The Puzzle of Kashmiri Stress: Implications for Weight Theory[1]

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Currently there are many proposals for analysing cross-linguistic vowel length and consonant weight distributions within an OT framework. The basic claim is that vowel length and consonant weight are determined by the interaction of markedness constraints on moraic content and constraints requiring faithfulness to underlying moraicity.

In this paper, I will show how the constraints used in one such proposal provide an analysis of the core syllable weight of Kashmiri, and that the inclusion of a few other constraints proposed in the literature provides an analysis of the previously puzzling distribution of stress in this language. The theoretical importance of the present work lies in the demonstration that closed syllables may vary in weight depending on surface stress assignment. This is in contrast with previous weight theories which treat consonant weight for a particular segment in a given syllabic position as static within a given language.

Using Optimality Theory (Prince and Smolensky 1993) and Correspondence Theory (McCarthy and Prince 1995), complex distributions of moraic segments are shown to be the result of the interaction of a limited number of general constraints. In addition, it is shown that reranking these constraints does not lead to a pathologic (unattested) interaction between stress and weight.

The paper is organised as follows. Section 1 is a brief introduction to moraic theory and the constraints and typology proposed in Morén (1997). In section 2, I describe the data. In section 3, an analysis of the observed facts is provided, and in section 4, some theoretical issues are discussed.

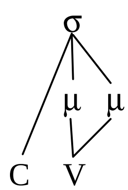
1 Background

The equivalence of long vowelled syllables (CVV) and closed syllables (CVC), as opposed to open syllables containing short vowels (CV), is found in many languages under a variety of circumstances, including stress assignment. Traditionally, this has been seen as a difference in syllable weight. CVV and CVC are heavy, and CV is light. It has also been shown that in languages with a CV/CVV distinction, CVC syllables do not always pattern with CVV, but may count as light and pattern with CV (e.g. Zec 1988).

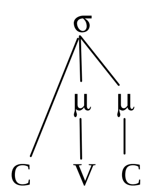
Under Moraic Theory (Hyman 1985; Prince 1976, 1983; Hayes 1989, etc.), the equivalence of CVV and CVC has been captured via bimoraicity. A long vowel has two moraic positions associated with a single vowel root node. A heavy closed syllable has one mora associated with the vowel and another mora associated with the coda consonant.

(1) Heavy syllables

a. [CVV]



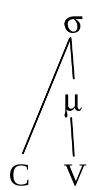
b. [CVC]



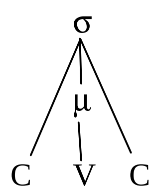
In contrast, in languages where closed syllables pattern with CV, both of these syllables are monomoraic.

(2) Light syllables

a. [CV]



b. [CVC]



Zec (1988) demonstrates that not only do CVC syllables pattern as either light or heavy, but CVC can act as light or heavy within the same language depending on the quality of the coda consonant. In some languages, a CVC with a higher sonority coda patterns with CVV, while a CVC with a lower sonority coda patterns with CV. For example, Lithuanian CVO (O=obstruent) is light, and CVS (S=sonorant) is heavy (Zec 1988).

In contrast with previous theories where consonant weight is constant for a particular segment in a given syllabic position within a language as a whole, I will show that CVC syllables can vary in weight within a language depending on whether or not they are stressed. I propose that in Kashmiri CVV and CV are always heavy and light, respectively. However, CVC is heavy only if it is the best potentially stressable syllable in the word, otherwise it is light. The conclusion that consonant weight is variable comes from the surface stress pattern of the language.

1.1 The Typology of Core Syllable Weight[2]

Morén (1997) claims that the core syllable weight of any language is the result of ranking faithfulness constraints on underlying moraic content relative to markedness constraints against moraic segments. The basic faithfulness constraint proposed is a modified Identity constraint of the McCarthy and Prince (1995) variety:

(3) **IDENTMORA[SEG]**: Correspondent segments are associated with the identical number of moras (based on Morén (1996)).[3] Basically, do not add moras to or delete moras from segments.

This constraint is actually short hand for a family of constraints relativised to different segments as shown in Morén (1996, 1997). However, to demonstrate the typology, this constraint family need only be relativised to the natural classes of consonants and vowels (see (4) and (5)).

(4) **IDENTMORA[V]**: "Do not add moras to or delete moras from vowels."
(5) **IDENTMORA[C]**: "Do not add moras to or delete moras from consonants."

In addition to faithfulness constraints, a set of markedness constraints are proposed. The basic markedness constraint is simply against moraic segments of different types.

(6) ***MORA[SEG]**: Do not associate a mora with a particular segment.

Again, to set up the core typology, these constraints may be relativised to the natural classes of consonants and vowels.

(7) ***MORA[V]**: Do not associate a mora with a vowel.
(8) ***MORA[C]**: Do not associate a mora with a consonant.

Finally, to capture the generalisations in Zec (1988), these markedness constraints are universally ranked with the constraints on less-sonorous segments higher-ranked.

(9) *MORA[C] >> * MORA[V]

Now, given the four constraints in (4), (5), (7), and (8), there are 12 possible rankings if we maintain the universal ranking of (9). These 12 rankings make the correct typological predictions and yield four attested core weight systems.

Rankings (10a-c) result in neither distinctive vowel length nor distinctive consonant weight. Languages of this type are Capanahua, Senufo, and Cayuvava. (10d-h) yield distinctive vowel length but not distinctive consonant weight. This language type is quite common, and includes Khalkha Mongolian, Axeninca, and Hawaiian. The ranking in (10i) results in distinctive consonant weight but not distinctive vowel length, and is seen in Italian and Ilokano. Finally, (10j-l) yield both distinctive vowel length and consonant weight. Languages of this type are Japanese and Finnish, and as will be shown in section 3.1, the ranking in (10j) accounts for the Kashmiri facts.

(10) a. *μ[C] >> *μ[V] >> IDENTμ[V] >> IDENTμ[C]
b. *μ[C] >> *μ[V] >> IDENTμ[C] >> IDENTμ[V]
c. *μ[C] >> IDENTμ[C] >> *μ[V] >> IDENTμ[V]
d. *μ[C] >> IDENTμ[V] >> *μ[V] >> IDENTμ[C]
e. *μ[C] >> IDENTμ[V] >> IDENTμ[C] >> *μ[V]
f. *μ[C] >> IDENTμ[C] >> IDENTμ[V] >> *μ[V]
g. IDENTμ[V] >> *μ[C] >> *μ[V] >> IDENTμ[C]
h. IDENTμ[V] >> *μ[C] >> IDENTμ[C] >> *μ[V]
i. IDENTμ[C] >> *μ[C] >> *μ[V] >> IDENTμ[V]
j. **IDENTμ[V] >> IDENTμ[C] >> *μ[C] >> *μ[V]**
k. IDENTμ[C] >> IDENTμ[V] >> *μ[C] >> *μ[V]
l. IDENTμ[C] >> *μ[C] >> IDENTμ[V] >> *μ[V]

2 Kashmiri

Kashmiri, a Dardic Indo-Aryan language spoken in the Kashmir province of India, shows an interesting relationship between vowel length, consonant weight, and stress assignment. In this section, I will provide a description of these phenomena. All data are taken from Bhatt (1989).

2.1 Length

The examples in (11) and (12) show that Kashmiri, like its cousin Hindi, has both long and short vowels, and long and short consonants.

(11) Long/short vowels
a. [phi.ki.ri] 'understand'
b. [mu.sii.bat^h] no gloss
c. [dee.vee.lii] 'name of Indian Festival'

(12) Long/short consonants
a. [mu.kad.di.ma] no gloss

Given that long vowels and consonants do not consistently appear in any one syllable in a word, and because they attract stress in various situations (to be discussed), I assume the conclusion implicit in Bhatt (1989) that both vowel length and intervocalic consonant weight are phonologically distinctive.

2.2 Stress

As (13) shows, in monomorphemic disyllabic words, the final syllable is never stressed, regardless of weight.

(13) a. [ná.nun] b. [mát.lab]
c. [dáa.naa] d. [péec.daar]
e. [bé.kaar] f. [náa.daan]

However, in words of more than two syllables, stress is determined by syllable weight. In words containing long vowels, the leftmost, non-final, long vowel is stressed.

(14) a. [zi.tóo.vuh] b. [mu.láa.he.za]
c. [ma.ha.rə́ə.nii] d. [náa.raa.za.gi]

In the absence of a long vowel, the leftmost non-final closed syllable is stressed.

(15) a. [ni.rán.jan] b. [mu.kád.di.ma]
c. [ba.gán.dar.la.din]

Note that the attraction of stress to closed syllables parallels the pattern seen with long vowels. Thus, we can conclude that stressed closed syllables are heavy.

Non-final closed syllables containing long vowels (superheavy) are stressed in preference to all other syllables.

(16) a. [boo.dées.var] 'Lord'

Finally, stress is assigned to the initial syllable if all non-final syllables are light.

(17) a. [phí.ki.ri] b. [ví.zi.tar]

The conclusion to be drawn from these data is that main stress in Kashmiri is as far left in a word as possible. However, it is weight sensitive, and retracts to the left-most heaviest syllable of the word (excluding final syllables).

The most puzzling aspect of the interaction between stress assignment and syllable weight in this language is that given the choice of stressing a non-final long vowel or non-final closed syllable within a single word, the long vowel is always stressed -- even if it is to the right of a closed syllable.

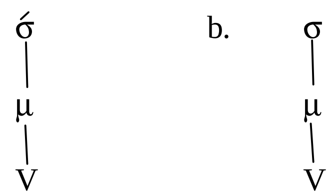
(18) a. [kad.náa.wun] b. [nar.píi.ras.taan]
c. [sam.pa.náa.wun]

This is a puzzle given standard assumptions about syllable weight. Under moraic theory, superheavy syllables are trimoraic, heavy syllables are bimoraic, and light syllables are monomoraic. Since it is obvious that both long vowels and closed syllables are heavy (they both attract stress), why are long vowels preferentially stressed?

3 Analysis

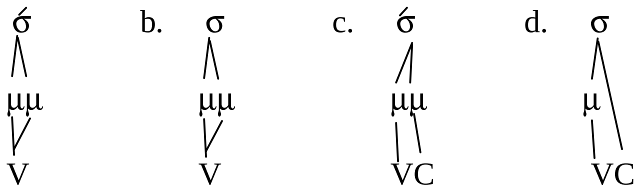
The answer proposed here is that despite surface appearances, weight is responsible for all cases of non-initial stress in Kashmiri. The intuition is that the inherent bimoraicity of long vowels (compare (1a) and (2a)) is the driving force behind stress attraction, but the ability of closed syllable weight to be variable across languages (compare (1b) and (2b)) allows for heavy closed syllables only when they are stressed on the surface. In contrast with many languages that treat syllables closed by particular segment types as always heavy or always light, Kashmiri closed syllable weight is variable and dependent on surface stress. This variability is the result of constraint interaction.

The surface representations proposed here for Kashmiri light and heavy stressed and unstressed syllable rhymes are shown in (19) and (20). In (19), both stressed and unstressed syllables containing simple rhymes are monomoraic.

(19) a.


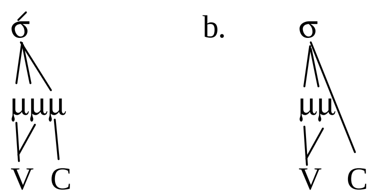
In (20a) and (20b), both stressed and unstressed long vowels are bimoraic. In (20c), a stressed closed syllable is bimoraic. However, in (20d), an unstressed closed syllable is monomoraic.

(20) a. b. c. d.



Finally, although the available data on superheavy syllables is limited to one word, the prediction made here is that the representations for stressed and unstressed syllables containing both a long vowel and a coda consonant is given in (21).

(21) a. b.



3.1 Distinctive Length

Recall from section 2 that both vowel length and consonant weight are distinctive in Kashmiri. Using the constraints proposed in Morén (1996, 1997) and reviewed in section 1, distinctive moraicity is analysed as the ranking a faithfulness constraint on underlying moraic content over a markedness constraint against moraic segments. To account for the distinctive vowel length, faithfulness to underlying vowel length must outrank markedness, as shown in (22) and (23). In (22), an underlyingly long vowel in the initial syllable surfaces as long.[4] (Note that the marks in parens are for the unstressed syllables not relevant to the present discussion, therefore they are not discussed. In addition, since the markedness constraints for consonants and vowels are both low-ranked, they are combined in a single constraint for the rest of the paper for ease of exposition.)

(22) /gri^{μμ}bi^{μ}/	IDENTMORA[V]	* MORA[SEG]
a. gri^{μ}.bi^{μ}	*!	*(*)
☞ b. gri^{μμ}.bi^{μ}		**(*)

Despite the fact that the initial syllable of candidate (b) violates the markedness constraint twice (once per mora), as opposed to the one violation of candidate (a), it is still optimal.[5] Candidate (a) violates the higher-ranked faithfulness constraint by shortening an underlyingly long vowel.

With an input containing a short vowel in the initial syllable, that vowel will surface as short straightforwardly, as shown in (23).

(23) /nu$^{\mu}$na$^{\mu}$r/	IDENTMORA[V]	* MORA[SEG]
☞ a. nu$^{\mu}$.na$^{\mu}$r		*(*)
b. nu$^{\mu\mu}$.na$^{\mu}$r	*!	**(*)

Tableaux (24) and (25) show that by ranking the consonant weight faithfulness constraint above the moraic markedness constraint, underlyingly moraic intervocalic consonants surface as geminates, and underlyingly non-moraic intervocalic consonants surface as onsets.

(24) /mu$^{\mu}$ka$^{\mu}$d$^{\mu}$i$^{\mu}$ma$^{\mu}$/	IDENTMORA[C]	* MORA[SEG]
a. mu$^{\mu}$.ka$^{\mu}$.di$^{\mu}$.ma$^{\mu}$	*!	*(***)
☞ b. mu$^{\mu}$.ka$^{\mu}$d$^{\mu}$i$^{\mu}$.ma$^{\mu}$		**(***)

(25) / nu$^{\mu}$na$^{\mu}$r /	IDENTMORA[C]	* MORA[SEG]
☞ a. nu$^{\mu}$.na$^{\mu}$r		*(*)
b. nu$^{\mu}$n$^{\mu}$a$^{\mu}$r	*!	**(*)

Distinctive vowel length and distinctive consonant weight are thus captured by the following ranking[6]:

(26) IDENTMORA[V], IDENTMORA[C] >> * MORA[SEG]

3.2 Left-aligned Stress

Recall that in the absence of a non-final long vowel or closed syllable, stress is initial. This can be explained by ranking a constraint aligning the head syllable of a prosodic word to the left edge of the prosodic word above a constraint aligning the head syllable to the right edge of the prosodic word.

(27) **ALIGNHEAD-Edge** - Align the head syllable of a prosodic word to an edge of that prosodic word (McCarthy and Prince (1993) - an alignment translation of Prince and Smolensky's (1993) EDGEMOST(pk; L/R; word) constraint).

As (28) shows, with ALIGNHD-L(eft) ranked above ALIGNHD-R(ight), given a choice between stressing the initial or a non-initial syllable, stress falls on the initial. Candidate (b) violates both of these constraints because neither the leftmost nor the rightmost syllable is stressed. Candidate (c) violates only the higher-ranked constraint, and candidate (a) violates only the lower-ranked constraint. Therefore, candidate (a) is optimal.

(28) /phikiri/	ALIGNHD-L	ALIGNHD-R
☞ a. <u>phí$^{\mu}$</u>.ki$^{\mu}$.ri$^{\mu}$		*
b. phi$^{\mu}$.<u>kí$^{\mu}$</u>.ri$^{\mu}$	*!	*
c. phi$^{\mu}$.ki$^{\mu}$.<u>rí$^{\mu}$</u>	*!*	

3.3 Weight Sensitivity

Recall that a non-final long vowel attracts stress away from the initial syllable. This was shown in (14), and is due to the ranking of a constraint requiring heavy syllables to be stressed above the alignment constraint.

(29) **WEIGHT-TO-STRESS PRINCIPLE (WSP)** - Heavy syllables are prominent - i.e. "heavy syllables must be stressed" (Prince and Smolensky (1993), based on Prince (1990)).

The tableau in (30) shows that although candidate (b) has initial stress, thus satisfying alignment, it violates WSP because the heavy syllable is not stressed. Since WSP is higher ranked, candidate (b) loses to candidate (a) which does not violate this constraint, although it does violate the lower-ranked alignment constraint.

(30) /zi$^{\mu}$to$^{\mu\mu}$vu$^{\mu}$h/	WSP	ALIGNHD-L
☞ a. zi$^{\mu}$.tó$^{\mu\mu}$.vu$^{\mu}$h		*
b. zí$^{\mu}$.to$^{\mu\mu}$.vu$^{\mu}$h	*!	

We must also account for the fact that underlyingly long vowels do not shorten to satisfy both WSP and left alignment. By surfacing as short, an underlyingly long vowel could circumvent WSP, and a candidate consisting of only short vowels would surface with initial stress. To prevent this from happening, the faithfulness constraint on vowel length is ranked higher than both of the other constraints. In (31), vowels maintain distinctive length and the leftmost long vowel is stressed. There is no argument yet to rank IDENTMORA[V] with respect to WSP.

(31) /zi$^{\mu}$to$^{\mu\mu}$vu$^{\mu}$h/	IDENTMORA[V]	WSP	ALIGNHD-L
☞ a. zi$^{\mu}$.tó$^{\mu\mu}$.vu$^{\mu}$h			*
b. zí$^{\mu}$.to$^{\mu\mu}$.vu$^{\mu}$h		*!	
c. zí$^{\mu}$.to$^{\mu}$.vu$^{\mu}$h	*!		

However, (32) shows that not only must faithfulness to vowel length be higher ranked than alignment, it must also dominate WSP. In cases where there is more than one non-final long vowel, the leftmost long vowel is stressed, and the others remain long. Candidates (c) and (d) both shorten the unstressed long vowel, thus violating the highest-ranked constraint. Candidate (b) violates alignment in addition to WSP. Candidate (a) violates only WSP, therefore is optimal. Note that it is the lower-ranked alignment constraint that, although dominated, is still active, and forces the leftmost of the long vowels to be stressed.[7]

(32) /na$^{\mu\mu}$ra$^{\mu\mu}$ya$^{\mu}$n/	IDENTMORA[V]	WSP	ALIGNHD-L
☞ a. ná$^{\mu\mu}$.ra$^{\mu\mu}$.ya$^{\mu}$n		*	
b. na$^{\mu\mu}$.rá$^{\mu\mu}$.ya$^{\mu}$n		*	*!
c. ná$^{\mu\mu}$.ra$^{\mu}$.ya$^{\mu}$n	*!		
d. na$^{\mu}$.rá$^{\mu\mu}$.ya$^{\mu}$n	*!		*

3.4 Non-Finality

The fact that the final syllable of a polysyllabic word is never stressed follows from an undominated constraint. Recall that although long vowels typically attract stress away from short vowels, final long vowels are never stressed -- even if they are preceded by only light syllables. To account for this, WSP must be dominated by a constraint against stressed final syllables, as shown in (34).

(33) **NONFINALITY (NONFINAL) -** No head of a prosodic word is final in the prosodic word (Prince and Smolensky (1993)).

(34) /be$^{\mu}$ka$^{\mu\mu}$r/	NONFINAL	WSP
a. be$^{\mu}$.ká$^{\mu\mu}$r	*!	
☞ b. bé$^{\mu}$.ka$^{\mu\mu}$r		*

The partial constraint ranking motivated in the last three sections is:

(35) NONFINAL, IDENTMORA[V] >> WSP >> ALIGNHD-L >> ALIGNHD-R

ALIGNHD-L ranked above ALIGNHD-R results in leftward-aligned stress. Undominated NONFINAL results in an absolute prohibition on final stress. WSP ranked above ALIGNHD-L results in the retraction of stress from initial position to heavy syllables. IDENTMORA[V] ranked above WSP results in distinctive vowel length in both stressed and unstressed positions.

3.5 Geminates and Closed Syllables

As discussed above, shown in (15), and repeated here as (36), if there are no long vowels, but there are closed syllables, then the leftmost non-final closed syllable is stressed.

(36) a. [ni.rán.jan] b. [mu.kád.di.ma]
c. [ba.gán.dar.la.din]

If the coda consonant is underlyingly moraic, it will surface as moraic straightforwardly, and the closed syllable will be stressed by WSP. This is the case for both geminates (see (37)) and underlyingly moraic non-geminate codas (see (38)).

(37) /mu$^{\mu}$ka$^{\mu}$d$^{\mu}$i$^{\mu}$ma$^{\mu}$/	WSP	ALIGNHD-L
a. mú$^{\mu}$.ka$^{\mu}$d$^{\mu}$i$^{\mu}$.ma$^{\mu}$	*!	
☞ b. mu$^{\mu}$.ká$^{\mu}$d$^{\mu}$i$^{\mu}$.ma$^{\mu}$		*

(38) /ni$^{\mu}$ra$^{\mu}$n$^{\mu}$ja$^{\mu}$n/	WSP	ALIGNHD-L
a. ní$^{\mu}$.ra$^{\mu}$n$^{\mu}$.ja$^{\mu}$n	*!	
☞ b. ni$^{\mu}$.rá$^{\mu}$n$^{\mu}$.ja$^{\mu}$n		*

Since underlyingly moraic intervocalic consonants do not surface as non-moraic onsets (degeminate) to satisfy the imperative to have initial stress, the constraint requiring faithfulness to underlying moraicity must be ranked above alignment, as shown in (39).

(39) /mu$^{\mu}$ka$^{\mu}$d$^{\mu}$i$^{\mu}$ma$^{\mu}$/	IDENTMORA[C]	ALIGNHD-L
☞ a. mu$^{\mu}$.ká$^{\mu}$d$^{\mu}$i$^{\mu}$.ma$^{\mu}$		*
b. mú$^{\mu}$.ka$^{\mu}$.di$^{\mu}$.ma$^{\mu}$	*!	

In addition, since non-geminate coda weight is nondistinctive in this environment, we satisfy Richness of the Base (Prince and Smolensky 1993) by assuming that an underlyingly non-moraic consonant in the input still attracts stress away from the initial syllable by surfacing as moraic. To force underlyingly non-moraic codas to surface as moraic, there must be an active constraint requiring codas to be heavy.

(40) **WEIGHT BY POSITION (WBYP)** - Coda consonants must surface as moraic (Based on Hayes (1989)).

Since the coda consonant surfaces with a mora that it did not have underlyingly, WBYP must outrank the faithfulness constraint against adding moras to consonants, as shown in (41).

(41) / $ni^{\mu}ra^{\mu}n^{\mu}ja^{\mu}n$ /	WBYP	IDENTMORA[C]
a. <u>$n\acute{i}^{\mu}$</u>.$ra^{\mu}n$.$ja^{\mu}n$	*!	
☞ b. ni^{μ}.<u>$r\acute{a}^{\mu}n^{\mu}$</u>.$ja^{\mu}n$		*

To ensure that the coda surfaces as heavy, despite the imperative to have initial stress, WBYP must also be ranked higher than the alignment constraint. (42) shows that with WBYP ranked above ALIGNHD-L, underlyingly non-moraic codas become moraic to bear stress. Recall that WSP >> ALIGNHD-L (see (38)) ensures that heavy syllables attract stress from the initial position.

(42) / $ni^{\mu}ra^{\mu}n^{\mu}ja^{\mu}n$ /	WBYP	ALIGNHD-L
a. <u>$n\acute{i}^{\mu}$</u>.$ra^{\mu}n$.$ja^{\mu}n$	*!	
☞ b. ni^{μ}.<u>$r\acute{a}^{\mu}n^{\mu}$</u>.$ja^{\mu}n$		*

To summarise the results of this section, WBYP >> IDENTMORA[C] >> ALIGNHD-L results in codas surfacing as moraic, and WSP and WBYP >> ALIGNHD-L results in closed syllables receiving stress.

3.6 Long Vowel and Closed Syllable Interactions

Recall that the interesting aspect of the Kashmiri stress pattern is that with an input containing a closed syllable positioned to the left of the leftmost non-final long vowel, the long vowel is stressed. This is unexpected since one would expect the leftmost heavy syllable to be stressed regardless of the segmental content of that syllable. I will show that with the correct constraint ranking, we get the effect that a closed syllable is only heavy and stressed if it is the best potential stressable syllable in a word.

In the absence of a non-final long vowel, a single closed syllable is forced to be heavy by WbyP ranked higher than both faithfulness to consonant weight and the constraint requiring initial stress. If WbyP were undominated, all closed syllables would be heavy, and there would be no weight difference between closed syllables and syllables containing long vowels. In such a situation, the leftmost heavy syllable would be stressed regardless of its segmental content. However, in Kashmiri, long vowels ARE stressed over closed syllables, therefore, some constraint must dominate WbyP. With WSP ranked above WbyP, we get the correct distribution.

As (43) shows, an input with an underlyingly non-moraic coda consonant surfaces as non-moraic because surfacing as moraic would cause a violation of WSP. In candidate (b), the long vowel violates WSP, and in candidate (c), the closed syllable violates WSP. To avoid a violation of WSP, either the long vowel could shorten, or the coda consonant could be non-moraic. However, shortening the vowel is prevented by IdentMora[V] >> WSP (see (31)) as shown in candidate (d). Since candidate (a) satisfies both higher-ranked constraints, it wins at the expense of violating WbyP.

(43) /ma$^{\mu}$sra$^{\mu\mu}$wu$^{\mu}$n/	IdentMora[V]	WSP	WbyP	AlignHd-L
☞ a. ma$^{\mu}$s.rá$^{\mu\mu}$.wu$^{\mu}$n			*	*
b. ma$^{\mu}$s$^{\mu}$.ra$^{\mu\mu}$.wu$^{\mu}$n		*!		
c. ma$^{\mu}$s$^{\mu}$.ra$^{\mu\mu}$.wu$^{\mu}$n		*!		*
d. ma$^{\mu}$s$^{\mu}$.ra$^{\mu}$.wu$^{\mu}$n	*!			

Similarly, if a closed syllable containing an underlyingly moraic consonant and a syllable containing a long vowel compete for stress, WSP ranked above both WBYP and consonant weight faithfulness forces an underlyingly moraic consonant to surface as non-moraic.

(44) /ma$^{\mu}$s$^{\mu}$ra$^{\mu\mu}$wu$^{\mu}$n/	WSP	WBYP	IDENTMORA[C]	ALIGNHD-L
☞ a. ma$^{\mu}$s.rá$^{\mu\mu}$.wu$^{\mu}$n		*	*	*
b. ma$^{\mu}$s$^{\mu}$.ra$^{\mu\mu}$.wu$^{\mu}$n	*!			
c. ma$^{\mu}$s$^{\mu}$.ra$^{\mu\mu}$.wu$^{\mu}$n	*!			*

The preference for stressing long vowels over closed syllables is now revealed to be the result of a constraint interaction which forces coda consonants to surface as non-moraic in proximity to long vowels.

To summarise, it is better to have a non-moraic coda consonant than it is to shorten a vowel. WSP ranked above WBYP prevents the moraification of a underlyingly non-moraic codas if there is a long vowel in the word, and WSP ranked above IDENTMORA[C] prevents an underlyingly moraic coda from surfacing as moraic if there is a long vowel in the word. WSP and WBYP are functionally similar in that they can both force violations of IDENTMORA[C], but they are different in that WSP forces consonant non-moraicity in some environments, and WBYP forces consonant moraicity in some environments.

The partial constraint ranking developed in this section is provided in (45) and a more complete ranking shown in (46).

(45) IDENTMORA[V] >> WSP >> WBYP >> IDENTMORA[C]

(46) NONFINAL, IDENTMORA[V] >> WSP >> WBYP >> IDENTMORA[C] >> ALIGNHD-L,*MORA[SEG]

3.8 Multiple Closed Syllables

A further result of the constraint ranking in (46) is that not only do unstressed closed syllables surface as light in the proximity of a long vowel (see (43) and (44)), but if more than one closed syllable is found in a single word, only the leftmost will be heavy. All others will be light. To demonstrate this, tableau (47) shows the evaluation of a set of likely candidates given one possible input. An input with two underlyingly moraic codas surfaces with the leftmost closed syllable as bimoraic and stressed, while the second closed syllable surfaces as monomoraic.

Candidates (e) through (h) violate the highest-ranked WSP because each has an unstressed heavy syllable. The remaining candidates all violate WBYP, but (a) and (b) incur one more violation than (c) and (d). Of these two remaining candidates, (c) violates the imperative to have stress as far left in the word as possible. Therefore, (d) is the winning candidate.

(47) /pa$^{\mu}$r$^{\mu}$me$^{\mu}$s$^{\mu}$wa$^{\mu}$r/	WSP	WBYP	IDENTMORA[C]	ALIGNHD-L
a. pá$^{\mu}$r.me$^{\mu}$s.wa$^{\mu}$r		**!	**	
b. pa$^{\mu}$r.mé$^{\mu}$s.wa$^{\mu}$r		**!	**	*
c. pa$^{\mu}$r.mé$^{\mu}$s$^{\mu}$.wa$^{\mu}$r		*	*	*!
☞ d. pá$^{\mu}$r$^{\mu}$.me$^{\mu}$s.wa$^{\mu}$r		*	*	
e. pá$^{\mu}$r.me$^{\mu}$s$^{\mu}$.wa$^{\mu}$r	*!	*	*	
f. pa$^{\mu}$r$^{\mu}$.mé$^{\mu}$s.wa$^{\mu}$r	*!	*	*	*
g. pa$^{\mu}$r$^{\mu}$.mé$^{\mu}$s$^{\mu}$.wa$^{\mu}$r	*!			*
h. pá$^{\mu}$r$^{\mu}$.me$^{\mu}$s$^{\mu}$.wa$^{\mu}$r	*!			

The constraint ranking in (46) also makes the strong prediction that there are no unstressed geminates in Kashmiri.[8] Since a geminate implies a moraic ambisyllabic consonant, and we have established that unstressed codas are non-moraic, then underlyingly moraic intervocalic consonants should syllabify as simple onsets if not in the coda of a stressed syllable. For example, if the input contains a moraic intervocalic consonant, and a non-final long vowel, as in (48), the long vowel will be stressed, and the underlying geminate will degeminate. Candidates (a) through (c) all violate WSP because they have unstressed heavy syllables. Candidates (c) and (d) violate WBYP by treating the [t] as a non-moraic ambisyllabic consonant. The winning candidate (e) satisfies WSP by losing the underlying mora from the consonant, and it satisfies WBYP by treating the [t] as a non-ambisyllabic onset.

(48) /$zi^{\mu}t^{\mu}o^{\mu\mu}vu^{\mu}h$/	WSP	WBYP	IDENTMORA[C]	ALIGNHD-L
a. $\underline{z\acute{\imath}^{\mu}t^{\mu}}o^{\mu\mu}.vu^{\mu}h$	*!			
b. $zi^{\mu}\underline{t^{\mu}\acute{o}^{\mu\mu}}.vu^{\mu}h$	*!			*
c. $\underline{z\acute{\imath}^{\mu}t}o^{\mu\mu}.vu^{\mu}h$	*!	*	*	
d. $zi^{\mu}\underline{t\acute{o}^{\mu\mu}}.vu^{\mu}h$		*!	*	*
☞ e. $zi^{\mu}.\underline{t\acute{o}^{\mu\mu}}.vu^{\mu}h$			*	*

3.10 Summary of the analysis of Kashmiri

We have seen a straightforward account of Kashmiri in which stressed closed syllables are bimoraic and unstressed closed syllables are monomoraic. This results from an interaction of several constraints that not only yields the overall stress pattern of the language, but also accounts for general vowel length and consonant weight distributions.

Following Morén (1997), the general distinctiveness of vowel length and consonant weight is captured by ranking moraic faithfulness constraints above moraic markedness constraints.

(49) IDENTMORA[V], IDENTMORA[C] >> *MORA[SEG]

The weight sensitive leftward alignment of stress with a proviso that stress not be on the final syllable is captured by ranking constraints proposed by Prince and Smolensky (1993) and McCarthy and Prince (1993).

(50) NONFINAL >> WSP >> ALIGNHD-L >> ALIGNHD-R

The preference for stressed long vowels over stressed closed syllables is the logical result of constraint interaction. The constraint ranking in (51) allows unstressed long vowels to remain long, but forces unstressed closed syllables to be light.

(51) IDENTMORA[V] >> WSP >> WBYP >> IDENTMORA[C]

The combined constraint rankings motivated in this analysis are (49) and (52). There is no evidence with which to rank *MORA[SEG] with respect to ALIGNHD-L and ALIGNHD-R.

(52) NONFINAL, IDENTMORA[V] >> WSP >> WBYP >> IDENTMORA[C] >> ALIGNHD-L >> ALIGNHD-R

4 Theoretical Issues

There are two theoretical issues addressed in this section. The first is a discussion of the difference between two constraints proposed by Prince and Smolensky (1993) to ensure that heavy syllables are preferred as stressed syllables. The second is a discussion of how the constraints used in the analysis of Kashmiri to preferentially stress long vowels over closed syllables cannot be reranked to yield the opposite (unattested) result -- closed syllables preferentially stressed over long vowels.

4.1 Peak Prominence

It is important to point out that until section 3.6, the constraint in (53) could have been substituted for WSP. This constraint says that there is a preference for stressing syllables such that stressed super-heavy syllables are better than stressed heavy syllables, which in turn are better than stressed light syllables.

(53) PEAK-PROMINENCE (PK-PROM) - Peak (x) is more harmonic than Peak (y) if |x| > |y|. Where |μμμ| > |μμ| > |μ|. (Prince and Smolensky (1993), based on McCarthy and Prince (1986), and using the prominence scale of Hayes (1991).)

For example, the tableau in (31) could be replaced with (54).

(54) /zi^{μ}to^{μμ}vu^{μ}h/	IDENTMORA[V]	PK-PROM	ALIGNHD-L
☞ a. zi^{μ}.<u>tó^{μμ}</u>.vu^{μ}h			*
b. <u>zí^{μ}</u>.to^{μμ}.vu^{μ}h		*!	
c. <u>zí^{μ}</u>.to^{μ}.vu^{μ}h	*!		

Here we see that candidate (b) violates PK-PROM because a short vowel is assigned the peak position instead of an available long vowel.

However, in comparing (43) and (44) with (55) and (56), it is clear that PK-PROM by itself makes the wrong predictions if comparing two syllables of equal prominence. Since PK-PROM is satisfied as long as one of the heaviest syllables is stressed, the non-peak status of the other syllables in unimportant. This leaves the lower ranked ALIGNHD-L to choose between candidates (b) and (c). The result is that the left-most heavy syllable is stressed regardless of its segmental content. In (55) and (56), a closed syllable is incorrectly stressed when there is an available non-final long vowel.

(55) /ma$^{\mu}$sra$^{\mu\mu}$wu$^{\mu}$n/	IDENTMORA[V]	PK-PROM	WBYP	ALIGNHD-L
a. ma$^{\mu}$s.rá$^{\mu\mu}$.wu$^{\mu}$n			*!	*
☞ b. má$^{\mu}$s$^{\mu}$.ra$^{\mu\mu}$.wu$^{\mu}$n				
☜ c. ma$^{\mu}$s$^{\mu}$.rá$^{\mu\mu}$.wu$^{\mu}$n				*!
d. má$^{\mu}$s$^{\mu}$.ra$^{\mu}$.wu$^{\mu}$n	*!			

(56) /ma$^{\mu}$s$^{\mu}$ra$^{\mu\mu}$wu$^{\mu}$n/	PK-PROM	WBYP	IDENTMORA[C]	ALIGNHD-L
a. ma$^{\mu}$s.rá$^{\mu\mu}$.wu$^{\mu}$n		*!	*	*
☞ b. má$^{\mu}$s$^{\mu}$.ra$^{\mu\mu}$.wu$^{\mu}$n				
☜ c. ma$^{\mu}$s$^{\mu}$.rá$^{\mu\mu}$.wu$^{\mu}$n				*!

This is important because it shows that although PK-PROM and WSP functionally overlap in some ways, they are functionally distinct in others.

This is not to say that PK-PROM plays no role in the phonology of Kashmiri. On the contrary, there is evidence from the preferential stressing of superheavy syllables over heavy syllables that Kashmiri needs PK-PROM in addition to WSP.

(57) a. [boo.dées.var] 'Lord'

WSP is not sufficient for this case because, it does not distinguish between bimoraic and trimoraic syllables. Therefore, the constraint ranking argued for thus far will incorrectly yield an output with initial stress if a heavy syllable containing a long vowel is to the left of a superheavy syllable, as shown in (58).

(58) /bo$^{\mu\mu}$de$^{\mu\mu}$sva$^{\mu}$r/	WSP	WBYP	IDENTMORA[C]	ALIGNHD-L
a. bo$^{\mu\mu}$.dé$^{\mu\mu}$s.va$^{\mu}$r	*	*!		*
b. bó$^{\mu\mu}$.de$^{\mu\mu}$s.va$^{\mu}$r	*	*!		
☜ c. bo$^{\mu\mu}$.dé$^{\mu\mu}$s$^{\mu}$.va$^{\mu}$r	*		*	*!
☛ d. bó$^{\mu\mu}$.de$^{\mu\mu}$s$^{\mu}$.va$^{\mu}$r	*		*	

However, if we include PK-PROM in the constraint hierarchy, and rank it above ALIGNHD-L, then the superheavy syllable will receive stress, as shown in (59).

(59) /bo$^{\mu\mu}$de$^{\mu\mu}$sva$^{\mu}$r/	WSP	WBYP	IDENTMORA [C]	PK-PROM	ALIGNHD -L
a. bo$^{\mu\mu}$.dé$^{\mu\mu}$s.va$^{\mu}$r	*	*!			*
b. bó$^{\mu\mu}$.de$^{\mu\mu}$s.va$^{\mu}$r	*	*!			
☞ c. bo$^{\mu\mu}$.dé$^{\mu\mu}$s$^{\mu}$.va$^{\mu}$r	*		*		*
d. bó$^{\mu\mu}$.de$^{\mu\mu}$s$^{\mu}$.va$^{\mu}$r	*		*	*!	

This demonstrates that WSP and PK-PROM are separate constraints, and that both are necessary to account for the distribution of stress in Kashmiri.

4.2 Pathologic Stress Patterns[9]

In the analysis of Kashmiri, it was shown that the assignment of stress preferentially to long vowels rather than closed syllables stems from a constraint ranking that forces unstressed coda consonants to become nonmoraic. Is it not possible, then, to rerank these same constraints for the opposite result? That is, can closed syllables be preferentially stressed over long vowels, while maintaining the vowel length on the surface? The answer is that they cannot because of a subset relation between the marks incurred by the relevant competing candidates.

To be more concrete, (60a) and (60b) illustrate the pattern seen in Kashmiri, and (61a) and (61b) illustrate the hypothetical pattern.

(60) a. $/CV^{\mu}C^{\mu}CV^{\mu\mu}CV^{\mu}/$ --> $[CV^{\mu}C\underline{C\acute{V}^{\mu\mu}}.CV^{\mu}]$
b. $/CV^{\mu}C^{\mu}CV^{\mu\mu}CV^{\mu}/$ --> $*[\underline{C\acute{V}^{\mu}C^{\mu}}.CV^{\mu\mu}.CV^{\mu}]$

(61) a. $/CV^{\mu\mu}CV^{\mu}C^{\mu}CV^{\mu}/$ --> $[CV^{\mu\mu}.\underline{C\acute{V}^{\mu}C^{\mu}}.CV^{\mu}]$
b. $/CV^{\mu\mu}CV^{\mu}C^{\mu}CV^{\mu}/$ --> $*[\underline{C\acute{V}^{\mu\mu}}.CV^{\mu}C^{\mu}.CV^{\mu}]$

In Kashmiri, stress is able to retract from the initial syllable to the long vowel because the constraint ranking allows the initial syllable to surface as light, yet still remain closed, as in (60a). However, it is impossible for the constraints to be reranked such that stress retracts from canonically left-aligned position to a closed syllable while maintaining a long vowel on the surface, as in (61a). This is because the long vowel is necessarily bimoraic, therefore it is always heavy, and always available to be the leftmost stressed syllable.

The key to the absolute prohibition of the hypothetical pattern is in examining the subset relationship of marks incurred by the competing output candidates. As (62) and (63) show, maintaining the left-alignment of stress and distinctive vowel length, there is no constraint ranking which will result in candidates (a) or (b) being optimal. Candidates with stressed closed syllables always have one more mark than candidates with stressed long vowels, therefore long vowels are always preferentially stressed. In tableau (62), WSP takes precedence over WBYP, and candidate (d) surfaces (as is the case for Kashmiri).

(62) $/CV^{\mu\mu}CV^{\mu}C^{\mu}CV^{\mu}/$	WSP	WBYP	ALIGNHD-L
a. $CV^{\mu\mu}.\underline{C\acute{V}^{\mu}C^{\mu}}.CV^{\mu}$	*!		*
b. $CV^{\mu\mu}.\underline{C\acute{V}^{\mu}C}.CV^{\mu}$	*!	*	*
c. $\underline{C\acute{V}^{\mu\mu}}.CV^{\mu}C^{\mu}.CV^{\mu}$	*!		
☞ d. $\underline{C\acute{V}^{\mu\mu}}.CV^{\mu}C.CV^{\mu}$		*	

Tableau (63) shows that if WBYP takes precedence over WSP, candidate (c) will surface. Candidates (b) and (d) violate the highest ranked constraint by not having moraic coda consonants. Although both candidates (a) and (c) violate WSP, candidate (a) incurs an additional violation by not having left-aligned stress. Therefore, candidate (c) has a subset of the violations of candidate (a) and is always more harmonic.

(63) $/CV^{\mu\mu}CV^{\mu}C^{\mu}CV^{\mu}/$	WbyP	WSP	AlignHD-L
a. $CV^{\mu\mu}.\underline{C\acute{V}^{\mu}C^{\mu}}.CV^{\mu}$		*	*!
b. $CV^{\mu\mu}.\underline{C\acute{V}^{\mu}C}.CV^{\mu}$	*!	*	*
☞ c. $\underline{C\acute{V}^{\mu\mu}}.CV^{\mu}C^{\mu}.CV^{\mu}$		*	
d. $\underline{C\acute{V}^{\mu\mu}}.CV^{\mu}C.CV^{\mu}$	*!		

Given that the hypothesised weight/stress pattern is unattested, it is a welcome result that the constraints proposed for the odd weight/stress pattern of Kashmiri will not yield such a pathological system.

5 Conclusion

The main purpose of this paper was to show that just because there is evidence in a language that some closed syllables are heavy, that does not necessitate all closed syllables being heavy. Counter to previous theories where consonant weight is constant for a particular segment in a given syllabic position within a language as a whole, I demonstrated that CVC syllables in Kashmiri vary in weight depending on surface stress. In doing this, I offered an analysis of Kashmiri vowel length, consonant weight, and stress assignment; and showed that seemingly complex distributions of moraic segments can be handled by the interaction of a limited number of general constraints. In support of Morén (1997), vowel length and consonant weight are analysed as interactions of various markedness constraints and faithfulness constraints on underlying moraic content. Finally, I demonstrated that constraints needed to explain the somewhat odd distribution of weight and stress in Kashmiri cannot be reranked to result in a pathologic weight-sensitive stress pattern.

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Notes

[1] Thanks to Linda Lombardi, Laura Benua and Caro Struijke for many insightful comments and suggestions.

[2] Core syllable weight refers to whether a language has distinctive vowel length, distinctive consonant weight, neither, or both.

[3] This constraint differs from McCarthy & Prince's (1995) featural identity constraints in two significant ways. First, it specifies a relationship between segments and moras, not segments and features. Second, it allows for the specification of segment type, whereas featural identity constraints normally do not (see Pater 1996 for an example of featural identity constraints that refer to different segment types).

[4] I am assuming an undominated constraint that requires syllable peaks to be minimally monomoraic -- thereby forcing at least one violate of the markedness constraint. This constraint is not discussed here.

[5] One advantage of Morén's approach over other recent OT accounts of vowel length, such as Broselow, et al (1997) and Borowsky and Harvey (1997), is that he does not need a constraint against "long vowels". Along the markedness dimension, a short vowel is always more harmonic than a long vowel since it always incurs one less mark. This derives the universal markedness of long vowels over short vowels.

[6] Since both vowel length and consonant weight are distinctive, the issue of the existence of trimoraic syllables containing a geminate following a long vowel should be addressed. Unfortunately, the limited data available at this time does not allow for this question to be answered satisfactorily. Therefore, I leave it to future research. However, with a constraint against trimoraic syllables ranked below consonant weight faithfulness, superheavy syllables ending in both non-geminate codas and the first half of a geminate can surface. With this constraint ranked between WBYP and consonant weight faithfulness, superheavy syllables containing non-geminate moraic codas can surface, but superheavy syllables containing geminate codas cannot.

[7] We are assuming that there is an undominated constraint (not shown) that allows only one main stress per prosodic word. Therefore, only one of the long vowels can bear stress.

[8] Due to the limited number of geminates discussed in the source material, the question of the accuracy of the predictions presented here must be left to future research.

[9] Thanks to Amy Weinberg and Norbert Hornstein for interesting discussions regarding the material in this section.