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Unbounded Stress and Factorial Typology[*]

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In this paper I demonstrate how a small set of constraints independently motivated for the analysis of bounded stress systems within Optimality Theory (OT; Prince & Smolensky 1993) is sufficient to account for the gross characteristics of strikingly different unbounded stress systems (see also Tesar 1998). This sufficiency is an important factorial typological consequence of the ranking of violable universal constraints, the cornerstone assumption of OT, a fact that serves as the primary motivating force behind this line of investigation. The constraints involved in the analysis and the logic of their interactions with one another turn out to reveal some important properties of constraint (in)activity through ranking in OT, a topic to which I devote particular attention.

1 Introduction

In some unbounded stress systems, main stress consistently falls on a syllable at or near an edge (left/right), regardless of syllable weight.[1] In other unbounded stress systems, main stress falls on the leftmost/rightmost heavy syllable, and in the absence of heavy syllables, on the leftmost/rightmost syllable. Each of the four combinations of leftmost/rightmost in this statement corresponds to attested languages (see Hayes 1995:296ff); the two cases in which the sides are the same are called *default to same side*, and the two cases in which the sides are different are called *default to opposite side* (the terminology is from Prince 1985).

Lists of languages fitting each of these gross typological characterizations are given in (1). These lists are based on those of Hayes 1995:296-297, with additional languages (in particular, those in (1a)) from Walker 1996.

(1) Unbounded stress systems: gross typological instantiations

a. *Consistently edgemost*
Leftmost: Tinrin, Yeletnye
Rightmost: Uzbek, Yavapai, Yawelmani

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[1] The distinction between "at" and "near" an edge is a nontrivial one that I nevertheless put aside here, as it involves the partially independent variables of extrametricality and rhythmic foot type (trochaic vs. iambic). I henceforth use the terms "left(most)" and "right(most)" with this caveat in mind. (See Prince & Smolensky 1993, Hayes 1995, Hung 1994, Walker 1996, and references therein on extrametricality.) The variable interpretations of "syllable weight" and "stress" are also glossed over here, as they also involve independent considerations. (See Hayes 1995:§7, de Lacy 1997, and references therein on the problem of syllable weight.)

b. *Default to same side (DTS)*
Leftmost heavy/leftmost: Amele, Au, Indo-European accent, Khalkha Mongolian, Lhasa Tibetan, Lushootseed, Mordwin, Murik, Yana
Rightmost heavy/rightmost: Aguacatec, Golin, Kelkar's Hindi, Klamath, Sindhi, Western Cheremis

c. *Default to opposite side (DTO)*
Leftmost heavy/rightmost: Komi Yaz'va, Kwakw'ala
Rightmost heavy/leftmost: Chuvash, Classical Arabic, Eastern Cheremis, Huasteco, Kuuku-Yaʔu, Selkup

It is generally agreed, I believe, that it is incumbent upon any adequate theory of unbounded stress systems to predict that in the general case, light-syllable forms are consistently stressed on an edgemost syllable, and that forms with heavy syllables are stressed in one of three ways: on the same edge as light-syllable forms (consistently-edgemost systems), on the heavy syllable closest to that edge (DTS systems), or on the heavy syllable furthest from that edge (DTO systems). The ensuing sections of this paper examine in detail the necessary rankings and interactions among well-established metrical constraints that does in fact predict this gross typology of unbounded stress systems in addition to that of bounded stress systems.

The table in (2) shows the pairs of purely classificatory and largely oversimplified forms employed for the purposes of this paper. 'σ' denotes a light syllable, 'Σ' a heavy syllable, and main stressed syllables are accented. The left edge is arbitrarily chosen as the default; each of these systems is understood to have a mirror-image counterpart with the default on the right. These idealized forms encompass all that is relevant to the points made in this paper, barring any obscuring interactions with morphological or even other phonological factors (recall the abstractions made explicit in footnote 1).

(2) Table of classificatory forms

	Edgemost	*DTS*	*DTO*
Light-syllable form	σ́ σ σ σ σ σ	σ́ σ σ σ σ σ	σ́ σ σ σ σ σ
Form with heavy syllables	σ́ σ Σ σ Σ σ	σ σ Σ́ σ Σ σ	σ σ Σ σ Σ́ σ

The paper is organized as follows. In section two, I review noniterative foot construction (a representational assumption made about the stress pattern of light-syllable forms in unbounded stress systems) and what has become the standard OT analysis of it. Forms with heavy syllables, which in these quantity-sensitive stress systems force semi-iterative foot construction, are considered and analyzed in section three. Constraints responsible for main stress placement are tossed into the mix in section four, accounting for the distinction between DTS and DTO systems. A couple of residual issues are addressed in section five, and section six concludes the paper.

2 (Non)iterativity

In forms consisting of light syllables, unbounded stress systems differ from bounded ones in that there is only one stress, at or near an edge (3a). Bounded stress systems, on the other hand, have multiple stresses in an alternating pattern (3b), with the most prominent or main stress being at or near an edge and the others being less prominent or secondary (indicated by a grave accent).

(3) a. σ́ σ σ σ σ σ b. σ́ σ σ̀ σ σ̀ σ

This difference between the two types of system was once taken to be evidence for a formal distinction between "unbounded" and "bounded" feet, respectively (whence the classificatory labels given to the systems themselves). The structural analyses thus given to the forms in (3) were as in (4), where parentheses indicate foot boundaries.

(4) a. (σ́ σ σ σ σ σ) b. (σ́ σ) (σ̀ σ) (σ̀ σ)

Instead of admitting both bounded and unbounded feet into the typology of foot types, Prince (1985) argues that iteratively constructed bounded feet in forms like (3b)/(4b) could simply be noniteratively constructed to account for the single stress in forms like (3a). The structural analysis given to the form in (3a) under this view is thus as in (5) instead of as in (4a).

(5) (σ́ σ) σ σ σ σ

This gross typological distinction can be captured by the interaction among the constraints ALLFT-L, ALLFT-R, and PARSE-σ, defined in (6) (on Generalized Alignment theory, see McCarthy & Prince 1993b). Here and throughout, a Prosodic Word (the domain of footing) is referred to as a PrWd.

(6) a. ALLFT-L — Align (Ft, L, PrWd, L)
The left edge of every foot is aligned with the left edge of a PrWd.
b. ALLFT-R — Align (Ft, R, PrWd, R)
The right edge of every foot is aligned with the right edge of a PrWd.
c. PARSE-σ — Parse Syllable
Syllables are parsed into feet.

When PARSE-σ is dominant, its demand to parse all syllables into feet overrides any desire on the part of the alignment constraints to have all feet aligned with the left or right edge of the PrWd, as shown in T1. (I ignore until §4 the distinction between main and secondary stress in the set of output candidates, and hence do not indicate stress on them at all.)

T1 Iterative footing: PARSE-σ » {ALLFT-L, ALLFT-R}[2]

Input: σ σ σ σ σ σ	PARSE-σ	ALLFT-L	ALLFT-R
a. (σ σ) σ σ σ σ	*!***		****
b. ☞ (σ σ) (σ σ) (σ σ)		******	******
c. σ σ σ σ (σ σ)	*!***	****	

When either ALLFT-L or ALLFT-R dominates PARSE-σ, the situation is reversed: only an edgemost pair of syllables is footed, at the expense of exhaustive metrification (cf. Halle & Vergnaud 1987, Halle 1989, 1990; see also §5 below). The higher-ranked member of the pair ALLFT-L and ALLFT-R determines the edge at which the foot is placed, as shown in T2.

T2 Noniterative footing: ALLFT-L » {PARSE-σ, ALLFT-R}

Input: σ σ σ σ	ALLFT-L	PARSE-σ	ALLFT-R
a. ☞ (σ σ) σ σ σ σ		****	****
b. (σ σ) (σ σ) (σ σ)	*!*****		******
c. σ σ σ σ (σ σ)	*!***	****	

Making ALLFT-L dominant as in T2 results in (default) main stress at the left edge. The opposite ranking of ALLFT-L and ALLFT-R results in (default) main stress at the right edge. I henceforth consistently rank ALLFT-L above ALLFT-R in order to confine our attention to the left edge-oriented cases, with the understanding that anything I say about ALLFT-L and ALLFT-R must be said of ALLFT-R and ALLFT-L, respectively, when speaking about the mirror-image, right edge-oriented cases.[3]

The ranking of ALLFT-L above PARSE-σ is thus a necessary component of the analysis of (left edge-oriented) unbounded stress systems.[4] The relative ranking of PARSE-σ and ALLFT-R becomes important when syllable quantity is taken into consideration, a topic to which we now turn.

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[2] A violation of PARSE-σ is assessed for each unfooted syllable and a violation of one of the alignment constraints is assessed for each syllable that separates the designated edge of a foot from the designated edge of the PrWd. Minimal violation of the higher-ranked member of the pair ALLFT-L and ALLFT-R when PARSE-σ is dominant derives directionality effects in odd-parity strings, an observation attributed by McCarthy & Prince (1993b) to Robert Kirchner.

[3] The same considerations apply to HDFT-L and HDFT-R, introduced in §4.

[4] Resurrecting the unbounded foot (4a), one could assume violability of the constraint demanding strict binarity of feet (FTBIN; Prince 1980, 1990, Prince & Smolensky 1993). When ranked below both ALLFT-L and ALLFT-R, an unbounded foot would be optimal, since it satisfies these constraints at the expense of FTBIN (see e.g. Kenstowicz 1994). I follow Hyde (1996) and Tesar (1998) in assuming that feet are (inviolably) maximally binary at the syllabic level, precluding such an analysis.

3 Quantity (in)sensitivity

The Weight-to-Stress Principle (WSP; Prince 1980, 1990) demands that all heavy syllables be prominent in foot structure and on the grid; i.e., that they be footed and stressed. When ranked below ALLFT-L, the WSP will be forced to be violated by any non-leftmost heavy syllables, as shown in T3. This thus yields a consistently edgemost main stress system.[5]

T3 Quantity insensitive footing: ALLFT-L » {WSP, PARSE-σ, ALLFT-R}

Input: σ σ Σ σ Σ σ	ALLFT-L	WSP	PARSE-σ	ALLFT-R
a. ☞ (σ σ) Σ σ Σ σ		**	****	****
b. (σ σ) (Σ) σ (Σ) σ	*!*****		**	********
c. σ σ (Σ) σ (Σ) σ	*!*****		****	****

The WSP potentially conflicts with the alignment constraints because it wants all heavy syllables, peripheral or nonperipheral, to be foot heads. When ranked above ALLFT-L, the quantity-sensitive nature of the WSP forces heavy syllables to be footed regardless of their position in the form, causing some left misalignment.[6] In light-syllable forms, as we already know from T2, ALLFT-L emerges from beneath the now-irrelevant WSP, and is satisfied at some expense to lower-ranked PARSE-σ and ALLFT-R. If in addition PARSE-σ is ranked above ALLFT-R, an initial foot will also be present in the optimal form, better satisfying PARSE-σ as shown in T4.

T4 Quantity sensitive footing I: WSP » ALLFT-L » PARSE-σ » ALLFT-R

Input: σ σ Σ σ Σ σ	WSP	ALLFT-L	PARSE-σ	ALLFT-R
a. (σ σ) Σ σ Σ σ	*!*		****	****
b. ☞ (σ σ) (Σ) σ (Σ) σ		******	**	********
c. σ σ (Σ) σ (Σ) σ		******	***!*	****

If ALLFT-R dominates PARSE-σ, the initial foot is absent (not, of course, if the initial syllable were heavy), better satisfying ALLFT-R, as shown in T5.

[5] Initial or peninitial, depending on rhythmic foot type (trochaic or iambic); see footnote 1. See Hyman 1977 and Walker 1996 on the general rarity of peninitial stress and, more interestingly, the unattestedness of default-to-peninitial.

[6] The ranking of the WSP above ALLFT-L partially undoes the ranking of ALLFT-L above PARSE-σ, because the WSP demands not that all syllables be footed, but rather that at least all heavy syllables be foot heads. In this sense, the WSP is, in part at least, a less *stringent* version of PARSE-σ (see Prince 1997 on stringency).

T5 Quantity sensitive footing II: WSP » ALLFT-L » ALLFT-R » PARSE-σ

Input: σ σ Σ σ Σ σ	WSP	ALLFT-L	ALLFT-R	PARSE-σ
a. (σ σ) Σ σ Σ σ	*!*		****	****
b. (σ σ) (Σ) σ (Σ) σ		******	*****!***	**
c. ☞ σ σ (Σ) σ (Σ) σ		******	****	****

A necessary but entirely uncontroversial assumption being made here is that the ranking of ALLFT-R above PARSE-σ as in T5 cannot force the absence of the initial and only foot in light-syllable forms in T2; that is, the conflicting demands of both alignment constraints cannot vacuously secure their mutual satisfaction by simply not having any feet to align. The alignment constraints themselves do not enforce the presence of any feet; rather, universally top-ranked LXÅPR (Prince & Smolensky 1993, McCarthy & Prince 1993ab) demands that every lexical word be a PrWd, with a headedness requirement demanding that a PrWd be headed by a foot (consistent with both the Weak Layering Hypothesis of Itô & Mester 1992 and the Strict Layering Hypothesis of Selkirk 1984, though the violability of PARSE-σ is only consistent with the former).[7]

Under the ranking in T5, then, an initial foot is absent in forms with heavy syllables and present otherwise. This is because ALLFT-R decides between candidates b and c, which fare equally on higher-ranked ALLFT-L — the only relevant candidates due to the overarching demands of the even higher-ranked WSP. More generally, given a pair of "opposite" constraints H and L, the higher-ranked member of the pair H does not necessarily render the lower-ranked member L inactive. L is potentially active if an even higher-ranked constraint C winnows a particular candidate set down to include only candidates that fare equally on H but not equally on L. In the case under discussion, this "even higher-ranked constraint C" is the WSP, which is only relevant in forms with heavy syllables—thus accounting for the observed complementary distribution of initial feet (absent in forms with heavy syllables and present otherwise).

The same result is demonstrated by Samek-Lodovici (1997) with similarly opposite (though nongradiently evaluated) focus-alignment constraints in syntax, which under a ranking configuration entirely parallel to the one in T5 results in an attested "mixed-focus" system with leftward and rightward focus being in complementary distribution. Nelson (1997) shows the activity of the same ranking schema in the formation of nicknames in French (with essentially the same alignment constraints discussed here), accounting for the complementary distribution of left-anchored and right-anchored hypocoristic forms observed in that language. In the following section, I discuss how not all pairs of intuitively opposite constraints exhibit this ranking effect.

[7] In more recent work (Selkirk 1995), Selkirk argues for the violability of more general, category-independent versions of PARSE-σ and the headedness requirement.

4 Main stress

Whether the total ranking of the constraints considered so far is as in T4 or as in T5, the result in light-syllable forms is the same, as in T2: only one foot, on the left edge, and hence initial main stress. This is because ALLFT-L is the highest-ranked constraint relevant to the evaluation of light-syllable forms, and this constraint prefers the monopodal candidate. The higher-ranked WSP is only relevant in the evaluation of forms with heavy syllables, forcing the presence of multiple feet as in T4 and T5. Only one of these multiple feet may bear main stress, however, and this variable is the topic of the present section.

I begin with the uncontroversial assumption that the head of a PrWd is a foot, and that this head foot is the one that bears main stress. The constraints responsible for the placement of the head of a PrWd are the alignment constraints in (7) (McCarthy & Prince 1994; cf. the End Rule of Prince 1983).

(7) a. HDFT-L — Align (PrWd, L, Hd(PrWd), L)
The left edge of every PrWd is aligned with the left edge of its head.

b. HDFT-R — Align (PrWd, R, Hd(PrWd), R)
The right edge of every PrWd is aligned with the right edge of its head.

Like the foot-alignment constraints in (6), the head-alignment constraints in (7) are assumed to be gradiently violable (see footnote 2): a violation is assessed for each syllable that separates the designated edge of the head foot from the designated edge of the PrWd. Note also that these constraints, again like those in (6), are "opposites" of each other. However, unlike those in (6), the constraints in (7) target a unique element: *the* head foot of the PrWd as opposed to *all* feet in the PrWd. There is no opportunity for the higher-ranked of the constraints in (7) to pass a decision among output candidates to the lower-ranked one, because every violation of one of these constraints translates into a nonviolation of the other; any set of candidates that tie on one of the constraints (i.e., violate or satisfy it equally) necessarily tie on the other. No matter what the rest of the constraint hierarchy dictates, the lower-ranked of the constraints in (7) is guaranteed to be inactive; that is, it is guaranteed never to be able to make a decision between any two competing output candidates.

This is a corollary of Prince's (1997) *Total Deactivation Property*, noted by Grimshaw (1997) with respect to a pair of morphosyntactic clitic-alignment constraints. The uniqueness of the target and the gradient violability of the alignment constraints in (7) and of those considered by Grimshaw entails a one-to-one correspondence between violations of one constraint and nonviolations of the other, so that their combined violations always total the same number (as long as the members of the candidate set are of equal length). This is shown by the calculations in the table below, where α is the unique element (the head foot, the case-marked clitic, etc.) targetted by the pair of alignment constraints.

(8) Total Deactivation

	Align-α-Left	+	Align-α-Right	=	Total
α x y	0 violations	+	2 violations	=	2 violations
x α y	1 violation	+	1 violation	=	2 violations
x y α	2 violations	+	0 violations	=	2 violations

Having established this, consider first the ranking in T4, under which forms both with and without heavy syllables receive at least an initial foot because PARSE-σ outranks ALLFT-R. Now recall that in light-syllable forms, this ranking predicts initial stress as in T2; in order to maintain this prediction, ALLFT-L must at least dominate conflicting HDFT-R, a ranking argument I leave for the reader to verify. The further ranking of HDFT-L above HDFT-R, no matter where they are otherwise ranked with respect to other constraints, predicts a system with consistently initial main stress and secondary stress on all noninitial heavy syllables. This is shown in T6.[8]

T6 Consistently edgemost main stress:
{WSP » ALLFT-L » PARSE-σ » ALLFT-R}, {HDFT-L » HDFT-R}

Input: σ σ Σ σ Σ σ	ALLFT-L	PARSE-σ	ALLFT-R	HDFT-L	HDFT-R
a. (σ́ σ) Σ σ Σ σ		****	****		****
b. ☞ (σ́ σ) (Σ̀) σ (Σ̀) σ	******	**	********		****
b´. (σ̀ σ) (Σ̀) σ (Σ́) σ	******	**	********	*!***	*
b´´. (σ̀ σ) (Σ́) σ (Σ̀) σ	******	**	********	*!*	***
c. σ σ (Σ̀) σ (Σ́) σ	******	***!*	****	*!***	*
c´. σ σ (Σ́) σ (Σ̀) σ	******	***!*	****	*!*	***

Now consider the opposite ranking of these constraints — that is, HDFT-R dominates HDFT-L. In the uninteresting case where HDFT-R also dominates ALLFT-L, every form (regardless of the light/heavy syllable distinction) has a word-final main-stress foot. Again, I leave it to the reader to verify this. The case of interest, in which ALLFT-L dominates HDFT-R, predicts main stress on the initial foot in light-syllable forms as shown above in T2, and on the last heavy syllable in forms with heavy syllables as shown below in T7. In other words, this is a default-to-opposite-side (DTO) system.

[8] The first candidate in this and all following tableaux fatally violates the top-ranked WSP. Due to page-width limitations, the WSP is simply left out of all tableaux and the first candidate is entirely shaded to indicate its irrelevance.

T7 DTO main stress I:
WSP » ALLFT-L » {{PARSE-σ » ALLFT-R}, {HDFT-R » HDFT-L}}

Input: σ σ Σ σ Σ σ	ALLFT-L	PARSE-σ	ALLFT-R	HDFT-R	HDFT-L
a. (σ́ σ) Σ σ Σ σ		****	****	****	
b. (σ́ σ) (Σ̀) σ (Σ̀) σ	******	**	********	**!**	
b´.☞ (σ̀ σ) (Σ̀) σ (Σ́) σ	******	**	********	*	****
b´´. (σ̀ σ) (Σ́) σ (Σ̀) σ	******	**	********	**!*	**
c. σ σ (Σ̀) σ (Σ́) σ	******	***!*	****	*	****
c´. σ σ (Σ́) σ (Σ̀) σ	******	***!*	****	**!*	**

Consider now the reverse ranking of ALLFT-R and PARSE-σ. As shown in T5 and discussed at length above, this ranking can force the absence of an initial foot. This thus yields another default-to-opposite-side system, but one with no initial foot in forms with (only noninitial) heavy syllables, as shown in T8 (recall once again that light-syllable forms still come out as in T2).[9]

T8 DTO main stress II:
WSP » ALLFT-L » {{ALLFT-R » PARSE-σ}, {HDFT-R » HDFT-L}}

Input: σ σ Σ σ Σ σ	ALLFT-L	ALLFT-R	PARSE-σ	HDFT-R	HDFT-L
a. (σ́ σ) Σ σ Σ σ		****	****	****	
b. (σ́ σ) (Σ̀) σ (Σ̀) σ	******	*****!***	**	**!**	
b´. (σ̀ σ) (Σ̀) σ (Σ́) σ	******	*****!***	**	*	****
b´´. (σ̀ σ) (Σ́) σ (Σ̀) σ	******	*****!***	**	**!*	**
c. ☞ σ σ (Σ̀) σ (Σ́) σ	******	****	****	*	****
c´. σ σ (Σ́) σ (Σ̀) σ	******	****	****	**!*	**

The ranking of HDFT-R above HDFT-L demands main stress placement on the *rightmost available foot*, where "rightmost available" is defined by the part of the constraint hierarchy dominating these constraints. In light-syllable forms, where the highest-ranked WSP isn't at issue, the next-highest-ranked constraint ALLFT-L makes the decisive choice in only allowing a single, left-aligned foot. In forms with one or more (noninitial) heavy syllables, the WSP forces minimal violation of ALLFT-L by forcing the heavy syllable(s) to be footed. The rightmost available foot in light-syllable forms is thus the initial and only one, and so the leftmost syllable receives default main stress, as shown in T2. In forms with heavy syllables, on the other hand, the rightmost available foot is the rightmost of the WSP-footed heavy syllables, and this rightmost heavy syllable receives main stress, as shown in T7 and T8.

[9] The empirical significance of the difference between the two predicted DTO main stress systems in T7 and T8 is discussed in §5 below.

Consider again the T7 ranking in which ALLFT-R dominates PARSE-σ. If HDFT-L dominates HDFT-R but is in turn dominated by ALLFT-R, the result is a system with stress on the *leftmost* available foot: the initial foot in light-syllable forms, as in T2, and the first heavy syllable in forms with heavy syllables — a default-to-same-side (DTS) system, as in T9.

T9 DTS main stress:
WSP » ALLFT-L » ALLFT-R » {PARSE-σ, {HDFT-L » HDFT-R}}

Input: σ σ Σ σ Σ σ	ALLFT-L	ALLFT-R	PARSE-σ	HDFT-L	HDFT-R
a. (σ́ σ) Σ σ Σ σ		****	****		****
b. (σ́ σ) (Σ̀) σ (Σ̀) σ	******	*****!***	**		****
b´. (σ̀ σ) (Σ̀) σ (Σ́) σ	******	*****!***	**	****	*
b´´. (σ̀ σ) (Σ́) σ (Σ̀) σ	******	*****!***	**	**	***
c. σ σ (Σ̀) σ (Σ́) σ	******	****	****	***!*	*
c´.☞ σ σ (Σ́) σ (Σ̀) σ	******	****	****	**	***

The ranking of HDFT-L above HDFT-R says to put main stress on the leftmost available foot, where "leftmost available" is again defined by the higher-ranked portion of the hierarchy. Part of this higher-ranked portion includes ALLFT-R, which by virtue of its rank above PARSE-σ chooses candidates without an initial foot. If HDFT-L were to dominate HDFT-R *and* ALLFT-R, we would get the uninteresting case of consistently edgemost stress, just as in T6: the leftmost available foot would indeed be leftmost, satisfying both ALLFT-L and HDFT-L.[10] But because HDFT-L is dominated by ALLFT-R, initial feet in forms with heavy syllables are dispreferred (unless the initial syllable itself is heavy). The leftmost available foot is thus the leftmost heavy syllable, and in the absence of heavy syllables, on the leftmost syllable.

There emerges from the analyses above a transparent and satisfying relation between the elements of the description of DTS/DTO systems ("stress the leftmost/rightmost heavy syllable, otherwise the leftmost/rightmost syllable") and the ranking statements that account for them. In forms with heavy syllables, the WSP forces the presence of multiple feet and main stress is placed by the higher-ranked of HDFT-L and HDFT-R. When there are no heavy syllables, the edge-oriented constraint ALLFT-L (or ALLFT-R, whichever is higher-ranked) emerges victorious from under the quantity-sensitive, and thus inactive, WSP. Whether this default in light-syllable forms is to the same or opposite side relative to forms with heavy syllables depends on the relative ranking of both pairs of alignment constraints. If the edges referred to by the higher-ranked of each pair match, then it's the same side; if they don't, it's the opposite side.

[10] This is because HDFT-L (like the WSP; see footnote 6) is in part a less stringent version of PARSE-σ. HDFT-L demands only the presence of an as-leftmost-as-possible foot, only partially undoing the ranking of ALLFT-R above PARSE-σ.

5 Residual issues

On the face of it, the foregoing analyses make a strong and apparently falsified prediction: that all heavy syllables will be footed (see T7, T8, T9) and hence presumably (secondarily) stressed. However, there do exist unbounded stress systems with no reported secondary stresses. This is unproblematic in the case of consistently edgemost stress systems, where the WSP can simply be subordinated (see T3). But high rank of the WSP is absolutely essential to the above analyses of DTS and DTO systems — there need to be multiple feet for ALLFT-R to emerge in the case of DTS and for HDFT-R to emerge in the case of DTO. The immediate prediction is that these other feet should be stressed.

This prediction is, I believe, a sub-case of the more general opacity effect caused by exhaustivity and conflation (Halle & Vergnaud 1987:50ff, Halle 1989, 1990). Halle (& Vergnaud) identify a number of cases in which exhaustive parsing of forms is necessary to locate main stress, even in the absence of secondary stress. (In serial terms, foot construction applies exhaustively, the head foot is located and stressed, and conflation rules remove all non-head feet.) The cases at hand, as analyzed here and by Prince (1985), are ones in which *semi*-exhaustive parsing of forms *with heavy syllables* is necessary to locate main stress, even in the absence of secondary stress.

In the present non-serial context, the necessary claim is that stress is partially independent of foot structure. Suppose that stress only surfaces on foot heads, but that foot heads needn't be stressed.[11] The WSP would have to be rephrased accordingly, requiring only that heavy syllables be foot heads, and an independent battery of constraints would be required in order to determine whether foot heads are stressed (i.e., prominent on the grid) or not. Elaboration of this idea is clearly beyond the scope of this paper; suffice it to say that whatever mechanism is necessary for the cases identified by Halle-Vergnaud should extend trivially to the cases under discussion here.

Another, independent prediction made in the case of T7 is the presence of an initial secondary stress foot in some DTO cases (compare T8). Cases like T7 are attested: according to Hayes 1995:296, Kuuku-Yaʔu is an example of such a system (cf. Walker 1996:45); other examples of DTO systems seem to be of the T8 variety (though this must of course be verified case-by-case). A fact worth noting here is that the distinction between the DTO systems in T7 and T8 is not complemented by a similar distinction between two DTS systems; i.e., between a system with an initial secondary stress foot (unattested) and one without such a foot (as in T9). This consequence is preserved from Prince 1985: because main stress in DTS systems is without exception on the *leftmost possible* syllable (still limiting our attention to cases in which the left edge is the default), a form with an initial secondary stress foot incurs additional and unnecessary violations of ALLFT-R (see candidate b´´ in T9).

[11] Walker (1996:40ff) explores a variant of this idea under the assumption that stress is possible in the absence of (i.e., is *completely* independent of) foot structure.

6 Conclusion

I hope to have shown in this paper that the gross characteristics of unbounded stress systems can be accounted for with different rankings of a set of constraints that are independently motivated in the analysis of (on the surface quite different) bounded stress systems. A desirable consequence of this result is that it may be the case that nothing new needs to be added to the basic theory to account for unbounded stress systems: the differences among all stress systems are accounted for by different rankings of the same set of constraints. This has obviously desirable consequences for learnability, as demonstrated by Tesar (1998) with respect to the grammars defined by the factorially many possible different rankings of the same basic set of constraints considered here.

Aside from the very general differences noted between bounded and unbounded stress systems in this paper, there are other particularities of each that need to be addressed in a complete unified theory of stress systems. In the case of unbounded stress systems, many of these particularities are discussed and analyzed by Walker (1996). Walker's analysis differs from the present one in certain, perhaps important, respects; my hope is that further research can bring the results of both analyses together in some principled way.

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