [mak(tá.ba)ti] 'my library'

/maktabati/	FT-BIN, RH-TYPE, RH-HARM, LX = PR, *CLASH, NON-FINσ́, FOOT-CONTIG	PARSE-2	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a. (**mak**)(**tá**.ba)ti	*! *CLASH			*	σ	σ
b. ☞ mak(**tá**.ba)ti		*	*	**	σ	σ
c. (**mák**)ta.ba.ti		**!		***		σσσ
d. (**mak**)ta(**bá**.ti)	*! FOOT-CONTIG			*	σσ	

(iii) /maktabatuhu/→ [mak(ta.ba)(tú.hu)] 'his library'

/maktabatuhu/	FT-BIN, RH-TYPE, RH-HARM, LX = PR, *CLASH, NON-FINσ́, FOOT-CONTIG	PARSE-2	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a. (**mak**)(**ta**.ba)(**tú**.hu)	*! *CLASH				4σ	
b. (**mák**)ta.ba.tu.hu		**!*		****		4σ
c. ☞ mak(**ta**.ba)(**tú**.hu)		*	*	*	4σ	
d. mak(**tá**.ba)(**tu**.hu)		*	*	*	4σ	σ!σ
e. (**mak**)ta.ba(**tú**.hu)	*! FOOT-CONTIG	*		**	σσσ	

Tableau (50 i) demonstrates how the dominated WSP resolves the tie on PARSE-2 between (50 i a and b). On the other hand, tableau (50 ii) shows how PARSE-2 and FOOT-CONTIG rule out otherwise more harmonious candidates (50 ii c and d). Finally, tableau (50 iii) highlights the decisive role of ALIGN-HEAD.

A further complication of introducing the constraint *CLASH is manifested in inputs with a final superheavy preceded by a heavy penult. *CLASH will dictate that at least one of the two syllables is not footed. In addition, as WSP is violated by both, it will not be able to resolve the optimisation of either of the two candidates that satisfy *CLASH. Therefore, the relative ranking of ALIGN-FOOT and ALIGN-HEAD will falsely optimise the output stressed on the penult. The following tableau demonstrates these constraint interactions:

(51) /muftaaħ/ → [.muf.táaħ.] 'key'

/muftaaħ/	FT-BIN, RH-TYPE, RH-HARM, LX = PR, *CLASH, NON-FINσ́, FOOT-CONTIG	PARSE-2	WSP	PARSE-SYL	ALIGN-FOOT	ALIGN-HEAD
a. [(**muf**)(**táa**)ħ]	*! *CLASH				σ	
b. ? [muf(**táa**)ħ]		*	*	*	σ!	
c.☞*[(**múf**)taa.ħ]		*	*	*		σ

Resolving this undesired consequence of the restriction imposed by the constraint *CLASH requires reversing the relative ranking proposed for ALIGN-FOOT and ALIGN-HEAD. This achieves the general pattern attested in Hijazi where primary stress is assigned to the right-most (non-final) heavy syllable. Nonetheless, this will have undesired consequences with candidates like (36 b), where the antepenult is the syllable satisfying condition (20 d). We saw that unless ALGN-FOOT dominates ALIGN-HEAD, the true output candidate [(ʃá.d͡ʒa)ri], whose head foot is not aligned with the word's right periphery, will end up being less harmonious than a false output like *[ʃa(d͡ʒá.ri)]. Hence, adopting the newly proposed ranking necessitates portraying the latter candidate false.

In a rule-based approach, forms like [ʃa(d͡ʒá.ri)], with an initial unfooted syllable, can be interpreted as outputs of a brute force rule imposed to mark initial syllables extrametrical. However, such a rule is not completely natural. Hayes (1995) reported that there is a cross-linguistic tendency towards confining extrametricality to the right edge. He translates that into one of the conditions he proposed to constrain the device:

(52) Edge Markedness:
The unmarked edge for extrametricality is the right edge.
(Hayes 1995: 57)

This condition is interpreted into an OT constraint militating against non-final stray syllables. By "stray syllables" I mean syllables that are not immediately dominated by a foot node.

(53) ALIGN-STRAY
Align (STRAYSYLLABLE, R, PrWd, R)
(Al-Mohanna 1998: 249)

Evaluation will be categorical, i.e. one violation for every syllable failing the constraint. In this case, a number of true outputs will (minimally) violate ALIGN-STRAY, indicating a ranking just higher than ALIGN-HEAD, and consequently ALIGN-FOOT. The following tableau demonstrates how the so far developed hierarchy of constraints optimises the true candidate analysis with antepenultimate stress, (ʃa.d͡ʒa)(rá.tu)hu:

(54) /ʃad͡ʒaratuhu/ → [ʃa.d͡ʒa.rá.tu.hu] 'his tree'

/ʃad͡ʒaratuhu/	FT-BIN, RH-TYPE, RH-HARM, LX=PR, *CLASH, NON-FINσ́, FOOT-CONTIG	PARSE-2	WSP	PARSE-SYL	ALIGN-STRAY	ALIGN-HEAD	ALIGN-FOOT
a.☞(**ʃa**.d͡ʒa)(**rá**.tu)hu				*		σ	2σ
b. ʃa(**d͡ʒa**.ra)(**tú**.hu)				*	*!		4σ

In addition, the following tableau demonstrates how the argument attains the desired optimisation of output candidates like (51 b):

(55) (54) /muftaaħ/ → [muftáaħ] 'a key'

/muftaaħ/	FT-BIN, RH-TYPE, RH-HARM, LX=PR, *CLASH, NON-FINσ́, FOOT-CONTIG	PARSE-2	WSP	PARSE-SYL	ALIGN-STRAY	ALIGN-HEAD	ALIGN-FOOT
a. [(**muf**)(**táa**)ħ]	*! *CLASH						σ
b. ☞ [muf(**táa**)ħ]		*	*	*	*		σ
c. [(**múf**)taa.ħ]		*	*	*	*	σ!	

Another undesired consequence of *CLASH arises when evaluating the footing of forms containing three successive heavy syllables /HHH/. In order to avoid any *CLASH violations, we must either deny one or more syllables any footing or metrify more than one heavy syllable in a single foot. The following tableau lays out the various possibilities and reveals the problems to be tackled:

(56) /mustaʕmal/ → [mus(táʕ)mal] 'second-hand'

/mustaʕmal/	FT-BIN, RH-TYPE, RH-HARM, LX = PR, *CLASH, NON-FINσ́, FOOT-CONTIG	PARSE-2	WSP	PARSE-SYL	ALIGN-STRAY	ALIGN-HEAD	ALIGN-FOOT
a. (mus)(táʕ)(mal)	*! *CLASH					σ	σσσ
b. (mús)taʕ(mal)	*! FOOT-CONTIG	*	*	*	*	σσ	σσ
c. mus.taʕ(mál)	*! NON-FINσ́	**	**	**	**		σσ
d. ? mus(táʕ)mal		*!*	**	**	*	σ	σ
e. (mús)taʕ.mal		*!*	**	**	*	σσ	
f. ☞ *(mús.taʕ)(mal)			*			σ	σσ

Candidates (56 a, b, and c) violate undominated constraints, so they are ruled out immediately. On the other hand, the remaining candidates avoid violating *CLASH by violating lower constraints. Candidate (56 e) is ruled out as it is a worse violator of ALIGN-HEAD than other competing candidates (56 d, and f). However, the true output, (56 d), is less harmonious than (56 f). Obviously, the latter does not violate PARSE-2, as all syllables are included in some foot, in a configuration that does not violate *CLASH. Also, it does not violate FT-BIN, as both feet are either moraically or syllabically binary.

To account for false output candidates like (56 f), Hewitt (1994) introduced various decompositions of the constraint FT-BIN. The one that relates to the matter in hand aims at evaluating the binarity violations in terms of foot Minimality and Maximality.

(57) a. FT-BIN^{max}: For the elements of category X (σ, N, μ) contained within a foot assess a violation for each element that exceed 2.

b. FT-BIN^{min}: For the elements of category X (σ, N, μ) contained within a foot assess a violation if the foot contains less than 2 such elements.

(Hewitt 1994: 23)

As a quantity-sensitive language, Hijazi will set these two constraints to count the moraic content of feet. Therefore, ranking them undominated, to substitute the original FT-BIN, will surely rule out (56 f). The initial foot in that output candidate is erected on two heavies (four moras), exceeding foot moraic binarity. The following tableau shows FT-BIN decomposition in action:[14]

(58)

/mustaʕmal/	FT-BIN$^{max \& min}$, RH-TYPE, LX = PR, *CLASH, NON-FINσ́, FOOT-CONTIG	PARSE-2	WSP	PARSE-SYL	ALIGN-STRAY	ALIGN-HEAD	ALIGN-FOOT
d. ☞ mus(táʕ)mal		**	**	**	*	σ	σ
f. (mús.taʕ)(mal)	*! FT-BIN^{max}		*			σ	σσ

By this, I conclude my analysis of the stress pattern attested in Hijazi after attaining some degree of control over the consequences of including *CLASH as an

[14] With FT-BIN^{max} , RH-HARM has become redundant. This is because any candidate that violates the latter must also violate the former, as (HL) is invariably a tri-moraic foot.

undominated constraint. Some constraints are introduced like PARSE-2, FOOT-CONTIG, ALIGN-STRAY, and a decomposition of FT-BIN.[15]

Finally, here are the overall hierarchies of constraints proposed for the three stress patterns:

(59)

PATTERN	HIERARCHY	
Palestinian	Undominated:	FT-BIN$^{max\ \&\ min}$, RH-TYPE, LX = PR, FOOT-CONTIG >>
	Dominated:	NON-FIN 3 >> WSP >> PARSE-SYL >> ALIGN-FOOT, ALIGN-HEAD
Cairene	Undominated:	FT-BIN$^{max\ \&\ min}$, RH-TYPE, LX = PR, FOOT-CONTIG, NON-FIN-σ́ >>
	Dominated:	WSP >> PARSE-SYL >> ALIGN-FOOT >> ALIGN-HEAD
Hijazi	Udominated:	FT-BIN$^{max\ \&\ min}$, RH-TYPE, LX = PR, FOOT-CONTIG, NON-FIN σ́, *CLASH >>
	Dominated:	PARSE-2 >> WSP >> PARSE-SYL, ALIGN-STRAY >> ALIGN-HEAD >> ALIGN-FOOT

4.0. Conclusion

The three processes of rhythm-driven (default) stress assignment, in Palestinian, Cairene, and Hijazi, maintain identical codes for foot form, directionality, headedness, and exhaustivity. However, the scope of non-finality distinguishes the patterns from one another. While Palestinian never allows final head feet (cf. /LL/ → *[<LL>] violates LX ≈ PR), Cairene never bans them (cf. /LLL/ → *[(LL)(L)] violates FT-BIN). Hijazi, though, poses a more challenging distribution, assigning headedness to final feet unless superseded by a stress attracting heavy antepenult. These discrepancies are resolved in the proposed constraint hierarchies. So, as Palestinian assumes the rigid implementation of non-finality provided by the constraint NON-FIN3, Cairene utilises the lenient NON-FIN-σ́. But, Hijazi extends beyond, including the constraint *CLASH which ultimately denies footing a final pair of light syllables to promote a heavy antepenult.

[15] See Al-Mohanna (1998) for other issues related to metrification such as Final /-CVC/ Footing, Final Vowel Shortening, and Stem-bound Footing.

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* ROA = Rutgers Optimality Archive: <http://ruccs.rutgers.edu/roa.html>

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