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An Optimal Alternative to Iterative Footing

Abstract

The process of stress assignment justifies creating metrical constituents. Reducing the ultimate effect of exhaustive footing to a mere counting tool breaches economy of representation. However, some derivational accounts require iterative footing to locate primary stress, even though no secondary stressing is attested. Using a rule as line conflation, the non-stressed feet are subsequently deleted. This derivation, nonetheless, is incompatible with OT that abstracts from serial processing. Thus, assuming a mono-foot account, for a number of bounded stress systems with no secondary stresses, requires adopting a different underlying principle. The notion of Parsability, that evaluates candidates for exhaustive footing, is introduced to achieve the crucial counting effect. The same rationale is extended to account for word-level headedness and directionality. The proposed mono-foot account is applied to a number of stress patterns like Cairene, Seminole/Creek, and Hindi. Disfavouring any redundant footing, constraint interaction nominates the proper sequence, in each pattern, for footing.

1 Introduction:

A number of derivational metrical accounts consider iterative foot construction as a mechanism required to assign primary stress although secondary stresses are not phonetically attested (Halle and Vergnaud 1987, Idsardi 1992, Hayes 1995, and others). For example, they argue that the stress pattern in Cairene (Mitchell 1960), which appears to depict no secondary stresses, entails a process of left-to-right iterative trochaic footing. The absence of a stress attracting superheavy ultima or heavy penult requires this exhaustive parsing to place stress on a designated syllable (the light penult or 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). Consequently, Line Conflation had to be developed to eliminate the effects of this intermediate stage, an epiphenomenon of iterative footing, viz. feet whose prominent flanks may not be allowed to percolate into headedness. However, this process of Line Conflation entirely relies on principles of serial derivation, where the output of a certain rule (Foot Construction) is the input to another (Word Layer Construction). This calls for considering other alternatives as the constraint-based framework of OT (Prince and Smolensky 1993/2002, McCarthy and Prince 1993a, b) does not accommodate intermediate stages of derivation.

In an attempt to attain the ultimate effects of Line Conflation within an OT analytical environment, a number of accounts were suggested, the Separability and the Sympathy (opacity) accounts of Crowhurst (1996) and Paul de Lacy (1998), respectively. Nonetheless, the former undermines the widely recognised inextricability of constituents and heads, decomposing footing into two separate processes of syllable parsing and head assignment. And, the latter extends Sympathy Theory allowing it to accommodate markedness constraints as selectors of sympathetic candidates weakening the entire purpose of the theory which endeavours to maintain a certain faithfulness relation between an input and some selected sympathetic candidate representing the intermediate stage in serial derivation.

Building on the assumption that primary and secondary stresses are assigned separately (van der Hulst 1984, 1996, 1999, Roca 1986, Goldsmith 1990, McGarrity 2003, and others), the proposed OT account offers an explanation that only allows a maximum of one foot per word, denying the environment of any secondary stress assignment. I will demonstrate that processes of primary stress assignment in languages like Cairene, Seminole/Creek, or even Hindi, that are treated with Line Conflation in derivational accounts, do not require iterative exhaustive footing. Constraint interaction will only optimize those candidate analyses with a single foot that locates a particular syllable, designated for stress eligibility, in a head position. This minimal foot construction is attributed to the interaction between the constraints Lx ≈ Pr (Prince and Smolensky 1993/2002) and *Ft (Paul de lacy 1998), a member of *Struc constraints (Zoll 1992 *cit* Prince and Smolensky 1993/2002). The former necessitates some sort of prosodic licensing, but the latter militates against prosodic structure, foot structure in particular.

The counting effect implemented by iterative footing, however, will be attributed to a constraint interpreting the Priority Clause (Hayes 1995) that requires scanning along a string in order to construct a proper foot where possible, if the portion of the string being scanned would yield a degenerate foot, interpreted here in terms of binarity. Therefore, the portion of the string allowed to intervene between the one foot and a designated edge (the left edge in Cairene for example) should be exhaustively parsable into immediately higher constituents, creating the environment for iterative exhaustive footing that is not executed unless the language requires secondary stressing. The proposed account further enforces the principle of economy as a certain set of constraints motivates primary stress assignment independently of secondary stressing, an option that a language may or may not choose to take.

2 Derivational Line Conflation:

Line conflation is a process executed by a rule suppressing constituents whose heads are not dominant in higher levels (Halle and Vergnaud 1987: 52). Thus, only a single (primary) stress is preserved in any given form; feet that could otherwise be docking sites for secondary stresses will be eliminated. The derivation in (1) below demonstrates the effects of Line Conflation, with a form like [mad.ra.sa.tú.hu] "his school *msa*":

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(1)   a.     . . . . *   .      line 2
            (* .) (*  .)(*  .)     line 1
            (1 2)(3  4)(5  6)      line 0
            mad ra sa tu hu
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Constituent Construction

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      b.     . . .  . *   .      line 2
             . . .  . (*) .      line 1
             1 2  3  4 (5  6)      line 0
            mad ra sa tu hu
```

Line Conflation

In (1a), the metrical constituent rules performed an iterative process of foot construction, designating the rightmost as head in word layer. Subsequently, Line Conflation, in (1b), nullifies other feet to justify lack of secondary stresses.

Consequently, this rule of Line Conflation appears to be totally dependent on derivational processing. Its environment of application is the output of an earlier rule, that of Constituent Construction. This, nevertheless, is not consistent with the principles of the constraint-based framework of OT, which does not accommodate intermediate stages of derivation. As a result, there were a number of attempts to offer an OT interpretation of Line Conflation. The following section presents two alternative OT accounts, suggested in the literature, offering an evaluation of their empirical and theoretical adequacy.

3 OT Accounts:

In an attempt to attain the ultimate effects of Line Conflation within an OT analytical environment, a number of accounts were suggested. In this section, I will review the Separability and the Sympathy (opacity) accounts of Crowhurst (1996) and Paul de Lacy (1998), respectively.

3.1 The Separability Account:

Undermining the widely recognised inextricability of constituents and heads, Crowhurst (1996) presents an OT account decomposing footing into two separate processes of syllable parsing and head assignment. Such an assumption means that creating headless feet is analytically feasible as the presence of metical heads is ascribed to a set of violable constraints. Thus, explaining the lack of secondary stresses, as an epiphenomenon of iterative footing, is attainable, given that the relevant constraints are ranked accordingly.

To translate these proposals into OT analytical tools, Crowhurst introduces a number of constraints targeting the two processes, evaluating foot construction and headedness.

(2) a. **Footing**:

σ-TO-FT: Link (σ, foot)

b. **Headedness**:

i. Foot Level:

TROCHEE/IAMB: Align (Head (Ft)-L/R, Ft-L/R)

FT-TO-HEAD: Link (Foot, Head (Ft))

ii. Word Level:

MAINSTRESS-L/R: Align (Head (PrWd)-L/R, PrWd-L/R)

PRWD-TO-HEAD: Link (PrWd, Head(PrWd))

Parsing is attributed to the constraint σ-TO-FT (cf. PARSE-SYL McCarthy and Prince (1993b)). However, in view of this account, it is not enough to assume constituent configuration, head position in particular. A linking constraint is required to associate the head to the preferred flank. Therefore, the constraints TROCHEE/IAMB and MAINSTRESS-L/R decide the position of the head, if it is assigned at all, and the constraints FT-TO-HEAD and PRWD-TO-HEAD prompt linking it to that designated position. Nonetheless, Crowhurst (1996) attributes lack of secondary stresses in languages like Cairene to a constraint maximising prominence, one which elevates foot headedness to PrWd headedness. Consequently, multiple foot-head linking is denied, vacuously satisfying such a constraint. On the other hand, another constraint will enforce constituent mono-headedness. The two constraints are formalised as follows:

(3) a. **HEADMAX**: Link (Head(Ft), Head(PrWd))
b. **MONOHEADEDNESS**: Prosodic constituents are uniquely headed.

The tableau below demonstrates how the constraints, in the proposed ranking, interact with one another to achieve the ultimate effect of Line Conflation:

(4) /maktabi/ → [mak.tá.bi] 'my office' Cairene Arabic

maktabi	MONO HEADEDNESS	HEADMAX	PRWD-TO-HEAD	TROCHEE	FT-TO-HEAD	σ-TO-FT	MAIN STRESS-R
a. ☞(mak)(tá.bi)					*		
b. (mák)(ta.bi)					*		σ!σ
c. (mak)(ta.bi)			*!		**		
d. (màk)(tá.bi)		*!					
e. (mák)(tá.bi)	*!						

The targeted candidate analysis (4d) is rendered less harmonious than the true output as the prominent element in its initial foot fails the maximality requirement, violating the undominated HEADMAX. The competing candidates (4c and e) satisfy this constraint but are not optimised as they violate other undominated constraints, PRWD-TO-HEAD and MONOHEADEDNESS respectively. Therefore, the optimal candidate (4a) must link head-to-foot, but only once and as close as possible to the designated (right) edge (cf. 4b).

This separability account raises a number of questions, however. For example, what is the cross-linguistic evidence justifying the fundamental generalisation behind the absence of secondary stresses, i.e. the maximality requirement? And more substantially, by neutralising the constituent-head coexistence constraint formalised by the Faithfulness Condition (Halle and Vergnaud 1987), can we argue for footless heads to cover the full spectrum (a factorial typology)? In addition, what are the empirical implications for the constraint *CLASH? With such assumptions, candidates with supposedly clashing feet will not be ruled out, as the adjacent heads, prompting the clash, may not be assigned whatsoever.

3.2 The Sympathy Account:

Paul de Lacy (1998) assumes that main stress assignment in Cairene Classical Arabic is an opaque process as the surface representation fails to demonstrate the iterative footing needed to calculate the stress docking site. Consequently, he suggests adopting the framework of Sympathy Theory (McCarthy 1998), an OT proposed account for opacity, as an alternative to Line Conflation. However, he argues for an extended version of Sympathy, allowing markedness constraints to be selectors of sympathetic forms.

The notion of Sympathy endeavours to maintain the correspondence between two otherwise failed candidates, one of which is the opaque actual output and the other represents the intermediate transparent stage, in a derivational account. The latter (the object of sympathy or the ❀-candidate) is the most harmonious satisfier of the Selector (✯), an Input/Output faithfulness constraint determined on a language particular basis. Therefore, a candidate-to-candidate sympathetic faithfulness constraint will enforce some sort of Candidate/Candidate correspondence, assuming the expected similarities between the actual output and the ❀-candidate. The interaction of this sympathetic faithfulness constraint with other constraints in a given hierarchy will render the actual output most harmonious.

Nonetheless, de Lacy's extended version of sympathy accommodates the stress pattern of Cairere by including markedness constraints as Selectors. The account assumes that the exhaustively footed form, which satisfies PARSE-σ, is a representation of the intermediate stage, to which the actual output is compared for faithfulness.

(5)

maktabi	O❁-IDENT-σ́	*FT	✯ PARSE-σ
a. ☞ mak(tá.bi)		*	¡*
b. (mák)ta.bi	*!	*	¡**
c. ❁ (màk)(tá.bi)		**!	

The constraint *FT militates against foot structure minimising the number to one foot per PrWd. The sympathetic constraint O❁-IDENT-σ́, on the other hand, maintains the correspondence between the object of sympathy (5 c) and other candidates competing for the actual output.

However, Sympathy (traditional Sympathy Theory) has been subjected to a substantial amount of criticism. McCarthy (2003) argues against this ‘inter-candidate’ faithfulness constraints claiming that such a framework is considerably powerful to the extent that it permits unattested patterns of opacity. In addition, Input/Output faithfulness, in the extended sympathy proposal, is interrupted by markedness evaluation. The account does not maintain the continuity of faithfulness, starting at the input, passing through the sympathetic candidate, and terminating at the actual output. The markedness constraint PARSE-σ appears somewhere in the middle to select the ❁-candidate whose identity is then mapped onto the output. This raises another concern about the empirical or theoretical justification for evaluating intermediate representations for markedness.

In the following section, I will argue for an alternative account.

4 Parsability:

The proposed account follows the assumption that primary and secondary stresses are assigned separately (van der Hulst 1984, 1996, 1999, Roca 1986, Goldsmith 1990, McGarrity 2003, and others). Thus, the four logical cross-linguistic distribution probabilities of the two factors (of primary and secondary stresses) are as follows:

(6) Word Stress Attested

	Word Stress	Attested
a.	primary and secondary	✓
b.	primary only	✓
c.	secondary only	×
d.	none	×

With the exception of some languages whose stress patterns may superficially indicate otherwise, the four logical probabilities above demonstrate that primary stress assignment is a prerequisite for any secondary stressing, but not vice versa. Languages either depict primary and secondary or primary only stress patterns. Coexistence is considered as an obligatory condition only to justify secondary stress, but not primary. Consequently, the proposed account will limit the process of (word) foot parsing in languages with only primary stress patterns, maximally allowing one foot per word. This will obviously deny any environment for secondary stress assignment as the head of this single foot, the sole candidate, will percolate into the higher level of word headedness.

Minimal foot construction will be attributed to the interaction between the constraints Lx ≈ Pr (Prince and Smolensky 1993/2002) and *Ft (Paul de lacy 1998), a member of *Struc constraints. The former obligates a minimum of prosodic configuration to license lexical representations, and the latter militates against any form of structuring, accounting for the principle of "necessity justifies action" (the 'do when you need' rationale) in OT formalisation. The tableau below demonstrates this constraint interaction:

(7)

	Lx ≈ Pr	*Ft	Parse-σ
a. ☞ σσ(σ́σ)		*	**
b. (σ̀σ)(σ́σ)		**!	
c. <x x x x>	*!		****

By ranking *Ft higher than Parse-σ, the exhaustively parsed candidate (7 b), that provides an environment for secondary stressing, is rendered less harmonious than (7 a). On the other hand, candidate (7 c) that fully satisfies *Ft, by virtue of having no structure, is ruled out by the undominated Lx ≈ Pr.

Selecting the appropriate sequence of stress bearing units within a stress domain, for the purpose of footing, poses the principal challenge for the proposed mono-foot account, however. The constraints and constraint interactions determining the proper foot to erect are the central issues to consider in what remains of this section.

In quantity-sensitive unbounded systems, stress is usually placed on the heavy syllable closer to a designated edge or, in the absence of such syllables, on the one at the same or opposite edge of the stress domain (PrWd). (See Halle and Vergnaud (1987), Hayes (1995), van der Hulst and Goedemans (in progress), among others, for a number of examples on such stress systems.) Therefore, a word with more than one heavy syllable will present more than one candidate for footing. Yet, after ruling out all multi-foot candidates, for the reasons specified above, the constraint hierarchy must optimize the mono-foot candidate analysis that matches the actual stress pattern of a given system. Consider the following tableau:

(8)

	Lx ≈ Pr	*Ft	WSP	Parse-σ
a. ? LL(H́ LL) HLL		*	*	*****
b. ? LLH(LLH́) LL		*	*	*****
c. ? (LLH́) LLHLL		*	*	*****
d. ? LLHLL(H́ LL)		*	*	*****
e. LL(H̀ LL) (H́ LL)		**!		**

The candidates (8 a-d) are equally harmonious. Each can be an optimal candidate for an actual output in either of four stress systems, evaluating the same input string. Therefore, detecting the particular string to be footed, in unbounded systems, calls for another factor, that of headedness. Aligning a certain edge of the prosodic word or foot with that of their heads accounts for the weight-sensitive and default stress patterns, respectively. Consequently, the hierarchy is augmented with the two alignment constraints ALIGN-HEAD(FT) and ALIGN-HEAD(PRWD) to evaluate dominant flanks in the foot and the prosodic word. Ranked undominated, the former will regulate default stress placement. On the other hand, ALIGN-HEAD (PRWD) advocates placing the head closer to a certain edge, in the case where a number of candidates (heavy syllables) compete for headedness. Consider the factorial typology below:

(9)	Weight Sensitive/Default	ALIGN-HEAD (PRWD)	ALIGN-HEAD (FT)
a.	**(L/L)**	**LEFT**	**LEFT**
Leftmost heavy σ, otherwise leftmost σ			
L L (H́ L L) H L L	(Ĺ L L L L L L)		
b.	**(R/R)**	**RIGHT**	**RIGHT**
Rightmost heavy σ, otherwise rightmost σ			
L L H (L L H́) L L	(L L L L L L Ĺ)		
c.	**(L/R)**	**LEFT**	**RIGHT**
Leftmost heavy σ, otherwise rightmost σ			
(L L H́) L L H L L	(L L L L L L Ĺ)		
d.	**(R/L)**	**RIGHT**	**LEFT**
Rightmost heavy σ, otherwise leftmost σ			
L L H L L (H́ L L)	(Ĺ L L L L L L)		

The two tableaux below demonstrate the effects of these two constraints, which are set to satisfy pattern (9 a):

(10) Leftmost heavy σ

	LX ≈ PR	ALIGN-HEAD(FT) LEFT	*FT	WSP	ALIGN-HEAD(PRWD) LEFT	PARSE-σ
a. ☞ L L (H́ L L) H L L			*	*	σσ	*****
b. L L H (L L H́) L L		σ!σ	*	*	σσσ	*****
c. (L L H́) L L H L L		σ!σ	*	*		*****
d. L L H L L (H́ L L)			*	*	σσσ!σσ	*****
e. L L (H̀ L L) (H́ L L)			**!		σσσσσ	**

(11) Otherwise, leftmost σ

	LX ≈ PR	ALIGN-HEAD(FT) LEFT	*FT	WSP	ALIGN-HEAD(PRWD) LEFT	PARSE-σ
a. ☞ (Ĺ L L L L L L L)			*			
b. (L L L L L L L Ĺ)		σ!σσσσσσ	*			

The three mono-foot candidates (10 b, c, and d) are rendered less harmonious since their attempts to align the left edge of the constituent's head with that of the constituent (foot or PrWd) are not as persistent as the true output's (10 a). Candidate (10 c), however, that appears to perfectly align the left edges of the head foot and the prosodic word, and consequently satisfy ALIGN-HEAD (PRWD), violates the undominated ALIGN-HEAD(FT), that is necessarily set to evaluate the left edge as revealed by the default pattern (tableau 11).

In a number of (quantity-sensitive) bounded systems, nonetheless, determining the proper string of elements for footing calls for further analytical tools, to attain the counting effect implemented by iterative footing. Precisely, I will introduce and capitalize on the notion of *Parsability*. Formalized into a constraint, this filter only sanctions a string of elements that are exhaustively parsable into immediately higher constituents, where parsability is interpreted on a language particular basis, assuming the syllable or the mora as the unit for counting evaluation.

The assumption presupposes considering a constraint that interprets the Priority Clause (Hayes 1995: 95):

> ***"If at any stage in foot parsing the portion of the string being scanned would yield a degenerate foot, the parse scans further along the string to construct a proper foot where possible."***

The suggested interpretation of this degenerate-foot avoidance strategy assumes the possibility of evaluating a partially footed string for exhaustive parsing. Therefore, any string of elements (σ or μ), that could be allowed to surface unparsed in a given candidate, may not be sanctioned unless it is exhaustively parsable into higher constituents. This means that the process of exhaustive footing is interrupted after the erection of one foot to evaluate the whole configuration for a number of things including the exhaustive parsability of any residual unparsed strings of elements. Consequently, the justification for iterative footing is rendered unnecessary as the number of unparsed elements (a string) allowed to intervene between the one foot and a designated edge should be exhaustively parsable into feet, moraic trochees in the case of Cairene. This, in turn, will maintain the environment for iterative exhaustive footing that is not executed unless the language requires secondary stressing.

(12) a. Left-to-Right Binary Footing:

[$\underline{\textbf{x} \quad \textbf{x} \quad \textbf{x} \quad \textbf{x}}$ (x x) x]$_{\omega}$

(parsable string)

b. Right-to-Left Binary Footing:

[x (x x) $\underline{\textbf{x} \quad \textbf{x} \quad \textbf{x} \quad \textbf{x}}$]$_{\omega}$

(parsable string)

The two unparsed strings in (12) are exhaustively parsable into binary feet. Hence, they produce the iterative effect required to locate the appropriate pair of elements for footing. Without erecting redundant feet, ones with no phonetic contribution to the surface stress pattern, this account abstracts form the need to assume multi-level optimization or constituent head separability.

Interpreting the Priority Clause's rationale for evaluating parsability, the proposed account introduces the markedness constraint Parsability which rules out unparsed strings unless they are exhaustively parsable:

(13) **Parsability**

Any sequence of elements that is not exhaustively parsable into immediately higher constituents is not allowed.

This constraint should be interpreted on a language particular basis. Thus, a candidate with an odd number of unparsed syllables occurring between the one foot and a designated edge will violate Parsability in (quantity insensitive) syllabic trochee stress patterns, but not necessarily in moraic trochee systems, for example.

(14)

							Parsability
a. moraic trochee	[	L	L	H	(L	L)]$_\omega$	✓
b. syllabic trochee	[	σ	σ	σ	(σ	σ)]$_\omega$	×

The unparsed string in (14 a) /LLH …/ is exhaustively parsable into moraic trochees: [(LL)(H) …]. However, the same number of syllables in (14 b) /σσσ …/ may not be exhaustively parsed into (non-degenerate) syllabic trochees.

Preserving the counting effect achieved by iterative footing in derivational accounts, the constraint Parsability helps locate the appropriate string for footing, in Cairene, i.e. the rightmost pair of light syllables separated form the left boundary by an even number of syllables. The tableau below demonstrates that:

(15) /ʃagaratuhu/ → [ʃa.ga(rá.tu)hu] ‘his tree *Cl*’

/ʃagaratuhu/	FT-BIN, RH-TYPE=T, NON-FIN (σ́), LX ≈ PR	*FT	PARSABILITY	PARSE-σ
a. ☞ ʃa.ga(rá.tu)hu		*		***
b. ʃa.ga.ra(tú.hu)		*	*!	***
c. ʃa(gà.ra)(tú.hu)		**!		*
d. ʃa.ga.ra.tu(hú)	*! FT-BIN	*		****

Candidate (15 a), which represents the true output, is rendered optimal because it is the most harmonious satisfier of Parsability. Its closest competitor (15 b), nonetheless, is ruled out as the string of light syllables occurring between the foot and the left boundary of the PrWd may not be exhaustively parsed into moraic trochees. Other attempts to satisfy Parsability (15 c and d) run into more fatal complications. A candidate like (15 c) vacuously satisfies Parsability by virtue of having only one unparsed syllable that does not constitute a sting to be evaluated for parsability. However, this multiple superfluous footing is a worse violator of the higher *Ft. On the other hand, candidate (15 d) keeps the *Ft violation to the minimum but violates foot binarity, a predominant principle in Cairene.

Locating an appropriate string for the mono-foot analysis is not always straightforward, however. The nature of complications the parsability account ought to consider is revealed when examining even numbered sequences of light syllables. Resolving the matter between candidates competing for different footing configurations should assess domains of analysis beyond Parsability. In particular, the analysis must have the capacity to measure the harmony of different Parsability satisfiers; candidates like (LL)LL, L(LL)L, or LL(LL) should be demonstrated to have varying harmony values in different languages. The following tableau demonstrates the challenge posed by a number of Parsability satisfiers that violate other principles:

(16)

	FT-BIN, RH-TYPE=T, NON-FIN (σ́), LX ≈ PR	*FT	PARSABILITY	PARSE-σ
a. ? L L (Ĺ L)		*		**
b. * L (Ĺ L) L		*		**
c. * (Ĺ L) L L		*		**

As for the hierarchy proposed, the three candidates have uniform harmony. Each assumes the mono-foot hypothesis and consequently equally violates the constraints *FT and PARSE-σ. In addition, they satisfy PARSABILITY as the unparsed sequences, if any (cf. 16-b), are exhaustively parsable.

So far, word-level headedness and footing directionality are not represented, and consequently regulated, by any constraint in the proposed hierarchy. This might seem reasonable as the mono-foot analysis can arguably abstract from the need to resolve word headedness or to decide the direction of footing. However, their effects are crucial in detecting the string of syllables (or the heavy syllable in moraic trochee systems) to be footed.

4.1 Word-level Headedness

Any OT analysis that assumes exhaustive parsing and potentially allows for multiple footing must be equipped with a device to locate word-level headedness, i.e. pinpoint a particular foot to be assigned primary stress. The alignment constraint ALIGN-HEAD L/R (McCarthy and Prince 1993) is the most frequently proposed to produce the desired effect. However, the parsability account is not fully compatible with this genre or constraints. The interaction between the two constraints PARSABILITY and ALIGN-HEAD may optimize false candidate analyses, with certain inputs. Consider the following rankings and harmony relations:

(17)	**Ranking**			**Harmony Relation (Cairene)**		
a.	ALIGN-HEAD	>>	PARSABILITY	*LLL(LL)	≻	LL(LL)L
b.	PARSABILITY	>>	ALIGN-HEAD	*L(H)LL	≻	LH(LL)

Therefore, the proposed account requires a different constraint to effect the same result, avoiding the reported limitations. More precisely, the failure to group adjacent syllables, at a designated edge, into a foot must be depicted as a violation of a certain constraint rather than merely failing to satisfy PARSE-σ.

More than one proposal in OT literature endeavours to interpret Selkirk's (1984) *Lapse* and/or Hayes' (1995) *Persistent Footing* that disfavour adjacent unparsed stress units. Kager (1994, 1996) introduces the constraint PARSE-2 to maintain this general underlying principle throughout the PrWd. Nonetheless, the head foot, in the mono-foot account, no longer competes with other feet within a form; it is the only candidate. Therefore, the erection must occur at or as close as possible to a designated edge. A pair of constraints to force parsing initially or finally, and consequently promote an edge for word-headedness, can be formalized as follows (cf. Al-Mohanna 1998):

(18) PARSE-2 (I/F)

a. **Leftmost Headedness:**

PARSE-2-I: Parsable stress units in **initial** sequences should be parsed by a foot.

b. **Rightmost Headedness:**

PARSE-2-F: Parsable stress units in **final** sequences should be parsed by a foot.

Adopting this informal wording of Kager's, the word *parsable* in particular, indicates that PARSE-2 should assume both syllable integrity and foot binarity. Therefore, only tautosyllabic moras and adjacent mono-moraic syllables are considered parsable in maraic trochee stress patterns, for example.

In Cairene, where the right periphery is promoted and accordingly PARSE-2-F is ranked comparatively high in the hierarchy, violations are tolerated only to satisfy undominated constraints or to avoid multi-foot construction. The tableau below shows how PARSE-2-F rules out false candidates like (16-c) above:

(19)

	FT-BIN, RH-TYPE=T, NON-FIN (σ́), LX ≈ PR	*FT	PARSE-2-F	PARSABILITY	PARSE-σ
a. ☞ L L (Ĺ L)		*			**
b. (Ĺ L) L L		*	*!		**
c. L L (Ĺ) L	*! FT-BIN	*			

Candidate (19-b) presents a parsable sequence of stress units (two adjacent mono-moraic syllables) in the final position violating PARSE-2-F. This renders that candidate less harmonious than (19-a) which parses the final pair of lights into a foot. On the other hand, candidate (19-c) endeavours to satisfy PARSE-2-F but runs into other complications involving violating FT-BIN, an undominated constraint in Cairene.

4.2 Directionality

Another logical assumption of analyses advocating exhaustive constituent parsing is the existence of a device controlling directionality. The need to nominate an edge from which footing proceeds towards the other is quite justified in bounded systems, for example. This is very much revealed when considering forms with an odd number of light (mono-moraic) syllables, as demonstrated below:

(20)		**FT-BIN**
a.	(LL)(LL)L	✓
b.	L(LL)(LL)	✓

As a result of proceeding form left-to-right, the parsing in (20-a) groups the two feet closer to the left periphery of the PrWd positioning the stray (unparsed) syllable rightmost, and vice versa in (20-b). As this ultimately contributes to locating the stress docking site, it is quite necessary for different stress systems to decide the directionality of footing and eventually optimize (20-a) or (20-b).

The alignment constraint ALIGN-FOOT L/R (McCarthy and Prince 1993) produces the required directionality effect by grouping feet as close as possible to a certain edge in the PrWd. However, such a constraint may not always be integrated in a mono-foot account. In Cairene for example, footing proceeds from left-to-right as exposed by the default stress pattern that refers to preceding sequences of lights. This indicates considering ALIGN-FOOT L. Nevertheless, word headedness is rightmost which is attributed to PARSE-2-F, as we saw above. Since the two requirements draw footing to opposite edges, the total evaluation of the two constraints may optimize false candidate analyses, especially in forms with an even number of syllables. Consider the following tableau:

(21)

	PARSE-2-F	ALIGN-FOOT L
a. * L (L L) L	✓	σ
b. ? L L (L L)	✓	σσ!
c. (L L) L L	*!	

The false output (21-a) will always be more harmonious than the candidate analysis for the true output (21-b), notwithstanding the relative ranking holding between ALIGN-FOOT L and PARSE-2-F. Therefore, and as we saw with word-headedness above, the proposed account requires a different rationale to manage directionality. In particular, the positioning of stray syllables can be viewed as a trigger rather than a mere epiphenomenon of the ultimate effects of directionality.

In odd numbered sequences of mono-moraic syllables, and as a consequence of FT-BIN, one syllable may not be included in any foot. Such syllable is always peripheral, a configuration attributed to a condition on Constituent Contiguity (cf. McCarthy & Prince

1990). This could be formalized into the constraint FOOT-CONTIG that maintains strict adjacency of sub-metrical elements ruling out any candidate analysis that allows anything but a foot to exist between two feet, which ultimately places stray syllables on the peripheries (Al-Mohanna 1998).

(22) FOOT-CONTIG

Metrical well-formedness is enforced over continuous strings of submetrical elements.

This evidently undominated constraint echoes the Peripherality condition proposed by (Hayes 1981) as a restriction on extrametricality.

(23)		**FOOT-CONTIG**
a. ☞	(L L) (L L) L	✓
b. ☞	L (L L) (L L)	✓
c.	(L L) L (L L)	×

The fact that unparsable (stray) syllables, in this type of sequences, are always peripheral indicates their residual status. This means that their positioning, leftmost or rightmost, exposes the direction of footing. In particular, a rightmost unparsable syllable designates a left-to-right parsing, and vice versa for leftmost stray syllables. Therefore, evaluating peripherality (left or right) accounts for directionality. This is formalized into the pair of constraints ALIGN-STRAY (L/R):

(24) ALIGN-STRAY (L/R)

a. **Left-to-Right Footing:**
ALIGN-STRAY (R)
Align (STRAY SYLLABLE, R, PRWD, R)

b. **Right-to-Left Footing:**
ALIGN-STRAY (L)
Align (STRAY SYLLABLE, L, PRWD, L)

The instances of evaluation, in (25) below, demonstrate how ALIGN-STRAY (R) determines the relative harmony of some candidate analyses. Violations are only sanctioned to maintain the requirements imposed on foot-form (Cairene). In a candidate like (25-iii-a), for example, ALIGN-STRAY (R) is violated once as the initial (non-final) mono-moraic syllable may not be included in any moraic trochee, given the proposed footing. (Only the underlined are ALIGN-STRAY (R) violators because they are unparsable non-final elements.)

(25) **ALIGN-STRAY (R)**

(i)	a.	(L L) L	✓
	b.	<u>L</u> (L L)	*!
(ii)	a.	L L (L L)	✓
	b.	<u>L</u> (L L) L	*!
(iii)	a.	<u>L</u> H (L L) L	*
	b.	<u>L</u> H <u>L</u> (L L)	**!

The tableau below shows how ALIGN-STRAY (R) rules out false candidates like (16-b) above:

(26)

	ALIGN-STRAY (R)	PARSE-2-F	PARSABILITY
a. ☞ L L (Ĺ L)			
b. (Ĺ L) L L		*!	
c. L (Ĺ L) L	*!		

The hierarchy below sums up the discussion for the stress pattern in Cairene, that places stress on a final superheavy, otherwise on a heavy penult, otherwise on the penult or the antepenult whichever is separated by an even number of light syllables from the first preceding heavy syllable or (if there is none) from the beginning of the word:

(27) Constraint Hierarchy for Cairene

a. Undominated Constraints:

FT-BIN, RH-TYPE=T, NON-FIN (σ́), LX ≈ PR **>>**

b. Dominated Constraints:

ALIGN-STRAY (R), *FT **>>** PARSE-2 (F) **>>** PARSABILITY, PARSE-σ

The dominated constraints are characterized as such to allow for their violation in some true output candidate analyses, as exemplified below:

(28)	**Dominated**	**Optimal Violators**
	ALIGN-STRAY (R)	<u>L</u> H (Ĺ L)
	*FT	σ σ <u>(σ́ σ)</u>
	PARSE-2 (F)	(H́) <u>H</u>
	PARSABILITY	<u>L H</u> (Ĺ L)
	PARSE-σ	<u>σ σ</u> (σ́ σ)

The following harmony relations holding between some candidate analyses offer justification for the proposed constraint rankings:

(29)	**Ranking**	**Harmony Relation**
	*FT >> PARSE-σ	σ σ (σ́ σ) ≻ * (σ̀ σ) (σ́ σ)
	*FT >> PARSE-2 (F)	(H́) H ≻ * (H̀) (H́)
	PARSE-2 (F) >> PARSABILITY	L H (Ĺ L) ≻ * L (H́) L L

The constraint ALIGN-STRAY (R) is ranked high in the hierarchy to emphasize the claim that violations are tolerated when interacting with constraints on foot-form, FT-BIN and RH-TYPE=T in particular.

The tableaux in (30) below demonstrate how the different elements of the proposed account interact with one another, viz. the mono-foot requirement (*FT), the iterative parsing effect (PARSABILITY), word-headedness (PARSE-2 (I/F)), and directionality (ALIGN-STRAY (L/R)).

(30)

(i) /ʃagari/ ‘my trees’

/ʃagari/	FT-BIN, RH-TYPE=T, NON-FIN (σ́), LX ≈ PR	ALIGN-STRAY (R)	*FT	PARSE-2 (F)	PARSABILITY	PARSE-σ
a. ☞(ʃá.ga)ri			*			*
b. ʃa(gá.ri)		*!	*			*
c. <ʃagari>	*! LX ≈ PR					
d. (ʃá.ga)(ri)	*! FT-BIN		**			

(ii) /ʃagarati/ ‘my tree’

/ʃagarati/	FT-BIN, RH-TYPE=T, NON-FIN (σ́), LX ≈ PR	ALIGN-STRAY (R)	*FT	PARSE-2 (F)	PARSABILITY	PARSE-σ
a. ☞ ʃa.ga(rá.ti)			*			**
b. (ʃá.ga)ra.ti			*	*!		**
c. (ʃà.ga)(rá.ti)			**!			
d. ʃa(gá.ra)ti		*!	*			**

(iii) /ʃagaratuhu/ ‘his tree *Cl*’

/ʃagaratuhu/	FT-BIN, RH-TYPE=T, NON-FIN (σ́), LX ≈ PR	ALIGN-STRAY (R)	*FT	PARSE-2 (F)	PARSABILITY	PARSE-σ
a.☞ʃa.ga(rá.tu)hu			*			***
b. ʃa.ga.ra(tú.hu)			*		*!	
c. (ʃá.ga)ra.tu.hu			*	*!*	*	***
d. ʃa(gá.ra)tu.hu		*!	*	*		***

(iv) /maktabi/ ‘my office’

/maktabi/	FT-BIN, RH-TYPE=T, NON-FIN (σ́), LX ≈ PR	ALIGN-STRAY (R)	*FT	PARSE-2 (F)	PARSABILITY	PARSE-σ
a. ☞ mak(tá.bi)			*			*
b. (mák)ta.bi			*	*!		**

(v) /katabtaha/ 'you *sg. ms.* wrote it'

/katabtaha/	FT-BIN, RH-TYPE=T, NON-FIN (σ́), LX ≈ PR	ALIGN-STRAY (R)	*FT	PARSE-2 (F)	PARSABILITY	PARSE-σ
a. ☞ ka.tab(tá.ha)		*	*		*	**
b. ka(táb)ta.ha		*	*	*!		***
c. (kà)(táb)ta.ha	*! FT-BIN		**	*		**

By this, discussion of Cairene stress pattern is concluded. The following subsection attempts to apply the proposed account to other stress patterns.

4.3 Other Stress Patterns

In this subsection, the two stress patterns of Seminole/Creek and Hindi are analysed implementing the mono-foot analysis as a more plausible alternative to iterative footing, when no secondary stresses are attested. The two systems differ in foot form and the directionality of parsing. Such differences are accounted for by means of simple constraint interactions.

Hayes (1995) offers an analysis of the accentual pattern of simplex words in Seminole/Creek. The pattern assumes the following algorithm:

(31) Seminole/Creek

(i) *Stress a heavy ultima:*

hoktí: 'woman'

hitotí: 'snow'

(ii) *Otherwise, stress a heavy penult:*

kofócka 'mint'

akcáwhka 'stork'

(iii) *Otherwise, stress the ultima or the penult, whichever is separated by an odd number of light syllables from the first preceding heavy syllable or (if there is none) from the beginning of the word:*

iŋkosapitá 'one to implore'

ta:shokíta 'to jump *dual subj.*'

isimahicitá 'one to sight at one'

itiwanayipíta 'to tie each other'

This stress algorithm, (31 iii) in particular, suggests iambic parsing from left-to-right and rightmost word-level headedness. Such metrification requires considering a number of constraints, as follows:

(32)

PATTERN	**METRIFICATION**	**CONSTRAINT**
odd *number of* ***preceding*** *lights*	Right-headed Feet (Iambs)	RH-TYPE=**I**
from a ***preceding*** *heavy or edge*	Left-to-Right	ALIGN-STRAY (**R**)
a heavy ***ultima****, otherwise …*	Rightmost Word-headedness	PARSE-2 (**F**)

The constraint on non-finality NON-FIN is no longer ranked undominated. Final head feet, that necessitate final head syllables in iambic parsing, are not only sanctioned but favoured in Seminole/Creek. Assuming foot binarity and left-to-right iambic parsability evaluation, the foot must be as close as possible to the right edge, separated at most by a single light stray syllable. This strongly indicates ranking PARSE-2 (F) undominated. The hierarchy in (33) sums up the suggested constraint rankings for Seminole/Creek:

(33) Constraint Hierarchy for Seminole/Creek

a. Undominated Constraints:

FT-BIN, RH-TYPE=I, LX ≈ PR, PARSE-2 (F) >>

b. Dominated Constraints:

ALIGN-STRAY (R), *FT >> PARSE-2 (F) >> PARSABILITY, PARSE-σ

The tableaux in (34) below demonstrate how the proposed mono-foot account provides a plausible analysis for the stress pattern in Seminole/Creek:

(34)

(i) *A heavy **ultima***

/hokti:/	FT-BIN, RH-TYPE=I, LX ≈ PR, PARSE-2 (F)	ALIGN-STRAY (R)	*FT	PARSABILITY	PARSE-σ
a. ☞ hok(tí:)			*		*
b. (hok)(tí:)			**!		
c. (hók)ti:	*! PARSE-2 (F)		*		
d. <hokti:>	*! LX ≈ PR				

(ii) *A heavy **penult***

/kofocka/	FT-BIN, RH-TYPE=I, LX ≈ PR, PARSE-2 (F)	ALIGN-STRAY (R)	*FT	PARSABILITY	PARSE-σ
a. ☞ (ko.fóc)ka			*		*
b. ko(fóc)ka		*!	*		**
c. ko(foc.ká)	*! RH-TYPE=I	*	*		*

(iii) *An **ultima** separated by an odd number of light syllables from the first preceding heavy syllable or (if there is none) from the beginning of the word*

/iŋkosapita/	FT-BIN, RH-TYPE=I, LX ≈ PR, PARSE-2 (F)	ALIGN-STRAY (R)	*FT	PARSABILITY	PARSE-σ
a. ☞ iŋ.ko.sa(pi.tá)			*		***
b. iŋ.ko(sa.pí)ta		*!	*	*	***
c. iŋ(ko.sá)pi.ta	*! PARSE-2 (F)		*		***
d. (íŋ)ko.sa.pi.ta	*!** PARSE-2 (F)		*		****

(iv) *A **penult** separated by an odd number of light syllables from the first preceding heavy syllable or (if there is none) from the beginning of the word*

/ta:shokita/	FT-BIN, RH-TYPE=I, LX ≈ PR, PARSE-2 (F)	ALIGN-STRAY (R)	*FT	PARSABILITY	PARSE-σ
a. ☞ ta:(sho.kí)ta			*		**
b. ta:.sho(ki.tá)		*!	*	*	**
c. (tá:)sho.ki.ta	*!* PARSE-2 (F)		*	*	***

Another stress pattern that poses a challenge for the iterative footing analysis is Hindi. In his analysis of this stress system, Hayes (1995) exploits a stress rule originally proposed by Grierson (1895) and later motivated in Fairbanks (1987a, b). The pattern, where no secondary stresses are attested (cf. Kelkar 1968), assumes the following algorithm:

(35) Hindi

(iv) *Stress a heavy penult:*

asúːǰ^{h}aː	'invisible'
čúːɽaː	'bangle'

(v) *Otherwise, stress a heavy antepenult:*

bánd^{h}ana	'binding'

(vi) *Otherwise, stress the antepenult or the preantepenult, whichever is separated by an odd number of light syllables from the first following heavy syllable or (if there is none) from the end of the word:*

titáliyaː	'butterfly (long form)'
ánumati	'approval'

(vii) *Otherwise, stress a light initial syllable in disyllabic and trisyllabic words:*

bála	'force'
kálaː	'art'
áditi	'proper name'

This stress algorithm suggests moraic trochee parsing from right-to-left and rightmost word-level headedness. Such metrification may be interpreted into OT constraints, as follows:

(36)

PATTERN	**METRIFICATION**	**CONSTRAINT**
odd *number of* ***following*** *lights*	Left-headed Feet (Trochees)	RH-TYPE=**T**
from a ***following*** *heavy or edge*	Right-to-Left	ALIGN-STRAY (**L**)
a heavy ***penult****, otherwise a heavy* ***antepenult***	Rightmost Word-headedness	PARSE-2 (**F**)

The constraint on non-finality NON-FIN will be ranked undominated in the constraint hierarchy, as final head feet are never allowed in Hindi. Another issue to consider is minimal foot binarity. To assign stress to an initial light syllable in /LH/ forms, for example, the metrification process will have to erect a foot on that initial light violating any constraint that maintains minimal binarity. This footing configuration indicates ranking FT-BIN^{min} (Hewitt 1994) dominated. The hierarchy in (37) sums up the suggested constraint rankings for Hindi:

(37) Constraint Hierarchy for Hindi

a. Undominated Constraints:

FT-BIN^{max}, RH-TYPE=T, LX ≈ PR, NON-FIN>>

b. Dominated Constraints:

FT-BIN^{min} >> ALIGN-STRAY (L), *FT >> PARSE-2 (F) >> PARSABILITY, PARSE-σ

Consider the tableaux in (38) below:

(38)

(i) *A heavy* ***penult***

/asuːɟ̆ʰaː/	FT-BIN^{max}, RH-TYPE=T, LX ≈ PR, NON-FIN	FT-BIN^{min}	ALIGN-STRAY (L)	*FT	PARSE-2 (F)	PARSABILITY	PARSE-σ
a. ☞ a(súː)ɟ̆ʰaː				*	*		**
b. a.suː(ɟ̆ʰáː)	*! NON-FIN			*		*	**
c. (á)suː.ɟ̆ʰaː		*!		*	**		**

(ii) *A heavy* ***antepenult***

/bandʰana/	FT-BIN^{max}, RH-TYPE=T, LX ≈ PR, NON-FIN	FT-BIN^{min}	ALIGN-STRAY (L)	*FT	PARSE-2 (F)	PARSABILITY	PARSE σ
a. ☞ (bán)dʰa.na				*	*		**
b. ban(dʰá.na)	*! NON-FIN			*			*
c. ban(dʰá)na		*!	*	*			**

(iii) *An **antepenult** separated by an odd number of light syllables from the first following heavy syllable or (if there is none) from the end of the word*

/titaliyaː/	FT-BIN^{max}, RH-TYPE=T, LX ≈ PR, NON-FIN	FT-BIN^{min}	ALIGN-STRAY (L)	*FT	PARSE-2 (F)	PARSABILITY	PARSE-σ
a. ☞ ti(tá.li)yaː				*	*		**
b. (tí.ta)li.yaː			*!	*	*	*	**
c. (tí)ta.li.yaː		*!		*	**		***
d. ti.ta.li(yáː)	*! NON-FIN			*		*	***

(iv) *A **preantepenult** separated by an odd number of light syllables from the first following heavy syllable or (if there is none) from the end of the word*

/anumati/	FT-BIN^{max}, RH-TYPE=T, LX ≈ PR, NON-FIN	FT-BIN^{min}	ALIGN-STRAY (L)	*FT	PARSE-2 (F)	PARSABILITY	PARSE-σ
a. ☞ (á.nu)ma.ti				*	*		**
b. a(nú.ma)ti			*!	*			**
c. a(nú)ma.ti		*!		*	*		***
d. a.nu (má.ti)	*! NON-FIN			*			**

(v) *A **light initial** syllable in **disyllabic** words*

/bala/	FT-BIN^{max}, RH-TYPE=T, LX ≈ PR, NON-FIN	FT-BIN^{min}	ALIGN-STRAY (L)	*FT	PARSE-2 (F)	PARSABILITY	PARSE-σ
a. ☞ (bá)la		*	*	*			*
b. ba(lá)	*! NON-FIN	*		*			*
c. (bá.la)	*! NON-FIN			*			
d. <bala>	*! LX ≈ PR						

(vi) *A **light initial** syllable in **trisyllabic** words*

/aditi/	FT-BIN^{max}, RH-TYPE=T, LX ≈ PR, NON-FIN	FT-BIN^{min}	ALIGN-STRAY (L)	*FT	PARSE-2 (F)	PARSABILITY	PARSE-σ
a. ☞ (á.di)ti			*	*			*
b. a(dí)ti		*!	*	*			**
c. (á)di.ti		*!		*	*		**
d. a(dí.ti)	*! NON-FIN			*			*

5 Conclusion:

The objective was to deny any environment for unattested secondary stressing in languages whose stress patterns may seem to require iterative parsing. The mono-foot assumption attains that by maintaining both prosodic licensing and minimal (metrical) structure. This balance is effected with interaction between the constraints LX ≈ PR and *FT. However, avoiding multiple footing in a non-serial framework calls for adopting the alternative notion of Parsability. Through the constraint PARSABILITY, it produces the rhythmic effect necessary to pinpoint the appropriate string for footing in languages like Cairene, Seminole/Creek, and Hindi. This notion is then extended to word-level headedness and directionality, to force parsing at a designated edge and to keep unparsable elements on the peripheries. Parsed initial or final sequences of stress units are demonstrated to be the most harmonious satisfiers of the constraint PARSE-2 (I/F). This, consequently, shows that stress is attracted to either of the two edges. Also, imposing peripherality of stray (unparsable) elements, via the constraint ALIGN-STRAY (L/R), reveals the directionality of parsing. Only in left-to-right footing, for example, a rightmost stray syllable may not be included in a preceding foot.

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