

UNIVERSITY OF CALIFORNIA

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**PERSPECTIVES ON QUANTITY-SENSITIVITY AND DECOMPOSED SCALAR  
CONSTRAINTS: A VIEW FROM HINDI STRESS**

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Abstract

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CONSTRAINTS: A VIEW FROM HINDI STRESS

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This work presents OT analyses of two Hindi dialects: Kelkar's Hindi and Eastern Standard. A metrical analysis of Eastern Standard is necessary since the stress pattern cannot be predicted without feet. A new constraint, S-WSP, must be added into the constraint set in order to predict the different behavior of superheavy and heavy syllables regarding non-finality and clash effects in Eastern Standard. S-WSP is similar to the familiar WSP in that it requires superheavy syllables to bear stress, but it does not require heavy syllables to bear stress, giving special status to superheavy syllables. In addition to the empirical argument from the Eastern Standard data, S-WSP is further argued for from a theoretical perspective. S-WSP and WSP should be viewed as the result of a decomposed scalar constraint on the weight of syllables in non-foot-head positions. The addition of S-WSP is not imprudent but in line with other scalar constraints.

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## 1 Introduction

Theories of word-level stress assignment can be classified into two theoretical categories. There are those stress systems that are deemed 'metrical' in that stress is assigned in an alternating pattern governed by a rhythm. Such systems are analyzed as having stress assigned via the typically binary structure, the foot, a level of structure in the phonological hierarchy above the syllable and below the phonological word. The head of each foot is assigned stress and is the more prominent member of the foot, thus resulting in the alternating stress pattern observed cross-linguistically. Alternatively, there are 'prominence' or 'unbounded' stress systems (Prince 1983, Hayes 1995) which do not possess an alternating stress pattern. Instead, stress is drawn to syllables with greater prominence in terms of syllable weight, word-peripherality, or sonority. Some of these prominence stress systems have been analyzed as having foot structure. These analyses use the same set of basic constraints used for analyzing stress systems having alternating stress (Baković 1998). However, other analyses (Prince 1983; Prince and Smolensky 1993; Walker 1996; Gordon 2002) question whether it is necessary to posit foot structure in languages with such stress systems and propose 'prominence-only' style analyses which abandon foot structure altogether and rely on alternative theories of stress assignment. Whether or not it is necessary to posit foot structure in languages that seemingly rely only on factors separate from metrical rhythm for stress assignment is an ongoing question.

This paper will propose an optimal theoretic metrical analysis of stress in two Hindi dialects: Kelkar's Hindi (Kelkar 1968) and Eastern Standard (Pandey 1989). A distinctive feature of the Eastern Standard dialect is a three-way distinction in syllable weight. This characteristic will motivate a new constraint, S-WSP, which dictates that superheavy (tri-moraic) syllables must bear stress. This constraint is further argued for from a theoretical basis by establishing that it is comparable to other constraints, specifically, deconstructed scalar constraints which can similarly account for non-binary distinctions.

## 1.1 Hindi dialects

The language commonly referred to as Hindi, Hindi-Urdu, or Hindustani denotes a large group of dialects in the Indo-Aryan language family spoken natively by over 470 million speakers primarily in central northern India (Indian Government 2001). While there is much confusion and variation to exactly which dialects of these terms refer to, Hindi can be generally grouped into two groups of dialects, Western and Eastern, which can be classified together based on both distinguishing linguistic characteristics and geographic location (Shapiro 2007; Varma 1971).

In the current analysis, I focus on two specific Hindi dialects, one from each of these two distinct linguistic groups. The Hindi traditionally referred to as “Kelkar’s Hindi” is a variety documented by Kelkar, who collected data from speakers while working at universities in Agra and Pune but who offers little information about his informants or data collection processes. The Hindi spoken Agra is considered to be a form of Western Hindi (Chatterji 1962). The variety of Hindi spoken by Kelkar’s informants in Pune is less clear since Pune is located in Maharashtra, where Marathi, not Hindi, is natively spoken. Despite this uncertainty, Kelkar’s Hindi is described as having a particular pattern of stress, and these stress judgments seem to be consistent with those judgments collected from speakers in Agra who speak a Western Hindi dialect. Additionally, Standard Hindi, the variety likely to be spoken outside of the native Hindi zones, like Pune, is based on a Western Hindi dialect (Shapiro 1997). While it is not completely clear what “Kelkar’s Hindi” refers to, it does seem most likely that it is some form of Western Hindi. The other dialect I focus on in this paper, which Pandey (1989) calls “Eastern Standard”, is the dialect spoken in Lucknow and Benares, urban centers in the area where Eastern Hindi varieties are spoken (Grierson 1903; Shapiro 2007).

Although both groups are identified as Hindi varieties, these two language groups are derived from separate dialect of Middle Indo-Aryan; Western Hindi comes from the prakrit,

Śaurasenī, while Eastern Hindi's source is the Ardha-Māgadhī prakrit. In addition to the distinct stress assignment patterns discussed below, their separate origins yield some noteworthy differences, including Eastern Hindi's lack of oblique case and active construction of past tense in transitive verbs (Chatterji 1962). In many ways, Eastern Hindi resembles other related Indo-Aryan languages spoken directly east, mainly the Bihari dialects. In its nominal and pronominal declensions, it resembles Bihari, while its phonology more closely follows Western Hindi (Grierson 1903).

## **1.2 Dialectal stress differences and previous analyses**

While Eastern Hindi's phonology may more closely resemble Western Hindi than the phonology of its eastern neighbors, there is some variation. The stress assignment patterns of Kelkar's Hindi, considered a representative of Western Hindi, and of Eastern Standard Hindi differ in several notable ways. This difference in stress assignment has led to divergence in previous analyses of the Hindi dialects in regard to foot structure. Kelkar's Hindi has previously been analyzed as having a prominence-only stress system which lacks foot structure (Prince and Smolensky 1993; Walker 1996). In contrast, the Eastern Standard dialect of Hindi has previously only been analyzed using foot structure in Pandey's (1989) derivational analysis.

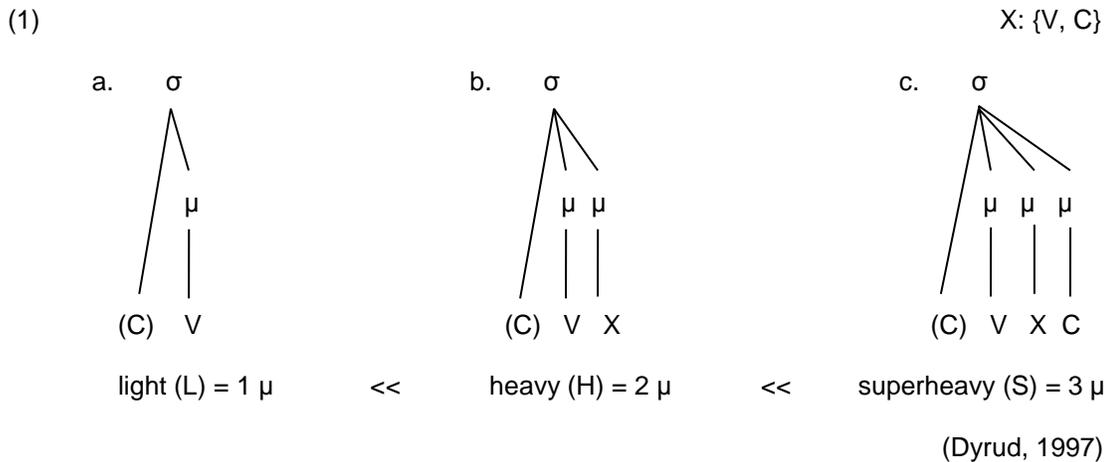
It is surprising that there are two drastically different analyses and a proposed major structural difference between two similar and mutually-intelligible dialects of the same language. In section 2, I present the stress systems of the two Hindi dialects in question. In sections 3 and 4, working in an optimality-theoretic framework (Prince and Smolensky 1993), I show that only Kelkar's Hindi can be captured using a prominence-only style of analysis, but that both dialects can successfully be analyzed using a single set of constraints which implements foot structure. The analysis introduces a new constraint, S-WSP, which targets superheavy syllables and can account for their special behavior, distinct from heavy and light syllables. By having a unified stress analysis for both dialects, the similarities and differences between the dialects can be better identified and compared.

In section 5, some of the typological predictions resulting from the constraint set used in my analysis are outlined. In section 6, I discuss how the introduction of S-WSP suggests that the constraint, PKPROM, often the driving force in these prominence-based analyses, is redundant and may be able to be removed from the universal constraint set to remove this unwanted overlap. I conclude in section 7.

## 2 Stress in Hindi

### 2.1 Syllable Weight

Critical to both stress systems is the fact that there a syllable can be one of three possible syllable weight. Long-vowels contribute two moras, while short vowels and coda consonants each contribute a single mora. A syllable with one mora is light, while two moras make a heavy syllable. Syllables with three moras are considered to be superheavy syllables:



Because coda consonants are moraic, we can assume that WEIGHT-BY-POSITION (Hayes 1989) is undominated in both dialects:

- (2) WEIGHT-BY-POSITION (W-BY-P): Assign a violation mark for each segment in the coda that is not moraic.

If all segments in the coda are in fact moraic, superheavy syllables that surface in the output will then violate a markedness constraint banning trimoraic syllables:

- (3) \*3 $\mu$ : Assign a violation for every syllable containing three or more moras.

This constraint penalizes superheavy syllables, and must be ranked below W-BY-P in order to predict that superheavy syllables in the input will remain intact with 3 moras in the output.

Given the undominated ranking of W-BY-P, changing the moraic content of the coda will not be a means to satisfy higher-ranked markedness constraints, and thus syllable weight will not be variable based on position or any other factor. An alternative analysis is feasible, which follows a “weight-by-position by position” style analysis (Rosenthal and van der Hulst 1999) wherein varying the moraic content and violating lower-ranked prosodic well-formedness constraints is justified in order to satisfy higher ranked syllable markedness constraints. Such an analysis is possible for Eastern Standard but cannot account for the pattern of Kelkar’s Hindi (Broselow, Chen, and Huffman 1997) and will not be discussed here.

## 2.2 Patterns of Stress Assignment

Stress assignment in Eastern Standard Hindi (Pandey 1989) is a complex pattern that is dependent on syllable weight, and thus it can be described based on the behavior of each weight class of syllables. Superheavy syllables are stressed whenever they appear, in any position in the word:

- (4)
- |    |   |   |                |                      |            |
|----|---|---|----------------|----------------------|------------|
| a. | L | Ś | si.tá:r        | ‘musical instrument’ |            |
| b. | H | Ś | a:ká:r         | ‘shape’              |            |
| c. | Ś | Ś | H <sup>1</sup> | à:n.dá:.lan          | ‘movement’ |

Heavy syllables are more restricted in when they can be stressed. They are stressed except when word-final or when they directly precede a stressed syllable, assuming stress is assigned from right to left:

- (5)
- |    |   |   |   |              |                            |         |
|----|---|---|---|--------------|----------------------------|---------|
| a. | H | Ĥ | H | da:.ró:.ga:  | ‘sub-inspector’            |         |
| b. | Ĥ | H | Ś | zàn.zi:.bá:r | ‘a name of an archipelago’ |         |
| c. | Ĥ | L | Ĥ | H            | pà:.ri.tó:.fjk             | ‘award’ |

The stress assignment pattern in (5a) exemplifies the restrictions on heavy syllables bearing stress. The final syllable is not stressed since it is in word-final position. The heavy penult receives stress since it is in neither of the conditions in which stress on a heavy syllable is

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<sup>1</sup> Prominence relation between stressed syllables varies. Rightward primary stress will be assumed as the default.

barred. The antepenultimate heavy syllable is not stressed as it precedes the stressed penult.

Light syllables are the most restricted in receiving stress. They are held to the same restrictions as heavy syllables, and additionally, light syllables that are preceded by heavy syllables do not receive stress as demonstrated in (6c):

- (6)
- |    |   |                |   |                     |           |
|----|---|----------------|---|---------------------|-----------|
| a. | L | ́              | L | atít <sup>h</sup> i | 'guest'   |
| b. | ́ | H <sup>2</sup> |   | kála:               | 'art'     |
| c. | ́ | L              | L | sáŋgati             | 'company' |
| d. | ́ | L              | H | máhila:             | 'lady'    |

The notable form in (6d) will prove critical in establishing the existence of foot structure in this dialect as discussed in section 3.2.

Kelkar's dialect demonstrates a different pattern of stress assignment (Kelkar 1968; Hayes 1995):

- (7) The heaviest syllable bears stress. If there is a tie, the rightmost non-final syllable is stressed.

Examples of the pattern follow in (8):

- (8)
- |    |   |   |   |                      |  |
|----|---|---|---|----------------------|--|
| a. | L | ́ |   | ki.d <sup>h</sup> ár | 'which way'                                      |
| b. | H | ́ |   | a:ká:r               | 'shape'  |
| c. | ́ | L | H | ré:z.ga.ri:          | 'small change'                                   |
| d. | H | H | ́ | he:.ra:.pé:.ri:      | 'deceitful interchanging of articles'            |
| e. | L | ́ | L | H                    | ǰa.kún.ta.la: 'name of a woman' (Shaligram 2000) |

(8a)-(8c) demonstrate that the heaviest syllable in the word bears stress, while (8d) and (8e) demonstrate that in the event of a tie, stress falls on the rightmost non-final tied syllable.

While the stress assignment patterns in Eastern Standard Hindi and Kelkar's Hindi are distinct, they have many similarities. Both systems depend on the three-way weight distinction in syllables and are quantity-sensitive in that stress prefers to be on heavier syllables compared to lighter ones. Additionally, in words with syllables of equal weight, stress falls on the penultimate syllable in both dialects. Another similarity is that stress is avoided on the final syllable, but superheavy syllables are exempt from this non-finality effect

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<sup>2</sup> Also reported as L<sup>h</sup>.

and may bear stress word-finally. There are two key differences between the stress systems in these dialects. In Kelkar's dialect, heavy syllables are also exempt from the non-finality effect similar to the superheavy syllables. However, in Eastern Standard, heavy syllables are not stressed word-finally and are subject to the non-finality effects. This results in a difference between the dialects in the placement of main stress in forms with final heavy syllables. The other difference between these stress systems is iterativity: Eastern Standard has secondary stress while Kelkar's Hindi has only one stress per word. The similarities and differences are summarized in the table below:

(9)

Characteristic	Eastern Standard	Kelkar's Hindi
a. L, H, S syllables	✓	✓
b. quantity sensitivity	✓ H L L	✓ H L L
c. clash avoidance on L & H	✓	N/A
d. penultimate stress when equal weight	✓ L L L	✓ L L L
e. rightward tendency	✓	✓
f. non-finality	✓	✓
i. super-heavy non-finality exemption	✓ L S	✓ L S
ii. heavy non-finality exemption	x L H L L H	✓ L H L L H
g. iterative stress	✓ L L L L	x L L L L

### 3 Prominence-Only Analysis

#### 3.1 Kelkar's Hindi

Prince and Smolensky<sup>3</sup> (1993) and Walker (1996) offer a prominence-only style of analysis that is independent from foot structure. Prince and Smolensky (1993) directly build the fact that stress is attracted to the heaviest syllable into their analysis by introducing PEAK-PROMINENCE into the constraint set:

<sup>3</sup> Prince and Smolensky do not specifically argue against the presence of feet in Hindi, and in fact suggest feet may be present. However, they do analyze stress assignment in Kelkar's Hindi without making reference to foot structure.

(10) PEAK-PROMINENCE (PKPROM):  $\text{Peak}(x) > \text{Peak}(y)$  if  $|x| > |y|$

In Hindi, since it is the heaviest syllable that receives stress, syllabic weight is the scale that is used by PKPROM to determine which syllable makes the optimal stress peak. This constraint states that the heavier peak is a more harmonic peak, and it demands that the heaviest syllable in the word serves as the stress peak in the word, meaning that it must bear the primary stress. Making this constraint undominated, and dominate all other constraints will correctly predict that the single heaviest syllable in a word will bear stress, no matter its position.

When there is a tie for the heaviest syllable in the word, PKPROM cannot select a winner.

Thus, it is left to the lower-ranked constraints:

- (11) NON-FINALITY (NONFIN): Assign a violation if the prosodic head of the word is not final.  
 (12) RIGHTMOST: Assign a violation if the prosodic head does not lie at the right edge of the word.

Since it is the rightmost non-final tied syllable that is stressed, NONFIN must outrank

RIGHTMOST:

(13) [a.kún.ta.la: 'name of a woman']

L H L H	PKPROM	NONFIN	RIGHTMOST
a. $\text{L } \acute{\text{H}} \text{ L H}$	$\acute{\sigma}_{\text{H}}$		**
b. $\text{L H L } \acute{\text{H}}$	$\acute{\sigma}_{\text{H}}$	*!	
c. $\text{L H } \acute{\text{L}} \text{ H}$	$\acute{\sigma}_{\text{L}}!$		*
d. $\acute{\text{L}} \text{ H L H}$	$\acute{\sigma}_{\text{L}}!$		****

The input contains both light and heavy syllables. PKPROM eliminates candidates that stress a syllable that is not tied for the heaviest in the word. In the case of (13), candidates c and d are eliminated. Candidate b, having final stress, is eliminated due to its violation of NONFIN. Candidate a remains and the candidate with stress falling on the rightmost non-final tied syllable is correctly selected as the winner.

### 3.2 Failure of “Prominence-Only” Analysis in the Eastern Standard Dialect

While the above ranking is quite straight-forward and requires only three constraints, such an analysis cannot correctly predict stress assignment in the Eastern Standard dialect. I will

show that predicting antepenultimate stress in LLH forms is impossible without postulating foot structure. In order to account for penultimate stress in words with equally heavy syllables, NONFIN must rank above RIGHTMOST:

(14) adíti 'feminine name'

LLL	NONFIN	RIGHTMOST
a. L L $\acute{L}$	*!	
b. $\text{☞}$ L $\acute{L}$ L		*
c. $\acute{L}$ L L		**!

A NONFIN( $\acute{\sigma}$ ) violation eliminates candidate a, and a second violation of RIGHTMOST eliminates candidate c. Candidate b, having penultimate stress, is selected as the winner.

Problematically, this ranking also selects the candidate with penultimate stress in LLH forms, which, as noted above, actually have stress fall on the antepenult:

(15) máhila: 'lady'

LLH	NONFIN	RIGHTMOST
a. L L $\acute{H}$	*W	L
b. $\text{☞}$ L $\acute{L}$ H		*L
c. $\text{⊗}$ $\acute{L}$ L H		**

( $\text{⊗}$  indicates the actual output form that has been wrongfully eliminated.) The elimination of candidates is identical to that in (14), however, the prediction of penultimate stress in this case is an undesirable one since RIGHTMOST favors the incorrectly selected candidate b over the actual output form. Other constraints, like PKPROM, cannot be added into the ranking in order correct this problem:

(16) máhila: 'lady'

LLH	NONFIN	PKPROM	RIGHTMOST
a. L L $\acute{H}$	*W	$\acute{\sigma}_H$ L	
b. $\text{☞}$ L $\acute{L}$ H		$\acute{\sigma}_L$	*L
c. $\text{⊗}$ $\acute{L}$ L H		$\acute{\sigma}_L$	**

PKPROM does not favor the actual output form, candidate c, over candidate b, and thus the ranking paradox remains unresolved.

Because the antepenultimate syllable in LLH forms are also the leftmost syllable, a constraint requiring that the peak of prominence fall at the left-edge of the word could potentially draw stress to the antepenultimate syllable as needed:

(17) LEFTMOST: The peak of prominence lies at the left edge of the word.

(18) máhila: 'lady'

LLH	NONFIN	LEFTMOST	RIGHTMOST
a. LLH́	*W	**L	
b. ĹLH		*W	*L
c. ɸ́LLH			**

LEFTMOST may be successful in predicting antepenultimate stress since by ranking it above RIGHTMOST, it will eliminate candidate b, the previously wrongly predicted winner, and leave candidate c as the winner. However, in order to maintain the prediction of penultimate stress in LLL forms, LEFTMOST must remain ranked below RIGHTMOST:

(19) adítí 'feminine name'

LLL	NONFIN	LEFTMOST	RIGHTMOST
a. LLĹ	*W	**W	
b. ☹ ĹLL		*	*
c. ɸ́LLL		L	**W

Violations of LEFTMOST eliminate the actual output form, and candidate c is wrongly selected as the winner. Therefore, promoting LEFTMOST is not a solution to the bad prediction in LLH forms as it creates a new bad prediction in LLL forms. Antepenultimate stress cannot be predicted in LLH forms without taking foot structure into account, the specifics of which I discuss in the following section.

#### 4 Foot-based Analyses

##### 4.1 Eastern Standard

Following Pandey (1989) and Hayes (1995), feet exist in Hindi and are moraic trochees.

The following constraints are needed to predict this foot type:

(20) RHTYPE=T: Assign a violation for every iambic foot.

(21) EVENTROCHEE: Assign a violation for every uneven trochee.

- (22) FOOTBINARITY(FTBIN): Assign a violation for every foot that is not minimally binary on the syllabic or moraic level.

By making these constraints undominated, only trochaic feet with the form (Š)<sup>4</sup>, (H), or (LL) will occur in the winning candidates. In addition to incorporating these constraints involving the foot-form, several additional constraints that reference feet are needed to account for the iterativity of footing and existence of secondary stress:

- (23) PARSE-σ: Assign a violation for every unfooted syllable.
- (24) ALL-FT-R: Align (Ft, R, PrWd, R). Assign a violation for every syllable between each foot's right edge and the right edge of the prosodic word.
- (25) ALL-FT-L: Align (Ft, L, PrWd, L). Assign a violation for every syllable between each foot's left edge and the right edge of the prosodic word.
- (26) RIGHTMOST-FT: Primary stress must occur in the rightmost foot in the word. Assign a violation if the head foot is not the rightmost foot in the prosodic word.
- (27) LEFTMOST-FT: Primary stress must occur in the leftmost foot in the word. Assign a violation if the head foot is not the leftmost foot in the prosodic word.

(26) and (27) are renamed versions of ER-R/ER-L (McCarthy 2003). These constraints are similar to the EDMOST constraints in that they require the prosodic head to occur at the word edge, but instead of calculating what counts as the edge on the syllabic level, they base it on the foot level.

Because stress will fall as rightward as possible, ALL-FT-R must rank above ALL-FT-L:

(28) adíti 'feminine name'

	L L L	ALL-FT-R	ALL-FT-L
a.  L (L L)			*
b. (L L) L		*!	

The relative high ranking of ALL-FT-R eliminates candidate b since the foot's right edge is not aligned with the right edge of the prosodic word as it is in candidate a.

<sup>4</sup> A foot composed of a single superheavy syllable will violate the maximal version of FTBIN. I assume that this version of FTBIN is outranked by PARSE-INTO-σ (Ito & Mester 2009), a constraint which requires all segmental material be parsed into syllables, thus resulting in trimoraic feet surfacing in the output.

A form cannot have secondary stress and fully satisfy ALL-FT-R since only one foot can be perfectly aligned in a given form. Because there is iterative footing in Eastern Standard, PARSE- $\sigma$  must rank above the ALL-FT-R since it is more important to parse more syllables (and therefore have secondary stress) than it is to have perfect alignment.

With iterative footing comes the question of which foot is the head and bears the primary stress. This task is usually delegated to the relative ranking of RIGHTMOST and LEFTMOST. However, the definitions in (26) and (27) are not the standard versions of these EDGEMOST constraints. The formulations I have used judge the level of edgemostness purely on the foot level but pay no attention to the edgemostness on the segmental level. The ranking of my formulation of these two constraints relative to one another can still be used to determine the location of the head foot just as the syllable-level versions can, as seen below in (29).

By ranking PARSE- $\sigma$  above both of the EDGEMOST-FT constraints and ALL-FT-R, iterative footing will be predicted. In order to account for the fact that the primary stress is on the rightmost foot, RIGHTMOST-FT must outrank LEFTMOST-FT:

(29) ànumáti ‘permission’

L L L L	PARSE- $\sigma$	ALL-FT-R	RIGHTMOST-FT	LEFTMOST-FT
a. $\sigma$ (Ḷ L) (Ḷ L)		**		*
b. (Ḷ L) (Ḷ L) <sup>5</sup>		**	*!	
c. L L (Ḷ L)	**!			
d. (Ḷ L) Ḷ L	**!	**		

Any candidate that does not have all its syllables parsed into as many well-formed feet as will fit in the word will be eliminated by PARSE- $\sigma$ , such as candidates c and d. The remaining candidates only in which foot primary stress falls, and RIGHTMOST-FT eliminates the candidate in which primary stress is not in the rightmost foot, namely candidate b, leaving candidate a as the winner.

<sup>5</sup> Pandey (1989) lists candidate b as an alternative form that appears in the output. Such a candidate may win under a harmonic rank ordering analysis (Coetzee 2004), making it the “first” or most harmonic loser and therefore the most likely variant. A partial ordering of constraints (Anttila 1997) in which RIGHTMOST-FT and LEFTMOST-FT unranked relative to one another could also account for the variation. Alternatively, the appearance of such a candidate in the output may be due to some unknown outside factor, such as position within the phrase.

The particular foot-level formulation of the EDGEMOST constraints is not crucial in the analysis of Eastern Standard Hindi. However, as will be discussed in section 4.2 below, it is necessary in the analysis of Kelkar’s Hindi. In order to maintain the same constraint set across dialects, the foot-versions are also implemented in the current analysis of the Eastern Standard dialect. What is important to observe here is that there is another ranking in addition to having ALL-FT-R or ALL-FT-L outrank PARSE- $\sigma$  that will predict non-iterative footing. If both EDGEMOST-FT constraints are ranked above Parse- $\sigma$ , the winner will lack secondary stress, since a candidate can simultaneously satisfy both constraints by having only one foot.

The above constraint ranking will accurately predict the location of primary and secondary stress in words with all light syllables, but more constraints must be incorporated into the ranking in order to account for the pattern of stress assignment in words with heavier syllables:

- (30) WSP: Assign a violation for every unstressed syllable that has at least 2 moras.
- (31) \*CLASH: Assign a violation for every adjacent pair of stressed syllables.
- (32) NONFIN( $\acute{\sigma}$ ): Assign a violation for every stressed word-final syllable.

Consider the behavior of heavy syllables: they are generally stressed except word-finally or when preceding another stressed syllable. This patterning can be predicted by the ranking if WSP, the constraint requiring all heavy syllables be stressed, is outranked by both NONFIN( $\acute{\sigma}$ ) and \*CLASH. These two constraints must also outrank PARSE- $\sigma$ , because in satisfying them, additional syllables must be left unparsed:

(33) máhila: ‘lady’

L L H	NONFIN( $\acute{\sigma}$ )	WSP	PARSE- $\sigma$	ALL-FT-R
a. $\text{L} \text{L} \text{H}$		*	*	*
b. $\text{L} \text{L} (\text{H})$	*!			*
c. $\text{L} \text{L} (\text{H})$	*!		**	

The higher-ranked NONFIN( $\sigma$ ) eliminates any candidate that has word-final stress, even those candidates with a final heavy syllable, like candidates b and c, in which word-final stress will help to comply with WSP. Candidate a, lacking word-final stress, is left as the winner despite its violations of WSP and PARSE- $\sigma$ .

(34) ki:tá:ŋu 'insects'

H L L	*CLASH	WSP	PARSE- $\sigma$	ALL-FT-R
a. $\text{H} (\acute{\text{H}}) \text{L}$		*	**	*
b. $(\acute{\text{H}}) \text{H L}$		*	**	**!
c. $(\acute{\text{H}})(\acute{\text{H}}) \text{L}$	*!		*	*

In (34), candidate c, due to its adjacent stressed heavy syllables, is eliminated by \*CLASH.

Candidate a is selected as the winner over candidate b since it better satisfies ALL-FT-R.

Note that in the above tableau, WSP and PARSE- $\sigma$  need not be crucially ranked. However, the stress pattern in HLL forms will demonstrate that PARSE- $\sigma$  must be ranked below WSP.

This form highlights the quantity-sensitive nature of this stress system; the candidate with a less rightward foot and which parses less syllables surfaces in the output, all to ensure that a heavy syllable is stressed:

(35) sángati 'company'

H L L	*CLASH	WSP	PARSE- $\sigma$	ALL-FT-R
a. $(\acute{\text{H}}) \text{L L}$			**	**
b. $\text{H} (\acute{\text{L}}) \text{L}$		*!	*	
c. $(\acute{\text{H}})(\acute{\text{L}}) \text{L}$	*!			**

Candidate c violates \*CLASH and is thus eliminated although it satisfies all the lower-ranked constraints. Candidate b violates WSP and is also eliminated. The actual output form, candidate a, remains as the winner. This ranking now accounts for the special restriction on light syllables which cannot bear stress when preceded by a heavy syllable.

Below a summary tableau is provided to demonstrate the effectiveness of the ranking thus far:

(36) da:.ró:.ga 'sub-inspector'

H H H	*CLASH	NONFIN(σ')	WSP	PARSE-σ	ALL-FT-R
a. $\sigma$ H (H́) H			**	**	*
b. (H́) H H			**	**	**!
c. H H (H́)		*!			
d. (H́) H (H́)		*!	*	*	**
e. (H́) (H́) H	*!		*	*	***
f. H (H́) (H́)	*!	*	*	*	*
g. (H́) (H́) (H́)	*!*	*			***

Candidates c, d, e, f, and g which violate either \*CLASH or NONFIN(σ') are eliminated by their violations of these high-ranking constraints, leaving candidates a and b. Since candidate a better satisfies ALL-FT-R, it is the winner.

The rankings provided thus far account for the stress patterns involving both light and heavy syllables. Superheavy syllables, however, are generally similar to heavy syllables but are distinct in two critical ways; unlike heavy syllables, superheavy syllables receive stress word-finally and can precede a syllable with stress. In order to account for the divergent behavior, an additional version of WSP must be incorporated into the constraint set:

(37) WSP: Assign a violation for each unstressed syllable with 2 or more moras.

(38) SUPERWSP (S-WSP): Assign a violation for each unstressed syllable with 3 or more moras.

Because of the implicational relationship between WSP and S-WSP wherein any candidate that violates S-WSP will always violate WSP to minimally the same extent if not more, a typology which predicts languages in which heavy but not superheavy syllables must be stressed is avoided while still allowing a completely free ranking of any and all constraints. With the addition of a constraint that references only superheavy syllables and not heavy ones, the different behavior of superheavy and heavy syllables can be predicted. In the above analysis, NONFIN(σ') is ranked above WSP to account for the fact that word-final heavy syllables do not bear stress. For the special status of superheavy syllables regarding the non-finality effect, S-WSP can simply rank above NONFIN(σ'), and WSP can rank below it:

(39) itihá:s 'history'

L L S	S-WSP	NONFIN(σ)	WSP
a. (L̄ L) S	*!		*
b. (L̄ L)(S̄)		*	

(40) máhila: 'lady'

L L H	S-WSP	NONFIN(σ)	WSP
a. (L̄ L) H			*
b. (L̄ L)(H̄)		*!	

It has already been established in (33) that WSP must be ranked below NONFIN(σ), since heavy syllables do not receive stress word-finally. (39) then demonstrates that S-WSP must be ranked above NONFIN(σ). Candidate a, with the unstressed final syllable is eliminated since it is superheavy, thus violating S-WSP. Candidate b wins, and the form surfaces in the output with final stress. Contrastingly in (40), candidate a, lacking final stress, is the winner. Because there are no superheavy syllables, S-WSP is not active in eliminating candidates and the addition of S-WSP is non-problematic in the evaluation of these kinds of forms. Candidate b, the candidate with final stress, is eliminated by its violation of NONFIN(σ), and candidate a wins as desired.

An analogous ranking strategy can be applied to \*CLASH to predict the divergent behavior of heavy and superheavy syllables regarding their ability to occur in stress clashes:

(41) ki:tá:nu 'insects'

H H L	S-WSP	*CLASH	WSP
a. (H̄)(H̄) L		*!	
b. H (H̄) L			*

(42) à:ndó:lan 'movement'

S S H	S-WSP	*CLASH	WSP
a. (S̄)(S̄) H		*	*
b. S (S̄) H	*!		**

(41) demonstrates that \*CLASH must outrank WSP to eliminate candidates with a heavy syllable involved in a stress clashes, such as candidate a. However, when a form with superheavy syllables is considered, as in (42), we must now rank S-WSP above \*CLASH to

permit candidates like candidate a which have the maximal number of stressed superheavy syllables to surface, stress clashes aside.

#### 4.2 Kelkar's Hindi

I will now demonstrate that Kelkar's Hindi can be successfully analyzed using the same set of foot-referencing constraints used in the analysis of the Eastern Standard dialect. Again following Pandey (1989) and Hayes (1995), feet in Hindi are moraic trochees, and RHTYPE=T, EVENTROCHEE, and FTBIN are undominated.

One of the main differences between the two dialects is that the Eastern Standard dialect has secondary stress while Kelkar's Hindi has only one stress per word. In order to prevent PARSE- $\sigma$ , S-WSP, and WSP from motivating additional footing, either ALL-FT-R or both the EDGMOST-FT constraints must rank above them. In order to determine which is the appropriate strategy, forms with equally heavy syllables must be examined. In these forms, it is the penult, or the rightmost non-final syllable that receives stress. If ALL-FT-R ranked above NONFIN( $\sigma$ ), this would not be predicted:

(43) he:.ra:.p<sup>h</sup>é:.ri: 'deceitful interchanging of articles'

	H H H H	ALL-FT-R	NONFIN( $\sigma$ )
a. ☹	H H (H́) H	*!	
b. ☺	H H H (H́)		*!

The actual output form's violation of ALL-FT-R eliminates it, and candidate b, having final stress, is wrongfully selected. ALL-FT-L cannot be responsible for this since it would predict initial stress if ranked high. Thus ALL-FT-R must be ranked below NONFIN( $\sigma$ ).

If this is true, ALL-FT-R must also rank below S-WSP and WSP. S-WSP and WSP must rank above NONFIN( $\sigma$ ) in order to predict that when the heaviest syllable in a word is final, it receives stress and is exempt from non-finality effects. In this variety of Hindi, unlike in the Eastern Standard dialect, heavy syllables pattern with superheavy syllables regarding their exemption from non-finality. Thus, instead of ranking NONFIN( $\sigma$ ) differently relative to S-WSP

and WSP as in the analysis of the Eastern Standard dialect, both WSP constraints must rank above NONFIN( $\acute{\sigma}$ ):

(44) tigná: 'three fold'

LLH	S-WSP	WSP	NONFIN( $\acute{\sigma}$ )
a. $\text{L L (H)}$			*
b. $(\text{L L}) \text{H}$		*!	

(45) musalmá:n 'Muslim'

LLS	S-WSP	WSP	NONFIN( $\acute{\sigma}$ )
a. $\text{L L (S)}$			*
b. $(\text{L L}) \text{S}$	*!	*	

Whether the final syllable is heavy as in (44) or superheavy as in (45), the violations of either of the WSP constraints will eliminate a candidate lacking stress on the heaviest syllables. The winner in both tableaux is candidate a, which has word-final stress but fully satisfies the WSP constraints.

Thus, if ALL-FT-R must rank below NONFIN( $\acute{\sigma}$ ), and NONFIN( $\acute{\sigma}$ ) must rank below S-WSP and WSP, ALL-FT-R must also rank below the WSP constraints by transitivity. If this is the case, ALL-FT-R cannot be the constraint responsible for prohibiting iterative footing since it must crucially rank below WSP and S-WSP, two constraints that motivate additional footing. Although ALL-FT-R cannot be ranked high enough to disallow secondary stress, the analysis is not condemned since as discussed in 4.1, if both EDMOST-FT constraints are ranked above the constraints that motivate iterative footing, they will eliminate any candidate that has more than one foot:

(46)

H L H L	RIGHTMOST-FT	LEFTMOST-FT	S-WSP	WSP	PARSE- $\sigma$	ALL-FT-R
a. $(\text{H}) \text{L} (\text{H}) \text{L}$	*!				**	****
b. $(\text{H}) \text{L} (\text{H}) \text{L}$		*!			**	****
c. $\text{H L (H) L}$				*	***	*
d. $(\text{H}) \text{L H L}$				*	***	***!

Undominated RIGHTMOST-FT and LEFTMOST-FT have this combined effect since the only kind of candidate that can simultaneously satisfy both constraints are those that vacuously satisfy

them by building only one foot or no feet at all. Candidates with no feet and therefore no stress violate the constraints  $LX \approx PR$  (Prince and Smolensky 1993) which requires lexical words to also be prosodic words. They also violate  $HEADEDNESS(PrWd)$  (Walker 1996 based on Garret 1996) which requires prosodic words to have a peak. Since these constraints are never violated by forms in this data, they can be assumed to be undominated. With all four of these constraints undominated, the ranking will only select winners with no more and no less than one foot. (Henceforth, only candidates with a single foot will be included in the following tableaux.)

The fact that in the above tableau, the winning candidate maintains stress on the more rightward heavy syllable as opposed to the initial heavy syllable can be attributed to the influence of the rightward alignment constraint,  $ALL-FT-R$ . However, like in the Eastern Standard dialect, Kelkar's Hindi also displays quantity-sensitivity; stressing a heavier syllable is more important than having stress better aligned with the right word-edge or parsing more syllables. In order to predict that the heaviest syllable in a word bears the single stress in this dialect, constraints that dictate heavier syllables be stressed must rank above the alignment constraint as well as  $PARSE-\sigma$ :

(47) dzjá:miti 'geometry'

H L L	S-WSP	WSP	PARSE- $\sigma$	ALL-FT-R
a. $\sigma$ (H) L L			**	**
b. H (L L)		*!	*	

Candidate b violates  $WSP$  and is eliminated. Candidate a is correctly predicted as the winner. Since only one foot can appear in the output form as explained above, the heaviest syllable will always bear stress, despite its distance from the right edge of the word.

Unlike in the analysis of the Eastern Standard dialect,  $S-WSP$  cannot be ranked relative to  $WSP$ . With a form having a both a superheavy syllable and a heavy syllable, the candidate with the stressed superheavy syllable will always win since both  $WSP$  and  $WSP-S$  are ranked above all other pertinent markedness constraints. Because  $S-WSP$  is a more specific version

of WSP, note that any violation of S-WSP implies a violation of WSP but not vice versa.

Thus either ranking of S-WSP relative to WSP will select candidate a in the tableau below:

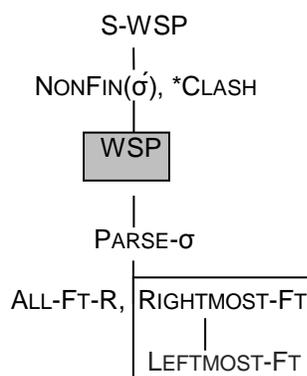
(48) sambrá:nti 'confusion'

H S L	S-WSP	WSP
a. $\text{H}(\acute{\text{S}})\text{L}$		*
b. $(\acute{\text{H}})\text{S L}$	*!	*

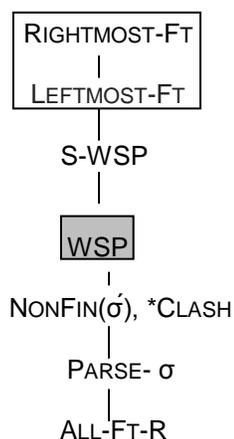
### 4.3 Summary of Footed Analyses

A summary of the ranking arguments for each dialect follow below:

(49) a. Eastern Standard



b. Kelkar's Hindi



The same constraint set is able to account for the pattern of stress assignment in both dialects of Hindi. The two critical differences between the dialects translate into two re-rankings: the difference in iterativity is accounted for by moving both EDGEMOST-FT constraints from the bottom of the Eastern Standard ranking to the top of the Kelkar's ranking, and the difference in the exemption of heavy syllables from non-finality effects is provided for by promoting WSP above NONFIN(σ) in the Kelkar's ranking. Sloos and van Oostendorp (2012) discuss how OT grammars of Dutch dialects show a gradual change across geographic distance. This analysis of these relatively closely spoken Hindi dialects with minimal re-rankings is in line with such dialectometry. This suggests that such a gradual shift in grammars, formally represented by the rankings, may be tenable with further

exploration, but having a metrical analysis for one dialect and prominence-only analysis for the other would prohibit such an understanding. Additionally, recent work by Bennett (2012) builds on previous work suggesting that the foot is necessary outside of the accentual realm and is indispensable phonological structure. Furthermore, this work reports that language learners show a cognitive bias towards the foot, further suggesting that feet may be a linguistic unit, even when not crucially required to account for the accentual pattern, as is the case in Kelkar's Hindi.

## 5 Typology

I will now discuss some of the typological predictions of the constraint set outlined in section 4. Specifically, I offer a factorial typology of S-WSP, WSP, NONFIN( $\acute{\sigma}$ ), and \*CLASH, assuming that the other lower-ranked constraints remain unchanged in their rankings. First we will assume that RIGHTMOST-FT and LEFTMOST-FT are low-ranking as in the ranking that predicts Eastern Standard. If we start with the ranking in Eastern Standard, and WSP is shifted to be ranked above instead of below NONFIN( $\acute{\sigma}$ ) and \*CLASH, then the ranking predicts a language in which both superheavy and heavy syllables receive word-final stress and can occur in clashes. It would resemble Kelkar's Hindi in terms of its behavior of superheavy and heavy syllables but with iterative stress. The same language would be predicted if we then shifted WSP to rank above S-WSP, and thus NONFIN( $\acute{\sigma}$ ) and \*CLASH. Of course, there is nothing requiring that WSP and S-WSP are ranked the same relative to NONFIN( $\acute{\sigma}$ ) and \*CLASH. Thus, there could be a language in which both superheavy and heavy syllables can receive stress word-finally, but only superheavy syllables can occur in stress clashes. Oppositely, there could be a language identical to Eastern Standard except for the that heavy syllables could also occur in stress clashes. These along with other predicted languages are listed below, assuming that the ranking is the same as it is in Eastern Standard Hindi unless noted:

- (50) a. S-WSP >> NONFIN(σ), \*CLASH >> WSP
- Iterative stress.
  - Superheavy syllables are stressed word-finally.
  - Superheavy syllables occur in stress clashes. (Eastern Standard Hindi)
- b. S-WSP >> NONFIN(σ) >> WSP >> \*CLASH
- Iterative stress.
  - Superheavy syllables are stressed word-finally.
  - Both heavy and superheavy syllables can occur in clashes.
- c. S-WSP >> WSP >> NONFIN(σ), \*CLASH  
WSP >> S-WSP >> NONFIN(σ), \*CLASH  
WSP >> \*CLASH >> S-WSP >> NONFIN(σ)  
WSP >> NONFIN(σ), \*CLASH >> S-WSP  
WSP >> NONFIN(σ) >> S-WSP >> \*CLASH
- Iterative stress.
  - Heavy and superheavy syllables are stressed word-finally.
  - Heavy and superheavy syllables can occur in clashes.
- d. S-WSP >> \*CLASH >> WSP >> NONFIN(σ)
- Iterative stress.
  - Superheavy and heavy syllables are stressed word-finally.
  - Superheavy syllables can occur in clashes.
- e. NONFIN(σ) >> S-WSP >> WSP >> \*CLASH  
NONFIN(σ) >> WSP >> S-WSP >> \*CLASH  
NONFIN(σ) >> WSP >> \*CLASH >> S-WSP
- Iterative stress.
  - No final stress.
  - Superheavy and heavy syllables can occur in clashes.
- f. NONFIN(σ) >> S-WSP >> \*CLASH >> WSP
- Iterative stress.
  - No final stress.
  - Superheavy syllables can occur in clashes.
- g. \*CLASH, NONFIN(σ) >> S-WSP >> WSP  
\*CLASH, NONFIN(σ) >> WSP >> S-WSP
- Iterative stress.
  - No final stress.
  - No stress clashes.

- h. \*CLASH >> S-WSP >> WSP >> NONFIN( $\acute{\sigma}$ )  
 \*CLASH >> WSP >> S-WSP >> NONFIN( $\acute{\sigma}$ )
- Iterative stress.
  - Superheavy and heavy syllables are stressed word-finally.
  - No stress clashes.
- i. \*CLASH >> S-WSP >> NONFIN( $\acute{\sigma}$ ) >> WSP
- Iterative stress.
  - Only superheavy syllables are stressed word-finally except when preceded by a superheavy syllable.
  - No stress clashes.
- j. \*CLASH >> WSP >> NONFIN( $\acute{\sigma}$ ) >> S-WSP
- Iterative stress.
  - Heavy syllables are stressed word-finally when preceded by a light syllable.
  - Superheavy syllables are stressed word-finally except when preceded by a light syllable.
  - No stress clashes.

If RIGHTMOST-FT and LEFTMOST-FT are promoted to an undominated position in the ranking, as in Kelkar's Hindi, a set of languages, all lacking secondary stress, will be predicted.

Because candidates with secondary stress will be eliminated by violations of the EDGEMOST-FT constraints, for these rankings, the position of \*CLASH will never effect the output, since candidates with secondary stress will be eliminated. The language predicted listed in (50)j may seem unlikely to be attested, since LS and LH forms will have final stress, but HS will not:

(51)

L H	*CLASH	WSP	NONFIN( $\acute{\sigma}$ )	S-WSP
a. $\text{L}(\acute{\text{H}})$			*	
b. $(\text{L})\text{H}$		*!		
c. $(\acute{\text{L}})(\acute{\text{H}})$	*!		*	
L S				
d. $\text{L}(\acute{\text{S}})$			*	
e. $(\acute{\text{L}})\text{S}$		*!		*
f. $(\acute{\text{L}})(\acute{\text{S}})$	*!		*	
H S				
g. $\text{H}(\acute{\text{S}})$		*	*!	
h. $(\acute{\text{H}})\text{S}$		*		*
i. $(\acute{\text{H}})(\acute{\text{S}})$	*!		*	

This prediction stems from the fact that both unstressed superheavy and unstressed heavy syllables incur equal violations of WSP, thus candidates g and h tie in terms of WSP.

Because NONFIN( $\acute{\sigma}$ ) ranks above S-WSP, candidate h will win since it lacks final stress. It seems odd that superheavy syllables are only stressed when preceded by light syllables but not heavy ones, and it remains to be seen if such a language is attested.

## **6 WSP as a Scalar Constraint**

### **6.1 Deconstructing PkPROM**

In the foot-based analyses of both dialects, I have used two separately rankable markedness constraints, WSP and S-WSP, to account for the quantity-sensitivity of stress assignment. While WSP is commonly used in analyses of quantity-sensitive stress systems, S-WSP had to be proposed and integrated into this ranking given the less cross-linguistically common weight distinction and variable behavior of bimoraic and trimoraic syllables. Most other systems with superheavy syllable shapes do not need to call on S-WSP because superheavy syllables exclusively appear word-finally. Word-final superheavy syllables are traditionally analyzed as having the final consonant as an appended non-moraic segment to the prosodic word, unparsed into the syllable, effectively creating a conditionally heavy syllable word-finally (Rosenthal & van der Hulst 1999). This violation of the PARSE-INTO- $\sigma$  is motivated by a need to satisfy higher-ranked constraints such as  $*3\mu$  and NONFIN. Under this kind of analysis, syllables that appear to be superheavy given their syllable shapes (CVVC or CVCC for instance) functionally behave as heavy syllables since their final consonants are not moraic rendering them bimoraic in the output. Thus a constraint like S-WSP is simply not needed since no syllable will ever surface with three moras, and a binary weight distinction remains.

In the non-footed analyses of languages with a three-way weight distinction, PkPROM has been the constraint motivating the quantity-sensitivity, as in Prince and Smolenky's analysis of Kelkar's Hindi. However, in the analyses offered above, PkPROM is not used, and instead WSP is implemented to motivate quantity-sensitivity. Firstly, because PkPROM only governs

main stress, it doesn't have any influence over secondary stress placement. In the Eastern Standard dialect, both the primary and secondary stress are quantity-sensitive, thus WSP (and S-WSP) is needed regardless of whether PkPROM is active or not. Because WSP can influence main stress placement as well as secondary, PkPROM may not actually be needed which will be discussed below in section 6.2. The second in using PkPROM in the analysis of Eastern Standard is that PkPROM is a single constraint and therefore can only be ranked one way relative to the other constraints. This is problematic in the Eastern Standard dialect because the superheaviness of a syllable can override the finality of its position syllable (as codified in the S-WSP >> NONFIN ranking), and thus final superheavy syllables are stressed. However, a merely heavy syllable is not "heavy enough" to prevail over being a bearer of stress in the marked final position (formalized as NONFIN(σ') >> WSP). A single constraint like PkPROM cannot produce this variable behavior:

(52)

L S	PkPROM	NONFIN(σ')
a. ☞ L Š	σ <sub>s</sub>	*
b. ☹ L̇ S	σ <sub>L̇</sub> !	

(53)

L H	PkPROM	NONFIN(σ')
a. ☞ L Ĥ	σ <sub>H</sub>	*
b. ☹ L̇ H	σ <sub>L̇</sub> !	

At first glance the ranking paradox demonstrated in (52) and (53) appears to remove PkPROM as a possible constraint in the analysis since superheavy and heavy syllables behave differently in regard to specific markedness constraints. This is not a fatal argument against PkPROM however, since it, being a scalar constraint, can be "deconstructed" into an equivalent series of ranked markedness constraints which can have other constraints ranked between them (Prince and Smolensky 1993; Prince 1999). The most famous example of this sort of deconstruction is the constraint HNUC:

(54) HNUC: If  $|x| > |y|$ , then Nuc/x > Nuc/y

This constraint dictates that a higher sonority nucleus is more harmonic than one of lower sonority. It is parallel to PKPROM which states that a higher weight peak is more harmonic than one of lower weight, only the harmonic scale (sonority vs. weight) and the position in question (stress peak vs. nucleus) differ. Prince and Smolensky (1993) contend that HNUC is better represented as a series of binary-valued markedness constraints based on the sonority scale:

- (55) Sonority:  $|a| > |i| > \dots > |t|$   
 Peak Harmony:  $P/a > P/i > \dots > P/t$   
 Peak Hierarchy:  $*P/t \gg \dots \gg *P/i \gg *P/a$

The peak harmony scale states that a high sonority peak is more harmonic than a low sonority peak. The peak hierarchy then results in a set of binary-valued markedness constraints. Thus having the least sonorous segment /t/ as a nucleus is the most serious violation. These constraints must be universally ranked relative to one another but can be ranked separately relative to other constraints.

De Lacy (2004), following Prince (1997a,b,c and 1998, 1999), makes a further proposal about the set of binary-valued constraints that can be based on a markedness hierarchy. In order to maintain that constraints can be freely ranked and to make the necessary typological predictions of so-called “anti-Paninian” systems, de Lacy proposes that instead of a fixed ranking, these hierarchical constraints are simply defined to maintain a stringency relationship:

- (56) Stringency Hierarchy:  $*P/t$   
 $*P/t \ i$   
 $*P/t, \ i, \ a$

Stringency is gained via a set of constraints in which each subsequent constraint refers to a larger continuous range of the markedness hierarchy, each starting with the most marked element. Thus the most specific constraint will only refer to the most marked element, but the most general constraint will ban all elements, even the least marked. The last constraint in (56),  $*P/t, \ i, \ a$ , is the most general constraint in the hierarchy: any nucleus, even the least

marked /a/, will violate it. Thus candidates with a /t/ as the nucleus will be harmonically bound by those with an /a/ as the nucleus.

I will demonstrate stringency theory in OT more explicitly with PKPROM. In order to deconstruct PKPROM, we will rely on the following hierarchies:

- (57) Weight: |S| > |H| > |L|  
 Peak Harmony:  $\acute{S} > \acute{H} > \acute{L}$   
 Peak Hierarchy:  $*\acute{L} \gg * \acute{H} \gg * \acute{S}$   
 Stringency Hierarchy:  $\begin{array}{l} * \acute{L} \\ * \acute{L}, \acute{H} \\ * \acute{L}, \acute{H}, \acute{S} \end{array}$

Since having a heavier stress peak is universally more harmonic than having a lighter one, the constraints must consider having a lighter stress peak as a more serious violation than having a heavier peak. This is shown in the peak hierarchy in (57) in the fixed-ranking version of deconstructed PKPROM. However, if we are to insist that all constraints are freely-rankable, we cannot impose this universal fact about markedness cannot be obtained via an imposed ranking. Instead this universal markedness fact is encoded in the definition of the constraints themselves as seen in the constraints listed in the stringency hierarchy in (57). Having a light stress peak, the least harmonic option, incurs a violation by every constraint in the set. On the other hand, having a superheavy stress peak, the most harmonic option, must only violate the most general constraint,  $* \acute{L}, \acute{H}, \acute{S}$ . The following tableau demonstrates that the ordering of these stringently defined constraints is not crucial:

(58)

S HL	$* \acute{L}$	$* \acute{L}, \acute{H}$	$* \acute{L}, \acute{H}, \acute{S}$
a. $\text{S}^{\text{e}} \acute{S} \text{H} \text{L}$			*
b. $\text{S} \acute{H} \text{L}$		*W	*
c. $\text{S} \text{H} \acute{L}$	*W	*W	*

Candidate a wins because it only violates the most general constraint. The other candidates violate this constraint to the same degree, but they have additional violations of the more specific constraints which will eliminate them. When defined in this manner, the constraints

will never favor a losing candidate, they will only either favor the winner or be violated equally by the losers and winner. Candidates b and c are harmonically bound by candidate a since candidate a incurs a proper subset of the violations incurred by b and of those incurred by c. Thus, even if  $*\acute{L}$ ,  $\acute{H}$ ,  $\acute{S}$  is undominated, candidate a's violation will not be fatal because the other candidates violate it equally.

By deconstructing PKPROM into a set of constraints, the initial reason PKPROM cannot be used in the analysis of Hindi, specifically the Eastern Standard dialect, is resolved, since it is now a series of constraints that can be ranked differently relative to other constraints to predict variable behavior of syllables of different weights.

However, if we try to implement the deconstructed PKPROM in the analysis of Eastern Standard, new issues arise and an argument for the deconstructed PKPROM in line with stringency theory is made. As a reminder, in the Eastern Standard dialect, heavy syllables cannot be stressed word-finally, but final superheavy syllables do bear stress. In order to predict that word-final heavy syllables are never stressed,  $\text{NONFIN}(\acute{\sigma})$  must rank above  $*\acute{L}$ :

(59)

L H	$\text{NONFIN}(\acute{\sigma})$	$*\acute{L}$	$*\acute{L}, \acute{H}$	$*\acute{L}, \acute{H}, \acute{S}$
a. $\acute{L} H$		*	*	*
b. $L \acute{H}$	*!		*	*

High-ranking  $\text{NONFIN}(\acute{\sigma})$  eliminates candidate b, leaving candidate a as the winner. Note that in (59), the ranking of  $*\acute{L}, \acute{H}$  relative to  $*\acute{L}, \acute{H}, \acute{S}$  does not matter since both candidates violate these constraints equally. In order for the actual output form to be chosen,  $\text{NONFIN}(\acute{\sigma})$  must be high-ranking since it is the only constraint that favors candidate a. When a form with a final superheavy syllable is considered, further rankings must be established:

(60)

L S	$*\acute{L}, \acute{H}$	$\text{NONFIN}(\acute{\sigma})$	$*\acute{L}$	$*\acute{L}, \acute{H}, \acute{S}$
a. $\acute{L} S$	*!		*	*
b. $L \acute{S}$		*		*

(60) demonstrates that \* $\acute{L}$  ,  $\acute{H}$  must rank above NONFIN( $\acute{\sigma}$ ) in order to eliminate candidate a. Since NONFIN( $\acute{\sigma}$ ) is ranked below \* $\acute{L}$  ,  $\acute{H}$ , the fact that the stressed syllable is final is not a fatal violation.

The required ranking of \* $\acute{L}$  ,  $\acute{H}$  above \* $\acute{L}$  concretely shows that the deconstructed version of PKPROM must be the stringency and not the fixed-ranking version. If we were to try to apply the constraints of the fixed-ranking version to the Eastern Standard dialect, a ranking paradox would follow:

(61)

L H	NONFIN( $\acute{\sigma}$ )	* $\acute{L}$	* $\acute{H}$	* $\acute{S}$
a. $\text{L}^{\text{H}}$		*		
b. $\text{L}^{\text{H}}$	*W	L	W*	

(62)

L S	NONFIN( $\acute{\sigma}$ )	* $\acute{L}$	* $\acute{H}$	* $\acute{S}$
a. $\text{L}^{\text{S}}$	L	W*		W
b. $\text{L}^{\text{S}}$	*			*

(63)

H S	NONFIN( $\acute{\sigma}$ )	* $\acute{L}$	* $\acute{H}$	* $\acute{S}$
a. $\text{H}^{\text{S}}$	L		W*	L
b. $\text{H}^{\text{S}}$	*			*

As when using the stringency set of constraints, NONFIN( $\acute{\sigma}$ ) must rank high in order to avoid stress falling on a final heavy syllable as shown in (61). However, an additional ranking to predict stressed final superheavy syllables is not possible in this case. In (62), the only way to predict final stress would be to have \* $\acute{L}$  rank above NONFIN( $\acute{\sigma}$ ), creating a ranking paradox. If the unstressed syllable were heavy as in (63), if \* $\acute{H}$  were to be ranked above NONFIN( $\acute{\sigma}$ ), it would eliminate candidate a as desired. This is not an option since \* $\acute{H}$  must remain lower-ranked than \* $\acute{L}$ . If we are to use to PKPROM to motivate main stress assignment in Eastern Standard Hindi, not only would we need to utilize the deconstructed version, but specifically the stringency set of constraints are required in order to account for the behavior of superheavy syllables in regard to non-finality (and anti-clash) requirements.

This distinct patterning of superheavy syllables as compared to the similar behavior of heavy and light syllables is an example of an anti-Paninian collapse as discussed by Prince (1999). Prince demonstrates that such anti-Paninian systems are only predicted by the stringently defined constraint sets because they require a more general constraint to be ranked above their more specific version. Prince establishes that in Paninian systems, only certain combinations of levels on hierarchy scale can be ‘fused’ and behave as a single class. In Paninian systems, levels on the scale are fused once, from the top of the harmonic scale down, since markedness constraints can occur in various positions among the hierarchy constraints, but the hierarchy constraints themselves cannot be re-ranked relative to one another. While this can be applied to any markedness scale such as sonority of the foot head (Prince 2004), for the scale regarding the weight of the stress peak, this means that S can fuse with H to the exclusion of L, but L and H cannot fuse together to the exclusion of S.

The possible scale ‘fusions’ on the weight scale are demonstrated below with a typology where M represents a relevant markedness constraint (such as NONFIN(σ')):

- (64) i. M >> \*L >> \*H >> \*S  
*All syllables types satisfy M in output forms.*  
 ii. \*L >> M >> \*H >> \*S  
 \*L >> \*H >> M >> \*S  
 \*L >> \*H >> \*S\* >> M  
*S and H fuse and both syllables types violate M in relevant forms, but L always satisfies M.*

Nowhere in the typology is a language in which grouping H and L syllables ‘fuse’ to behave distinct from S syllables in regard to M. Either all syllable types group together as in 64.i or H and S become a class as in 64.ii. Eastern Standard Hindi is an example of this unpredicted language, where both heavy and light syllables cannot violate NONFIN(σ') and \*CLASH, but superheavy syllables can. Prince (1999) identifies Kelkar’s Hindi as an example of the Paninian system using the weight scale but questions whether or not there is an example of an anti-Paninian system referencing weight. Eastern Standard provides an answer to his question.

## 6.2 WSP vs. PKPROM

It may seem like the stringency version of deconstructed PKPROM is sufficient to account for main stress assignment in Eastern Standard Hindi. However, in the analysis in section 4, WSP and the newly proposed S-WSP are used instead. Walker (1996) contends that WSP is not formulated to make the scalar evaluations needed in ternary weight distinction as in Hindi, and PKPROM is therefore uniquely suited for analyses of languages with such three-way distinctions. However, the addition of S-WSP into the constraint set can account for the same typological patterns discussed by Walker and may ultimately replace PKPROM.

Walker (1996) and Prince and Smolensky (1993) acknowledge that there is considerable overlap in WSP and PKPROM; both generally penalize stress on lighter syllables. However, they go about it by making different demands. PKPROM requires that the best (heaviest) syllable serve as the peak and bear stress. WSP, on the other hand, disallows any suitable (heavy) peak to not bear stress. Let us review the common definition of WSP (although not the exact formulation used in the analysis in section 4):

(65) WSP: Assign a violation for every unstressed heavy syllable.

The definition in (65) makes it clear that WSP is not a constraint about what syllables can bear stress like PKPROM is, but rather, a constraint on what syllables can be unstressed. WSP could be more transparently named “\*H<sub>weak</sub>”. For instance, WSP would not care whether a light syllable is stressed or not, but a candidate with a stressed light syllable would incur a violation of every markedness constraint in the deconstructed PKPROM set. Thus, both constraints use the syllable weight scale to make markedness judgments but do so while targeting different positions. PKPROM uses the scale to restrict what kind of syllable can serve as the head of the head foot of the prosodic word (the bearer of primary stress), while WSP uses it to restrict what syllables can occur in non-foot-heads. Besides the positions they target, note that the orientation of the harmonic scale also reverses. PKPROM, targeting the head, considers heavier syllables to be more harmonic than lighter ones. Oppositely, WSP, targeting non-heads, considers heavier syllables to be less harmonic than lighter ones.

This comparison between PKPROM and WSP leads one to view WSP not just as an isolated markedness constraint but really as a markedness constraint that is situated within a harmonic scale, as a member a deconstructed scalar constraint set. This implies that there is another constraint,  $*L_{\text{weak}}$ , that is simply never discussed as it must always be ranked below  $*H_{\text{weak}}$  in order to maintain the harmonic weight scale in non-head position.<sup>6</sup> If we consider that WSP already is defined as a constraint based on the harmonic scale of syllabic weight in non-peak positions, the introduction  $*S_{\text{weak}}$  is neither surprising nor imprudent. It simply encodes the fact that if a heavy syllable is a worse non-head than a light syllable, a superheavy syllable is an even worse one.

(66) Weight:  $|S| > |H| > |L|$

Non-Peak Harmony:  $L_{\text{weak}} > H_{\text{weak}} > S_{\text{weak}}$

Non-Peak Hierarchy:  $*S_{\text{weak}} \gg *H_{\text{weak}} \gg *L_{\text{weak}}$

Stringency Hierarchy:  $*S_{\text{weak}}$   
 $*S_{\text{weak}}, H_{\text{weak}}$   
 $*S_{\text{weak}}, H_{\text{weak}}, L_{\text{weak}}$

Like the other deconstructed scalar constraints, these new markedness constraints can also be defined so that they are in a stringency relationship as outlined above. It is the stringency version of deconstructed WSP that is used in the above analyses in section 4:

(67) WSP ( $*S_{\text{weak}}, H_{\text{weak}}$ ): Assign a violation for each unstressed syllable with 2 or more moras.

(68) S-WSP ( $*S_{\text{weak}}$ ): Assign a violation for each unstressed syllable with 3 or more moras.

By recognizing WSP as a scalar constraint and introducing its more specific version, S-WSP, into the constraint set, the overlap with PKPROM becomes even more glaring since PKPROM is no longer exceptionally capable of handling ternary weight-distinctions.

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<sup>6</sup>  $*L_{\text{weak}}$ 's main effect would be to motivate every light syllable to be stressed. Other constraints, such as  $*\text{CLASH}$  and foot well-formedness constraints and certain alignment constraints would generally block this effect from being seen in output forms. However, in proposing such a constraint, it could theoretically be ranked above all such constraints which would make the unattested prediction of a language in which every syllable bears stress.

I have now demonstrated that the stringency version of both deconstructed PKPROM and deconstructed WSP can predict the stress assignment patterns seen in the Hindi dialects in question. The redundancy of these constraint families is problematic if we want to have a restricted grammar, namely a minimal universal set of constraints (CON). The WSP family of constraints is not able to be removed from CON since it is responsible for motivating quantity-sensitive secondary stress, which is the situation in which secondary stress only falls on heavy syllables.<sup>7</sup> This is a task that deconstructed PKPROM constraint set cannot perform since it exclusively refers to main stress.

The more feasible option is to eliminate PKPROM<sup>8</sup> from CON. In her typology of prominence-based stress systems, Walker (1996) implements both WSP and PKPROM and admits this may be problematic. In examining the typology, the work of PKPROM can be replaced by WSP and S-WSP as is done in the above analyses of Hindi. Of course, WSP induces additional stresses, while PKPROM does not. In languages without secondary stress, WSP may be a problem since it will undesirably motivate candidates with multiple heavy syllables to stress those syllables and have secondary stress.

This is the situation found in Kelkar's Hindi. In my footed analysis, I rely on ranking both RIGHTMOST-FT and LEFTMOST-FT above the WSP constraints, which will eliminate any secondary stress from appearing in output forms. Walker, abandoning foot structure, instead ranks \*GRIDSTRUC from the \*STRUC family of constraints (Prince & Smolensky 1993; cf. \*STRESS proposed by Garrett 1996) above WSP to prohibit secondary stress:

(69) \*GRIDSTRUC: Do not have grid structure. (Assign a violation for every stress.)

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<sup>7</sup> S-WSP does lead to the interesting prediction that there is a language in which secondary stress only falls on superheavy and not heavy or light syllables. I am not aware of any language that confirms this prediction, but given the infrequency of superheavy syllables, particularly in non-final positions, this may be an accidental gap related to the separate issue of the general markedness of superheavy syllables.

<sup>8</sup> This specifically refers to the version of PKPROM that refers to syllable weight. I make no claims about versions that refer to other scales, like sonority.

So long as either of these methods is applied, the WSP constraints will not induce multiple stresses. The deconstructed WSP constraint set will also have the effect that the heaviest peak which conforms to any higher-ranked markedness constraints will be selected to bear stress as demonstrated in section 4.2 in the analysis of Kelkar's Hindi, notably without using PKPROM.

In examining systems that actually do have secondary stress, Walker notes that there are systems, like that of Koya, in which WSP is satisfied, but PKPROM is violated by output forms. In her analysis, PKPROM is ranked low enough to where it is not active in eliminating candidates, thus not having it there at all would make no difference.

She also identifies languages with secondary stress in which both WSP and PKPROM are satisfied by output forms. In some, like Kuuku-Yaꞑu, she acknowledges that the ranking of PKPROM is not crucial. Here again, if PKPROM were not in CON, it would not affect the selected output forms in such a language; in satisfying WSP, the outputs also satisfy PKPROM, thus demonstrating their overlap.

In other languages in which both WSP and PKPROM are fully satisfied such as Khalka and Buriat, Walker relies on both PKPROM and WSP to select the correct forms. Forms from Khalka with stress marked follow below:

(70)	Khalkha		
	Ḧ Ḧ̃	[á:rù:l]	'dry cheese curds'
	Ḧ L Ḧ̃	[úitgartàe]	'sad'
	Ḷ Ḧ L Ḧ̃	[dòló:dugà:r]	'seventh'
	Ḧ Ḧ L L	[bàegú:lagdax]	'to be organized'
	Ḷ Ḧ Ḧ L	[xòndi:rý:len]	'to separate' (modal)
	Ḧ Ḧ Ḧ̃	[ù:rtàegàr]	'angrily'
	Ḧ Ḧ L Ḧ̃	[bàigú:llagà:r]	'by means of the organization'
	Ḷ Ḧ Ḧ L Ḧ̃	[ùlà:nbá:tarà:s]	'Ulaanbaatar' (ablative)
	Ḷ Ḧ Ḧ Ḧ L	[ùlà:nbà:trí:nxan]	'the residents of Ulaanbaatar'

Walker proposes the following rankings are necessary to account for the stress pattern:

- (71) WSP, ALIGN L (PrWd, Pk) >> \*GRIDSTRUC  
 PKPROM >> NONFIN(Ḷ), ALIGN L (Ḷ, PrWd) >> ALIGN R (P̃k, PrWd)

Ranking WSP over \*GRIDSTRUC can account for secondary stress on heavy syllables. If main stress generally falls as rightward as possible due to the effect of ALIGN R (Ṗk, PrWd), it seems as if in order to explain why a H H L L form surfaces as Ḣ Ḣ L L instead of as Ḣ Ḣ L̇ L, PKPROM must rank above ALIGN R (Ṗk, PrWd) to draw main stress leftward onto the heavier syllable. WSP cannot do this since both of these candidates violate WSP equally. It seems as if this is a particular trait of the main stress that cannot be accounted for by simply requiring that all heavy syllables be stressed:

(72)

H H L L	WSP ALIGN L (PrWd, Pk) PKPROM	NONFIN(σ̇)	ALIGN R (Ṗk, PrWd) *GRIDSTRUC
a. $\text{Ḣ Ḣ L L}$			** (ALIGN R) **(Grid)
b. $\text{Ḣ Ḣ L̇ L}$	*! (PKPROM)		* (ALIGN R) *** (Grid)

Looking at the competition between candidates a and b, it is clear that candidate b's violation of PKPROM eliminates candidate b in (72). PKPROM's influence is drawing stress from a more rightward light syllable onto a less rightward heavy syllable, which WSP cannot do since it doesn't distinguish main stress from secondary stress. However, looking at the lower-ranked constraints, an additional ranking of \*GRIDSTRUC above ALIGN R (Ṗk, PrWd) will also correctly select candidate a as the winner without having to have PKPROM in the constraint set:

(73)

H H L L	WSP ALIGN L (PrWd, Pk)	NONFIN(σ̇)	*GRIDSTRUC	ALIGN R (Ṗk, PrWd)
a. $\text{Ḣ Ḣ L L}$			**	**
b. $\text{Ḣ Ḣ L̇ L}$			***!	*

By having main stress fall on a heavy syllable as in candidate a, an additional secondary stress will be avoided. Because WSP is high-ranking, all heavy syllables must be stressed whether or not the main stress falls on a heavy syllable. Since the heavy syllable bearing main stress would have to bear secondary stress regardless due to the effect of WSP,

candidate a saves itself an additional stress by having its main stress fall on a heavy syllable. Candidates like candidate b that satisfy WSP but have additional stresses will violate \*GRIDSTRUC more and will be eliminated based on those additional violations. Walker establishes the necessary ranking for first for main stress location and then creates a separate ranking to account for secondary stress placement. If one considers the overall stress system as a whole, PKPROM is not necessary.

With this possible ranking, there is no case that Walker discusses in which PKPROM's presence is crucial. Thus, if we want to address the problem of the redundancy of PKPROM and WSP as serious problem, eliminating PKPROM from CON may be a viable solution.

One may worry that in eliminating PKPROM, there will be no constraint that, when ranked above relevant faithfulness constraints, will induce strengthening of syllables so that they serve as better peaks as is typologically attested. Although PKPROM may not be in CON, SWP (Myers 1987; Riad 1992) still remains:

(74) SWP: If stressed, then heavy. (Assign a violation for each stressed syllable that is not heavy.)

SWP is quite similar to PKPROM. Both are requirements on stressed syllables, namely that they are heavy. Parallel to WSP, SWP could be renamed as \* $\acute{L}$ . Of course, this resembles one of the markedness constraints in the deconstructed PKPROM set. What distinguishes SWP and PKPROM is that PKPROM refers to the main stress peak, or the head of the head foot, while SWP refers to not just the head of the head foot but to all stressed syllables.

SWP, like WSP, references the weight hierarchy: when the head of a foot, it is better to be heavy than it is to be light. It may be possible to expand SWP to include the full weight scale: when the head of a foot, it is better to be heavy than it is to be light, but it is even better to be superheavy. Perhaps a more specific version of SWP analogous to WSP's S-WSP could be proposed:

(75) S-SWP: Assign a violation for each stressed heavy or light syllable.

Again, this set of markedness constraints could either be in a fixed ranking or defined in a stringency relationship:

- (76) Weight: |S| > |H| > |L|  
 Head Harmony:  $\acute{S} > \acute{H} > \acute{L}$   
 Head Hierarchy:  $*\acute{L} \gg * \acute{H} \gg * \acute{S}$   
 Stringency Hierarchy:  $\begin{array}{l} * \acute{L} \\ * \acute{L}, \acute{H} \\ * \acute{L}, \acute{H}, \acute{S} \end{array}$

To determine whether or not S-SWP is necessary in CON would require a survey of languages that both strengthen stressed syllables to become heavier and which have superheavy syllables surface in the output. The question to ask is whether or not these stressed syllables are strengthened to become only heavy, or if there is a case in which a stressed syllable violates faithfulness to become superheavy in the output. Strengthening to become superheavy could not be predicted the traditional SWP alone.

The validity of S-SWP will not be explored here, but minimally SWP must remain in CON in order to produce the attested process of strengthening stressed syllables. By having SWP remain in CON, there will continue to be some overlap with WSP since both can potentially drive stress to fall on heavy syllables in the output, and in certain rankings they may be interchangeable. However, this redundancy seems unavoidable since both strengthening of stressed syllables and quantity-sensitive secondary stress are attested. Conversely, it appears as though PkPROM is truly superfluous and that there need not be a specific constraint referencing the weight scale which exclusively targets main stress.

## 7 Conclusion

In summary, I have demonstrated that a prominence-only style of analysis is only feasible in Kelkar's Hindi, but both dialects in question can be analyzed using a single constraint set which employs foot structure. The similarity between the two dialects is highlighted and instead of imposing a completely new analysis for a separate dialect, both are predicted by a simple re-ranking of several constraints, which is appealing given the typological nature of

OT. While the stress systems of the two examined dialects are indeed distinct, it is a matter of how to represent this difference. We expect prosodic characteristics of dialects to be related and should try to offer analyses which reflect this similarity if possible and should not unnecessarily deviate unnecessarily. Ultimately, from the pan-dialectal view of Hindi, the foot-based analysis is the favorable one.

In both dialects of Hindi, superheavy syllables can violate certain markedness constraints when heavy and light syllables cannot. While PKPROM can predict this in Kelkar's dialect, this constraint must firstly be deconstructed into a set of markedness constraints since these constraints must be ranked differently relative to other markedness constraints. Secondly, PKPROM must be deconstructed such that the constraints are in a stringency relationship instead of in a fixed ranking to account for the anti-Paninian patterning in Eastern Standard Hindi. Of course, if the stringency version of deconstructed PKPROM were to be used in the analysis, WSP would still be crucial, since there is quantity-sensitive secondary stress.

Using the stringency version of deconstructed PKPROM can account for main stress placement in both dialects. However, superheavy syllables with secondary stress also have these same special privileges in violating certain markedness constraints in surface forms, thus a constraint is needed that demands that only superheavy syllables be stressed which can be ranked above the relevant markedness constraints. I propose the new constraint S-WSP which requires that any syllable which contains three moras bears stress. S-WSP and WSP reference the weight scale, but instead of making judgments on what is and is not a good peak, it makes judgments as to what is an acceptable and unacceptable non-head, S-WSP and WSP are parallel to deconstructed PKPROM, only the position and therefore the harmonic orientation of the weight scale differ.

I have identified that PKPROM is not the only scalar constraint that references the weight hierarchy. WSP does as well since it dictates that a light syllable is a more harmonic non-foot-head than a heavy syllable. Under my analysis of Eastern Standard, a need for a constraint which simply continues this harmonic hierarchy to the end of the scale is required,

and naturally follows in the form of S-WSP which says that a superheavy syllable is the worst non-foot-head of all.

Crucially, as my analyses in section 4 show, PkPROM is not necessary and correct predictions can be made using only S-WSP and WSP, eliminating a noted issue of redundancy between the constraints. Previously PkPROM was considered indispensable since it makes a three-way weight distinction. However, by recognizing that WSP also references the weight scale, the existence of S-WSP is motivated since it is in-line with this harmony hierarchy. With the addition of S-WSP into CON, the ability to account for ternary weight distinctions is no longer exclusive to PkPROM. The notion that PkPROM may be excluded from CON is supported by the languages in Walker's (1996) typology, none of which must rely on PkPROM to make accurate predictions if S-WSP is utilized.

There are many constraints that have a version which reference the head structure of a given type and a version which reference the structures in general, heads and nonheads. Thus, both the more specific head-only version will overlap with the more general versions since both will require the same thing of the head structure. For instance, PkPROM and SWP both require primary stress be heavy. The question we must seriously pursue is whether the typological facts motivate both versions or if only the more general constraint is needed.

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