

## Sympathetic Stress

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### Abstract

A phonological process is opaque if its triggering environment is not apparent in the phonological output. The placement of main stress in Cairene Classical Arabic exhibits opacity since it crucially relies on prosodic structure that does not appear in the surface form. While McCarthy's (1998a) Sympathy Theory is a response to explaining opacity within parallel Optimality Theory, it is demonstrated that it cannot account for Cairene Classical Arabic stress. To resolve this, it is argued that Sympathy must be extended; specifically, markedness constraints must be able to select the sympathetic form (i.e. the form that approximates the intermediate stage in a serial derivation).

**Keywords:** stress, opacity, Optimality Theory, Sympathy Theory, Cairene Classical Arabic.

## Sympathetic Stress\*

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### 1 The Problem: Opacity in Cairene Classical Arabic

The location of main stress in Cairene Classical Arabic can be explained if trochaic feet are constructed exhaustively from left to right (McCarthy 1979a). Main stress is then placed on the foot closest to the right edge, with the proviso that the final syllable cannot be stressed.<sup>1</sup> However, while foot structure is crucial to this analysis there are no secondary stresses to support its existence.

Both the fully footed form and the actual phonetic form are given in the examples below. As indicated, the heads of non-primary feet (marked with a grave accent `) are not realised with any stress.<sup>2</sup> The examples are in four groups: those with (I) all light (CV) syllables, (II) initial heavy syllables, (III) medial heavy syllables, and (IV) final heavy syllables.

	<u>Footed Form</u>	<u>Actual Stress</u>	<u>Gloss</u>
(I)	(ká.ta)(bà) (ǰā.dʒa)(rá.tu)(hù)	[kátaba] [jadʒarátuhu]	'he wrote' 'his tree'
(II)	(ka:)(tá.ba) (mùn)(tá.xa)(bà)	[ka:tába] [muntáxaba]	'to keep up a correspondence' 'elected (pausal)'
(III)	(kà)(táb)(tà) (mù)(qà:)(tí.la)	[katábtá] [muqa:tíla]	'you (m.sg.) wrote' 'fighter (pausal)'

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<sup>1</sup> This description only holds for words without superheavy syllables; superheavy syllables are always final and always attract main stress – see §3.3 for discussion. For descriptions and analyses of Cairene Classical Arabic stress see Harrell (1957, 1960), Langendoen (1968:102), Allen (1973), Mitchell (1956, 1960, 1975), McCarthy (1979a,b), Welden (1980), Kenstowicz (1980), Harms (1981), Hayes (1981, 1995:67-71), Prince (1983), Selkirk (1984), Halle & Vergnaud (1987:60-63), Halle (1991), and Crowhurst (1996). Data is taken from Mitchell (1975).

<sup>2</sup> Welden (1980) claims that there is phonetically overt secondary stress, but this is disputed (McCarthy p.c.). In any case, Welden's (1980) observations are different from those expected given left to right trochaic footing (noted in Hayes 1995:71, also see Halle & Vergnaud 1987:60, cf Harms 1981).

- (IV) (ká)(tàb) [kátab] ‘write’  
 (ǰā.dʒa)(rá.tu)(hú)(mà:) [ǰadʒaratuhúma:] ‘their (dual) tree’  
 (?àd)(wi.ja)(tú.hu)(mà:) [ʔadwijatúhuma:] ‘their (dual) drugs’

A number of researchers have taken the lack of secondary stresses to indicate that there are no feet in the phonological output (Halle & Vergnaud 1987, Halle 1991, Crowhurst 1996). However, this is at odds with the need for a fully footed form to locate main stress in the first place.

One mechanism that has been used to explain this conundrum in serial derivational theories is conflation (Halle & Vergnaud 1987: 50-55, Halle 1991, Halle & Kenstowicz 1991:462). Conflation is the elimination of a prosodic tier, such as the Foot tier. In Cairene Classical Arabic, feet would be constructed from left to right, main stress would be assigned, and then the foot tier would be eliminated by conflation, effectively expunging all secondary stresses and leaving only the main stress. Conflation requires at least three levels of representation: the underlying form, the fully prosodified intermediate form, and the conflated output.

This process can be identified with a more general phonological phenomenon – opacity. Using Kiparsky’s (1971, 1973:79) formulation of opacity, a rule of the form A→B/C\_D is opaque if there are surface structures with B, where B has been derived by that rule yet occurs in an environment other than C\_D. In other words, a rule has applied in the course of derivation, but its environment is not visible in the surface representation. In Cairene Classical Arabic, the main-stress rule is opaque since it crucially refers to foot structure that does not appear in the surface form.

It has been pointed out on numerous occasions that such processes pose a significant problem for parallelist Optimality Theory (OT – Prince & Smolensky 1993) since they seem to require reference to an intermediate level of representation (see references in McCarthy 1998a: §1, as well as many of the articles in Roca 1997). This challenges the parallelist assumption that the only significant representations are the Input and Output.

The aim of this article is to provide a solution to the problems posed for parallel OT by the opaque process of main stress placement in Cairene Classical Arabic. To do this, McCarthy’s (1998a) approach to opacity – Sympathy Theory – will be adopted. However, it is argued that McCarthy’s theory must be extended to account for the case under consideration.

Section 2 introduces Sympathy Theory and illustrates how it deals with opacity within OT. In section 3 it is shown that Sympathy Theory cannot account for Cairene Classical Arabic stress. However, it is argued that an extension of Sympathy – permitting markedness constraints to be sympathetic selectors – does offer an explanation for this phenomenon. This proposal supports similar

conclusions made by Itô & Mester (forthcoming) on very different grounds (i.e. with regard to truncation patterns in German). Section 4 discusses alternative solutions as well as some empirical implications of this proposal.

## 2 Sympathy

A typical case of opacity is illustrated in the following forms from Tiberian Hebrew (McCarthy 1998a):<sup>3</sup>

- (2) a. Epenthesis into final clusters:  
 e.g. /melk/ → [melex] ‘king’  
 b. ?-Deletion in codas:  
 e.g. /qaraʔ/ → [qārā] ‘he called’  
 c. Epenthesis, followed by ?-Deletion:  
 /deʃʔ/ → deʃeʔ → [deʃe] ‘tender grass’

Epenthesis is triggered by a constraint against tautosyllabic consonant clusters – \*COMPLEX, and ?-deletion is triggered by a constraint banning glottal stops in codas – CODACOND.

In (c), the underlying final consonant cluster /ʃʔ/ triggers epenthesis of e (epenthetic vowels are marked with underlining). However, due to the ensuing deletion of /ʔ/ the environment that triggers epenthesis – i.e. a final consonant cluster – is not apparent in the output form. This means that epenthesis is an opaque process. This case is somewhat similar to stress placement in Cairene Classical Arabic (CCA). In both cases, the output is missing structure that triggered some process. In Hebrew, the lack of a coda in the output renders epenthesis opaque while in CCA the lack of feet means that main stress placement is not transparent.

This poses a problem for standard Optimality Theory. In the Tiberian Hebrew case, for deʃe to be the output there can be no other candidate that fares better than it in terms of markedness and faithfulness. For markedness, though, the alternative candidate deʃ does equally well, avoiding both \*COMPLEX and

<sup>3</sup> The case presented here is intended as an illustration of the basic workings of Sympathy Theory, and not as an in-depth analysis of Tiberian Hebrew phonology. See McCarthy (1998a) for details.

CODACOND violations.<sup>4</sup> So, for *deʃe* to be output, it must beat its competitor *deʃ* in faithfulness. However, there is no dimension in which *deʃ* is more faithful to the input than *deʃe*; both candidates lack a correspondent for underlying /ʃ/ in the Input→Output relation (i.e. both incur equal violations of MAX-IO). In fact, *deʃe* is eliminated as a possible output when the Output→Input relation is considered: there is no underlying correspondent for the *e* in *deʃe*, so violating DEP-IO. On the other hand, every segment in *deʃ* has an underlying correspondent, so satisfying DEP-IO. This means that *deʃe* cannot be the most harmonic form on faithfulness grounds, and therefore cannot be the most harmonic form overall – its competitor *deʃ* is incorrectly predicted to be the output.

The failure of classical OT to account for the Hebrew case can be attributed to the lack of formal recognition given to the form that is the intermediate representation in serial analyses – i.e. *deʃeʔ*. If it were possible to refer to such a form, a ranking with *deʃe* as the output would be possible. This would be accomplished by a faithfulness constraint that compared the output to *deʃeʔ*. Such a constraint would prefer *deʃe* over its competitor *deʃ* because *deʃe* is more like the intermediate form *deʃeʔ* than *deʃ* is.

Sympathy Theory (ST) remedies this problem by giving formal status to the form that approximates the intermediate representation in a serial derivation without recourse to serialism. In ST, this candidate is termed the sympathetic form, and is distinguished by the fact that it does not violate a designated constraint – the selector – and least-violates the remaining constraints in the hierarchy.<sup>5</sup>

For Tiberian Hebrew, the selector is MAX-IO “For every segment in the input, there is a corresponding segment in the output”, and is marked with ‘★’ below. The following tableau shows the role of this constraint in identifying the sympathetic form:

<sup>4</sup> Violations of other potentially significant markedness constraints (e.g. NOCODA) are irrelevant since their effects do not show up in other output forms, indicating that they are outranked by faithfulness constraints.

<sup>5</sup> Not all constraints are considered in determining the sympathetic form: constraints that refer to sympathetic candidates are ignored otherwise this would lead to circularity. See McCarthy (1998a) for discussion.

(3) **Tableau 1: Selecting the Sympathetic Form**

/deʃʔ/	★ MAX-IO	*COMPLEX	CODACOND
deʃ	x	x	
deʃe	x		
deʃʔ		x	x
☉ deʃeʔ			x

The symbol | marks a fatal violation with respect to choosing the sympathetic candidate. The candidates *deʃ* and *deʃe* are ruled out immediately since they violate the selector MAX-IO, which the sympathetic candidate must not violate. This leaves the candidates *deʃʔ* and *deʃeʔ*. The remaining constraints decide between these two. The ‘epenthesis-triggering’ constraint \*COMPLEX is crucial in this regard: as shown in the tableau, *deʃʔ* violates this constraint whereas *deʃeʔ* does not. This means that *deʃeʔ* is the sympathetic form, as indicated by ‘☉’.

Once the sympathetic form has been identified, it is a straightforward matter to achieve the correct output. As noted above, the actual output *deʃe* is more faithful to the sympathetic form than is its competitor *deʃ*. So, the constraint MAX-☉ “Every segment in the sympathetic candidate has a correspondent in the output” is violated less by *deʃe* than *deʃ*. This is illustrated in the following tableau:

(4) **Tableau 2: Determining the Output with Sympathy**

/deʃʔ/	CODACOND	*COMPLEX	MAX-☉	★ MAX-IO
a. deʃ			x x!	x
☉ b. deʃe			x	x
c. deʃʔ	x!	x	x	
☉ d. deʃeʔ	x!			

As discussed above, since candidates (a) and (b) violate the selector constraint MAX-IO they are eliminated as potential sympathetic forms. Of the remaining candidates, (c) is less harmonic than (d) with respect to the remaining constraints so (d) must be the sympathetic form. Identification of the output form is now straightforward: only (a) and (b) do not violate any markedness constraints, and (b) is more faithful to the sympathetic form than (a). Hence, (b) is the output.

McCarthy (1998a) hypothesises that the selector constraint must be a faithfulness constraint: i.e. a constraint that refers to Input-Output correspondence relations, such as is the case with MAX, DEP, and IDENT (McCarthy & Prince 1995).

This makes a fairly obvious prediction: in all cases of opacity, the sympathetic form is more faithful (in some way) to the input than the output is. For example, in the Hebrew case the sympathetic *deʃeʔ* is more faithful to the input /deʃʔ/ than *deʃ* is in terms of MAXIO.

The sympathetic form cannot be less faithful to the input than the output is. If this were so, it would be impossible to identify a faithfulness constraint to act as the selector. The sympathetic form cannot even be equally as faithful as the output with respect to every faithfulness constraint. If this were so, the sympathetic form and the output would fare equally well on the selector. It would then be up to the remaining constraints to choose between them to determine which is the sympathetic candidate. Since the actual output must satisfy the remaining constraints better than any other form (trivially, since it is the output), the output would also be the sympathetic candidate. However, if the output is the sympathetic candidate, the process is not opaque.

The fact that McCarthy's theory predicts that the sympathetic form must be more faithful to the input than the output in some way will be crucial in demonstrating the need for markedness constraints as selectors, as shown in the next section.

### 3 Extended Sympathy Theory

Before a Sympathetic analysis of CCA stress is presented, it is well to consider why standard OT cannot account for this case. As argued by Halle & Vergnaud (1987), Halle (1991), Crowhurst (1996), and shown in §1, main stress placement crucially relies on an exhaustive parsing of syllables into feet. Exhaustive parsing implies that a constraint that demands foot structure must outrank every constraint that militates against that structure. For example, the constraint PARSE-σ (Prince & Smolensky 1993), which requires that every syllable be parsed into a foot, must outrank \*Ft, which bans foot structure.<sup>6</sup> On the other hand, the actual output forms show a distinct sparseness of foot structure: only the head foot is present. This can only be the case if a constraint that is against foot structure outranks all

<sup>6</sup> \*Ft is a member of the \*STRUC family of constraints (Zoll 1992 *cit* Prince & Smolensky 1993:25). Assuming a principle of Headedness, \*Ft will always be violated at least once since every PrWd must contain at least one foot (Itó & Mester 1992, Selkirk 1995). Also, it has been suggested that ALIGN(Ft, L, PrWd, L) could take the place of \*Ft. This is not so in the present case since ALIGN(Ft, L, PrWd, L) cannot distinguish between a form with only one non-leftmost foot (e.g. *ka:(tába)*) and a form with both a leftmost foot and a non-leftmost foot (e.g. *(kà):(tába)*). This distinction is crucial, as will become evident in the analysis of CCA stress in §3.3.

those that induce it. Hence, \*Ft must outrank PARSE-σ. At this point, we have reasoned into a ranking paradox: \*Ft must both outrank and be outranked by PARSE-σ. This result indicates that an alternative explanation is necessary – Sympathy.

### 3.1 Extended Sympathy: Markedness Constraints as Selectors

As shown in §2, the sympathetic candidate approximates the role of the intermediate level in a serial derivation. So, to apply this theory to Cairene Classical Arabic stress, the sympathetic candidate must be fully footed. The output refers to this footing in order to place main stress. In the case of *ka:tába*, for example, the input is /ka:taba/, the sympathetic candidate is ☉(*kà:)(tába*) and the actual output is *ka:(tába)*. The location of the actual output's main stress is determined by referring to that of the sympathetic candidate:

(5) ☉O-IDENT-σ:

“If *x* corresponds to *y* (*x* ∈ Sympathetic form, *y* ∈ Output) and *x* is dominated by a main stressed syllable, then *y* is dominated by a main stressed syllable.”

This constraint requires the location of the main stressed syllable to be the same in both the output and the sympathetic candidate.<sup>7</sup>

It remains to show how the sympathetic candidate is determined. Since the sympathetic candidate must be fully footed, the most straightforward proposal would be that the selector constraint enforces exhaustive footing. The obvious choice for this is PARSE-σ “Every syllable must be dominated by some foot”. The following tableau illustrates PARSE-σ's role as the sympathetic selector.

(6) **Tableau 3: Outline of a Sympathetic Analysis of CCA Stress**

/ka:taba/	☉O-IDENT-σ	*Ft	✱ PARSE-σ
☉ a. ka:(tába)		x	x
b. (ká:)taba	x !	x	x x
☉ c. (kà:)(tába)		x x !	

<sup>7</sup> This constraint is of the positional faithfulness type (Beckman 1998, Alderete forthcoming). IDENT-σ is not unique to the Output☉ dimension. For example, it can be used on the input-output dimension to require preservation of the location of underlying stress in languages with lexically-marked stress (see Kager 1995 for a similar constraint).

As mentioned above, \*O-IDENT-σ ensures that the location of main stress is the same on the sympathetic form and the output. The ranking of \*Ft above PARSE-σ is crucial in banning foot structure in the output.

Only candidate (c) satisfies the selector constraint PARSE-σ since it alone is fully footed, effectively ensuring its identity as the sympathetic candidate.<sup>8</sup> However (c) fares badly with regard to \*Ft, eliminating it as a potential output. This leaves (a) and (b). The crucial constraint in this regard is O-IDENT-σ. Since (b) does not have stress in the same location as the sympathetic candidate, (a) is the most harmonic form.

PARSE-σ must be ranked below \*Ft, otherwise the output would be fully footed. However, \*Ft does not affect the choice of sympathetic candidate due to the fact that the selector constraint – PARSE-σ – is antagonistic to it. In other words, \*Ft and PARSE-σ incur near complementary violations: for PARSE-σ to be satisfied, \*Ft must be violated and vice-versa.<sup>9</sup> In fact, this is a common factor to all sympathetic analyses: the requirement that the selector must be least-violated by the output form has an effect that is tantamount to re-ranking it above every other constraint. Hence, the influence of any antagonistic constraints, even if they are actually higher-ranked than the selector, is effectively nullified.

This antagonism supports the choice of PARSE-σ as the selector. The selector must be a constraint that directly induces footing on the sympathetic form. If this was not so, the fact that \*Ft outranks PARSE-σ would force the sympathetic form to be minimally footed.

In this section it has been demonstrated that using the markedness constraint PARSE-σ as the selector achieves the correct results. However, this challenges McCarthy's (1998a) claim that only Input-Output faithfulness constraints can be selectors. This raises the question of whether it is possible to reanalyse CCA stress using a faithfulness constraint as the selector. This issue is addressed in the next section.

### 3.2 Faithfulness Constraints as Selectors

In ST, it is stipulated that only faithfulness constraints can be selectors. As pointed out in §2, one result of this is that the sympathetic form must be more harmonic

<sup>8</sup> Other fully footed candidates (e.g. *(ká:)(tába)*) are ruled out by constraints on foot structure (discussed in §3.3).

<sup>9</sup> In any opaque interaction the selector must be in an antagonistic relation with a higher ranked constraint. If this were not so, the sympathetic candidate and the output candidate would be the same and the process would not be opaque.

with respect to some faithfulness constraint than the output is. This leads us to ask a relatively simple question: in what respect is a fully footed candidate more faithful to the input than a minimally footed one?

The answer is that it is not: the proliferation of prosodic structure on a form has no relevance to input-faithfulness. If anything, a fully footed form violates DEP-IO more than a minimally footed one since there are more prosodic nodes without underlying correspondents, if DEP can refer directly to prosodic structure.<sup>10</sup>

So, the selector cannot be a faithfulness constraint in Cairene Classical Arabic; the only alternative is to use a markedness constraint. §4 discusses the empirical and theoretical implications of this extension to Sympathy Theory. The following section fills in the details of the analysis of CCA stress, essentially explaining how the sympathetic candidate comes to have the form that it does.

### 3.3 Details

The following is significantly indebted to Crowhurst's (1996) analysis of CCA stress. Although the premises behind her analysis are significantly different from this one (see §4), the constraints used here are identical to those employed in her analysis.<sup>11</sup> The main difference is in the directionality effects: whereas Crowhurst employs ALL-Ft-R to achieve 'left-to-right' footing, the constraint CLASH will be used in this analysis:

- (7) CLASH                      Stressed syllables must not be adjacent.  
(Prince 1983, Selkirk 1984)

The constraints \*Ft and \*O-IDENT-σ have been introduced in previous sections.

<sup>10</sup> From another point of view, in order for an Input-Output faithfulness constraint to select a fully footed sympathetic candidate, the input would have to be fully footed. This is tantamount to claiming that Cairene Classical Arabic stress is lexically specified, and therefore unpredictable. Since it is predictable, the input's prosodic structure cannot be fixed (due to the principle of Richness of the Base – Prince & Smolensky 1993:191).

<sup>11</sup> One exception is in terminology: the more standard name 'PARSE-σ' is used in place of Crowhurst's 'σ-TO-FOOT'.

Since the output form has only one foot, the ranking [ $*\text{Ft} \gg \text{PARSE-}\sigma$ ] must obtain:

(8) **Tableau 4:**  $*\text{Ft} \gg \text{PARSE-}\sigma$ : The output has minimal foot structure.

/ka:tába/	$*\text{Ft}$	$\text{PARSE-}\sigma$
$\text{ka:}(\text{tába})$	x	x
$(\text{kà:})(\text{tába})$	x x!	

The remaining rankings serve to correctly foot the sympathetic candidate. Since oversize feet are absolutely banned in CCA,  $\text{FtMAX}$  – a constraint limiting foot size to two moras – is undominated. On the other hand, as Crowhurst points out, undersize (degenerate) feet are permitted: (*ǰádʒa*)(*rátu*)(*hú*)(*mà:*) ‘their (dual) drugs’. This is due to the ranking [ $\text{PARSE-}\sigma \gg \text{FtMIN}$ ] – the need to fully parse syllables into feet ( $\text{PARSE-}\sigma$ ) outranks any desire to avoid mono-moraic feet. As a final note on foot form, feet are always trochaic in CCA, hence  $\text{TROCHEE}$ , requiring leftmost position of the foot-head in a foot, is undominated.

Turning to stress, since main stress never falls on the final syllable  $\text{NONFINALITY}$ , which bans final stressed syllables, outranks  $\text{MAINSTRESSR}$  (which demands a rightmost main stress).  $\text{O-IDENT-}\sigma$  must also outrank constraints on foot form and stress placement, especially  $\text{MAINSTRESSR}$  and  $\text{FtMIN}$ . If this were not so, main stress on the output would appear at the right-edge of the syllable, not on a location corresponding to the sympathetic candidate’s main stress, and degenerate main stress feet would not be permitted in the output (cf *ǰaʒaratu(hú)ma:*).

There is one final ranking: [ $\text{CLASH} \gg \text{MAINSTRESSR}$ ]. This is necessary to achieve the correct stress on odd-parity light-syllable words:

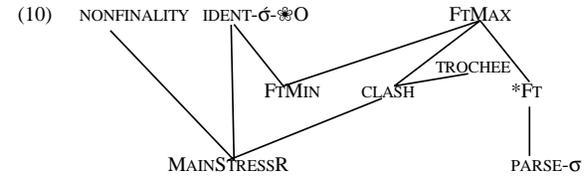
(9) **Tableau 5:**  $\text{CLASH} \gg \text{MAINSTRESSR}$ : Avoiding clash is more important than having a rightmost head syllable.

kataba	$\text{CLASH}$	$\text{MAINSTRESSR}$
$(\text{kà})(\text{tába})$	x!	x
$(\text{káta})(\text{bà})$		x x

One result of this constraint system is that there is no need to invoke a constraint on the ‘direction’ of footing, such as  $\text{ALIGN}(\text{Ft}, \text{L}, \text{PRWD}, \text{L})$  (McCarthy & Prince 1993). The correct footing falls out from the constraint ranking due to the influence of  $\text{TROCHEE}$  – requiring trochaic form – and  $\text{CLASH}$ . If  $\text{TROCHEE}$  is obeyed absolutely, then clash results if feet are ‘constructed from right-to-left’ (i.e.

if the degenerate foot is leftmost): e.g.  $(\text{kà})(\text{tába})$ . To obey both  $\text{TROCHEE}$  and  $\text{CLASH}$  the degenerate foot must appear rightmost, giving the sense of left-to-right footing:  $(\text{káta})(\text{bà})$ .

The following diagram summarises the rankings:<sup>12</sup>



A representative example is *kataba* ‘he wrote’. In the following tableau, the undominated constraints  $\text{NONFINALITY}$ ,  $\text{TROCHEE}$ , and  $\text{FtMAX}$  are excluded for the sake of brevity – only candidates that do not violate these constraints will be considered:

(11) **Tableau 6**

/kataba/	$\text{O-IDENT-}\sigma$	$\text{FtMIN}$	$\text{CLASH}$	$*\text{Ft}$	$\text{MAINSTRESSR}$	$\text{PARSE-}\sigma$
$\text{a.}(\text{káta})\text{ba}$				x	x x	x
$\text{b.}(\text{kà})(\text{tába})$	x !			x	x	x
$\text{c.}(\text{kà})(\text{tába})$	x !	x	x	x x	x	
$\text{d.}(\text{ká})(\text{tába})$		x !	x	x x	x x x	
$\text{e.}(\text{káta})(\text{bà})$		x !		x x	x x	

The correct output *kátaba* is identified due to the fact that its main stressed syllable is in the same location as in the sympathetic candidate (i.e. over the substring *ka*). Candidates (b) and (c) are eliminated since their main stress is not in the same location. Candidates (d) and (e) fail for another reason: they contain more feet than (a), incurring greater violations of  $*\text{Ft}$ .

<sup>12</sup> In the preceding text, it was not demonstrated that constraints of the topmost rank ( $\text{NONFINALITY}$ ,  $\text{TROCHEE}$ , and  $\text{FtMAX}$ ) necessarily outranked the other constraints. However, the rankings given here are essential:  $\text{FtMAX}$  outranks  $\text{FtMIN}$  since oversize feet are banned whereas degenerate feet are not; it outranks  $*\text{Ft}$  since oversize feet are not preferred over feet *per se*; it outranks  $\text{CLASH}$  since oversize feet are not employed to avoid clash in sequences of heavy syllables.

As for the determination of the sympathetic candidate, candidates (a) and (b) are immediately excluded as they are not most harmonic with respect to the selector PARSE-σ: both (a) and (b) have unfooted syllables. Of the remaining candidates, all have the same number of feet (so violating \*Ft equally) and all have degenerate feet (so violating FTMIN). The major difference between them is that candidate (e) has ‘left-to-right’ footing, whereas candidates (c) and (d) have ‘right-to-left’ footing, so incurring a CLASH violation. This leaves (e) as the sympathetic candidate.

As a final note, Cairene Classical Arabic stress is also remarkable for its superheavy syllables (i.e. CV:C and CVCC syllables). In a word with a superheavy syllable – which may only appear finally – that syllable is stressed. A variety of explanations have been offered for this (McCarthy 1979b, Halle & Vergnaud 1987, Hayes 1995, de Lacy 1997). The particular solution adopted is not likely to affect the analysis developed herein in any significant way. The main focus of this analysis is that non-surface-present feet influence the output form; superheavy syllables in no way perturb this fact.

#### 4 Alternatives and Implications

There have been alternative proposals for the opacity problem presented by Cairene Classical Arabic stress that have not employed a derivational solution. One idea is that all words in CCA are fully footed but non-head feet are not phonetically interpreted (see Hayes 1995: 119 for discussion). Representational solutions have also been proposed. Some have suggested that certain feet may lack heads; hence, a word may be fully footed yet there would be no phonetic evidence of this since stress is assigned to heads (Bye 1996, Crowhurst 1996, Crowhurst & Hewitt 1995, Hewitt 1992, Hung 1994). In the CCA case, only the main stress foot would have a head, while all other feet would lack heads. Another approach is to allow multiple co-present autosegmental planes: one would be fully footed but phonetically unrealised and the other would refer to the fully-footed plane to locate its stress (Rappaport 1984, Halle & Vergnaud 1987, Parker 1998). These proposals are non-trivial extensions of representation and of the interpretative system. The aim in this paper has been to hold representational assumptions to a minimum. This predicts that every case of reference to ‘covert’ prosodic structure is opacity, and such cases can be explained in a manner analogous to CCA stress.

Certainly, CCA is not alone in this regard. While it is perhaps the best known cases of ‘covert’ prosodic structure, it is certainly not unique. Another language that refers to non-surface-present prosodic structure in placing accent is

Seminole/Creek (Haas 1977, McCarthy 1979b, Hayes 1995:64-67). There are also a number of cases of vowel reduction that refer to non-surface-present feet, as documented for Tiberian Hebrew (Prince 1975, McCarthy 1979a, Rappaport 1984, Halle & Vergnaud 1987, Churchyard 1990) and Yawelmani (Archangeli 1984). Yidin’ exhibits a case of vowel lengthening that is conditioned by covert foot structure (Hayes 1982) and there are cases where deletion, allomorphy and epenthesis are sensitive to foot structure that does not match that seen on the surface (Winnebago – Halle & Vergnaud 1987, Capanahua – Loos 1969, Shipibo – Lauriault 1948, and Huariapano – Parker 1998).<sup>13</sup> Hence, the analysis presented herein offers an approach to accounting for these cases: reference to a footed sympathetic candidate would provide an explanation for these phenomena. More generally, many cases that are dealt with in derivational theories by conflation or by positing multiple planes (Rappaport 1984, Keyser & O’Neill 1985:6-12, Parker 1998) are likely to be amenable to an Sympathy analysis with markedness constraints as selectors.

In addition, covert prosodic structure is not limited to feet. Cases of syllable-based opacity such as Spanish s-aspiration and n-velarisation could be approached by positing a sympathetic candidate that is syllabified differently from the output form (Harris 1993:182).

Even though these cases cannot be explored here, it is evident that sympathetic markedness constraints open up a range of possibilities for explaining phenomena that otherwise pose significant difficulties for parallelist OT and standard Sympathy Theory. With this range of phenomena in mind, extending Sympathy Theory to allow markedness constraints as selectors is desirable from an empirical point of view. Conceptually speaking, the proposed extension is also desirable since it removes the stipulation that selectors may only be faithfulness constraints.<sup>14</sup>

<sup>13</sup> I am indebted to Steve Parker for bringing Capanahua, Shipibo, and Huariapano to my attention.

<sup>14</sup> See McCarthy (1998b) for some discussion of the ramifications of this proposal.

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