

Prosodic Weight*
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Introduction

Syllable weight has been standardly characterized in terms of subsyllabic constituency, and computed by making reference to mora count, as argued in Hyman 1984, McCarthy and Prince 1986 and Hayes 1989, among others.¹ Certain recent proposals, however, posit additional syllable weight distinctions, based on the sonority of the nucleus (e.g., Hayes 1995, Gordon 1999). While continuing to maintain that syllable weight in terms of mora count is the sole weight mechanism associated with the syllable as a prosodic constituent, I will argue that cases of weight distinctions based on the sonority of the nucleus fall under an entirely different rubric. My central claim is that such cases crucially reflect how the syllable relates to the other members of the prosodic hierarchy, notably the foot, bringing into relief the role of sonority in characterizing this relation.

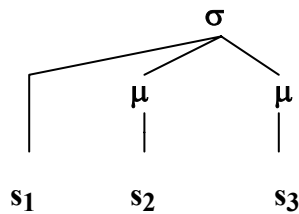
We will begin with the relevant properties of the prosodic hierarchy, given in (1) (see Nespor and Vogel 1986, McCarthy and Prince 1986 among others).

1. ω prosodic word
- ϕ foot
- σ syllable
- μ mora

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Each constituent within the hierarchy establishes a direct relation with the level of segments by imposing a minimal sonority threshold. It has been demonstrated (in Zec 1988, 1995) that the constituents at the lower end of the hierarchy, the mora and the syllable, restrict the minimal sonority thresholds of segments they dominate.² In English, for example, the syllable imposes a minimal sonority threshold on segment **s₂** in (2), admitting only vowels and sonorant consonants in its nuclear position, while the threshold imposed by the mora is unrestricted, permitting any segment in position **s₃**, under the second mora of a heavy syllable.

2.

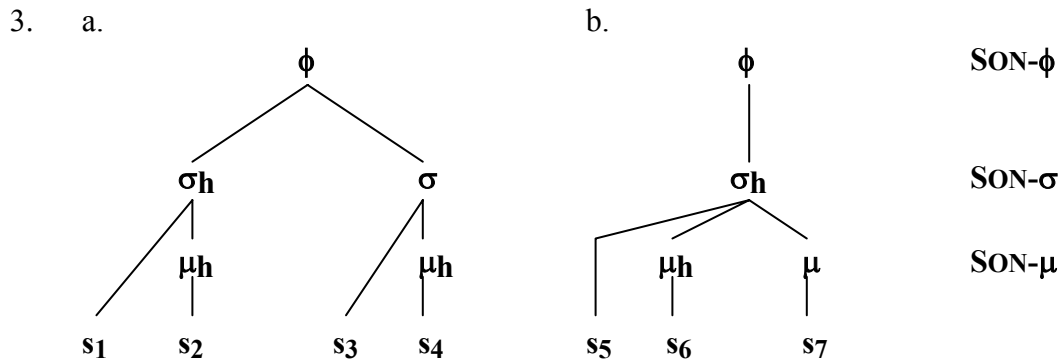


I will argue here that the higher levels of the prosodic hierarchy, the foot and the prosodic word, also impose their own minimal sonority thresholds. Crucially, weight distinctions based on the sonority of the nucleus are governed by the foot or the prosodic word and thus associated with the extrasyllabic portion of the prosodic constituency.

¹ Or in terms of branchingness of the rime, as for example in P. Kiparsky 1981, Steriade 1982 and Levin 1987.

² I am assuming the following sonority scale: obstruents, nasals, liquids, vowels. This scale will be fine-grained when the cases discussed here call for it. On the significance of sonority in characterizing syllable structure, see Hooper 1976, P. Kiparsky 1979, 1981, Steriade 1982, Selkirk 1984b, Clements 1990, Zec 1988, 1995 and the references therein.

With this essential background, I now turn to the implementation of this proposal. Taking Optimality Theory as a frame of reference (cf. McCarthy and Prince 1993a, 1993b, 1995, Prince and Smolensky 1993), I posit the **SON(ority)** family of constraints, which governs the sonority relations within the prosodic hierarchy, as shown in (3).



Assuming that each prosodic constituent possesses a head, corresponding to one constituent at the next lower level (marked by the *h* subscript), the **SON** constraint at each prosodic level imposes a sonority threshold on the segment at the bottom of its head path, as in (3). Back to the case at issue, the relevant constraint for cases of weight distinctions based on the sonority of the nucleus is **SON-ϕ**. This constraint is responsible for the minimal sonority threshold imposed by the foot, and belongs to the family of constraints responsible for minimal sonority thresholds imposed by the other constituents in the prosodic hierarchy: **SON-σ** for the syllable, and **SON-μ** for the mora. In (3), segment **s7** is under the jurisdiction of **SON-μ**, **s4** is under the jurisdiction of both **SON-μ** and **SON-σ**, while **s2** and **s6** are under the jurisdiction of all three **SON** constraints. I will show

that only those syllables that act as foot nuclei are subject to weight evaluation based on the sonority of the nucleus; therefore, in (3), only segments **s₂** and **s₆**, but not **s₄**, could constitute insufficiently sonorous syllable nuclei.³

In sum, the prosodic constituency is viewed here as a hierarchy of sonority peaks. It is regulated by several principles which, if viewed as constraints, will have to be undominated constraints. One is the principle of strict layering (Selkirk 1984a, 1995), which excludes any dominance relations other than those in (1) and, additionally, calls for the postulate stated in (4), whereby each prosodic constituent possesses one subconstituent marked as the head, that is, as its most perspicuous element (Zec 1988, Itô and Mester 1993, Selkirk 1995).

4. **HEADEDNESS:** A prosodic constituent must contain a head, i.e., constituent *n* must immediately dominate exactly one constituent *n-1* designated as its most prominent element, and marked by the *h* subscript. (“No skipping of prosodic levels.”)

The headedness relation, captured in (4), has already been invoked in (3), where it plays a crucial role in characterizing the hierarchy of prosodic constituents as a prominence hierarchy.

Another important principle, the Prosodic Peak Transparency, stated informally in (5), ensures that prosodic constituents higher in the hierarchy impose more restrictive sonority thresholds than those subordinated to them.⁴

³ Prince and Smolensky’s 1993 proposal can be interpreted as recognizing two peaks within the syllable that are constrained in terms of minimal sonority, the nucleus and the rime. While on p. 115 they propose a mechanism whereby only the syllable nucleus is constrained in terms of sonority, on p. 163, they allow for “a somewhat more complex approach [which] introduces a separate Rime Hierarchy of constraints...” However, Prince and Smolensky do not envision any sonority thresholds associated with the prosodic constituents other than the syllable.

5. **PROSODIC PEAK TRANSPARENCY:** the sonority threshold associated with prosodic constituent n may not be less restrictive than the sonority threshold associated with its head.

In other words, **SON- σ** is visible only if it is more restrictive than **SON- μ** , and **SON- ϕ** is visible only if more restrictive than both **SON- σ** and **SON- μ** .

We now turn to the case studies which provide evidence for positing a sonority threshold constraint external to the syllable. The cases arguing for a sonority constraint imposed by the foot are those of English, Mordwin, and Old Church Slavonic. By positing a **SON- ϕ** constraint for each of these languages, I account for the occurrence of light and heavy syllable nuclei in English, for preferred and dispreferred loci of stress in Mordwin, and for the absence of a class of vowels from so-called strong positions in Old Church Slavonic. The case of Asheninca, in contrast, argues for a sonority constraint imposed by the prosodic word, with syllable nuclei classified into light and heavy for the purposes of primary, but not secondary, stress. In the concluding section we address the issue of the overall organization of prominence within the prosodic hierarchy.

⁴ The effect of Prosodic Peak Transparency can be achieved, formally, in terms of constraint conjunction, as elaborated in Zec 2000.

English: light and heavy syllable nuclei

English possesses two classes of syllable nuclei: while any [+sonorant] segment in English may act as a syllable nucleus (e.g., vowels and liquids, as in *butter*, *murky*, *bottle*, *cuddle*, *apple*, and nasals, as in *sudden*, *button*, *sedentary*), not all syllable nuclei are on an equal footing. We can clearly distinguish a difference in the distribution of those syllables whose nuclei correspond to *l* or a nasal, and those whose nuclei are either a vowel or *r*. The former class of syllables, those with light nuclei, have a severely restricted distribution, as stated in (6):

6. Distribution of syllables with *l* or a nasal in the nucleus (L = *l* or nasal):
 - a. CL and CLC syllables are never stressed
 - b. there are no monosyllabic CLC words, or disyllabic CLCL words
 - c. CLC syllables are restricted to positions within the word inflicted by “extraprosodicity” (*student*, *prudent*)

The restricted distribution in (6) is explained by positing minimal sonority thresholds both at the level of the syllable and at the level of the foot. Crucially, while all [+sonorant] segments are possible syllable nuclei, only vowels and *r* are sufficiently sonorous to satisfy the sonority threshold imposed by the foot, thus excluding *l* and nasals from this position. To be more specific, vowels and *r*, but not *l* and nasals, may occupy segmental positions **s₂** and **s₆** in (3).

The collocations listed in (6), from which syllables with light nuclei are excluded, are precisely those in which they would also act as foot nuclei. First, because stressed syllables have to be foot heads, a CL(C) syllable may not bear stress, as stated in (6a). Next, a prosodic word must, minimally, contain a foot, yet

a syllable with a light nucleus is incapable of sustaining a foot, which accounts for the absence of CLC monosyllables or CLCL disyllables, as stated in (6b). Finally, CLC syllables, which like other heavy syllables should correspond to feet, as in (3b), occur in only those positions in which they cannot be granted the foot status, that is, in positions inflicted by extraprosodicity, as stated in (6c) (see Hayes 1982).

No such restrictions are associated with syllables headed by a vowel or *r*, as described in (7), since both these segments meet the sonority threshold imposed by the foot.

7. Distribution of syllables with *r* in the nucleus (CR(C)), which is identical with the distribution of CV(C) syllables:
 - a. CR(C) syllables may be stressed, as in *murky*, *covert*, *furnace*;
 - b. CR and CRC may occur in monosyllables: *fur*; *turf*, *curl*, *terse*;
 - c. Disyllables of the CRCL shape are possible, as in: *curtain*, *curdle*.

In other words, the SON- ϕ constraint for English imposes a cut-off point for foot sonority between *r* and *l*. But, do *r* and vowels, the only foot-bearing syllable nuclei, form a natural class? Kahn 1978 shows that *r* and *l* pattern differently with respect to flapping and release, the former patterning with glides and the latter with obstruents.⁵ Therefore, in the spirit of Kahn's 1978 proposal, I assume that *r* is a [-consonantal] segment and that it exhibits both glide-like and vowel-like behavior. The constraint in (8a) demarcates the class of foot-bearing segments in

⁵ According to Kahn 1978, flapping occurs after vowels, glides, and *r*, as in *potting*; *loiter* and *shouting*; *forty* and *parting*. Flapping does not occur after *l*: **malted*, **shelter*. (In flapped forms like *winter* the nasal is elided.) Also, voiceless stops in pre-pausal position are unreleased after vowels and glides (*sit*, *height*), and after *r* (*heart*), but are released after obstruents and *l* (*apt*, *list*, *belt*).

English, which correspond to the [–consonantal] set, and is more restrictive than (8b), which captures the class of English syllable nuclei.

8. English:

- a. minimal sonority threshold imposed by the foot
SON- ϕ [–consonantal]
- b. minimal sonority threshold imposed by the syllable
SON- σ [+sonorant]

To conclude, English CL(C) syllables are lighter than other syllables in the language. I have argued against positing a hybrid weight hierarchy, along the lines proposed by Hayes 1995 and Gordon 1999, as in (9), with CL and CLC syllables figuring as lightest.

9. CVC, CVV, CRC >> CV, CR >> CL, CLC.

Instead, I invoke an additional sonority threshold, that imposed by the foot, and rely on the constraint SON- ϕ [–consonantal] to account for the distinction between light and heavy nuclei.

In English, the SON- ϕ [–consonantal] constraint is surface true and as such appears to be undominated, since no segments other than the [–consonantal] ones serve as foot nuclei. Since this constraint does not seem to interact with any relevant constraints from the faithfulness family, we assume that these constraints are also undominated. What we encounter, as a result, is a fixed distribution of syllables with light and heavy nuclei, as stated in (8) and (9).

Mordwin: preferred and dispreferred loci of stress

Of particular interest are those cases that provide evidence for interactions among SON- ϕ and the faithfulness constraints (henceforth **FAITH**). One such case will be illustrated by Mordwin, whose stress-related alternations call for the ranking with **FAITH** dominating SON- ϕ .

The Mokshan dialect of Mordwin (Kenstowicz 1996, Tsygankin and Debaev 1975) possesses two types of syllables, which differ in their readiness to bear stress. For this purpose, Mordwin vowels are divided into two classes, “broad” (e, o, ä, a) and “narrow” (i, u, χ). Only syllables headed by the former class receive stress under all circumstances, while those headed by the latter class are stressable under restricted conditions. In words which contain only broad vowels, as well as those that contain only narrow vowels, stress falls on the leftmost syllable, as in (10a) and (10b) respectively. But in words with both broad and narrow vowels, as in (10c), stress falls on the leftmost broad vowel. (The stressed vowel is underlined, and boldfaced.)

10. Distribution of stress

- a. in words which contain only broad vowels:
s'**är**'äd'an 'you arrive', r'**ä**masak 'you buy it', k'**el**'askä 'fox', n'**old**asak 'you release it'
- b. in words which contain only narrow vowels:
p'**uv** χ nd χ ms 'to press', k'**iz**' χ fn' χ ms 'to ask', p'**xs**'t' χ rd χ ms 'to roll with the feet', k'**ul**it'i 'in that ash'
- c. in words which contain both broad and narrow vowels:
s'**as** χ ndat 'you arrive', t'**rg**adat 'you fight', tuš'**χ**ndat 'you go away', tuč'**än**'ä 'cloud', k'**el**' χ pt' χ ms 'to widen'

These facts strongly suggest that, in the very least, broad vowels are the preferred foot nuclei. This is clearly shown by the forms in (10c), those that contain both broad and narrow vowels. These forms justify positing a **SON- ϕ** constraint, which captures the minimal threshold for foot sonority in Mordwin. As stated in (11), the syllable and the foot are associated with different sonority thresholds: the threshold imposed by the foot, in (11a), is more restrictive than the threshold imposed by the syllable, in (11b).

11. Mordwin:

- a. minimal sonority threshold imposed by the foot
SON- ϕ [-consonantal, -high]
- b. minimal sonority threshold imposed by the syllable
SON- σ [-consonantal]

While all syllable nuclei in Mordwin satisfy (11a), only those that contain broad vowels satisfy, also, (11b). Note that Mordwin calls for fine-graining the sonority scale in the realm of vowels, with high vowels treated as less sonorous than the nonhigh class.

The locus of stress is regulated by the alignment constraint in (12), which requires that the stress-bearing foot be aligned with the left edge of the prosodic word (McCarthy and Prince 1993b). This specific foot is referred to here as the head of the prosodic word, in accordance with the **HEADEDNESS** requirement in (4).⁶

⁶ I follow Kenstowicz 1996 in assuming that Mordwin possesses unbounded left-headed feet.

12. **ALIGN-L**: Align the head of prosodic word with the left edge of prosodic word.

The interactions between the **SON- ϕ** [–consonantal, –high] constraint in (11a) and **ALIGN-L** in (12) are given in the tableau in (13), which clearly shows that the former dominates the latter. In the optimal candidate, stress falls on the rightmost syllable, which satisfies **SON- ϕ** [–consonantal, –high] and thus leads to the violation of **ALIGN-L**.

13. Form with broad and narrow vowels: **SON- ϕ** >> **ALIGN-L**


tušχndat	SON-ϕ	ALIGN-L
tušχnd <u>át</u>		* *
<u>tú</u> šχndat	* !	

We will turn now to forms in (10b), those with only narrow vowels. Even though these forms do not contain any syllable that satisfies **SON- ϕ** , they are stressed, with stress falling on a narrow vowel, in violation of **SON- ϕ** [–consonantal, –high]. This establishes the ranking of **SON- ϕ** [–consonantal, –high] with respect to two other relevant constraints. One hypothetical option would be to leave a form with only narrow vowels unstressed, thus vacuously satisfying **SON- ϕ** . This, however, would lead to a fatal violation of the constraint in (14), which requires that each prosodic word possess a head, that is, dominate at least one foot (cf. the principle of **HEADEDNESS** in (4)):

14. **HEAD- ω** : A prosodic word must have a head.


The tableau in (15) establishes that **HEAD- ω** ranks higher than **SON- ϕ** : the winning candidate receives stress, in violation of **SON- ϕ** , to satisfy **HEAD- ω** , while the suboptimal one, which has no stressed syllable, fatally violates the latter constraint.

15. Form with narrow vowels: **HEAD- ω** >> **SON- ϕ**

	HEAD-ω	SON-ϕ
kulit'i		
 k <u>u</u> lit'i		*
kulit'i	* !	

Next, we can establish that **SON- ϕ** [-consonantal, -high] ranks lower than any **FAITH** constraint: a narrow vowel remains faithful to its input counterpart at the cost of violating **SON- ϕ** , which results in a lowered sonority threshold on feet. The relevant interactions are shown in the tableau in (16), where stress falls on the leftmost syllable in both candidate forms, in full compliance with **ALIGN-L**. Note that the losing candidate, which satisfies **SON- ϕ** due to a conversion of *u* to *o*, concomitantly commits a violation of **FAITH**.

16. Form with narrow vowels: **FAITH** >> **SON- ϕ**

	FAITH	SON-ϕ
kulit'i		
 k <u>u</u> lit'i		*
k <u>o</u> lit'i	* !	

In sum, there is no need to posit two classes of syllable nuclei for Mordwin or establish an additional syllable weight metric based on the sonority of the nucleus. Under the analysis proposed here, the distribution of stress in Mordwin results, first, from different sonority thresholds imposed by the syllable and the foot and, second, from the mutual ranking of **SON- ϕ** and **FAITH**. Because the latter constraint outranks the former, narrow vowels are dispreferred loci of stress, although they may be stressed if no broad vowel is available.

Old Church Slavonic: lowering of jer vowels in strong positions

Old Church Slavonic (henceforth OCS), the language preserved in the earliest Slavic written documents,⁷ illustrates the reversed ranking of **SON- ϕ** and **FAITH** from that found in Mordwin. OCS restricts the set of syllabic segments to vowels, the relevant constraint being **SON- σ** [–consonantal]. But as in English and Mordwin, syllable nuclei fall into two classes: those that can and those that cannot sustain a foot. This is demonstrated by the behavior of the so-called jer vowels, which belong to the latter class and participate in a specific set of phonological alternations. Before turning to these alternations, we will first look into the vocalic system of OCS and the place of jer vowels in this system.

⁷ OCS is the language of the earliest Slavic documents translated by Cyril and Methodius, and their disciples, between ninth and eleventh centuries, most likely spoken in the region of Thessaloniki (Lunt 1959 and references therein). The documents that this analysis is based on are Codex Zographensis (hereafter Zogr), a twelfth century copy of an early manuscript, which according to Lunt 1959:6 is “phonetically ... nearest to the language of Cyril and Methodius” and Ostromirovo Evangelie (hereafter Ostr), which dates from 1056 and possesses certain East Slavic traits.

Listed in (17) and (18) are the vocalic segments of OCS. The jer vowels are the high lax vowels *I* and *U* in (17). Following Lightner 1972, I distinguish them from the other OCS vowels by designating them as [–tense] segments, the other vowels in the language being [+tense].

17. Historically short vowels

I	U	high	jers: [–tense]
e	o	non-high	

The vowels in (17) correspond to short vowels in Common Slavic, while those in (18) correspond to what clearly used to be long vowels. It is not obvious, however, that vocalic length was phonologically relevant in the OCS dialect described here. For reasons of accuracy, I state that the vowels in (17) historically correspond to short, and those in (18), to long Common Slavic vowels. But since we have no clear evidence regarding the status of vocalic length at the stage we focus on, the analysis is free of any assumptions in this regard.⁸

18. Historically long vowels

i	y u	high
□	ǫ	nonhigh
ě	a	

⁸ Vocalic length is entirely absent from the modern counterparts of the dialects that serve as the basis of our analysis – Russian and Macedonian/Bulgarian. Among the historically long vowels in (18), □ and ǫ were nasalized vowels, and ě was an open mid vowel that may have been a diphthong in some dialects.

The jer vowels exhibited a characteristic pattern of lowering in certain collocations, a phenomenon known as Havlík's Law (based on Isačenko 1970):

19. Havlík's Law:

- a. Word-final jers and jers in syllables followed by vowels other than jers become weak (weak jers are subsequently dropped)
- b. Jers in syllables followed by a weak jer become strong
- c. Strongjers *I* and *U* merge with *e* and *o* respectively (in OCS and Old East Slavic, as represented in Zogr and Ostr)

To paraphrase, jers in so-called strong positions lower to the corresponding nonhigh vowels, while those in weak positions remain unaltered.⁹ Crucial for my argument is the fact that jers in strong positions are immediately followed by another jer, which strongly suggests that this phenomenon is related to foot structure.

The examples in (20) - (22) illustrate the alternations described in Havlík's Law.¹⁰ I first focus on the behavior of jers in disyllabic forms, given in (20), which demonstrate that the jer vowels are subject to lowering only when the underlying form contains consecutive jers, as in (20c). In the other cases, namely, (20a), (20b), in which the jer is either followed or preceded by a "regular" vowel, jer lowering does not take effect.

⁹ This is the case at the historical stage I am capturing here. At a later time, jers in weak positions were lost, but this aspect of Havlík's Law is outside the scope of this paper (cf. (19a)).

¹⁰ In the schematized representations of OCS examples, I use the following abbreviations: c = any consonant, v = any non-jer vowel, U = jer vowel.

20. Forms with two syllables

underlying	surface	
a. cvcU		
stolU	stolU	‘throne’ (Nom)
b. cUcv		
sUnu	sUnu	‘dream’ (Dat)
dIne	dIne	‘day’ (Gen, Sg)
zUla	zUla	‘evil’ (adj. nom.sg.fem)
c. cUcU		
sUnU	sonU	‘dream’ (Nom)
dInI	denI	‘day’ (Nom, Sg)
zUIU	zolU	‘evil’ (adj. nom.sg.masc)

This strongly suggests that a cUcU sequence is footed as (cUcU). Because it is the leftmost jer that lowers, yielding (cvcU), we can conclude that the foot system is trochaic and that the leftmost syllable within the foot is subject to **SON- ϕ** , whose effect is manifested as jer lowering.

The trisyllabic forms in (21) further corroborate what we observe in (20). Forms that contain only one jer vowel, as in (21a), (21b), and (21c), or those that contain jers interspersed with non-jer vowels, as in (21d), do not exhibit any alternations. Alternations are found in only those forms that underlyingly contain consecutive jers. Those in (21e) and (21f), each containing two consecutive jers, are footed as cv(cUcU) and (cUcU)cv, respectively, with the leftmost jer lowering. The crucial case is (21g), with three consecutive jer vowels, which clearly shows that footing is binary, and that the directionality of footing is right-to-left: a cUcUcU form is footed as cU(cUcU), yielding cU(cvcU), rather than *(cUcU)cU, yielding *(cvcU)cU. In each case, the resulting feet are disyllabic (and of course bimoraic) trochees.

21. Forms with three syllables

underlying	surface	
a. cUcvcv		
vUzglasi	vUzglasi	‘announce’
b. cvcUcv		
tetUka	tetUka	‘aunt’ (Nom, Sg)
otIca	otIca	‘father’ (Gen, Sg)
c. cvcvcU		
bolitU	bolitU	‘ache’ (3 rd person Sg, Present)
d. cUcvcU		
mUnogU	mUnogU	‘many’
e. cvcUcU		
otIcI	otecI	‘father’ (Nom, Sg)
rabU tU	rabU tU	‘this slave’
f. cUcUcv		
□ItIca	□etIca	‘reader (Gen)’
sUnIna	sonIna	‘of sleep’ (adj. nom. sg. fem)
tImIna	temIna	‘dark’ (Nom, Sg, Fem)
sUnIma	sonIma	‘gathering’ (Gen, Sg)
vU tImě	vo tImě	‘in the darkness’
g. cUcUcU		
□ItIcI	□ItecI	‘reader (Nom)’
sUnInU	sUnenU	‘of sleep’ (adj. nom. sg. masc)
tImInU	tImenU	‘dark’ (Nom, Sg, Masc)
sUnImU	sUnemU	‘gathering’ (Nom, Sg)

In (22) are listed forms containing four syllables, and with at least two consecutive jer vowels in the underlying form. All cases of jer lowering in (22) are accounted for under the assumption that binary footing proceeds from right to left.

22. Forms with four syllables

underlying	surface	
a. cUcUcvcU		
vUskrIsnetU	voskrIsnetU	‘resurrect’ (3 rd person Sg, Present)
b. cUcUcvcv		
sU mUnojQ	so mUnojQ	‘with me’
c. cUcUcUcv		
pIpIrIca	pIperIca	‘pepper’ (Gen, Sg) [constructed]
vU sUnImě	vU sonImě	‘in (the) gathering’ (Loc)
d. cUcUcUcU		
pIpIrIcI	pepIrecI	‘pepper’ (Nom, Sg)
vU sUnImU	vo sUnemU	‘to (the) gathering’ (Acc)

To conclude, the distribution of strong and weak jers results from binary footing, assuming the system of moraic trochees. This is captured by the following foot-related OT constraints (following Prince 1990, McCarthy and Prince 1993a, 1995, Prince and Smolensky 1993):

23. **FTBIN:** Feet are binary.

24. **ALIGN-R:** Align every foot with the right edge of the prosodic word.

While **FTBIN** requires that feet are maximally, and minimally, bimoraic, the alignment constraint in (24) mimics the effect of right-to-left footing, guaranteeing that a cUcUcU sequence becomes cU(cvcU) rather than *(cvcU)cU.

Jer lowering is explained as a sonority threshold restriction on feet in OCS: the vowel heading the foot may not be a jer; that is, it has to belong to the class of [–consonantal, +tense] segments. Jers are thus sufficiently sonorous to be syllabic but are insufficiently sonorous to be foot bearing, as captured by the constrains in (25):

25. OCS:


- a. minimal sonority threshold imposed by the foot
SON- ϕ [-consonantal, +tense]
- b. minimal sonority threshold imposed by the syllable
SON- σ [-consonantal]

We now turn to the complexities of OCS foot structure, which is characterized by opaque constraint interactions. **SON- ϕ** plays a central role in evaluating optimal foot structure but for this purpose is, crucially, dominated by **FAITH**. The evaluation of optimal foot nuclei, however, calls for the reversed ranking, with **SON- ϕ** dominating **FAITH** (to allow for jer lowering).

Opaque constraint interactions in OCS will be resolved by positing two phonological levels: level 1, at which **FAITH** dominates **SON- ϕ** , as in Mordwin; and level 2, at which this dominance relation is reversed.¹¹ This move is necessary because concomitant jer lowering and footing would lead to undesirable results (see note 12). At Level 1, at which all footing takes place, no jers are lowered due to the ranking **FAITH** >> **SON- ϕ** . The tableau in (26) shows that selecting a foot nucleus that meets the **SON- ϕ** requirement is more important than satisfying **ALIGN-R**.

¹¹ We would avoid introducing multiple levels by invoking a sympathy-based evaluation in addition to input-output evaluation, following McCarthy's 2000 proposal. I opt for a level-based analysis to keep the focus on the central concern of this study; the question of the status of levels in phonology is outside its scope.

26. Level 1: **ALIGN-R** >> **SON- ϕ**


cvcUcU	ALIGN-R	SON-ϕ
 cv(cUcU)		*
(cvcU)cU	*!	

At this point I introduce an additional foot-related constraint, **FTFORM**, in (27), which ensures that trochaic feet containing a jer and a non-jer vowel are not headed by the jer. As a result, cUcUcv is footed as (cUcU)cv rather than *cU(cUcv).

27. **FTFORM**: Feet of the (cUcv) shape are prohibited.


The tableau in (28) provides evidence that **FTFORM** dominates **ALIGN-R**, and the tableau in (29) shows that this constraint also dominates **FTBIN**.¹²

28. Level 1: **FTFORM** >> **ALIGN-R**

cvcUcv	FTFORM	ALIGN-R
 (cvcU)cv		*
cv(cUcv)	*!	

¹² Crucially, **FTFORM** takes effect only if **FAITH** >> **SON- ϕ** [-consonantal, +tense], thus preventing jer lowering. Under the reversed ranking, **SON- ϕ** >> **FAITH**, the input cv(cUcv) in (28) would yield *cv(cvcv) as the optimal output; and the input cUcv in (29) would yield *(cvcv) as optimal. This provides pivotal evidence that the evaluation of OCS forms needs to proceed in two steps.

29. Level 1: **FTFORM** >> **FTBIN**

cUcv	FTFORM	FTBIN
 cU(cv)		*
(cUcv)	*!	

The optimal candidate in (29) contains a monomoraic foot, in violation of **FTBIN**. This analysis, which admits monomoraic feet in OCS, is supported by the forms in (30): a jer found in monosyllabic, and monomoraic, forms is subject to lowering and thus constitutes a foot head.

30. Monosyllables


- a. **cv**
to to ‘that’
- b. **cU**
nU no ‘but’

In (30b), **FTBIN** is violated under the pressure of the constraint in (31), which ensures that each prosodic word possesses a foot; the effect of this constraint has already been evidenced in Mordwin.

31. **HEAD- ω** : A prosodic word must have a head.


Because a prosodic word must contain a foot, the footing of a monomoraic form proceeds in violation of **FTBIN**, as shown in (32).

32. Level 1: **HEAD- ω** >> **FTBIN**

cU	HEAD-ω	FTBIN
 (cU)		*
cU	*!	

We now turn to the interactions at level 2, and the **SON- ϕ** >> **FAITH** ranking that OCS provides evidence for. Once all footing is in place, the jer vowels that occupy the positions of foot nuclei are converted to the corresponding non-jer vowels, in order to meet the requirements of **SON- ϕ** . In other words, the pattern of jer lowering in strong positions calls for **SON- ϕ** >> **FAITH**. The tableau in (33) presents a level 2 interaction, its input form being the output from level 1.

33. Level 2: **SON- ϕ** >> **FAITH**

cv(cUcU)	SON-ϕ	FAITH
 cv(cocU)		*
cv(cUcU)	*!	

Thus far, I have only documented disyllabic feet, those in (3a), and this is precisely what Havlík's Law focuses on, if interpreted in terms of foot structure. An obvious further line of investigation is to look for monosyllabic feet, those in (3b), that correspond to a single heavy syllable. This brings us to the so-called exceptions to Havlík's Law: in Ostromirovo Evangelie (see note 7, jers in syllables closed with liquids do not follow the strong/weak pattern predicted by

Havlík’s Law. According to V. Kiparsky 1979: 100, “U and I in the groups tUrt, tIrt, tUlt were always treated as if ‘strong’.”

Late Common Slavic is characterized by a strong tendency toward open syllables (Bethin 1998 and references therein). By the time of the earliest written records, most closed syllables had been eliminated from the language. The phenomenon known as pleophony is part of the general open syllable strategy in Late Common Slavic and is characteristic of East Slavic (cf. Bethin 1998). As shown in (34), all syllables closed with liquids other than those with a jer nucleus were eliminated by copying the nuclear vowel.

34. oLC → oLoC
 eLC → eLeC
 but ULC → ULC (with ULUC in certain dialects)

As a result, CUL is the only closed syllable in the East Slavic dialect of OCS, and the only heavy syllable headed by jer. This closed syllable, being bimoraic, forms a trochaic foot.¹³

And indeed, in later East Slavic manuscripts, jers in syllables closed with liquids are lowered (Borkovskij and Kuznecov 1965, Shevelov 1965, V. Kiparsky 1979, Bethin 1998). In (35)-(37) I compare the forms found in

¹³ By Late Common Slavic, bimoraic syllables ending in a liquid were transformed in several ways as part of the general open syllable strategy. While in Old East Slavic, they were transformed through pleophony, presented in (34), in Old South Slavic, such syllables were transformed by virtue of liquid metathesis, with VLC yielding LV:C, accompanied by the lengthening of the nuclear vowel. Since this is an obvious case of compensatory lengthening, it crucially argues for the moraic status of liquids in Late Common Slavic. The set of moraic segments in Late Common Slavic, and most likely also in OCS, was the [+sonorant, –nasal] class. For details, see Bethin 1998 and references therein..

Ostromirovo Evangelie, from the eleventh century, and their correspondents in thirteenth-century manuscripts.

	11 th c. (Ostr)	13 th c.	
35.	a. tUrgU	torgU	‘square’
	b. sUmIrtI	smertI	‘death’
	c. mUlnIji	molnIja	‘lightening’
36.	a. tUrgovati	torgovati	‘trade’
	b. vIrba	verba	‘willow’
	c. pIrvyi	pervyi	‘first’
	d. gUrlo	gorlo	‘throat’
	e. vUlna	volna	‘wave’
37.	gUrnlcI	gornecl	‘jar’

All the forms in the left-hand column contain syllables closed with a liquid whose nucleus is a jer vowel. Note that, in the thirteenth-century forms, the jer lowers in (35), where there is a weak jer in the immediately following syllable; in (36), where the lowered jer is the sole jer in the word; and in (37), where there is a strong jer in the following syllable. Thus, jer lowering in closed syllables does not fall under Havlík’s Law, which is why this case had been treated as an exception.

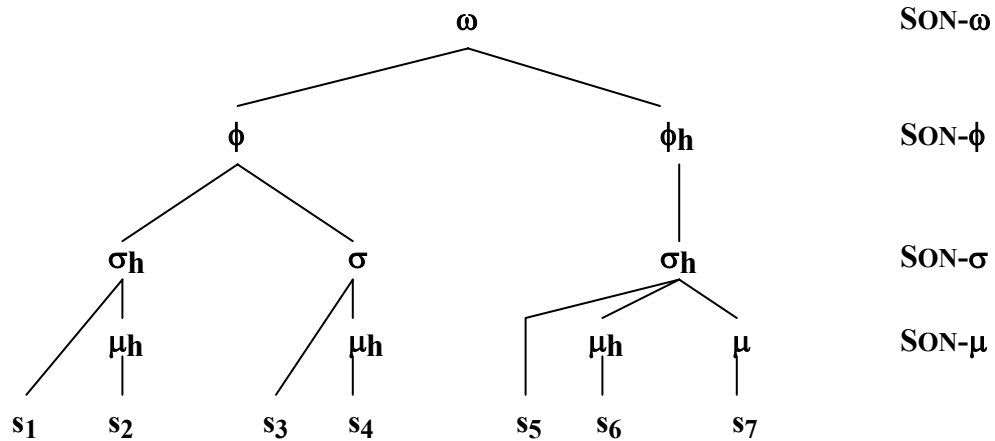
But under the account of jer lowering proposed here, we can explain why a jer in a CUL syllable behaves like a strong jer: it occupies the head position within a foot. We also explain why the jer in a CUL syllable does not adhere to Havlík’s Law: this law refers only to jers in monomoraic syllables but not to those in bimoraic syllables, that is, to disyllabic but not to monosyllabic feet. The proposed analysis thus provides a unified account, covering both the cases that

fall under Havlik's Law and those that are seen as its exceptions: we expect jer lowering in all types of trochaic feet, both monosyllabic and disyllabic.

Asheninca Campa: the impact of the prosodic word

In the three cases analyzed thus far, the prosodic constituent responsible for the distinction between light and heavy syllable nuclei is the foot, or rather, the minimal sonority threshold that it imposes. But if the prominence structure of the entire prosodic hierarchy is governed by sonority, and if a minimal sonority threshold is imposed by each prosodic constituent, the obvious question to ask is whether the prosodic word also participates in prosodic prominence. This prosodic constituent crucially differs from the foot, the syllable, and the mora in having a dual identity, both prosodic and morphosyntactic, which would allow for the possibility that the prosodic word does not contribute to the SON family of constraints. But if it did, we would have a fourth SON constraint, SON- ω , which would impose its own sonority threshold. With both SON- ω and SON- ϕ as active constraints, and the former more restrictive than the latter, segments s_2 and s_6 in (38) would fall under the jurisdiction of SON- ϕ , and segment s_6 would be additionally evaluated by SON- ω .

38.



A case that would constitute supporting evidence for this is one in which primary stress would be associated with a higher sonority threshold than the secondary stress. This is precisely what we find in Asheninca, as described in Payne 1990.

The distribution of stresses in Asheninca follows an iambic footing pattern, with feet corresponding to (LL), (LH), and (H), as shown in (39) and (40). In addition, a final syllable may not be footed, which leaves at least one syllable, and in some cases as many as two syllables in word-final position unfooted. Since a final syllable may not be footed, a disyllabic form, as in (39h), contains only a single monomoraic foot.

39. Forms with monomoraic syllables

- | | |
|-----------------------------|-------------------------|
| a. pa.mé.na.kó.weN.tá.ke.ro | ‘take care of her’ |
| b. ha.má.naN.tá.ke.né.ro | ‘he bought it for her’ |
| c. no.kó.wa.wé.ta.ka | ‘I wanted (it) in vain’ |
| d. no.tóN.ka.méN.to | ‘my gun’ |
| e. ka.máN.ta.ke | ‘he/she said’ |
| f. no.pí.to | ‘my canoe’ |

g. syoN.kí.ri	‘type of partridge’
h. há.ka	‘here’

40. Forms with monomoraic and bimoraic syllables

a. no.má.ko.ryáa.wái.ta.páa.ke	‘I rested a while’
b. pi.ñáa.páa.ke	‘you saw on arrival’
c. i.kyáa.píiN.ti	‘he always enters’
d. póo.ka.ná.ke.ro	‘you threw it out’
e. páa.ti.ká.ke.ri	‘you stepped on him’

The stresses in (39) and (40) are all equal in status. Moreover, any vowel in the Asheninca inventory, which includes *i*, *e*, *a*, and *o*, may serve as the foot nucleus in (39) and (40). But once the distinction between the primary and the secondary stress is taken into account, we note that one of the vowels in the inventory, the high vowel *i*, may not serve as the primary stress nucleus, although it is a possible secondary stress nucleus.¹⁴

According to Payne 1990, primary stress falls within the four-syllable window at the word’s right edge.¹⁵ In our terms, stress falls on one of the final two feet in a word: either the foot not headed by *i*, or the rightmost one.¹⁶ In (41a) - (41d), the rightmost foot is headed by a vowel other than *i*, and can thus serve as

¹⁴ Syllables with *i* in the nucleus, and either \emptyset or *sy* in the onset, are according to Payne 1990 extralight and, as such, repel stress. One possible reason for this could be that vowels in such syllables are devoiced, judging by the conditions on vowel devoicing in Japanese (Tsuchida 1997 and references therein); if so, the properties of extralight syllables, most likely, are not strictly part of the weight system.

¹⁵ I follow Payne’s 1990 interpretation of the distribution of primary stress. Hayes 1995 presents a somewhat different picture of primary stress assignment in Asheninca, subsuming under this phenomenon the facts of clash resolution. I assume, together with Payne, that clash resolution is a phenomenon orthogonal to primary stress assignment.

the bearer of primary stress. However if, as in (41e)-(41g), the final foot has *i* as its nucleus, and the one immediately preceding has any vowel other than *i*, then the penultimate foot is the bearer of primary stress. Finally, in (41h), we see that a syllable with an *i* nucleus is selected for primary stress if neither foot is headed by a vowel other than *i*.

41. Primary and secondary stress

- | | | |
|----|--|-----------------------------------|
| a. | ((sàa).(sáa)).ti | ‘type of partridge’ |
| b. | ((no.tòN).(ka.méN)).to | ‘my gun’ |
| c. | iN.kiN.ki.syi.re.tà.((ko.tà).(wa.ké)).ri | ‘he thought about it for a while’ |
| d. | na.wì.((sa.wè).(ta.ná)).ka | ‘I went in vain’ |
| e. | ((máa).(ki.ri)).ti | ‘type of bee’ |
| f. | ñàa.wyàa.((ta.wá).(ka.ri)).ri | ‘what he saw in a vision’ |
| g. | nò.syi.ya.pì.ca.tàN.((ta.ná).(ka.ri)).ri | ‘I escaped from him’ |
| h. | i.kàN.((ta.syi).(ta.rí)).ra | ‘he said it without thinking’ |

These facts strongly suggest that the following SON constraints are active in Asheninca:

42. Asheninca:

- a. minimal sonority threshold imposed by the prosodic word
SON- ω [–consonantal, –high]
- b. minimal sonority threshold imposed by the foot
SON- ϕ [–consonantal]
- c. minimal sonority threshold imposed by the syllable
SON- σ [–consonantal]

¹⁶ A mechanism is needed to ensure that no feet other than the final two are considered for primary stress assignment. The one proposed by Hayes 1995 is to add the level of the colon to the prosodic hierarchy and then to assign primary stress within the rightmost colon.

It is by virtue of the **SON- ω** constraint that Asheninca distinguishes between the segmental positions **s₂** and **s₆** in (38): the latter, but not the former may not be occupied by *i*, whose sonority is sufficient to meet constraint (42b) (and incidentally, also (42c)) but not (42a), which imposes a more restrictive sonority threshold on those feet that serve as heads of the prosodic word. Thus, Asheninca provides evidence that the prosodic word imposes its own sonority threshold, which further suggests that every constituent in the prosodic hierarchy in (1), and in (38), participates in a prominence structure governed by sonority.

Concluding remarks

I have proposed an account of light and heavy syllable nuclei without resorting to a hybrid weight hierarchy in which syllable weight would be computed on the basis of both mora count and the sonority of the nucleus. By positing the **SON** family of constraints I have in effect factored out subparts of what may appear to be a hybrid weight system. In the first three cases analyzed here, English, Mordwin, and OCS, the relevant segmental positions are **s₂** and **s₆** in (38). In these positions, English prohibits syllabic liquids and nasals, OCS induces jers lowering, and Mordwin allows high vowels only under duress. This is because segments **s₂** and **s₆** in (38) are under the jurisdiction of **SON- ϕ** , which overrides the effect of **SON- σ** and **SON- μ** . The **s₄** position is free for syllabic liquids and nasals in English or for jers in OCS, being under the jurisdiction of **SON- σ** (and **SON- μ**), but not **SON- ϕ** . In Asheninca, however, in which the

distinction between light and heavy syllable nuclei is relevant for determining the minimal sonority of syllables associated with primary stress, but not of those associated with secondary stress, the sonority constraint at work is **SON- ω** . This constraint crucially distinguishes between segments **s₂** and **s₆** in (38), imposing an additional sonority requirement on the latter but not on the former. This is because segment **s₆**, but not **s₂**, is under the jurisdiction of **SON- ω** , which singles out only those feet that act as heads of the prosodic word. Cases of light and heavy syllable nuclei are thus a direct result of sonority constraints imposed by the prosodic constituents that belong to the extrasyllabic portion of the prosodic hierarchy. This is due to the role of sonority in the overall prominence structure of the prosodic constituency, with constituents at each prosodic level governing the sonority of segments that occupy relevant prosodic positions.

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