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Cairene Arabic Word Stress: A Constraint-Based Analysis

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ABSTRACT

This paper is an account of Cairene Arabic word-stress patterns in a constraint-based framework (Prince and Smolensky 1993, McCarthy and Prince 1993a, b). In order to do just that, we demonstrate two things: (1) the set of constraints whose violations yield sub-optimal forms, and (2) the relative ranking of these constraints. It is shown that the constraints whose violation may yield incorrect stress patterns in Cairene Arabic are Lx=Pr, PARSE-σ, MAIN-RIGHT, ALL-FEET-LEFT, TROCHAIC, NONFINAL, and FOOT BINARITYμ. We also show that, for Cairene Arabic word-stress placement purposes, the relative ranking of these universal and violable constraints is as follows: TROCHAIC, MAIN-RIGHT, Lx=Pr, PARSEσμμμ >> NONFINAL >> PARSEσμμ >> FOOT-BINARITYμ>> ALL-FEET-LEFT >> ALL-FEET-RIGHT. Adopting claims made in Al-Jarrah (2002), the present study departs from other analyses of Arabic word stress in at least two things. First, it is argued that NONFINAL is an effect of parsibility, not "a substantive stress-specific constraint" (See Prince and Smolensky 1993: 42; Crowhurst 1996: 415; Hyde 2003: 2). And second, the discussion provides evidence that some constraints can be relativized, namely relativizing PARSE-σ to syllable weight.

Keywords: Cairene Arabic, Arabic word stress, Optimality Theory, Constraint ranking.

1. INTRODUCTION

Word stress in Arabic in general and in Cairene Arabic in particular has been studied extensively in a number of typological investigations of stress (cf. Cf. Mitchell 1960; 1975; Langendoen 1968; Brame 1971, 1973, 1974; McCarthy 1979b; Welden 1980; Al-Ghazo 1984; Al-Mozainy et al. 1985; Al-Sughayer 1990; Hung 1995; Crowhurst 1996; Al-Jarrah 2002; Abu-Abbas 2003; Al-Mohanna 2005). However, most of these investigations were carried out in pre-optimality frameworks. By situating the proposed analysis in the context of other accounts of Cairene Arabic stress, this paper, we claim, presents a more fully developed proposal to divide the parse-syll constraints into a family of constraints differing in the weight of the syllable to which they refer.

Word stress in Cairene Arabic(1) falls into one of three categories: ultimate, penultimate and antepenultimate stress. Cairene Arabic word stress, then, never falls on a pre-antepenultimate syllable. Based on data from Mitchell (1960), Langendoen (1968: 102) states the general principles governing the distribution of stressed and unstressed syllables in Cairene Arabic as produced by educated natives of Cairene Arabic as in (1) below:

(1)

Ulimate: "Main word stress falls on the last syllable of the word iff (if and only if) it is superheavy", i.e., /cvcc/ or /cvvc/ (e.g. kaTABT, *dukKAAN, baBEEN,* ħasaNEIN, sakaKIIN etc.)

Penultimate: "If the final syllable is not superheavy, stress goes to the penult if it is heavy", i.e., /cvc/ or /cvv/ (e.g BEItak, ʕaMALti, maKAAtib, *kaTABna, muDARris,* etc.)

Antepenultimate: "If the final syllable is not superheavy, and if the penult is not heavy, stress falls on either the penult or the antepenult whichever is separated from a preceding heavy syllable (or word boundary) by an even number of light syllables, including zero" (e.g., *KAtaba, yikTIbu, makTAbah (makTAba), muxTAlifa, kataBAtaa, šajarah (*šagara*), šajaratuhu,* ?*adwiyatuhumaa*, ?Abadan etc.)

In this paper, I undertake the task of accounting for these completely regular stress patterns(2) in a constraint-based framework. In order to do that, we need to find out the constraints whose violations yield suboptimal forms, and how these constraints are ranked relative to each

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other. The major contributions of this paper are two. First, it offers a uniform account for the "the rejection of stress by heavy antepenults" when in fact a heavy syllable is stressed in penult position - a state of affairs which McCarthy (1979b: 446) considers 'genuinely anomalous'. Second, it posits a set of moraic-sensitive Parse constraints to derive the attraction of stress by final superheavy syllables.

2. SET OF CONSTRAINTS

The following constraints, we hypothesize, are high-ranking in Cairene Arabic. That is, violation of any of them yields an incorrect stress pattern:

(2)

Lx = Pr	every lexical word must consist of a prosodic word, …e.g. (min) >min (from)
NONFINAL	the final syllable should not be parsed into a higher prosodic structure e.g. (kita)(bu)hum > (kita)(bu)(hum) (their book)
PARSE-σ	a syllable must be parsed into a higher prosodic structure (i.e. a foot) e.g. (kitaa)(bu)hu > (kita)buhu (his book)
MAIN-RIGHT	align the head-foot with the word, on the right edge, e.g. (ki)(TAAB) > (KI)(taab) (a book)
ALL-FEET-LEFT	align each foot with the word, on the left edge, e.g. (kita)(bu)hu > (ki)(tabu)hu (his book)
TROCHAIC	align the head-syllable with its foot, on the left edge, e.g. (šaja)(ratu)hu > (šaja)(ratu)hu (his tree) e.g. (šaja)(ratu)hu > (šaja)(RAtu)hu (his tree)
FOOT BINARITY	feet are binary under a moraic analysis e.g. (šaja)(ratu)hu > (ša)(ja)(ra)(tu)hu (his tree) e.g. (mak)(TUU)bun > (MAktu)bun(3) (a letter)

In the next section, we turn to find out how these constraints are ranked relative to each other.

3. CONSTRAINT INTERACTION IN CAIRENE ARABIC

3.1 Minimality Requirement

According to Al-Jarrah (2002), a Cairene Arabic monosyllabic word consists of a heavy ($\sigma_{\mu\mu}$) syllable, or superheavy syllable ($\sigma_{\mu\mu\mu}$), or two light syllables, but never a light syllable (σ_{μ}). Consider the words in (3) below:

(3) a. min, fii "from"
b. ?umm "mother"
c. kana "was"
*d. mi, fi _____

Words such as those in (3a,b and c) above are, then, possible (and in fact actual) Arabic words, but those in (3d) are not. Al-Jarrah (2002) argues that 'this minimality requirement is entailed by the interaction of two constraints, namely FOOT-BINARITYμ and Lx=Pr:

Lx = Pr every lexical word must consist of a prosodic word.

FOOT-BINARITYμ feet are binary at the moraic level

In pre-Optimality literature, the requirement of Lx = PR is formulated as a restriction on extrametricality (Hayes 1979, 1995; Hammond 1999); that is, extrametricality is blocked "if it would render the entire domain of the stress rules extrametrical" (see Hung 1994: 7). In OT, this is discussed under the notion of "Blocking" (see Prince and Smolensky 1993: 33). Unfooting the lexical word (or any part of it) suggests that it surface unstressed (see candidate c in tableau 1 below). This would run contrary to the assertion that each and every word must be stressed in Cairene Arabic. Lx=Pr is statisfied if at least one metrical foot is erected over the word. As for the size of that foot, FOOT-BINARITY comes into play. We suggest that FOOT-BINARITY be interpreted here under a moraic analysis, which basically means that a metrical foot consists of exactly two moras ($\mu\mu$). As a result, a single heavy syllable ($\sigma_{\mu\mu}$) constitutes a foot of its own, and two successive light syllables ($\sigma_{\mu}\sigma_{\mu}$) pair up together to make one foot (for details on the bimoraic Minimality requirement in Cairene Arabic and other colloquial varieties of Arabic, see McCarthy and Prince 1990).

According to Hayes (1987, 1991, 1995), this parse is called the moraic trochee. For stress placement purposes in Cairene Arabic, we argue that parses like (HL) or (LH) are totally lacking. In addition, we believe that splitting a heavy syllable among two successive feet is not sanctioned at all, providing evidence that the syllable is the stress-bearing unit in Cairene Arabic. Therefore, when bracketing /si.jaa.ra.tu.hu/ (*his cigarette*) into metrical feet, the heavy syllable cannot be interrupted as (si ja)(ara)(tuhu). In other words, foot-bracketing must coincide with syllable boundaries (for details see Halle 1990).

Tableaus (1) and (2) below show how the interaction of Lx=Pr and FOOT-BINARITYμ helps account for the desired output forms of monosyllabic and disyllabic words, respectively:

Tableau (1) stressing a monosyllabic word

Input: /H/ /fii/ (*in prep.*)	**Lx=Px**	**F-Bμ**
a- ☞ (fii)		
b- (fi)i		*!
c- fii	*!	

Tableau (2) stressing a disyllabic word

Input:/LL/ /ra.ma/ (*he threw*)	**Lx=Pr**	**F-Bμ**
a- (rama)		
b- (ra)ma		*!
c- ra(ma)		*!
d- (ra)(ma)		*!*
e- rama	*!	

Notice that a disyllabic Arabic word is sanctioned when at least one foot is erected over the word. Only candidate (e) incurs a violation of Lx=Pr. The competition between the remaining candidate forms (a-d) is resolved by prioritizing other conflicting requirements.

3.2 Nonfinality and Nonexhaustiveness

However, the reason why a pointing hand ☞is not used to mark the output form that incurs fewer violations of Lx=Pr and FOOT-BINARITYμ in Tableau (2) above (namely candidate a) is that it is not the one that ultimately wins the competition; rather, it is (b) that wins the competition. This is so because candidate (a) violates a high-ranking violable constraint, namely the anti-parsing constraint NONFINAL:

NONFINAL the final syllable must not be parsed into a higher
prosodic structure

As far as the formulation of NONFINAL, we make two contributions. First, NONFINAL is intended to be "a general mechanism for achieving descriptive invisibility", i.e. to focus on the parsability of the final segment. In pre-Optimality literature, unfooting the final constituent (be it final segment, mora, syllable, foot, or even phonological word) is handled by positing the notion of extrametricality (Cf. McCarthy 1979b; Hayes 1979, 1982, 1991; 1995; Prince 1980; Ito 1986, 1989; Borowsky 1986b; Hung 1993, 1994). The OT successor which does much of the work of extrametricality in pre-optimality literature is NONFINALITY (McCarthy and Prince 1993a, b; Prince and Smolensky 1993; Hyde 2003). The important point is that definition of NONFINALITY has never been uniform (For details see Prince and Smolensky 1993: 42; Hyde 2003: 1; Crowhurst 1996: 415). In addition, there has been always a disagreement on what constituent (mora, syllable, foot) is subject to nonfinality (for discussion see Crowhurst 1996: 415-16).

We propose that it is *only* the final syllable that should be subject to nonfinality, and the stressing of a final syllable is due to the claim (fundamental in OT analysis) that the anti-parsing constraint NONFINAL is violable, i.e. dominated by other conflicting requirements that take priority. This suggestion, we believe, provides a more uniform analysis for all Cairene Arabic stress patterns; hence the argument presented so far calls for respecting the integrity of the syllable (see discussion

about FOOT-BINARITYμ above). The more traditional approach assumes final consonant extrametricality (McCarthy 1979a, b; Ito 1986, 1989; Borowsky 1986b; Hung 1993; Crowhurst 1996). Following McCarthy (1979a), Crowhurst (1996: 416), for example, suggests that the final superheavy syllable of words like [fi.himt] and [ka.takiit] be a disyllabic sequence [him.t] and [kii.t], where final Cs are treated as "degenerate feet". To her, NONFINAL is violated if the so-called final degenerate syllable [t] is stressed. What this basically means is that the first part of the final syllable is stressed, but the second part is unstressed. In our present analysis, however, the syllable is not segmented (for stress is a property of the syllable as a whole), again securing the integrity of the syllable (for details see Prince 1996; Prince and Smolensky 1993; Blevins 1995; Hayes 1995; for counter argument see Halle and Vergnaud 1987a; Everett 1996; Crowhurst 1996).

However, given the present suggestion that the final syllable, due to the anti-parsing constraint NONFINAL above, must not be parsed into a higher prosodic structure, the inquiry then concerns the stressing of final superheavy syllables (e.g. baBEEN, kaTABT, etc.). That is, how can the stressing of the final superheavy syllable in Cairene Arabic be accounted for when in fact there is a constraint militating against parsing it into a metrical foot? The answer put forward in Al-Jarrah (pending) and re-sketched in section 3.4 below is that parsing constraints (namely PARSEσ) and and anti-parsing constraints (i.e. NONFINAL) are factored out. By maintaining the Weight-by-Position rule which requires that postvocalic consonants be moraic (Hayes 1989; Kager 1999; Hyde 2003), the rationale runs as follows: parsing a final three-mora syllable is sanctioned by a sub-constraint which does not sanction a two-mora syllable and so on. In other words, PARSE-σ and NONFINAL are mora-sensitive in the sense that parsing the final syllable depends on its weight. This suggestion, we believe, is superior to the more traditional approach which assumes final consonant extrametricality (see discussion in 3.4 below)[(4)].

Be that as it may, the competition between candidates (a) and (b) in Tableau (2) above necessitates a ranking argument. If FOOT-BINARITY-μ dominated NONFINAL, candidate (a) would win. If, however, FOOT-BINARITY-μ was dominated by NONFINALσ, candidate (b) would surface as the actual output form. Longer words provide evidence why NONFINAL is higher-ranking; hence, its violation yields a sub-optimal form:

Tableau (3)

Input: /HHL/ /mak.tab.hum/ (their office)	**Lx=Pr**	**F-Bμ**	**NF**
a- ☞ (mak)(tab)hum			
b- (mak)(tab)(HUM)			*
c- maktabna	*!		

Tableau (4)

Input: /HH/ /mak.Tab/ (an office)	**Lx=Pr**	**F-Bμ**
a- !☞ (mak)(tab)		
b- (mak)(tab)		
c- maktab	*!	

Tableau (5)

Input: /HH/ /mak.tab/ (an office)	**Lx=Pr**	**NF**	**F-Bμ**
a- ☞ (mak)tab			
a- !☞ (mak)(tab)		*!	
b- (mak)(tab)		*!	
c- maktab	*!		

Having satisfied the requirement of Lx=Pr, candidate (a) bests candidate (b); it surfaces with the correct stress pattern. It is interesting to note that candidate (b) in Tableau (3) above loses the competition because it violates high-ranking NONFINAL. If the requirement of NONFINAL were not met, stress would wrongly surface on the final syllable of /maktab/, for example:

Notice that although competitor (a) in Tableau (4) above satisfies the requirements of Lx=Px, and FOOT-BINARITYμ, it is not the optimal parse. For /maktab/ does not surface with main stress on the final syllable. Again. we can account for this state of affairs by positing that candidate (a) in Tableau (4) above violates NONFINAL.

In our analysis, NONFINAL is only satisfied if the final syllable (irrespective of its intrinsic weight) is unfooted. However, the unfooting of the final syllable creates a problem. It though satisfies NONFINAL, runs counter to the requirement of another universal and violable constraint, namely PARSE-σ, which requires that each and every syllable be part of the next higher-level prosodic category (i.e. foot):

PARSE-σ a syllable must be parsed in a higher prosodic structure

The advancement of PARSE-σ, then, creates a constraint conflict as far as the footing of the final syllable is concerned. Whereas PARSE-σ favors a footed form over an unfooted form (e.g. competitor a in tableau 6 below), NONFINAL requires that the final syllable be unfooted altogether (e.g. competitor c).

In a constraint-based framework, constraint conflict like this one is resolved by positing the notion of constraint ranking. In Crowhurst's (1996: 411) terms "constraints…are violated when conflicting requirements have priority". The fact that stress surfaces on the first syllable of /maktab/ suggests that NONFINAL should outrank PARSE-σ. In other words, the need to have the last syllable unfooted is stronger than the need to have each and every syllable get footed.

(4) Constraint Ranking I

NONFINAL >> PARSE-σ

This proposal, however, raises the issue of stressing monosyllabic words. If NONFINAL were undominated, monosyllabic words would then surface stressless, which is of course not true.

Tableau (7)

Input: /H/ /min/ (from)	**NF**	**P-σ**
a- (min)	*	
b- min		*

Tableau (6)

Input: /HH/ /mak.tab/ (an office)	**Lx=Pr**	**M-R**	**NF**	**F-Bμ**	**P-σ**
a- ☞ (mak)tab					*
b- (ma)ktab				*!	*
a- (mak)(tab)			*!		
b- (mak)(tab)		*!	*		
e- maktab	*!				**

Tableau (7) shows that either NONFINAL or PARSE-σ can be satisfied but not both. Only the satisfaction of PARSE-σ guarantees that /min/ surfaces with main stress. What this means is that PARSE-σ should outrank NONFINAL as far as /min/ is concerned.

(5) Constraint Ranking II

PARSE-σ >> NONFINAL

Notice that we have reached an ordering paradox. NONFINAL must outrank PARSE-σ to get the correct stress pattern in /maktab/; in the meantime, PASRE-σ must outrank NONFINAL to get the correct stress pattern in /min/.

In order to get over this ordering paradox, our proposal is to assume that NONFINAL outranks PARSE-σ (e.g. /maktab/):

(6) Constraint Ranking III

NONFINAL >> PARSE-σ

And the stressing of monosyllabic words (e.g. /min/) is sanctioned by another higher-ranking constraint, namely Lx=Pr:

Lx = Pr every lexical word must consist of a prosodic word

Lx=Px is only violated if no foot is constructed over the word. In order for at least one foot to be constructed over the monosyllabic word, Lx=Pr has to dominate NONFINAL:

(7) Constraint Ranking IV

Lx=Pr >> NONFINAL >> PARSEσ

Tableau (8)

Input: /H/ /min/ (from)	**Lx=Pr**	**NF**	**Pσ**
a- (min)		*	
b- min	*!		*

Tableau (9)

Input: /HH/ /mak.tab/ (an office)	**M-R**	**Lx=Pr**	**NF**	**P-σ**
a- ☞(mak)tab				*
b- (mak)(tab)			*!	
c- maktab		*!		

Tableau (10)

Input: /H/ /min/ (from)	**M-R**	**Lx=Pr**	**NF**	**P-σ**
a- ☞(min)			*	
b- min		*!		*

Accordingly, output (a) violates NONFINAL, and output (b) violates Lx=Pr. Neither of them violates both NONFINAL and Lx=Pr simultaneously. If NONFINAL dominated Lx=Pr, output (b) would win the competition, and would ultimately surface stressless. If, however, Lx=Pr dominated NONFINAL, output (a) would win the competition, and would ultimately surface stressed. Because output (a) is the actual output form, Lx=Pr must dominate NONFINAL. Lx=Pr is, then, a higher-ranking constraint. Given the constraint ranking in (7) above, /maktab/ and /min/ can both surface with the correct stress pattern:

3.3. Directionality and prominence

In longer words, when more than one foot is erected over the prosodic word, main word-stress tends to fall as close to the right edge of the word as possible. What this basically means is that MAIN-RIGHT is a high-ranking constraint in Arabic:

MAIN-RIGHT align the head-foot with the word, on the right edge

Notice that, unlike probably all previous treatments, MAIN-RIGHT is interpreted here as a non-gradient constraint. If the foot closest to the right edge of the word is the head foot, MAIN-RIGHT is satisfied; if some other foot is the head of the prosodic word, MAIN-RIGHT is violated. The examples in (8) below provide evidence for the enhancement of the rightmost stress:

(8) (LL)(**L**)<L> (ka.ta)(BA)ha (he wrote it)

(LL)(**H**)<L> (ka.ta)(BAA)ha (they both wrote it)

(H)(**H**)<H> (mak)(TUU)bun (a letter)

(H)(H)(**H**)<H>[5] (mar)(suu)(MAA)tun (they are drawn)

However, in all previous examples the foot closest to the right edge of the word is erected over one syllable. Hence, FOOT-BINARITY is interpreted under a moraic analysis, i.e. a single heavy syllable makes up a foot of its own; and two successive light syllables pair up together to make one foot. The question that we need to ponder on

is what if the foot closest to the right edge of the word is erected over two light syllables as in (9) below:

(9) (šaja)(ratu)<hu> (his tree)

For one of them to receive prominence, we need another constraint which singles out the syllable that functions as the head of the foot. We argue that there is ample evidence that Arabic is a trochaic system, i.e. feet constructed over two light syllables are left-headed:

TROCHAIC align the head-syllable with its foot, on the left edge

To illustrate, the examples in (10) below provide ample evidence that parsing is trochaic in Cairene Arabic:

(10) (**L**L)H (šaja)rah (a tree)

(LL)(**L**L)<L> (šaja)(ratu)<hu> (his tree)

Tableau (11) below shows how the optimal output form for /ša.ja.ra.tu.hu/ wins the competition when syllables are parsed trochaically:

Tableau (11)

Input: //LLLLL/ /ša.ja.ra.tu.hu/ (his tree)	**Lx=Pr**	**TR**	**M-R**	**NF**	**P-σ**	**FB-μ**
a- ☞ (šaja)(ratu)hu					*	
b- (šaja)(ratu)hu		*!			*	

Tableau (12)

Input: //LLLLL/ /šajaratuhu/ (his tree)	**Lx=Pr**	**TR**	**MR**	**NF**	**P-σ**	**FB-μ**	**A-F-L**	**A-F-R**
a- ☞ (šaja)(ratu)hu					*		**	*,***
b- (šaja)(ra)(tu)hu					*	*!*		
c- (šaja)ratuhu					**!*			
d- (šaja)(ratu)(hu)				*!				
e- (šaja)(ratu)hu			*!					
f- (šaja)(ratu)hu		*!						
g- šajaratuhu	*!							

A note worthy of mention here is that in this example the directionality of parsing (whether syllables are parsed into metrical feet on a left-to-right or right-to-left basis) is irrelevant. To illustrate, having satisfied the requirement of NONFINAL, /šajaratuhu/ is parsed into two binary feet. Adopting a left-to-right or right-to-left parsing creates the same output form:

(11) a. left-to-right parsing (šaja)(ratu)<hu> (his tree)

b. right-to-left parsing (šaja)(ratu)<hu> (his tree)

And due to the interaction of MAIN-RIGHT and TROCHAIC, the left-hand syllable of the foot closest to the right edge of the word receives prominence.

(12) (šaja)(ratu)<hu> (his tree)

The model then correctly predicts that in /šajaratuhu/ stress falls on the light antepenultimate syllable.

However, in words like /šajaratun/, where stress falls on the light penultimate syllable, the directionality of parsing (i.e. the pairing of light syllables into feet from right to left or from left to right) is crucial. We argue that only a left-to-right parsing yields the desired output form. Let us consider how main stress surfaces on /šajaratun/:

First, the final syllable, due to NONFINAL, is left out unfooted:

(13) šajara<tun> (a tree)

The remaining part of the prosodic word must, due to PARSE-σ, be footed. Adopting a left-to-right parsing creates (14a) below, but a right-to-left parsing creates (14b):

(14) a. (šaja)ra<tun> (a tree)

b. ša(jara)<tun> (a tree)

In either case, one more syllable is left out unfooted. To account for how stress surfaces on the light penult of /šajaratun/, we need to decide upon two things in advance: (1) whether the left-over syllable should be footed; and (2) the directionality of footing.

As for parsing a left-over syllable into a metrical

foot, the interaction of PARSE-σ and FOOT-BINARITYμ comes into play. The interaction of these two universal and violable constraints is patent in words with stressed light penult as in (15) below:

(15) (H)(L)<H> makTAbah (a library)

(LL)(L)<h> šajaRAtun (a tree)

We argue here that for stress to surface on a light penult, PARSE-σ should outrank FOOT- BINARITYμ. Consider how in a word like /maktabah/ stress surfaces on the penultimate syllable:

First, once the requirement of NONFINAL is met, we get:

(16) makta<bah> (a library)

The remaining part of the prosodic word is, due to FOOT-BINARITYμ, parsed into binary feet as below:

(17) (mak)ta<bah> (a library)

Notice that this parsing creates a left-over syllable, which will ultimately be the main word stress carrier. Given this analysis, the only way for stress to surface on that left-over syllable is to sanction the construction of degenerate feet as in (18) below:

(18) (mak)(ta)<bah> (a library)

But this can be tolerated if FOOT-BINARITYμ is demoted one step below PARSE-σ:

(19) Constraint Ranking V

Lx=Pr >> NONFINAL >> PARSEσ >> FOOT-BINARITYμ

Tableau (13)

Input: /HLH/ /mak.ta.bah/ (a library)	**Lx=Pr**	**MR**	**NF**	**P-σ**	**FBμ**
a- ☞(mak)(ta)bah				*	*
b- (mak)tabah				*!*	
c- (mak)ta(bah)			*!	*	
d- (mak)(ta)bah		*!			
e- maktabah	*!			***	

Tableau (14)

Input: /LLLH/ /ša.ja.ra.tun/ (a tree)	**Lx=Pr**	**TR**	**MR**	**NF**	**P-σ**	**FB-μ**	**A-F-L**	**A-F-R**
a- ☞ (šaja)(ra)tun					*	*	**	**
b- (ša)(ja)(ra)tun					*	**!*		
c- (šaja)ratun					**!*			
d- (šaja)(ratun)				*!				
e- (šaja)(ra)tun			*!					
f- (šaja)ratun		*!						
g- šajaratun	*!							

Given the constraint ranking in (19) above, the optimal form (candidate a) wins the competition.

As for the directionality of footing, the examples in (20) below provide crucial evidence that parsing must start at the left-most edge of the word.

(20) šajaRAtun (a tree)

maktabuHUmaa (their office 'both')

To illustrate, if we assumed that syllables are footed on a right-to-left basis, then stress would, due to MAIN-RIGHT, TROCHAIC and NONFINAL, wrongly surface on the light antepenultimate syllable of /šajaratun/ as shown in (21) below:

(21) ša(JAra)<tun> (a tree)

In order to avoid this unhappy conclusion, we suggest two things: (1) a left-over syllable is parsed into a degenerate foot (i.e. PARSE-σ is ranked higher than FOOT-BINARITYμ); and (2) syllables are parsed into feet from left to right (i.e. ALL-FEET-LEFT is ranked higher than ALL-FEET-RIGHT):

ALL-FEET-LEFT align each foot with the word,

on the left edge

ALL-FEET-RIGHT align each foot with the word, on the right edge

Accordingly, the footing of /šajaratun/ looks like (22) below:

(22) (šaja)(ra)<tun> (a tree)

And stress, due to MAIN-RIGHT and TROCHAIC, surfaces on the penult. Consider Tableau (14) below:

This conclusion goes in tandem with the typological evidence in that in languages where degenerate feet are not sanctioned except by higher ranking constraints, ALL-FEET-LEFT must dominate ALL-FEET-RIGHT (McCarthy and Prince 1993b)(6).

Another piece of evidence that suggests the relative ranking of ALL-FEET-RIGHT and ALL-FEET-LEFT on the one hand, and PARSE-σ and FOOT-BINARITYμ on the other comes from the fact that stress in Arabic does not fall on a pre-antepenultimate syllable. A light penult or antepenult is stressed provided that it is separated from a preceding heavy syllable or the initial word boundary by an even number of light syllables (including zero). The location of this degenerate foot is decisive for stress placement. Consider how stress surfaces on the light penult in */madrasatuhu/*:

First, due to NONFINAL, the last syllable is not parsed into a higher prosodic structure (i.e. extrametrical):

(23) mad rasatu<hu> (his school)

If parsing proceeds right to left, we get:

(24) (mad)(ra)(satu)<hu>

And due to MAIN-RIGHT and TROCHAIC, stress surfaces on the antepenult:

(25) *(mad)(ra)(SAtu)<hu>

If, however, parsing proceeds left to right, we get:

(26) (mad)(rasa)(tu)<hu>

And due to MAIN-RIGHT, main-word stress surfaces correctly on the penult:

(27) (m?ad)(rasa)(tu)<hu>

Notice that this is possible provided that PARSE-σ outranks FOOT-BINARITY, so that the penult makes up a degenerate foot:

(28) (m?ad)(rasa)(tu)<hu>

And stress, due to MAIN-RIGHT and TROCHAIC, correctly surfaces on the light penultimate syllable:

(29) (mad)(rasa)(tu)<hu>

If, however, FOOT-BINARITYμ outranks PARSE-σ, we get:

(30) (mad)(rasa)tu<hu>

And stress would, due to MAIN-RIGHT and TROCHAIC, wrongly surface on a pre-antepenultimate syllable:

(31) (mad)(RAsa)tu<hu>

It turns out that the decision concerning the directionality of footing (i.e. the relative ranking of ALL-FEET-LEFT and ALL-FEET-RIGHT) is crucial In Cairene Arabic. If ALL-FEET-RIGHT is ranked higher than ALL-FEET-LEFT, the wrong output form is obtained (Cf. 25). If ALL-FEET-LEFT is ranked higher than ALL-FEET-RIGHT, the correct output form is obtained (Cf. 27). It is worth mentioning then that stressing a light penultimate in Cairene Arabic can be accounted for with a left-to-right parsing. Consider (32) below:

(32) a. left-to-right (cvcv) (CV)<cv> kataBAha "he wrote it"

*b. right-to-left (cv) (CVcv)<cv> kaTAbaha "he wrote it"

c. left-to-right (cvc)(cvcv)(CV)<cv> maktabaTUhu "his library"

*d. right-to-left (cvc)(cv)(CVcv)<cv> maktaBAtuhu "his library"

As can be seen, left-to-right parsing of syllables into feet yields the correct stress patterns (32a and 32c), but a right-to-left parsing fails to yield the correct stress patterns (32b and 32d). In fact, it fails to yield the correct output form for all words where stress falls on a degenerate foot. The reason is that a right-to-left parsing always results in having the degenerate foot as far to the left as possible (e.g. 32b and 32d)- a state of affairs that we want to avoid. What we actually need is to have the degenerate foot fall as far to the right as possible (e.g. 32a and 32c above). This can only be done with left-to-right parsing (Cf. 32a and 32c).

A left- to-right parsing can then account for stressing a light antepenult as well as a light penult. Recall that for a light penult or antepenult to be stressed in long words, there must always be an even number of light syllables (including zero) between the stressed syllable and a preceding heavy syllable or word boundary above. If stress falls on the antepenult, that syllable must pair with the light penult to make up a left-headed metrical foot. If, however, stress falls on the penult, that syllable must make up a degenerate foot (Cf. 32a and 32c). The degenerate foot cannot be constructed over the light penult unless parsing takes place on a left-to-right basis,

i.e. ALL-FEET-LEFT >> ALL-FEET-RIGHT.

(33) Constraint Ranking VI

ALL-FEET-LEFT >> ALL-FEET-RIGHT

(34) Constraint Ranking VII

TROCHAIC, MAIN-RIGHT, NONFINAL >> PARSEσ >> FOOT-BINARITYμ, ALL-FEET-LEFT >> ALL-FEET-RIGHT

3.3. Relativizing PARSE-σ to syllable weight

The constraint ranking in (34) above, however, raises one more interesting point: the place of stress on final superheavy syllables. To illustrate, if NONFINAL were undominated as in (34) above, the final syllable could never receive stress because it would never be footed. But we know that monosyllabic words surface with main word-stress in Arabic, and we also know that all Arabic words that end in a superheavy syllable receive stress on that syllable.

To show how this can be accounted for, we maintain the relative ranking of NONFINAL and PARSEσ as in (34) above, so that we can account for why polysyllabic words that end with light or heavy syllables do not receive stress on that final syllable, but we also assume that there is (are) some constraint(s) that outrank(s) NONFINAL. Again, the proposal that NONFINAL should be dominated by some higher-ranking constraint is needed to account for two things: (1) why monosyllabic words surface with main word-stress, and (2) why words that end with a superheavy syllable receive main word-stress on that syllable.

The problem concerning the place of stress in monosyllabic words has been tackled earlier. We suggested that NONFINAL is outranked by Lx=Pr (Cf. Tableaus 9 and 10 above). The other problem that the existing ranking of constraints in (34) above still cannot handle concerns the place of stress on final superheavy syllables. For an Arabic polysyllabic word that ends in a superheavy syllable ($\sigma_{\mu\mu\mu}$) is stressed on that syllable:

(35) a šanTAAT (bags)

b. ka.SAAT; da.RAST (drinking vessels; I studied).

If NONFINAL were undominated in Arabic, the last syllable of each and every word would be invisible to parsing, and thus, would never receive stress. But the fact of the matter is that all Arabic words that end in superheavy syllables (Cf. 35) must receive stress on that final superheavy syllable.

For polysyllabic words which end in superheavy syllables to receive main stress on the last syllable, that syllable must be footed. But parsing the last syllable into a metrical foot violates NONFINAL. Because the need to have the final superheavy syllable footed is greater than the need to satisfy the requirement of NONFINAL, we then must allow the violation of NONFINAL. One way to have the last syllable footed is to have PARSEσ outrank NONFINAL. However, it has already been demonstrated that NONFINAL must outrank PARSEσ. Otherwise, we cannot account for the fact that light (σ_{μ}) and heavy syllables ($\sigma_{\mu\mu}$) never receive stress in final position. The alternatives then are as follows: NONFINAL outranks PARSEσ so as to account for the fact that light and heavy syllables are stressless in final position (see 36 below); or PARSEσ outranks NONFINAL so as to account for the fact that final superheavy syllables ($\sigma_{\mu\mu\mu}$) are always stressed (see 37 below):

(36) Constraint Ranking

TROCHAIC, MAIN-RIGHT, Lx=Pr >> NONFINAL >> PARSEσ >> FOOT-BINARITYμ >> ALL-FEET-LEFT >> ALL-FEET-RIGHT

(37) Constraint Ranking

TROCHAIC, MAIN-RIGHT, Lx=Pr, PARSEσ >> NONFINAL >> FOOT-BINARITYμ >> ALL-FEET-LEFT >> ALL-FEET-RIGHT

It is suggested earlier that nonfinality is motivated on independent grounds, and it is only blocked if it renders the whole word unfooted. That is, only Lx=Pr dominates NONFINAL. The suggestion that PARSEσ dominate NONFINAL will create more problems than it can solve. It seems that we need to capitalize on the former option where NONFINAL outranks PARSEσ. With this relative ranking, we account for why light and heavy syllables surface stressless in final position. Meanwhile, to account for how superheavy syllables are stressed in final position, we posit a new constraint that forces a superheavy syllable to be footed. This new constraint has to be ranked above NONFINAL. Satisfying the demands of this new constraint is far more compelling than satisfying the demands of NONFINAL.

What this basically means is that we need to parameterize PARSEσ. That is, we need to show that while a light and a heavy syllable are invisible to parsing, a superheavy syllable is not. So we need PARSEσ to apply distinctively to light and heavy syllables on the one hand, and to superheavy syllables on the other. We then suggest that PARSEσ can be factored out as in (38) below:

(38) PARSE$\sigma_{\mu\mu\mu}$ … PARSE$\sigma_{\mu\mu}$ … PARSEσ_{μ}

And since the distinction is between PARSE$\sigma_{\mu\mu\mu}$ on the one hand, and PARSE$\sigma_{\mu\mu}$ and PARSEσ_{μ} on the other (hence both PARSEσ_{μ} and PARSE$\sigma_{\mu\mu}$ are invisible to parsing in final syllables) (38) can be reformulated as in below (39):

(39) PARSE$\sigma >_{\mu\mu}$ … PARSE$\sigma \leq_{\mu\mu}$

If this were true, the fact that a final superheavy syllable receives word main stress in Arabic can be accounted for by establishing a relative ranking of these two constraints with NONFINAL. All we need do is have PARSE$\sigma >_{\mu\mu}$ outrank NONFINAL, which in turn outranks PARSE$\sigma \leq_{\mu\mu}$ as below:

(40) PARSE$\sigma >_{\mu\mu}$ >> NONFINAL >> PARSE$\sigma \leq_{\mu\mu}$

In a word like /šantaat/**,** the final syllable, due to the fact that PARSE$\sigma_{\mu\mu\mu}$ outranks NONFINAL, must be footed; and thus, be the word main stress carrier.

Tableau (15)

Input: /šan.taat/ (bags)	**Lx=Pr**	**TR**	**MR**	**P$\sigma >_{\mu\mu}$**	**NF**	**P$\sigma \leq_{\mu\mu}$**	**FBμ**	**A-F-L**	**A-F-R**
a-☞(šan)(taat)					*	*	*	*	*
b- (šan)taat				*!					*

Tableau (15) shows that splitting PARSEσ accounts for final effect demotion (i.e. stresslessness of final light and final heavy syllables) as well as stressing superheavy syllables in that position.

4. CONCLUSION

In the foregoing discussion, I have shown that Lx=Pr, TROCHAIC, MAIN-RIGHT, PARSEσ, NONFINAL, FOOT-BINARITY and ALL-FEET-LEFT are the only constraints whose violations yield incorrect stress patterns in Cairene Arabic. First, the fact that each word must surface with main stress in Cairene Arabic provides evidence that Lx=Pr is high ranking. Second, Cairene Arabic stress patterns like (**H**)<H> and (**L**L)<L> (e.g. "MAKtab and "KAtaba") suffice to corroborate the suggestion that the moraic trochee be the optimal parse with final extrametricality. Once the final syllable is considered extrametrical, stress patterns like (H)(**H**)<H>, (LL)(**L**)<L>, etc. (e.g. makTABhum, kataBAha, etc.) provide evidence for the enhancement of the rightmost stress. If this is true, stressing a light penult as in /ka.ta.ba**.**ha/ suggests two things: (1) syllables are bracketed into metrical feet from left to right (LL)L<L>; and (2) a left-over syllable is parsed into a degenerate foot (LL)(**L**)<L>. Finally, the discussion has shown that the stressing of superheavy syllables in final position can be accounted for straightforwardly by factoring out some metrical constraints, namely Pσ. The rationale underlying this parameterization is that parsing a syllable depends on its weight: the heavier the syllable is, the more likely it gets parsed; and thus maintaining two things: (1) Nonfinality falls out of parsability, and (2) the integrity of the syllable is respected; hence the syllable is the stress-bearing unit. The discussion concludes that the relative ranking of these constraints is as follows:

Lx=Pr, TROCHAIC, MAIN-RIGHT >> PARSE$\sigma_{\mu\mu\mu}$ >> NONFINAL >>

PARSE$\sigma_{\mu\mu}$, FOOT-BINARITYμ >> ALL-FEET-LEFT >> ALL-FEET-RIGHT

NOTES

(1) "Since there is no pandialectal tradition for stressing Classical Arabic" (McCarthy 1979b: 446), the examples used throughout are Cairene Arabic forms as produced by natives of Cairene Arabic. However a couple of points are in order here. Classical Arabic refers to the High variety of Arabic or the so-called *'lfuşħa* in contrast to the regional dialects or *'al'ammiya* (Ferguson 1959 (1972): 234). Numerous studies have noted that there are differences between the High variety of Arabic and the lower varieties of Arabic as far as word stress placement is concerned. (Cf. Mitchell 1960; 1975; Langendoen 1968; Brame 1971, 1973, 1974; McCarthy 1979b; Welden 1980; Al-Ghazo 1984; Al-Mozainy et al. 1985; Al-Sughayer 1990; Hung 1995; Abu-Abbas 2003 Al-Mohanna 2005). The stress patterns stated in (1) are based on Mitchell's 1960 and 1975, where the assertion is made that Cairene is the lower variety of Arabic that has preserved many of the

original stress patterns of Classical Arabic (for further details see McCarthy 1979b based on Mitchell 1975). Yet, there are still significant differences reported in the literature between the High variety and the lower varieties of Arabic. For example, whereas Classical Arabic cvv is not stressed in final position (Cf. RA?aa "he saw"), Egyptian cvv is stressed in that position (Cf. *šaFUU* "they saw him") (see McCarthy 1979b: 446; Welden 1980: 102). In addition, Classical Arabic allows "longer strings of light syllables" (McCarthy 1979b: 447), and thus "allows retraction of stress a potentially infinite distance from the right boundary, rather than the maximum of three syllables" (McCarthy 1979b: 461) as is in almost all the lower varieties of Arabic. Some lower varieties of Arabic (e.g. Jordanian, Levantine, Iraqi, Saudi Arabic, etc.) have undergone more radical changes as far as word stress is concerned. For example, whereas superheavy syllables are restricted to final position in Classical Arabic, they can be found in nonfinal position in some lower varieties (Cf. Jordanian XAAl.hum "their uncle"). Second, whereas a light penult is stressed in Classical Arabic even if preceded by a heavy penult (gaaTAla), stress in many lower varieties of Arabic shifts to the heavy antepenult (Cf. GAAtala).

However, the important point is that the examples in (1), which are based on Mitchell (1960) and (1975), are Arabic forms as produced by natives of Cairene Arabic; and are thus listed in their H forms. A note worthy of mention here is that, given Arabic diglossia (Ferguson 1959), the High variety of Arabic is produced by educated native speakers of Arabic in almost identical manner irrespective of the lower variety of Arabic they are native of. Quranic Arabic illustrates this point. Native speakers of Arabic, irrespective of their native dialect, recite the holly Quran in remarkably similar fashion. This does not mean that the stress patterns of the colloquial dialects never alter the Classical patterns, but following McCarthy (1979b: 447) "the accentuation of Cairene Arabic words is another source of information" about the Lower varieties stress rule. However, due to the complexities of the resulting stress patterns, further probing is badly needed. Apart form the dialectal peculiarities, we should finally make clear that the present paper aims to develop an OT analysis for the stress patterns stated in (1) above.

(2) Main word stress in Cairene Arabic is non-phonemic.

(3) The stressing of a light syllable (even when a heavy syllable is part of the prosodic word) constitutes a violation of PK-PROM - a constraint whose violation does not yield incorrect stress pattern in Arabic whatsoever.

(4) There has always been disagreement on which constituent (final mora, consonant, syllable, etc.) should be considered extrametrical (see Prince 1980; Hayes 1991; Hung 1994). For final consonant extrametricality see Prince (1980) for Estonian; and for final syllable extrametricality see Hung (1994) for Aguaruna.

Factoring out NONFINAL entails that it is the final syllable that should always be considered extrametrical. And the (non)parsing of that syllable depends on its weight.

(5) As for non-head feet, Arabic is cited to disallow secondary stresses (see Mitchell 1960, Langendoen 1968, and McCarthy 1979a for Cairene Arabic; Brame 1973, and Kenstowicz and Abdul-Karim 1980 for Palestinian Arabic). In pr-optimality literature, Halle and Vergnaud (1987a) suggests "conflation" as a repair mechanism that removes un-wanted secondary stresses. Crowhurst (1996) deals with conflation in Cairene Arabic in an optimality-theoretic fashion.

(6) For a counter argument, see Crowhurst (1996: 414).

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ملخـص

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