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A Third Parameter for Unbounded Stress

Rachel Walker
University of California, Santa Cruz

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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, and with regard to analysis, 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. I will further demonstrate that the range of stress patterns predicted by factorial ranking of these three constraints is attested, and this factorial ranking suggests a new typological classification for peak-alignment stress systems that do not make reference to foot structure.

1. Two parameters for unbounded stress

Traditional descriptions of unbounded stress conceive of a four-way typology resulting from the exhaustive combination of two binary parameters (Hayes 1980, 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 the stress peak 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 (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 *Amele, Au, Lhasa Tibetan, Lushootseed, Yana.*	L	L
ii	Stress leftmost heavy σ, else rightmost σ *Komi, Kwakw'ala.*	L	R
iii	Stress rightmost heavy σ, else leftmost σ *Kuuku-Yaʔu, Huasteco, Chuvash, Eastern Cheremis.*	R	L
iv	Stress rightmost heavy σ, else rightmost σ *Aguacatec, Golin.*	R	R

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As P&S (1993: 38-39) have pointed out, in Optimality Theory (OT) unbounded stress systems in which both parameters are set to the same side can be captured without making reference to foot structure by simply ranking a constraint on peak prominence over a constraint aligning the peak to the edge of the prosodic word (PrWd). 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. This constraint is stated 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 stress pattern, 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 pattern, which stresses the rightmost heavy syllable, else the rightmost syllable (type (iv) in (1)). The tableau in (4) demonstrates the results in a form with heavy "H" and light "L" 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

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

(5) illustrates the effect of the constraint ranking in a form with only light syllables. Because all syllables in such a form have an equal intrinsic prominence, PK-PROM does not come into play, and the force of ALIGN PK results in complete alignment to the right.

(5) PK-PROM >> ALIGN PK R

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

In the default-to-opposite-edge systems, ranking PK-PROM over ALIGN PK will correctly realize the stress pattern in words with at least one heavy syllable, but something further will be needed for the opposite default. Just PK-PROM and ALIGN PK are otherwise sufficient 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. I will show, however, that the actual stress pattern of Khalkha in fact crucially differs from this early description, in part because Khalkha stress exhibits a nonfinality effect. On the basis of Khalkha stress and additional unbounded systems which exhibit nonfinality, 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 a classic example of an unbounded stress system of type (i) in table (1), as described in (6) below (see, for example, Hayes 1980, 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 these 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."

Khalkha	Ĺ L	[á̲xa]	'brother'
	Ĺ L L	[ún̲ʃisan]	'having read'
Buriat	Ĺ L	[xá̲da]	'mountain'

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

Khalkha	L H́	[dalá̲e]	'sea'
	L H́	[galú̲u]	'goose'
Buriat	L H́	[xadá̲ar]	'through the mountain'

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

Khalkha	L H́ H	[morió̲oroo]	'by means of his own horse'
NB!	L H H́ H	[dalaegá̲araa]	'by one's own sea'
Buriat	L H́ H	[dalá̲igaar]	'by sea'
	L H́ H	[mor'ó̲oroo]	'by one's own horse'
	L H H́ H	[dalaigá̲araa]	'by one's own sea'

The description in (7a-b) agrees with the early description of Khalkha stress in (6). Yet (7c) contains an important difference: in forms with more than one heavy syllable, stress falls on the penultimate heavy syllable rather than on the leftmost one. The crucial form distinguishing the corrected description of Khalkha from the early one is the form [dalaegá̲araa] 'by one's own sea'. Notice that all of the other examples are consistent with either description. This considerable overlap in the output of the two patterns is likely a source of the system being at first mistaken for the simpler same-side left-oriented system.

Bosson's description of Khalkha stress confirms 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. These forms are thus consistent with two patterns: one stressing the second last (or penultimate)

of the heavy syllables in the word, even when all heavies are nonfinal (e.g. H H H L L) and the other stressing the rightmost nonfinal heavy (e.g. H H H L L), in which case the "penultimate" characterization of stress was engendered by the examples chosen. My own research with a native Khalkha speaker and consultation with James Bosson (p. c. 1994) concerning Buriat and Khalkha stress indicates that stress can fall on the rightmost nonfinal heavy syllable, whether it is the second last heavy in the word or not (see bolded forms in (8)).[1] In other words stress is not tied to being penultimate but to being nonfinal.[2]

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

Khalkha		
H́ H	[áaruul]	'dry cheese curds'
H́ L H	[úitgartae]	'sad'
L H́ L H	[doloódugaar]	'seventh'
H H́ L L	[baegúulagdax]	'to be organized'
H H́ H	[uurtáegaar]	'angrily'
H H́ L H	[baigúullagaar]	'by means of the organization'
L H H H́ L	[ulaanbaatríinxan]	'the residents of Ulaanbaatar'
Buriat		
H́ H	[bóosoo]	'bet, wager'
L H́ L H	[xudáalingdaa]	'to the husband's parents' (collective)
H H́ L L L	[taarúulagdaxa]	'to be adapted to'
L H H́ L	[namaatúulxa]	'to cause to be covered with leaves'
H L H́ H	[xyyxengéeree]	'by one's own girl'
H L H H́ L	[buuzanuudíije]	'steamed dumplings' (acc.)

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. Because I will not be concerned with the analysis of opposite-edge default in this paper, I will focus only on stress in Mongolian words with a heavy syllable (see Zoll 1995 for a proposed analysis of opposite-edge default). Since Mongolian stress is basically right-oriented and unbounded, the analysis will require the PK-PROM and ALIGN PK R constraints, as in the systems in the two-

[1] Recordings were made of the Khalkha forms read by a native speaker over 40 years of age, who was born in Mongolia and spent most of his life in the city of Ulaanbaatar. The forms were read in isolation and in the sentence [xün "X" gev] 'someone said "X"'. The recordings were made in November 1994 using a portable cassette recorder (Sony TCS-430). Signals were then 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 (or penultimate) of the heavy syllables in the word. While this is an interesting phenomenon, I will not be concerned with it here and focus solely on variants in which stress falls on the rightmost nonfinal heavy.

parameter typology. However, in order to capture the nonfinality effect, the NONFINALITY constraint proposed by P&S (1993: 52; cf. Hung 1993) will also be necessary. This constraint, (in (10)), requires that the head of a PrWd be nonfinal in the PrWd. After P&S (1993: 41), I assume that the syllable with the main stress qualifies as a head of the PrWd.

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

In order to capture the nonfinality effect 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 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

H H H uurtaegaar	NONFINALITY	ALIGN PK R
☞ (a) H H́ H		σ
(b) H H H́	*!	

The tableau in (12) demonstrates that PK-PROM must be ranked above NONFINALITY. This example 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

L H xadaar	PK-PROM	NONFINALITY
☞ (a) L H́		*
(b) Ĺ H	*!	

Finally, (13) shows the need for PK-PROM over ALIGN PK R, although by transitivity from the other rankings we already know that this relation must hold. 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 is better aligned.

(13) PK-PROM >> ALIGN PK R

H H L H baiquullaqaar	PK-PROM	NONFINALITY	ALIGN PK R
☞ (a) H H́ L H			σσ
(b) H H Ĺ H	*!		σ

A summary of the constraint ranking needed to capture the rightmost nonfinal heavy stress of Khalkha and Buriat is given in (14).

(14) Mongolian stress: PK-PROM >> NONFINALITY >> ALIGN PK R

As this ranking shows, NONFINALITY is simply positioned in between the PK-PROM-over-ALIGN-PK ranking already established for the unbounded systems in (1).

3. A typology of unbounded systems with nonfinality

The Mongolian stress pattern demonstrates that unbounded stress can exhibit a nonfinality effect. Some other instances of nonfinality effects in unbounded stress have been discussed by Kaye (1990), Prince (1983). I will turn now to making a case for

adding Nonfinality as a third parameter to the typology of unbounded systems by showing that it interacts with virtually all of the unbounded patterns. I will also 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 is only 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 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 L H́	[rupiáa]	'rupee'
L H́:	[dʒanáab]	'sir'
H H́:	[asbáab]	'goods'
H́: H H	[réezgaarii]	'small change'

Rightmost nonfinal candidate stressed in case of tie:

L Ĺ L	[samíti]	'committee'
L H́ H	[rukáajaa]	'stopped' (trans.)
H H́ H	[roozáanaa]	'daily'
H: H́: H:	[aasmáandʒaah]	'highly placed'
H́: H H:	[áasmāādʒaah]	'highly placed' (var.)

In their analysis of Hindi stress, P&S (1993: 40-42) propose the constraint ranking in (16). Notice that this is the same ranking as that required for Khalkha and Buriat (in (14)), although Hindi still contrasts with Mongolian in that Hindi stress defaults to the same side rather than the opposite edge.

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

The effect of the constraint ranking in (16) for Kelkar's Hindi is illustrated in (17-18). 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

L H H rukaajaa	NONFINALITY	ALIGN PK R
☞ (a) L H́ H		σ
(b) L H H́	*!	

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

H H: asbaab	PK-PROM	NONFINALITY
☞ (a) H Ḧ:		*
(b) Ḧ H:	*!	

By transitivity, PK-PROM must also be ranked over ALIGN PK R. As we saw for Khalkha and Buriat in (13), this ranking ensures that peak prominence is respected when making a choice between nonfinal syllables. Stressing the heaviest syllable will thus always win over stressing a lighter syllable, even if the heaviest syllable is worse aligned.

Sindhi provides a second example of QS Nonfinality in a system stressing the rightmost heavy else rightmost syllable. Stowell describes the Sindhi pattern as: "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" (1979: 70). This pattern is the same as that of Hindi except that there are two levels of syllable weight rather than three. The analysis of Sindhi stress will be parallel to the one 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. The final syllable in a word is never stressed. This pattern is illustrated by the forms in (19). Note that heavy syllables in Western Cheremis are those with full vowels, while reduced vowels ([ə]) count as light.

(19) *Western Cheremis*
Rightmost nonfinal heavy syllable is stressed:

Ḧ H	[o̱ʃma]	'sand'	H Ḧ L	[oʃma̱ʃtə]	'sand' (iness.)
Ḧ L L	[ko̱rnəʃtə]	'way' (iness.)	Ḧ L H	[βa̱ʃtəlam]	'I laugh'

Rightmost nonfinal light syllable is stressed when no nonfinal heavies:

L̲ L	[pə̱rə]	'go in!'	L L̲ L	[pərə̱ʃəm]	'I went in'
L̲ H	[pə̱ra]	'go in' (pres. 3sg.)	L L̲ H	[əmə̱ltem]	'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.

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

(21-22) illustrate the key points of the ranking. In the two previous systems, we saw that ranking NONFINALITY over ALIGN PK R captures the basic nonfinality effect. (21) illustrates what is new in Western Cheremis. In this case NONFINALITY is also 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.

(21) NONFINALITY >> PK-PROM

L H pəra	NONFINALITY	PK-PROM
☞ (a) L̲ H		*
(b) L̲ L̲	*!	

(22) shows the second part of the ranking. Here the NONFINALITY constraint is respected and a choice must be made between two nonfinal syllables. Stressing a heavy syllable wins out over stressing a better-aligned light one, so PK-PROM must supercede alignment.

(22) PK-PROM >> ALIGN PK R

H L H βaʃtəlam	NONFINALITY	PK-PROM	ALIGN PK R
☞ (a) H́ L H			σσ
(b) H Ĺ H		*!	σ

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 nonfinality in systems stressing the rightmost heavy else leftmost syllable. We have already seen such a system with QS Nonfinality in Khalkha and Buriat, and the analysis for this pattern was 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 1980, 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, where CVV and CVC qualify as heavy syllables.[3] The basic stress pattern of Classical Arabic is illustrated in (23). [ħ] represents a voiceless pharyngeal glide.

(23) *Classical Arabic*
Rightmost nonfinal heavy syllable is stressed:

L H́ L L	[juʃáariku]	'he participates'
L H́ H	[kitáabun]	'book' (nom. sg.)
H́ L L H	[mámlakatun]	'kingdom' (nom. sg.)
L H H́ H	[manaadíiluu]	'kerchiefs' (nom.)

Initial syllable is stressed when no nonfinal heavies:

Ĺ L L H	[bálaħatun]	'date' (nom. sg.)
Ĺ L L	[kátaba]	'he wrote'

The stress pattern of Classical Arabic is the same as that of Western Cheremis, but with default to the opposite rather than the same side. Aside from this difference in default stress, the analysis of Classical Arabic will be parallel to that of Western Cheremis, 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 ALIGN PK R .

3.3 Stress leftmost heavy else leftmost with nonfinality

We have now seen that both types of Nonfinality occur with each kind of system stressing the rightmost heavy, and I will 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-

[3] A superheavy syllable (CVVC, CVCC) can attract final stress, but these syllables only appear in pausal forms before major syntactic breaks. The fact that a final superheavy attracts stress thus is not a counter-example to the nonfinal stress pattern but is instead a feature of the prosodically-special pausal structure.

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 nonfinality.

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 (Kenstowicz 1993 citing Bhatt 1989). 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. The pattern is illustrated in (24) (Kenstowicz does not supply glosses for the forms).

(24) *Kashmiri*

Heaviest nonfinal syllable is stressed:

Ĺ C	[nójid]	H́ L H	[ʃáarikaa]
Ĺ H	[sálaam]	H́ C C	[báagambar]
Ć C	[mátlab]	L Ć L L	[mukáddima]
H́ H	[dáanaa]	L L H́ L	[maharə́əni]
Ć L C	[rə́phvarukh]	C L H́ C	[nandikéeʃor]
L Ć H	[nojídgii]	C H́ L L	[aŋgóolika]
L H́ C	[zitóovuh]	C H́ C H	[narpíirastaan]

Leftmost nonfinal candidate stressed in case of tie:

Ĺ L L	[phíkiri]	H́ H L L	[náaraazagi]
Ĺ L L C	[sírinagar]	L H́ H L	[maháaraazi]
Ĺ L L L H	[páharadarii]	H́ H C	[níiraazan]
L Ć C L C	[bagándarladin]	C L H́ H C	[ardonóoriiʃor]
Ć C H	[gánpaθjaar]	H́ H H	[déeviilii]

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 (25), where stressing a nonfinal closed syllable wins over stressing a final heavy, even though this violates the otherwise active effect of peak prominence.

(25) NONFINALITY >> PK-PROM

L C H nojidgii	NONFINALITY	PK-PROM
☞ (a) L Ć H		*
(b) L C H́	*!	

3.4 Stress leftmost heavy else rightmost with nonfinality

Only one set of cases remains to be examined. These are systems stressing the leftmost heavy, else the rightmost nonfinal syllable. An example of such a system has not yet been identified, but Goroa exhibits a related pattern. Stress in Goroa is assigned to the leftmost heavy, otherwise a final closed syllable; otherwise the penult (see (26)) (Hayes 1980 based on Seidel 1900). Heavy syllables are those with a long vowel or diphthong.

(26) *Goroa*

Leftmost heavy syllable is stressed:

H́ L H	[dúugunoo]	'thumb'	L C H́ L	[girambóoda]	'snuff'
[illegible]	[illegible]	[illegible]	L L H́	[heninái]	'young'

When no heavies, final closed syllable is stressed, otherwise the penult:

L Ć	[adúx]	'heavy'	L L Ĺ L	[oromíla]	'because'
L L Ć	[axemís]	'hear'	L C Ĺ L	[idirdána]	'sweet'

From the form [giramb**óó**da] 'snuff', it is evident that closed syllables do not qualify as heavy, because a better-aligned closed syllable does not attract stress over a syllable with a long vowel. However, word-final closed syllables do exhibit special behaviour in the nonfinality effect of Goroa. Nonfinality in Goroa differs from the previous examples in that it is violated when the head mora of the stressed syllable is flush with the PrWd edge rather than simply being violated by any word-final stressed syllable (see Kenstowicz 1995 for discussion of a similar nonfinality effect in Literary Mari). Versions of NONFINALITY with separate formulations holding at the level of the syllable and the foot have also been proposed by P&S (1993 40-3). Violations of a moraic level NONFINALITY constraint with respect to different syllable structures are illustrated in (27).

(27)

Syllable type		NONFINALITY$_\mu$
Open σ, short vowel	CV́]$_{PrWd}$	*
Closed σ, short vowel	CV́C]$_{PrWd}$	√
Open σ, long vowel or diphthong	CV́V]$_{PrWd}$	√

Because NONFINALITY holds at the moraic rather than syllabic level in Goroa, it will never be violated by stressing a final heavy. There is thus no evidence for ranking between PK-PROM and NONFINALITY, so a distinction between QS versus QI Nonfinality will not be relevant in this case. It is important to note that while Goroa provides an example of a nonfinality effect in a leftmost heavy else rightmost pattern, it does not fill a slot in our typology of syllable-level nonfinality. Whether the missing systems simply have not yet surfaced or the gap in the typology is significant remains to be determined.[4]

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 (28a-b). 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 but one of the eight basic types are attested. In addition, for each attested type of system with a nonfinality effect, cases of both QI and QS Nonfinality have been identified. These results clearly indicate that Nonfinality is a robust parameter in unbounded stress.

(28a) An eight-way typology of unbounded stress (systems i-iv)

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

[4] Tahitian stress as described by Tryon (1976) appears to be an example of a system stressing the leftmost heavy syllable, else the rightmost with QS Nonfinality, but Bickmore (1995) shows that stress in Tahitian is [illegible] the word, so this cannot serve as an example of unbounded stress. Thanks to Michael Kenstowicz for bringing these facts to my attention.

(28b) An eight-way typology of unbounded stress (systems v-viii)

	DESCRIPTION	Heavy σ	Default	Nonfinality
v	Stress leftmost nonfinal heavy σ, else leftmost σ Q.S. NF: no contrast with type (i). Q.I. NF: *Kashmiri.*	L	L	Y
vi	Stress leftmost heavy σ, else penult ? *(moraic-level nonfinality in Goroa).*	L	R	Y
vii	Stress rightmost nonfinal heavy σ, else leftmost σ Q.S. NF: *Khalkha, Buriat.* Q.I. NF: *Classical Arabic.*	R	L	Y
viii	Stress rightmost nonfinal heavy σ, else penult Q.S. NF: *Hindi, Sindhi.* Q.I. NF: *Western Cheremis.*	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 a parameter-based typology of unbounded stress. In an Optimality-Theoretic framework, 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. OT predicts factorial constraint ranking. I now turn to demonstrating that all rankings for the three constraints yield attested patterns.

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, 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 (29). 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.

(29) 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 (29) will be exemplified. Note that the rankings in (v) and (vi), where ALIGN PK R dominates both NONFINALITY and PK-PROM, will not contrast in their result. When ALIGN PK R dominates NONFINALITY the resulting system has no nonfinality effect, and when ALIGN PK R dominates PK-PROM, stress-alignment will be quantity insensitive. Thus, 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. (v) and (vi) will consequently not produce different systems.

4.1 Exemplification

The first ranking in (29) places NONFINALITY over PK-PROM over ALIGN PK R.

This ranking will yield a quantity-sensitive, right-oriented, 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.

Ranking (ii), which places PK-PROM over NONFINALITY over ALIGN PK R, realizes a right-oriented 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.

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. 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). This stress pattern is illustrated in (30).

(30) *Aguacatec*
Rightmost heavy syllable is stressed:

L H́	[ʔintáa]	'my father'	H́ L	[ŋqéerats]	'that isn't it'
H́ L	[míitu?]	'cat'	H H H́	[tʃiiwuutzúu?]	'eye'[5]

Rightmost syllable is stressed when no heavy syllables:

L Ĺ	[taʔál]	'its juice'	L Ĺ	[kaʔpén]	'in two days'
L L Ĺ	[tʃinhojlíhts]	'they seek me'			

We have already seen in (4-5) how ranking PK-PROM over ALIGN PK R produces the rightmost heavy else rightmost pattern. Evidence for the second part of the ranking: ALIGN PK R >> NONFINALITY, is given in (31). This tableau compares stress patterns on a form with syllables of equal weight. In such a form, alignment to the right always wins over nonfinality, resulting in no nonfinality effect .

(31) ALIGN PK R >> NONFINALITY

H H H tʃiiwuutzuu?	ALIGN PK R	NONFINALITY
☞ (a) H H H́		*
(b) H H́ H	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, as illustrated in (32) (Kroeber 1963, Newman 1944) (see also Hyman 1977 for a list of languages with this stress pattern). Syllables with long vowels in Yawelmani are heavy, and I assume that closed syllables are also heavy, although nothing hinges on this.

(32) *Yokuts (Yawelmani dialect)*
Penult is stressed regardless of syllable weight:

H́ L	[nóono]	'man'	L L L H́ H	[hutuluwéeitʃ]	'large owl'
L H́ L	[xomóoti]	'south'	L L Ĺ L	[melikáno]	'white man'
H H́ H	[goolánkil]	'king snake'	H Ĺ H	[sapsábits]	'mouse'
Ĺ H	[jókots]	'person'			

[5] Stress on [tʃiiwuutzuu?] was not shown in the source but follows McArthur & McArthur's rule.

(33-34) illustrate the constraint ranking. (33) shows that NONFINALITY dominates ALIGN PK R, paralleling the analysis of nonfinality in the systems already examined.

(33) NONFINALITY >> ALIGN PK R

L L L L melikano	NONFINALITY	ALIGN PK R
☞ (a) L L Ĺ L		σ
(b) L L L Ĺ	*!	

(34) 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.

(34) ALIGN PK R >> PK-PROM

H L H sapsabits	NONFINALITY	ALIGN PK R	PK-PROM
☞ (a) H Ĺ H		σ	*
(b) H́ L H		σσ!	

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, as shown in (35) (Poppe 1962: 4-5) (see also Hyman 1977 for a list of further examples). I assume that closed syllables are heavy in addition to syllables with long vowels, but this is not crucial.

(35) *Uzbek*

Final syllable is stressed regardless of syllable weight:

L H́	[kitób]	'book'	L L H́	[kitobím]	'my hook'
H L H́	[aŋlamóq]	'to understand'	H Ĺ	[aitdí]	'he said'
H L L H́	[aŋladilár]	'they understood'	H Ĺ	[baazí]	'some, certain'[6]

Evidence for the constraint ranking is given in (36-37). Uzbek has no nonfinality effect, so as in the other cases without nonfinality, ALIGN PK R outranks NONFINALITY.

(36) ALIGN PK R >> NONFINALITY

H L H aŋlamoq	ALIGN PK R	NONFINALITY
☞ (a) H L H́		*
(b) H́ L H	σ!σ	

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

(37) ALIGN PK R >> PK-PROM

H L aitdi	ALIGN PK R	PK-PROM	NONFINALITY
☞ (a) H Ĺ		*	*
(b) H́ L	σ!		

[6] Stress on the form for [baazí] was not shown in the source but has been applied by Poppe's rule.

All of the possible rankings of PK-PROM, ALIGN PK R and NONFINALITY have now been shown to be attested, as summarized in (38). 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.

(38) PK-PROM >> ALIGN PK R

i	**NONFINALITY**	>>	PK-PROM	>>	ALIGN PK R	*W. Cheremis, Cl. Arabic* QS unbounded stress. Stress is never final.
ii	PK-PROM	>>	**NONFINALITY**	>>	ALIGN PK R	*Mongolian, Hindi, Sindhi* QS unbounded stress. QS overrides nonfinality.
iii	PK-PROM	>>	ALIGN PK R	>>	**NONFINALITY**	*Aguacatec* QS unbounded stress without nonfinality.

ALIGN PK R >> PK-PROM

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

Notice that the table in (38) does not precisely match the one in (28). A few differences underlie this mismatch. First of all, only the cases with right-peak alignment have been included in the factorial constraint ranking, and because I have not been concerned with the analysis of opposite-edge default, those systems have not been separated out from same-side default systems here. Perhaps the most important difference is that some quantity-insensitive systems have been added in (38). This points to an interesting connection between typology and theory. The typology in (28) is based on a framework with parameters which derives a set comprising all the quantity-sensitive unbounded systems. On the other hand, if the typology is instead derived from factorial constraint ranking in OT, as in (38), then certain quantity-insensitive systems become grouped with the unbounded ones. This new grouping consists of the stress systems which can be captured through peak alignment without reference to foot structure.

5. Conclusion

In conclusion, this paper has argued that Nonfinality belongs in a typology of unbounded stress. In terms of descriptive parameters, Nonfinality merits status as a third parameter with a secondary distinction between QS versus QI Nonfinality. In an Optimality-Theoretic framework, these two kinds of nonfinality can be derived by minimally reranking NONFINALITY with PK-PROM. Furthermore, these constraints can be ranked factorially with ALIGN PK, and the typology derived in this framework yields a new grouping in which certain quantity-insensitive systems belong with unbounded stress as the set of peak-alignment stress patterns which do not make use of foot structure.

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Board of Studies in Linguistics
Stevenson College
University of California, Santa Cruz
Santa Cruz, CA 95064

walker@ling.ucsc.edu