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Rachel Walker
Ove Lorentz
Haruo Kubozono

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Mongolian Stress: Typological Implications for Nonfinality in Unbounded Systems

Rachel Walker
University of California, Santa Cruz
walker@ling.ucsc.edu

This paper examines the typology and analysis of unbounded stress systems. From a typological perspective I will propose that a parameter of Nonfinality should be added to the descriptive typology of unbounded stress, while on the subject of phonological theory, I will argue that just three constraints in an Optimality Theoretic framework (as developed by Prince & Smolensky 1993; henceforth P&S 1993) are sufficient to capture the core features of an unbounded system. In addition, I will demonstrate that the range of stress patterns predicted by factorial ranking of these three constraints are all attested.

1 Two parameters for unbounded stress

Traditional typologies of unbounded stress conceive of a four-way contrast resulting from the exhaustive combination of two binary parameters (Hayes 1981, Prince 1983). The first of these parameters reflects the quantity sensitivity of these systems by requiring that stress fall on the leftmost/rightmost heavy syllable in the word. The second parameter reflects the edge-aligned nature of default stress by fixing stress on the leftmost/rightmost syllable in words with no heavy syllables. A chart of the four systems in this typology is given in (1) with examples of languages for each (examples are from Hayes 1995).

(1) A four-way typology of unbounded stress:

L=left, R=right

DESCRIPTION	Heavy σ	Default
i Stress leftmost heavy σ , else leftmost σ <i>Amele, Au, Lhasa Tibetan, Lushootseed, Murik, Yana.</i>	L	L
ii Stress leftmost heavy σ , else rightmost σ <i>Komi, Kwakw'ala.</i>	L	R
iii Stress rightmost heavy σ , else leftmost σ <i>Kuuku-Ya?u, Huasteco, Chuvash, Eastern Cheremis.</i>	R	L
iv Stress rightmost heavy σ , else rightmost σ <i>Aguacatec, Golin.</i>	R	R

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1.1 Unbounded stress in Optimality Theory: PK-PROM >> ALIGN PK

As P&S (1993: 38-39) have pointed out, unbounded stress systems in which both parameters are set to the same side can be captured by simply ranking a constraint on peak prominence over a constraint aligning the peak to the edge of the prosodic word. The peak-alignment constraint determines the left or right orientation of stress by requiring that any prominence-peak be aligned to the left/right edge of some prosodic word (PrWd). This constraint is formalized in (2) following the generalized form of McCarthy & Prince 1993.

- (2) ALIGN (PK, L/R, PRWD, L/R) (henceforth ALIGN PK L/R)

The peak prominence constraint in (3) realizes the quantity-sensitive nature of the system, stating that a given element *x* makes a better peak than an element *y* if the intrinsic prominence of *x*, such as syllable weight or tone, is greater than that of *y* (P&S 1993: 39).

- (3) PK-PROM: Peak (*x*) > Peak (*y*) if |*x*| > |*y*|.

The effect of ranking PK-PROM over ALIGN PK is illustrated in (4-5) for a same-side right-oriented stress system, which stresses the rightmost heavy syllable, else the rightmost syllable (type (iv) in table (1)). The tableau in (4) demonstrates the results in a form with heavy and light syllables. Here PK-PROM ensures that the stressed syllable is heavy by ruling out candidate (c), which satisfies alignment but stresses a light syllable. ALIGN PK R then has the effect of selecting the candidate which stresses the rightmost of the heavy syllables in the PrWd, as is evident from comparison of candidates (a) and (b).

- (4) PK-PROM >> ALIGN PK R. Schematic form with heavy and light syllables.

	HHL	PK-PROM	ALIGN PK R
☞ (a)	H H́ L		σ
(b)	H́ HL		σ!σ
(c)	HH Ĺ	*!	

The tableau in (5) illustrates the effect of the constraint ranking in a form with no heavy syllables. Because all syllables in such a form have the same level of intrinsic prominence, the PK-PROM constraint does not come into play, and the force of the alignment constraint results in complete alignment to the right.

- (5) PK-PROM >> ALIGN PK R. Schematic form with no heavy syllables.

	LLL	PK-PROM	ALIGN PK R
☞ (a)	LL Ĺ		
(b)	L Ĺ L		σ!
(c)	Ĺ LL		σ!σ

In the default to opposite edge systems, the ranking of PK-PROM over ALIGN PK will correctly realize the stress placement in words with at least one heavy syllable, but something further will be needed to realize the opposite-edge default. Just the two constraints, PK-PROM and ALIGN PK, are otherwise sufficient, however, to capture the core features of the unbounded systems in the four-way typology.

2 Mongolian stress

I turn now to the unbounded stress pattern of Khalkha, an East Mongolian language, which has long been thought to conform to the two-parameter typology outlined in the preceding section. I will show, however, that the actual stress pattern of Khalkha is in fact crucially different from the early descriptions of this system, in part, because Khalkha stress exhibits a nonfinality effect. On the basis of Khalkha stress and additional unbounded systems which exhibit nonfinality effects, I will argue that Nonfinality should be added as a third parameter to the typology of unbounded stress.

2.1 The corrected description of Khalkha stress

In the theoretical literature, Khalkha has come to be known as an example of an unbounded stress system of type (i) in table (1), in which the leftmost heavy syllable is stressed and the default stress falls on the leftmost syllable, as in (6) below (see, for example, Hayes 1981, 1995, Prince 1983, Hammond 1986, Halle & Vergnaud 1987, Idsardi 1992). The description that appears in the theoretical literature is based on the work of Street (1963: 62), who refers to the grammar of Poppe (1951: 13).

- (6) Khalkha stress (early version):
Stress the leftmost heavy syllable; otherwise stress the leftmost syllable.

This early description of Khalkha stress has since been found to be mistaken, and Bosson (1964) and Poppe (1970) have provided a corrected description. Another East Mongolian language, Buriat, is reported to share the same stress pattern (Poppe 1960). Poppe's description of Khalkha stress is given in (7) along with the examples he gives for Khalkha and Buriat to illustrate the pattern. In the examples, two adjacent vowels, e.g. [aa] and [ae], signify a long vowel and diphthong respectively. Stress in these and subsequent forms is marked by both underlining and an acute accent.

- (7) Poppe on Khalkha stress (1970: 47). Same system for Buriat (Poppe 1960: 19).

- a. "Words containing no geminate vowel phonemes or diphthongs have the stress on the initial syllable."

<i>Khalkha</i>	<u>í</u> L	[áxa]	'brother'
	<u>í</u> LL	[úŋísan]	'having read'
<i>Buriat</i>	<u>í</u> L	[xáda]	'mountain'

- b. "Words containing one geminate vowel phoneme or one diphthong have the stress on the geminate vowel or diphthong, respectively."

<i>Khalkha</i>	L <u>í</u>	[daláe]	'sea'
	L <u>í</u>	[galúu]	'goose'
<i>Buriat</i>	L <u>í</u>	[xadaár]	'through the mountain'

- c. "Words containing more than one geminate vowel phoneme or diphthong have the stress on the penultimate geminate vowel or diphthong."

<i>Khalkha</i>	L <u>í</u> HH	[morióoroo]	'by means of his own horse'
	NB! LH <u>í</u> H	[dalaegáaraa]	'by one's own sea'
<i>Buriat</i>	L <u>í</u> HH	[dalaígaar]	'by sea'
	L <u>í</u> HH	[morióoroo]	'by one's own horse'
	LH <u>í</u> H	[dalaígaaraa]	'by one's own sea'

The description of the forms in (7a-b) agrees with the early description of Khalkha stress in (6). However, the portion of the description that appears in (7c) reveals an important difference, because in forms with more than one heavy syllable, stress falls on the penultimate heavy syllable rather than on the leftmost one. The crucial form which distinguishes the corrected description of Khalkha from the early one is the form [dalaegáaraa] ‘by one’s own sea’. Notice that all of the other forms given are consistent with either description. This considerable overlap in the expected output of the two patterns is likely a source of the system at first being mistaken for the simpler same-side left-oriented system.

Bosson gives a description of Khalkha stress similar to that of Poppe’s, confirming the correction. Bosson states that “if the word contains several syllables with long vowels, the stress falls on the penultimate long vowel” (1964: 21). Note that both Poppe and Bosson characterize the stressed syllable as the “penultimate” heavy, and in each of the examples provided with more than one heavy syllable, the stressed syllable happens to fall in the penultimate position in the word. The question thus arises whether the “penultimate” heavy syllable is intended to refer to the rightmost nonfinal heavy (e.g. H H H L L) or whether it is the second last of the heavy syllables in the word, regardless of whether all heavy syllables are nonfinal (e.g. H H H L L). My own research with a native speaker of Khalkha and consultation with James Bosson (personal communication 1994) concerning Buriat and Khalkha stress indicates that stress can fall on the rightmost nonfinal heavy syllable, whether it is the penultimate syllable in the word or not.^{1,2} This pattern is illustrated in the list of forms in (8) which shows different heavy-light configurations.

(8) Khalkha and Buriat: stress the rightmost nonfinal heavy syllable.

Khalkha

<u>H</u> H	[áaruul]	‘dry cheese curds’
<u>H</u> LH	[úitgartae]	‘sad’
L <u>H</u> LH	[dolóodugaar]	‘seventh’
H <u>H</u> LL	[baegúulagdax]	‘to be organized’
LH <u>H</u> L	[xöndiirüülen]	‘to separate’ (modal)
H <u>H</u> H	[uurtáegaar]	‘angrily’
H <u>H</u> LH	[baigúullagaar]	‘by means of the organization’
LHH <u>H</u> L	[ulaanbaatrinxan]	‘the residents of Ulaanbaatar’
<i>Buriat</i>		
<u>H</u> H	[bóosoo]	‘bet, wager’
L <u>H</u> LH	[xudáalingdaa]	‘to the parents of the husband in their mutual relation’
H <u>H</u> LL	[taaruulagdaxa]	‘to be adapted to’
H <u>H</u> L	[öög[ööxe]	‘to act encouragingly’
LH <u>H</u> L	[namaatúulxa]	‘to cause to be covered with leaves’
HL <u>H</u> H	[xüüxengeeree]	‘by one’s own girl’
HLH <u>H</u> L	[buuzanuudije]	‘steamed dumplings’ (acc.)

¹ Recordings were made of the Khalkha forms as read by a native speaker of Khalkha Mongolian, over 40 years of age, who was born in Mongolia and spent most of his life living in the city of Ulaanbaatar. The forms were read in isolation and also in the sentence [xün “X” gev] ‘someone said “X”’. The recordings were made in November 1994 using a portable cassette recorder (Sony TCS-430). The forms were digitalized using MacRecorder, and phonetic analysis was performed using Signalyze 2.0 software.

² My investigation has found that the assignment of stress in forms with more than one heavy syllable is sometimes in free variation between stress on the rightmost nonfinal heavy and stress on the second last heavy syllable in the word. While this is an interesting phenomenon in itself, I will not be concerned with it here, and will focus solely on the variants in which stress falls on the rightmost nonfinal heavy.

The stress pattern of Khalkha and Buriat can thus be described as in (9):

- (9) Khalkha and Buriat stress (corrected version):
- (i) Stress the last syllable if it is the only heavy syllable;
 - (ii) Otherwise stress the rightmost nonfinal heavy syllable of the word.
 - (iii) If there are no heavy syllables, stress the initial syllable.

From the corrected description, it has emerged that rather than being a left-oriented stress system with default to the same side, Khalkha stress is in fact basically right-oriented with nonfinality and default to the opposite edge.

2.2 Analysis of Mongolian stress

With the description of Khalkha and Buriat stress established, its implications for the analysis of unbounded systems can be examined. Since the stress pattern is basically a right-oriented unbounded one, the analysis will require the PK-PROM and ALIGN PK R constraints, as in the systems in the two-parameter typology. However, in order to capture the nonfinality effect in Mongolian stress, the NONFINALITY constraint proposed by P&S (1993: 52) will also be necessary. This constraint, given in (10), requires that the head of a PrWd be nonfinal in the PrWd. I assume that for the purposes of this constraint, a stress peak qualifies as a head of the PrWd.

- (10) NONFINALITY: No head of PrWd is final in PrWd.

In order to capture the nonfinality in Khalkha and Buriat stress, NONFINALITY must be ranked over ALIGN PK R, as illustrated in (11). This tableau has a form in which all syllables are of equal weight. The selection of the optimal candidate with nonfinal stress in (a) over the nonoptimal candidate in (b) with final stress, shows that it is more important to have stress fall on a nonfinal syllable than it is to perfectly satisfy alignment.

- (11) NONFINALITY >> ALIGN PK R
Form: H H H [uurtáegaar] 'angrily' (Khalkha)

	H H H uurtaegaar	NONFINALITY	ALIGN PK R
☞ (a)	H <u>H</u> H		*
(b)	H H <u>H</u>	*!	

The tableau in (12) demonstrates that PK-PROM must be ranked above NONFINALITY. This example form shows that when the only heavy syllable in a word is final, the heavy syllable gets the stress, even though stressing it violates NONFINALITY.

- (12) PK-PROM >> NONFINALITY
Form: L H [xadaár] 'through the mountain' (Buriat)

	L H xadaar	PK-PROM	NONFINALITY
☞ (a)	L <u>H</u>		*
(b)	<u>L</u> H	*!	

Finally, the tableau in (13) provides evidence for ranking PK-PROM over ALIGN PK R, although by transitivity this ranking must hold anyway because of the rankings already

established for Khalkha and Buriat. The crucial effect of the ranking is apparent from comparison of candidates (a) and (b). Here we see that in a form where a nonfinal syllable is stressed, PK-PROM must dominate alignment in order to ensure that a heavy syllable gets stress rather than a light one, even when the light syllable is better aligned.

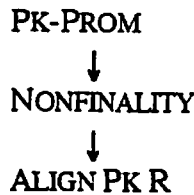
(13) PK-PROM >> ALIGN PK R

Form: H H L H [baiguullagaar] 'by means of the organization' (Khalkha)

	H H L H baiguullagaar	PK-PROM	NONFINALITY	ALIGN PK R
(a)	H <u>H</u> L H			σσ
(b)	H H <u>L</u> H	*!		σ
(c)	H H L <u>H</u>		*!	
(d)	<u>H</u> H L H			σσ!σ

The diagram for the constraint ranking needed to capture the rightmost nonfinal heavy stress of Khalkha and Buriat is given in (14). As this diagram shows, NONFINALITY is simply ranked in between the PK-PROM over ALIGN PK ranking already established for the unbounded systems in (1). Something more will be necessary to capture the opposite-edge default of the stress system, but I will not be concerned with the analysis of opposite-edge effects in this paper.

(14) Constraint ranking diagram for Mongolian stress



3 A typology of unbounded systems with nonfinality

The Mongolian stress pattern demonstrated that unbounded stress can exhibit a nonfinality effect. Hayes (1981) and Prince (1983) have also noted some instances of nonfinality effects in unbounded stress. I will turn now to making a case for adding Nonfinality as a third parameter to the descriptive typology of unbounded systems by showing that Nonfinality interacts with all of the unbounded patterns, and I will argue that the NONFINALITY constraint readily captures the nonfinality effects.

First I will distinguish between two types of nonfinality effects. One type I will refer to as quantity-sensitive (QS) Nonfinality, in which the last syllable may only be stressed when it is the only heavy syllable in the word. The second type I will refer to as quantity-insensitive (QI) Nonfinality, in which the last syllable is never stressed under any circumstances. If Nonfinality interacts exhaustively with unbounded systems, we expect both types of Nonfinality to occur with each of the four types of unbounded patterns in (1).

3.1 Stress rightmost heavy else rightmost with nonfinality

I will begin by considering nonfinality in systems which stress the rightmost heavy else the rightmost syllable. The dialect of Hindi described by Kelkar (1968) provides an example of such a system with QS Nonfinality. This dialect contrasts three levels of syllable weight: light ("L" CV), heavy ("H" CVV, CVC), and superheavy ("H:" CVVC, CVCC).

As Hayes observes, the stress pattern of Kelkar's Hindi is such that "stress falls on the heaviest available syllable, and in the event of a tie, the rightmost nonfinal candidate wins" (Hayes 1995: 276). This pattern is illustrated by the forms in (15).

(15) *Kelkar's Hindi*

Heaviest syllable is stressed:

L <u>H</u>	[ki <u>d</u> ár]	'which way'
L L <u>H</u>	[rupi <u>á</u> a]	'rupee'
L <u>H</u> :	[dʒa <u>ná</u> ab]	'sir'
H <u>H</u> :	[as <u>bá</u> ab]	'goods'
<u>H</u> : H H	[<u>rée</u> zgaarii]	'small change'

Rightmost nonfinal candidate stressed in case of tie:

L <u>L</u>	[sa <u>mí</u> ti]	'committee'
L <u>H</u> H	[ru <u>ká</u> ajaa]	'stopped' (trans.)
H <u>H</u> H	[roo <u>zá</u> anaa]	'daily'
H: <u>H</u> : H:	[a <u>as</u> máandʒaah]	'highly placed'
<u>H</u> : H H:	[<u>á</u> asmáādʒaah]	'highly placed' (var.)

In their analysis of stress in Kelkar's Hindi, P&S (1993: 40-42) propose the constraint ranking in (16).

(16) Kelkar's Hindi stress: PK-PROM >> NONFINALITY >> ALIGN PK R

Notice that this is the same ranking as that required for Khalkha and Buriat stress. The system of Hindi stress contrasts with the Mongolian one in that Hindi stress defaults to the same side rather than the opposite edge, and Hindi has three rather than two levels of syllable weight.

The effect of the constraint ranking in (16) for Kelkar's Hindi is illustrated in (17-19). First, (17) shows how the nonfinality effect is captured by ranking NONFINALITY over ALIGN PK R, paralleling the analysis of nonfinality in Khalkha and Buriat in (11).

(17) NONFINALITY >> ALIGN PK R

Form: L H H [rukáajaa] 'stopped' (trans.)

L H H rukajaa	NONFINALITY	ALIGN PK R
(a) L <u>H</u> H		*
(b) L H <u>H</u>	*!	

Next, in (18) the quantity sensitive nature of the nonfinality is built in by ranking PK-PROM over NONFINALITY. With this ranking, satisfying peak prominence is more important than making stress nonfinal, so a final syllable will be stressed if it is the heaviest syllable.

(18) PK-PROM >> NONFINALITY

Form: H H: [asbáab] 'goods'

H H: asbaab	PK-PROM	NONFINALITY
(a) H <u>H</u> :		*
(b) <u>H</u> : H:	*!	

Finally, (19) shows the effect of ranking PK-PROM over ALIGN PK R. In forms where a choice must be made between stressing a syllable with greater intrinsic prominence or stressing a better-aligned lighter syllable, this ranking ensures that peak prominence is respected, and the heaviest syllable wins. In (19) stressing a superheavy syllable is selected over stressing a heavy one which better satisfies alignment.

- (19) PK-PROM >> ALIGN PK R
 Form: \acute{H} : H H: [aasmāādʒaah] 'highly placed' (var.)

	H: H H: aasmāādʒaah	PK-PROM	NONFINALITY	ALIGN PK R
(a)	\acute{H} : H H:			Q0
(b)	H: \acute{H} H:	*!		Q
(c)	H: H \acute{H} :		*!	

Sindhi provides a second example of QS Nonfinality in a system stressing the rightmost heavy else rightmost syllable. The Sindhi stress pattern is described by Stowell as follows: "stress the last syllable if it is the only heavy syllable; else stress the rightmost heavy syllable, skipping the last; if there are no heavy syllables stress the penult syllable" (Stowell 1979: 70). This stress pattern is the same as that of Kelkar's Hindi except that there are only two levels of syllable weight rather than three. The analysis of the Sindhi pattern will be parallel to the one presented above for Kelkar's Hindi.

Western Cheremis is also a rightmost heavy else rightmost stress system, but it has QI Nonfinality. As described by Itkonen (1955: 28) and noted in Hayes (1995: 297), Western Cheremis stresses the rightmost nonfinal heavy syllable, otherwise the rightmost nonfinal syllable is stressed. The final syllable in a word is never stressed. This pattern is illustrated by the forms in (20). Note that full vowels constitute heavy syllables in Western Cheremis, while reduced vowels count as light.

- (20) *Western Cheremis*

Rightmost nonfinal heavy syllable is stressed:

\acute{H} H	[oʃma]	'sand'
\acute{H} L	[kɔrnə]	'way'
\acute{H} L L	[kɔrnəstə]	'way' (inessive)
\acute{H} L H	[βəstəlam]	'I laugh'
H \acute{H} L	[oʃmāstə]	'sand' (inessive)

Rightmost nonfinal light syllable (=reduced) is stressed when no nonfinal heavies:

\acute{L} L	[pərə]	'go in!'
\acute{L} H	[pəra]	'go in' (pres. 3 sg.)
L \acute{L} L	[pərəʃəm]	'I went in'
L \acute{L} H	[əməltəm]	'I shade'

Because the nonfinality effect in Western Cheremis is quantity insensitive, the analysis of Western Cheremis will differ from that of Hindi and Mongolian stress by reversing the ranking of NONFINALITY and PK-PROM, so that NONFINALITY is highest.

- (21) Western Cheremis stress: NONFINALITY >> PK-PROM >> ALIGN PK R

The constraint ranking in (21) is illustrated in the tableaux in (22-24). (22) simply shows that ranking NONFINALITY over ALIGN PK R is necessary in order to capture the basic nonfinality effect, as in each of the previous systems with nonfinality.

- (22) NONFINALITY >> ALIGN PK R
Form: \acute{H} H [ófma] 'sand'

	H H ofma	NONFINALITY	ALIGN PK R
☞ (a)	\acute{H} H		*
(b)	H \acute{H}	*!	*

(23) illustrates what is different about Western Chereemis. Here NONFINALITY is ranked over PK-PROM, because it is more important in this language to satisfy nonfinality by stressing a light nonfinal syllable than it is to respect peak prominence by stressing a final heavy. Nonfinality thus holds in all forms, regardless of the weight of the final syllable.

- (23) NONFINALITY >> PK-PROM
Form: \acute{L} H [péra] 'go in' (pres. 3 sg.)

	L H péra	NONFINALITY	PK-PROM
☞ (a)	\acute{L} H		*
(b)	L \acute{H}	*!	*

The tableau in (24) completes the illustration by showing the effect of PK-PROM dominating ALIGN PK R. In the candidates in (24), the undominated NONFINALITY constraint is respected and a choice must be made between two nonfinal syllables. Here stressing a heavy syllable wins out over stressing a better-aligned light one, so peak prominence must supercede alignment.

- (24) PK-PROM >> ALIGN PK R
Form: \acute{H} L H [βástəlam] 'I laugh'

	H L H βástəlam	NONFINALITY	PK-PROM	ALIGN PK R
☞ (a)	\acute{H} L H			*
(b)	H \acute{L} H		*!	*

3.2 Stress rightmost heavy else leftmost with nonfinality

We have now seen that the same-side right-oriented stress systems occur with both QS and QI Nonfinality. I will next examine cases of nonfinality effects in systems which stress the rightmost heavy else leftmost syllable. We have already seen such a system with QS Nonfinality in the stress pattern of Khalkha and Buriat. The analysis for this type of system has already been laid out in section 2.2.

Classical Arabic is an example of QI Nonfinality in a system stressing the rightmost heavy else leftmost syllable. As described by McCarthy (1979: 460) (see also Hayes 1979, 1981, 1995, Prince 1983), Classical Arabic stresses the rightmost nonfinal heavy syllable; otherwise stress falls on the initial syllable. In this language stress never falls on a final heavy syllable, where CVV and CVC qualify as heavy syllables. McCarthy notes that a superheavy syllable (CVVC, CVCC) can attract final stress, but these syllables have a very limited distribution in that they can only occur in pausal forms that occur before major syntactic breaks. The fact that final superheavy syllables attract stress thus seems not to be a counter-example to the nonfinal stress pattern of Classical Arabic but is instead a feature

of the prosodically special syntactic pausal position. The basic stress pattern of Classical Arabic is illustrated in (25). In these forms [h] represents a voiceless pharyngeal glide.

(25) *Classical Arabic*

Rightmost nonfinal heavy syllable is stressed:

L <u>H</u> L L	[ju <u>ʃa</u> ariku]	'he participates'
L <u>H</u> H	[ki <u>ta</u> abun]	'book' (nom. sg.)
<u>H</u> L L H	[<u>ma</u> mlakatun]	'kingdom' (nom. sg.)
L H <u>H</u> H	[mana <u>adi</u> luu]	'kerchiefs' (nom.)

Initial syllable is stressed when no nonfinal heavies:

<u>L</u> L L H	[<u>ba</u> lahatun]	'date' (nom. sg.)
<u>L</u> L L	[<u>ka</u> taba]	'he wrote'

The stress pattern of Classical Arabic is the same as that of Western Chereemis, but with default to the opposite side rather than the same side. Aside from this difference in default stress, the analysis of Classical Arabic will be parallel to that of Western Chereemis, with QI Nonfinality captured by ranking NONFINALITY above PK-PROM and the basic quantity-sensitive right-orientation of stress captured by ranking PK-PROM over the ALIGN PK R constraint.

3.3 *Stress leftmost heavy else leftmost with nonfinality*

We have now seen that both types of Nonfinality occur with each type of system stressing the rightmost heavy, and I will now go on to the cases which stress the leftmost heavy. First consider a pattern with QS Nonfinality which stresses the leftmost heavy, otherwise the leftmost syllable. Such a system will not in fact be distinguishable from a leftmost heavy else leftmost system without nonfinality. With QS Nonfinality, a nonfinality effect will not be apparent in words with heavy syllables, because it is the leftmost heavy which is stressed, even when it is final. Furthermore, since the default stress is leftmost, the right-oriented nonfinality effect will not emerge in the default pattern. The same-side leftmost systems with QS Nonfinality will thus not be absent in the typology, but simply will not contrast with the corresponding systems without a nonfinality effect.

A nonfinality effect will be apparent in a leftmost heavy else leftmost stress pattern when the nonfinality is quantity insensitive. Kashmiri provides an example of such a system. Like Kelkar's Hindi, Kashmiri contrasts three levels of syllable weight, although rather than having the light, heavy, superheavy series of Hindi, Kashmiri distinguishes light ("L" CV), closed ("C" CVC), and heavy ("H" CV:). The stress pattern of Kashmiri is such that stress falls on the heaviest nonfinal syllable, and in the event of a tie, the leftmost candidate wins. Stress is never final in the word (Kenstowicz 1993, citing Bhatt 1989). The pattern is illustrated in (26) (Kenstowicz does not supply glosses for the forms).

(26) *Kashmiri*

Heaviest nonfinal syllable is stressed:

<u>L</u> C	[<u>no</u> jid]	C <u>H</u> C	[mas <u>ra</u> awun]
<u>L</u> H	[<u>sa</u> laam]	<u>H</u> C C	[<u>ba</u> agambar]
<u>C</u> C	[<u>ma</u> tlab]	L <u>C</u> L L	[mu <u>ka</u> addima]
<u>H</u> H	[<u>da</u> anaa]	L L <u>C</u> L L	[ju <u>ni</u> varsiti]
L <u>C</u> C	[<u>mi</u> randzan]	L L <u>H</u> L	[ma <u>ha</u> ræni]
<u>C</u> L C	[<u>ra</u> phvarukh]	L <u>H</u> L L	[mu <u>la</u> aheza]
L <u>C</u> H	[<u>no</u> idgii]	C L <u>H</u> C	[na <u>ndi</u> ke[or]
L <u>H</u> C	[<u>zi</u> toovuh]	C <u>H</u> L L	[a <u>ng</u> oolika]
<u>H</u> L H	[<u>sa</u> arika]	C <u>H</u> C H	[na <u>rp</u> irastaan]

Leftmost nonfinal candidate stressed in case of tie:

\acute{L} LL	[<u>ph</u> kiri]	\acute{H} H LL	[náaraazagi]
\acute{L} L LC	[<u>si</u> rinagar]	L \acute{H} H L	[maháaraazi]
\acute{L} L L L H	[<u>pa</u> haradarii]	\acute{H} H C	[<u>mi</u> raazan]
L \acute{C} C L C	[ba <u>ga</u> ndarladin]	C L \acute{H} H C	[ardonóorii]for]
\acute{C} C H	[<u>ga</u> npaθjaar]	\acute{H} H H	[déeviiii]

In Kashmiri, NONFINALITY must be ranked over PK-PROM in order to capture the QI Nonfinality, just as in Western Cheremis and Classical Arabic. The tableau illustrating this ranking is given in (27), where stressing a nonfinal closed syllable wins over stressing a final heavy, even though this violates the otherwise active effect of peak prominence.

- (27) NONFINALITY >> PK-PROM
Form: L \acute{C} H [nojɔdɔii]

L C H nojɔdɔii	NONFINALITY	PK-PROM
(a) L \acute{C} H		*
(b) L C \acute{H}	*!	

3.4 Stress leftmost heavy else rightmost with nonfinality

The final set of cases to examine for interaction with nonfinality is the patterns which stress the leftmost heavy, else the rightmost syllable. Tahitian has such a pattern that exhibits QS Nonfinality. The stress pattern of Tahitian assigns stress to the leftmost heavy syllable, otherwise the penult. In Tahitian a syllable with a long vowel or vowel cluster qualifies as heavy, and stress is final if the only heavy syllable is final (Hayes 1981: 113-114 based on Tryon 1976. See also Stowell 1979, Prince 1983). The pattern is exemplified in (28).

- (28) *Tahitian*
Leftmost heavy syllable is stressed, even when final:
- | | | |
|---------------------|----------------------|----------|
| \acute{H} L | [<u>t</u> iare] | 'flower' |
| L \acute{H} H | [<u>ta</u> maaroa] | 'boy' |
| L L L \acute{H} L | [aʔa <u>hi</u> aata] | 'dawn' |
| L \acute{H} | [<u>pa</u> hi] | 'ship' |
- Penult is stressed when no heavy syllable:
- | | | |
|-----------------|-------------------|---------|
| \acute{L} L | [<u>f</u> áre] | 'house' |
| L \acute{L} L | [ʔo <u>hi</u> pa] | 'work' |

For Tahitian, PK-PROM must be ranked above NONFINALITY, which is the now familiar way of realizing QS Nonfinality. The effect of this ranking is illustrated in (29), where a final heavy is stressed to satisfy peak prominence, even though doing so violates Nonfinality.

- (29) Quantity sensitivity supercedes Nonfinality: PK-PROM >> NONFINALITY
Form: L \acute{H} [pahii] 'ship'

L H pahii	PK-PROM	NONFINALITY
(a) L \acute{H}		*
(b) \acute{L} H	*!	

Both QI and QS Nonfinality have now been demonstrated to interact virtually exhaustively with the unbounded systems, and only one system remains unattested. This is the case of QI Nonfinality in a system stressing the leftmost heavy else rightmost syllable. Since QI Nonfinality is attested for all of the other cases, there is no reason to believe that this remaining system will not emerge after further research.

3.5 The expanded typology of unbounded stress

The typology of unbounded stress revised from (1) to include a third parameter of Nonfinality is given in (30). The typology has now been expanded to comprise eight basic systems. The first four are simply those that constituted the four-way typology in (1), while the cases in (v-viii) are the ones that have been added. The latter four types each correspond to one of the first four, but also have a nonfinality effect. Significantly, all of the eight basic types are attested. In addition, for each type of system with a nonfinality effect, both cases of QI and QS Nonfinality are attested for all but type (vi). These results clearly indicate that Nonfinality is a robust parameter in unbounded stress.

(30) An eight-way typology of unbounded stress:

	DESCRIPTION	Heavy σ	Default	Nonfinality
i	Stress leftmost heavy σ , else leftmost σ <i>Amele, Au, Lhasa Tibetan, Lushootseed, Murik, Yana.</i>	L	L	N
ii	Stress leftmost heavy σ , else rightmost σ <i>Komi, Kwakw'ala.</i>	L	R	N
iii	Stress rightmost heavy σ , else leftmost σ <i>Kuuku-Ya?u, Huasteco, Chuvash, E. Cheremis.</i>	R	L	N
iv	Stress rightmost heavy σ , else rightmost σ <i>Aguacatec, Golin.</i>	R	R	N
v	Stress leftmost nonfinal heavy σ , else leftmost σ Q.S. NF: no contrast with type (i). Q.I. NF: <i>Kashmiri.</i>	L	L	Y
vi	Stress leftmost heavy σ , else penult Q.S. NF: <i>Tahitian.</i> Q.I. NF: ?	L	R	Y
vii	Stress rightmost nonfinal heavy σ , else leftmost σ Q.S. NF: <i>Khalkha, Buriat.</i> Q.I. NF: <i>Classical Arabic.</i>	R	L	Y
viii	Stress rightmost nonfinal heavy σ , else penult Q.S. NF: <i>Hindi, Sindhi.</i> Q.I. NF: <i>Western Cheremis.</i>	R	R	Y

4 Factorial ranking of PK-PROM, NONFINALITY, and ALIGN PK R

The previous section established that the parameter of Nonfinality is motivated in the descriptive typology of unbounded stress. From a theoretical perspective, only the NONFINALITY constraint was needed in addition to the already motivated PK-PROM and ALIGN PK constraints to capture the nonfinality effects in unbounded systems. These three constraints are each active in many languages, but so far only a few rankings of these

constraints have been examined. Optimality Theory predicts factorial constraint ranking. I now turn to demonstrating that all rankings for the three constraints yield attested patterns.

4.1 Six constraint rankings

Before introducing NONFINALITY, just PK-PROM and ALIGN PK were needed to capture the core of the unbounded stress cases without a nonfinality effect. As established in section 1.1, ranking PK-PROM over ALIGN PK realizes the same-side quantity-sensitive unbounded stress systems (see (4-5)). A reverse ranking of these constraints will realize a quantity-insensitive system with stress always at one edge, because alignment must always be respected. The NONFINALITY constraint can be added to each of the rankings of PK-PROM and ALIGN PK in three different places, giving a total of six possible rankings, as shown in (31). I will examine ALIGN PK R here and not ALIGN PK L, because left peak alignment does not interact as significantly with the right-oriented nonfinality effects.

(31) PK-PROM >> ALIGN PK R

i.	NONFINALITY	>>	PK-PROM	>>	ALIGN PK R
ii.	PK-PROM	>>	NONFINALITY	>>	ALIGN PK R
iii.	PK-PROM	>>	ALIGN PK R	>>	NONFINALITY

ALIGN PK R >> PK-PROM

iv.	NONFINALITY	>>	ALIGN PK R	>>	PK-PROM
v.	ALIGN PK R	>>	NONFINALITY	>>	PK-PROM
vi.	ALIGN PK R	>>	PK-PROM	>>	NONFINALITY

Each of the rankings in (31) will be exemplified. Note that the rankings in (v) and (vi) will not contrast in their result. In (v) and (vi), ALIGN PK R dominates NONFINALITY, so the resulting system will have no nonfinality effect. In addition, ALIGN PK R dominates PK-PROM, producing quantity-insensitive stress alignment. When ALIGN PK R dominates both of these constraints, PK-PROM and NONFINALITY will not interact, since the effect of each is already neutralized by a higher-ranked constraint. The different ranking of NONFINALITY and PK-PROM in (v) and (vi) will thus not produce different systems.

4.2 Exemplification

The first ranking in (31) places NONFINALITY over PK-PROM over ALIGN PK R. This ranking will yield a quantity-sensitive unbounded stress pattern, where stress is never final, even when the only heavy syllable is final. This ranking has already been motivated for the stress patterns of Western Cheremis and Classical Arabic.

i. NONFINALITY >> PK-PROM >> ALIGN PK R *W. Cheremis, Cl. Arabic*

Ranking (ii), which places PK-PROM over NONFINALITY over ALIGN PK R, realizes an unbounded stress pattern with nonfinality, where stress is final when the last syllable is the only heavy syllable in the word. This ranking was established for the stress patterns of Khalkha, Buriat, Hindi, and Sindhi.

ii. PK-PROM >> NONFINALITY >> ALIGN PK R *Khalkha, Buriat, Hindi, Sindhi*

Ranking (iii) places NONFINALITY below ALIGN PK R, which in turn is ranked below PK-PROM. Since ALIGN PK R outranks NONFINALITY, this ranking captures a quantity-sensitive unbounded stress pattern in which there is no nonfinality effect, so it will achieve the same result as simply ranking PK-PROM over ALIGN PK R before NONFINALITY was introduced, as in (4-5). Aguacatec is a language which exhibits this type of stress pattern. Aguacatec stress is described as stressing the rightmost heavy syllable, where a heavy syllable contains a long vowel; otherwise the rightmost syllable is stressed (McArthur & McArthur 1956, 1966). This stress pattern is illustrated in (32).

iii. PK-PROM >> ALIGN PK R >> **NONFINALITY** *Aguacatec*

(32) *Aguacatec*

Rightmost heavy syllable is stressed:

L <u>H</u>	[ʔintáa]	'my father'
<u>H</u> L	[mítuʔ]	'cat'
<u>H</u> L	[ŋqéerats]	'that isn't it'
H H <u>H</u>	[tʃíiwuutzúuʔ]	'eye' ³

Rightmost syllable is stressed when no heavy syllables:

L <u>L</u>	[kaʔpén]	'day after tomorrow'
L <u>L</u>	[taʔal]	'its juice'
L <u>L</u>	[ʔiŋkok]	'my back'
L L <u>L</u>	[tʃínhojliŋ-ts]	'they search for me'

Evidence for the ranking in (iii) is given in (33-35). The form in (33) compares stress patterns on syllables of equal weight. In such a form, alignment to the right always wins over nonfinality, since there is no nonfinality effect in Aguacatec.

(33) ALIGN PK R >> NONFINALITY
Form: HHH [tʃíiwuutzúuʔ] 'eye'

	H H H tʃíiwuutzúuʔ	ALIGN PK R	NONFINALITY
☞ (a)	H H <u>H</u>		*
(b)	H <u>H</u> H	σ!	

(34) shows the ranking of PK-PROM over ALIGN PK R. Here it is evident that peak prominence must supercede alignment so that stressing a nonfinal heavy will win over stressing a perfectly-aligned final light syllable.

(34) PK-PROM >> ALIGN PK R
Form: H L [ŋqéerats] 'that isn't it'

	H L ŋqéerats	PK-PROM	ALIGN PK R
☞ (a)	<u>H</u> L		σ
(b)	H <u>L</u>	*!	

³ Stress on the form for 'eye' was not shown in the source grammars, so stress in this form has simply been applied by rule.

Finally, (35) shows that in a form with only light syllables, PK-PROM will not come into play, resulting in complete right alignment in the default cases.

- (35) Default stress: ALIGN PK R >> NONFINALITY
Form: L L L [tʃinhojlih-ts] 'they search for me'

L L L tʃin <u>hojli</u> h-ts	PK-PROM	ALIGN PK R	NONFINALITY
(a) L L <u>L</u>			*
(b) L <u>L</u> L		σ!	

In the fourth ranking, NONFINALITY dominates ALIGN PK R, which dominates PK-PROM. This ranking realizes a quantity-insensitive system in which stress always falls on the penultimate syllable. The Yawelmani dialect of Yokuts exhibits such a stress pattern (Kroeber 1907, 1963, Newman 1944) (see also Hyman 1977 for a list further languages with this basic stress pattern). Syllables with long vowels in Yawelmani are heavy, and because coda consonants trigger vowel shortening in this language (see Kenstowicz and Kisseberth 1979: 83-85), I assume that closed syllables are also heavy, although nothing hinges on this. Yawelmani stress is illustrated in (36).

iv. **NONFINALITY** >> ALIGN PK R >> PK-PROM *Yokuts (Yawelmani)*

- (36) *Yokuts (Yawelmani dialect)*

Penultimate stress on a heavy syllable:

<u>H</u> L	[n <u>o</u> ono]	'man'
L <u>H</u> L	[xom <u>o</u> oti]	'south'
L L L <u>H</u> H	[hutuluwe <u>e</u> it]	'large owl'
H <u>H</u> H	[gool <u>a</u> nkil]	'king snake'

Penultimate stress on a light syllable:

L L <u>L</u> L	[melik <u>a</u> no]	'white man'
<u>L</u> H	[j <u>o</u> kots]	'person'
H <u>L</u> H	[saps <u>a</u> bits]	'mouse'

(37-38) illustrate the constraint ranking. (37) shows that NONFINALITY dominates ALIGN PK R, paralleling the analysis of nonfinality effects in other systems already examined.

- (37) NONFINALITY >> ALIGN PK R
Form: L L L L [melikano] 'white man'

LLL melikano	NONFINALITY	ALIGN PK R
(a) L L <u>L</u> L		*
(b) L L L <u>L</u>	σ!	

(38) illustrates the need for ranking ALIGN PK R over PK-PROM. This ranking has the effect of making the system quantity insensitive, so in choosing between two nonfinal syllables, a better-aligned light syllable will win over a worse-aligned heavy.

- (38) ALIGN PK R >> PK-PROM
Form: H L H [sapsábits] 'mouse'

H L H sapsabits	NONFINALITY	ALIGN PK R	PK-PROM
(a) H <u>L</u> H		σ	*
(b) <u>H</u> L H		σ!σ	

The final ranking, which combines the noncontrastive cases of (v) and (vi), places ALIGN PK R over NONFINALITY and PK-PROM. This ranking yields a quantity-insensitive system in which stress is always final. Uzbek exhibits this pattern of stress (Poppe 1962: 4-5) (see also Hyman 1977 for a list of further examples of this type). Uzbek stress is illustrated in (39). I assume that closed syllables are heavy in addition to syllables with long vowels, but this is in no way crucial.

v/vi. ALIGN PK R >> NONFINALITY, PK-PROM Uzbek

- (39) Uzbek

L <u>H</u>	[kitó ́]	'book'
L L <u>H</u>	[kitob ím]	'my book'
H L <u>H</u>	[a ń lamó q]	'to understand'
H L L <u>H</u>	[a ń lad í lar]	'they understood'
H <u>L</u>	[ait d í]	'he said'
H <u>L</u>	[suud a]	'in the water'
H <u>L</u>	[baaz i]	'some, certain' ⁴

The tableaux in (40-41) exemplify the constraint ranking. Uzbek has no nonfinality effect, so as in the other cases without nonfinality, ALIGN PK R outranks NONFINALITY.

- (40) ALIGN PK R >> NONFINALITY
Form: H L H [a**ń**lamó**q**] 'to understand'

H L H a ń lamó q	ALIGN PK R	NONFINALITY
(a) H L <u>H</u>		*
(b) <u>H</u> L H	σ!σ	

(41) illustrates the second part of the ranking. Here a light syllable is stressed over a heavy one, because the light syllable is better-aligned. Accordingly, ALIGN PK R must dominate PK-PROM.

- (41) ALIGN PK R >> PK-PROM
Form: H L [ait**d**í] 'he said'

H L ait d í	ALIGN PK R	PK-PROM	NONFINALITY
(a) H <u>L</u>		*	*
(b) <u>H</u> L	σ!		

⁴ Stress on the forms for 'in the water' and 'some, certain' was not shown in the source grammar and has been applied by rule.

4.3 Summary of the rankings

All of the possible rankings of PK-PROM, ALIGN PK R and NONFINALITY have now been shown to be attested, as summarized in (42). Notice that all the cases in which PK-PROM outranks ALIGN PK R realize a system with quantity-sensitive unbounded stress, while those in which PK-PROM is ranked below ALIGN PK R are quantity-insensitive systems.

(42)

PK-PROM >> ALIGN PK R

i	NONFINALITY	>>	PK-PROM	>>	ALIGN PK R	<i>Western Chereemis, Classical Arabic</i> QS unbounded stress. Stress is never final.
ii	PK-PROM	>>	NONFINALITY	>>	ALIGN PK R	<i>Khalkha, Buriat, Hindi, Sindhi</i> QS unbounded stress. QS overrides nonfinality.
iii	PK-PROM	>>	ALIGN PK R	>>	NONFINALITY	<i>Aguacatec</i> QS unbounded stress without nonfinality.

ALIGN PK R >> PK-PROM

iv	NONFINALITY	>>	ALIGN PK R	>>	PK-PROM	<i>Yokuts (Yawelmani dialect)</i> Always penultimate stress. QI system.
v	ALIGN PK R	>>	NONFINALITY	>>	PK-PROM	<i>Uzbek</i> Always final stress. QI system.
vi	ALIGN PK R	>>	PK-PROM	>>	NONFINALITY	Same as (v).

5 Conclusion

In conclusion, this paper has argued that Nonfinality merits status as a third parameter in the typology of unbounded stress, as it has been shown to interact exhaustively with the other two parameters for these systems. In addition to this typological result, this paper has shown that from the point of view of analysis only the three constraints: PK-PROM, ALIGN PK, and NONFINALITY are required to capture the core features of the unbounded stress systems in the expanded typology. Three of the rankings of these constraints realize attested unbounded stress patterns, while the remaining three possible rankings yield attested quantity-insensitive systems. This is a positive result for Optimality Theory both because the expected factorial ranking of constraints is in fact justified and because simple ranking of the three constraints is able to capture a wide range of stress patterns.

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