Adjustable word edges and weight-sensitive stress

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1 Introduction

In standard Optimality Theoretic analyses of weight-sensitive stress, no consideration is given to the possibility that languages may reposition the edges of the prosodic word in order to avoid violations of constraints related to syllable weight. I propose here that this type of constraint interaction does occur.

Past work has noted that in some cases, the prosodic word seems to slightly misalign with the morphosyntactic word, due to phononological pressures.[1] If this is true, we might expect – given that word-level stress placement (among other phenomena involving the prosodic word) is often sensitive to syllable weight – that in some cases, prosodic word edges can shift in service of syllable-weight-related constraints. I propose that this underexplored prediction is borne out in Karuk (isolate, California) and Majhi Punjabi (Indo-Aryan). Previous accounts of the stress systems of these languages have resorted to novel footing mechanisms (Karuk: Sandy 2017; Majhi Punjabi: Dhillon 2010). With adjustable prosodic word edges, such special mechanisms can be avoided.

Section 2 analyzes the placement of stress on heavy-adjacent syllables in Karuk. I propose that the optimal prosodic word ends in a heavy syllable, and that the optimal position for stress is the penultimate syllable of the prosodic word. This leads to placement of stress on the syllable preceding the rightmost heavy syllable, as in (1). Section 3 analyzes a pattern of mixed stress attraction/repulsion by superheavy syllables in Majhi Punjabi. I propose that a constraint penalizes unstressed superheavy syllables within the prosodic word. Violations of this constraint are avoided either by placing stress on a superheavy syllable (stress attraction, (2a)) or by excluding a superheavy syllable from the prosodic word (stress repulsion, (2b)). Section 4 discusses some facts that suggest that prosodic constituents are created early, in the morphology-phonology interface module (following e.g. Lee and Selkirk 2022). Section 5 concludes.

(1)   [kun.pa.xee.ˈ**pa**.jaatʃ.]$_\omega$ha   'they won it from them'   (Karuk; Sandy 2017:102)

(2)   a.   [ʈəɽ.ˈ**buuʤ**]$_\omega$ 'watermelon'   (Majhi Punjabi; Dhillon 2010:22)

    b.   [ˈ**məŋ**.gəl.]$_\omega$vaaɽ   'Tuesday'   (Majhi Punjabi; Dhillon 2010:23)

2 Heavy-adjacent stress in Karuk

The prosody of Karuk, a polysynthetic isolate of northern California, is analyzed in detail in a dissertation by Sandy (2017). One of Sandy's major insights is that in derived words without input tone, stress placement follows a predictable pattern, shown in (3). (In this language, a syllable is classified as heavy if and only if it contains a long vowel.)

(3)   *In derived words, default stress placement is:*
    – on the syllable preceding the rightmost heavy syllable, as in (4a);
    – otherwise on an initial heavy syllable, as in (4b);
    – otherwise on the penultimate syllable, as in (4c);
    – otherwise on the only syllable.

[1] For instance, it has been proposed that in a number of languages, onsetless word-initial syllables are excluded from the prosodic word in certain contexts (e.g. Downing 1998, Akinbo 2019).

(4)   *A minimal illustration of (3) – see Sandy 2017 for more examples. Heavy syllables are <u>underlined</u>.*

    a.   kun.pa.<u>xee</u>.ˈ**pa**.jaatʃ.ha   'they won it from them'   (Sandy 2017:102)

         pa.ʔa.van.ˈ**sa**.<u>xii</u>.ti.tʃas   'the boys'   (Ararahih'urípih[2] JPH_KT-05)

         ip.ma.ˈ**hoon**.<u>koo</u>.na.ra   'he didn't feel'   (Sandy 2017:101)

    b.   ˈ<u>**neek**</u>.ʃu.pih   'he made me understand'   (Ararahih'urípih VS-10)

    c.   ax.ˈ**ra**.tip   'gooseberry bush'   (Sandy 2017:97)

This preference for stress on the syllable preceding the rightmost heavy syllable is unusual. In canonical weight-sensitive stress systems, stress is attracted to heavy syllables, not to heavy-adjacent syllables. To account for the pattern, Sandy proposes that Karuk has a preferred foot shape previously thought to be unattested: a trochee whose second syllable is heavy. (Subsequent work by Beguš and Jurgec (2021) has appealed to this foot shape to account for similar data in Žiri Slovenian.) The crosslinguistic absence of this foot shape preference was thought not to be an accidental gap, but a principled one: as Sandy notes, it violates Hayes's (1995) typology based on the Iambic/Trochaic Law.[3] Sandy's proposed footing also lacks independent language-internal motivation – the only evidence is data like (4a).

I present an alternative analysis which does not rely on this novel foot shape (or feet at all[4]). Instead, I assume that the phonological grammar is able to adjust the edges of the prosodic word. This assumption allows a straightforward account of the Karuk data. I implement adjustable word edges within a model that assumes prosodic word edges exist in the phonological underlying representation (following e.g. Lee and Selkirk 2022). This is not particularly crucial – standard alignment constraints which directly reference a morphosyntactic unit would also work.[5] But see section 4 for some evidence that prosodic word edges may be created early in the derivation.

I propose the constraint in (5), which favors faithful positioning of the right edge of the output prosodic word. This is a gradient constraint which penalizes each syllable of misalignment. (For Karuk, a both-edges formulation of the constraint would work just as well as this right-edge formulation – though only the right-edge version will work for the Majhi Punjabi data in section 3.)

(5)   INTEGRITYR$_\omega$: assign one violation for every syllable to the right of the prosodic word in the output which corresponds to prosodic-word-internal material in the input.

Since stress is penultimate in words which lack a heavy syllable (as in (4c)), I posit the constraint in (6), which favors stress on the penultimate syllable of the prosodic word. (The penultimate stress preference could of course be modeled as emerging from a combination of constraints instead – for instance a nonfinality constraint alongside a right-alignment constraint, as I will propose for Majhi Punjabi in section 3. I use one dedicated constraint here for simplicity's sake.)

(6)   STRESSPENULT$_\omega$: assign a violation if the penultimate syllable of the output prosodic word is unstressed.

Finally, I propose that the optimal prosodic word ends in a heavy syllable. Word-final phonetic lengthening is well-attested, and in some languages, this seems to have phonologized into a preference for word-final heavy syllables. For instance, to account for phonological vowel lengthening in Early Vedic word-final /CV/ syllables, Keydana (2018) proposes an OT constraint which disfavors final light syllables. I adopt a version of this constraint, presented in (7).

(7)   *σ_L]$_\omega$: assign a violation if the output prosodic word ends in a light syllable.

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[2] Online corpus, linguistics.berkeley.edu/~karuk

[3] The syllable which Sandy analyzes as stressed bears high tone, and the following heavy syllable bears low tone. Given that high tone and weight are both crosslinguistic correlates of stress, Sandy observes that it is not obvious which of the two syllables is actually stressed. Sandy ends up analyzing the syllable with high tone as stressed, and I follow this analysis here, but which syllable is actually stressed remains an open question. Golston and Paulsen (2022) argue that in Ancient Greek words which have high tone preceding a heavy syllable, it is actually the heavy syllable which is stressed. It may turn out that Karuk is similar – though this would not change the fact that the preferred sequence of high tone preceding a heavy syllable with low tone is unusual, and a foot of this shape violates the Iambic/Trochaic law.

[4] Relevantly, Karuk lacks secondary stress.

[5] I thank Sam Zukoff for helpful discussion of this.

The difference between Karuk and Early Vedic arises from different constraint rankings. In Early Vedic, the constraint DEP-μ which disfavors vowel lengthening is low-ranked, while INTEGRITYR$_\omega$ is high-ranked. Lengthening the vowel of a word-final light syllable ends up being the optimal way to avoid a *σ_L]$_\omega$ violation. Karuk's constraint ranking is different: INTEGRITYR$_\omega$ is low-ranked and DEP-μ is high-ranked. This yields a different repair strategy: instead of lengthening the vowel of an offending syllable, Karuk excludes the offending syllable from the prosodic word.

The constraint ranking DEP-μ >> *σ_L]$_\omega$ >> STRESSPENULT$_\omega$, INTEGRITYR$_\omega$ straightforwardly gets the right facts, as shown in (8). (Recall that syllables are heavy in this language if and only if they contain a long vowel.)

(8)

	DEP-μ	*σ_L]$_\omega$	STRESSPENULT$_\omega$	INTEGRITYR$_\omega$
/[kunpaxeepajaatʃha]$_\omega$/				
→ [kun.pa.xee.ˈ**pa**.jaatʃ.]$_\omega$ha				*
[kun.pa.xee.pa.ˈ**jaatʃ**.ha]$_\omega$		*!		
[kun.pa.xee.pa.ˈ**jaatʃ**.haa]$_\omega$	*!			
/[neekʃupih]$_\omega$/				
→ [ˈ**neek**.]$_\omega$ʃu.pih			*	**
[neek.ˈ**ʃu**.pih]$_\omega$		*!		
[neek.ˈ**ʃu**.piih]$_\omega$	*!			
/[axratip]$_\omega$/				
→ [ax.ˈ**ra**.tip]$_\omega$		*		
[ax.ˈ**ra**.tiip]$_\omega$	*!			

3   Mixed stress attraction/repulsion in Majhi Punjabi

This section analyzes the stress system of Majhi Punjabi (Indo-Aryan) as described by Dhillon (2010). In many languages, stress is attracted to heavy syllables. This is standardly assumed to result from the Weight-to-Stress Principle (WSP), a constraint which penalizes unstressed heavy syllables. If we assume WSP only applies to syllables within the prosodic word, we would predict that in some languages with weight-sensitive stress, the edge of the word should shift to exclude a heavy syllable in some contexts, in order to avoid violating WSP. This could yield mixed patterns where heavy syllables seem to repel stress in some contexts but attract stress in other contexts. I propose that this is borne out for superheavy syllables in Majhi Punjabi.

Majhi Punjabi has three tiers of syllable weight. Coda consonants are moraic. Monomoraic (= (C)V) syllables are **L**ight; bimoraic (= (C)VX) syllables are **H**eavy; and trimoraic (= (C)VXC) syllables are **S**uperheavy. Stress placement in disyllabic and trisyllabic stems is entirely predictable based on syllable weight. In disyllabic stems, stress is final if the second syllable is superheavy and the first syllable is not superheavy, as in (9a); otherwise stress is initial, as in (9b).

(9)   *Stress in disyllabic stems (Dhillon 2010:22). L = light, H = heavy, S = superheavy.*

    a.   nə.ˈ**ʃaan** (LS)   'a mark'
           ʈəɽ.ˈ**buuʤ** (HS)   'watermelon'
    b.   ˈ**pe**.laa (LH)   'before'
           ˈ**kan**.daa (HH)   'thorn'
           ˈ**dɔɔl**.naa (SH)   'to spill'
           ˈ**aaʤ**.kaal (SS)   'nowadays'

The list of disyllabic stem shapes in (9) is exhaustive. Stems cannot end in a light syllable. This restriction also applies to trisyllabic stems, alongside some other restrictions on stem shape. I am not aware of any work that attempts to explain these restrictions, and I will not do so here – though I will return to this issue in section 4.

It is easy to imagine an analysis of (9) without adjustable word edges. On the one hand, there is pressure for stress to be on the first syllable, formalized in (10). On the other hand, there is pressure for stress be on a superheavy syllable, formalized in (11). The latter pressure outranks the former, yielding (9a). There would seem to be nothing more to be said.

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(10)   NONFINALITY$_\omega$: assign a violation if the output prosodic word ends in a stressed syllable.

(11)   WSP$_\omega$-S : assign one violation for every unstressed superheavy syllable in the output prosodic word.

I assume, though, that the language actually has a low-ranked INTEGRITYR$_\omega$ constraint. This assumption complicates the analysis of disyllabic stems, but will prove useful for a unified analysis of disyllabic and trisyllabic stems. The definition of INTEGRITYR$_\omega$ is repeated in (12).

(12)   INTEGRITYR$_\omega$: assign one violation for every syllable to the right of the prosodic word in the output which corresponds to prosodic-word-internal material in the input.

The analysis is illustrated in (13). If the final syllable is not superheavy, as in 'pe.laa, initial stress is optimal since it violates no constraints. If the final syllable is superheavy and the initial syllable is not, as in ʈəɽ.'buuʤ, final stress is optimal since it satisfies WSP$_\omega$-S. The optimal candidate violates NONFINALITY$_\omega$, but this cannot be avoided without violating the higher-ranked constraint WSP$_\omega$-S. Excluding the final syllable from the prosodic word would not help: while this would avoid a WSP-S violation, it would yield a monosyllabic prosodic word, meaning NONFINALITY$_\omega$ would have to be violated anyway – so there would be no benefit to the INTEGRITYR$_\omega$ violation. Finally, if both syllables are superheavy, as in 'aaʤ.kaal, it is optimal to exclude the final syllable from the prosodic word to avoid a WSP-S violation, even though this leads to a NONFINALITY$_\omega$ violation. The fact that the second syllable is excluded instead of the first reflects a ranking of INTEGRITYL$_\omega$ (not shown) above INTEGRITYR$_\omega$.

(13)

	WSP$_\omega$-S	NONFINALITY$_\omega$	INTEGRITYR$_\omega$
/[pelaa]$_\omega$/ (LH)			
[pe.'**laa**]$_\omega$		*!	
→ ['**pe**.laa]$_\omega$			
/[ʈəɽbuuʤ]$_\omega$/ (HS)			
→ [ʈəɽ.'**buuʤ**]$_\omega$		*	
['**ʈəɽ**.buuʤ]$_\omega$	*!		
['**ʈəɽ**.]$_\omega$buuʤ		*	*!
/[aaʤkaal]$_\omega$/ (SS)			
[aaʤ.'**kaal**]$_\omega$	*!	*	
['**aaʤ**.kaal]$_\omega$	*!		
→ ['**aaʤ**.]$_\omega$kaal		*	*

In trisyllabic stems, the pattern is more complex. Stress preferentially appears on a nonfinal superheavy syllable, as in (14a). Otherwise, if the last two syllables are heavy, stress is penultimate, as in (14b). Otherwise stress is initial, as in (14c).[6]

(14)   *Stress in trisyllabic stems (Dhillon 2010:23). L = light, H = heavy, S = superheavy.*

      a.   səŋ.'**giit**.naa (HSH)   'to sing and dance'
            bɪ.'**ʧaaɽ**.naa (LSH)   'to think'
      b.   bɪ.'**ʃaa**.lɔɔ (LHH)   'you may lay something down'
            bəkʰ.'**suu**.wii (HHH)   'safety pin'
      c.   '**ʃɔ**.ʈi.aa (LLH)   'little ones'
            '**hɔɽ**.tə.ɽaa (HLH)   'odd'
            '**məŋ**.gəl.vaaɽ (HHS)   'Tuesday'

Dhillon (2010) accounts for this pattern using an intricate footing system that emerges from an elaborate constraint set. This footing lacks independent motivation (like Karuk, Majhi Punjabi lacks secondary stress) and relies on an ad hoc constraint, CONTOUR(H)(H): "leftmost footed heavy syllables are stressed in sequences of (H)(H)." I will present a much simpler account using adjustable word edges.

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[6] Like for the disyllabic stems, the list of trisyllabic stem shapes in (14) is exhaustive, and I will not attempt to explain why the other logical possibilities are ruled out. In earlier work, Dhillon (2007) also lists LHS as a possibility, but Dhillon (2010:23) later corrects this, saying that the apparent LHS words were actually mistranscribed HHS words.

One aspect of the Majhi Punjabi stress system that seems especially puzzling (or would seem puzzling, if I hadn't already foreshadowed my solution) is the behavior of stem-final superheavy syllables. In disyllabic stems, final superheavy syllables *attract* stress. For instance, HH stems have initial stress, but HS stems have final stress – i.e. taking a HH stem and swapping in a S as the final syllable has the effect of moving stress *toward* the S syllable. In trisyllabic stems, though, final superheavy syllables have the opposite effect: they *repel* stress. HHH stems have stress on the second syllable, but HHS stems have stress on the first syllable – i.e. taking a HHH stem and swapping in a S as the final syllable has the effect of moving stress *away* from the S syllable.

As it turns out, this puzzling-seeming behavior is very straightforwardly accounted for in a model with adjustable word edges. The mixed stress attraction/repulsion pattern is actually predicted by the constraint ranking in (13). And to extend the analysis to the entire stress system of the language, just one constraint needs to be added: a gradient right alignment constraint, defined in (15).

(15)   STRESSR$_\omega$: assign one violation for every mora to the right of the stressed syllable in the output prosodic word.

The tableau in (16) shows the crucial constraint interactions. In the HHS word, it is worthwhile to exclude the final syllable from the prosodic word because this saves a NONFINALITY$_\omega$ violation. This contrasts with the HS word, where excluding the final syllable is not worthwhile because it would not be able to save a NONFINALITY$_\omega$ violation.

The LLH word is included in the tableau to show the role of STRESSR$_\omega$. If the right edge's position were to stay faithful to the input, penultimate stress would violate STRESSR$_\omega$ twice, since the prosodic-word-final syllable would be bimoraic. Moving the right edge to exclude that syllable means that the output prosodic word ends in a monomoraic syllable. This allows stress to be nonfinal while only violating STRESSR$_\omega$ once.

		WSP$_\omega$-S	NONFIN$_\omega$	STRESSR$_\omega$	INTEGRITYR$_\omega$
/[pelaa]$_\omega$/	→ ['**pe**.laa]$_\omega$			**	
'before' (LH)	[pe.'**laa**]$_\omega$		*!		
/[ʈəɽbuuʤ]$_\omega$/	['**ʈəɽ**.buuʤ]$_\omega$	*!		***	
'watermelon' (HS)	→ [ʈəɽ.'**buuʤ**]$_\omega$		*		
	['**ʈəɽ**.]$_\omega$buuʤ		*		*!
/[ʃɔʈiaa]$_\omega$/	[ʃɔ.'**ʈi**.aa]$_\omega$			**!	
'little ones' (LLH)	→ ['**ʃɔ**.ʈi.]$_\omega$aa			*	*
/[bəkʰsuuwii]$_\omega$/	→ [bəkʰ.'**suu**.wii]$_\omega$			**	
'safety pin' (HHH)	['**bəkʰ**.suu.]$_\omega$wii			**	*!
/[məŋgəlvaaɽ]$_\omega$/	[məŋ.'**gəl**.vaaɽ]$_\omega$	*!		***	
'Tuesday' (HHS)	[məŋ.gəl.'**vaaɽ**]$_\omega$		*!		
	→ ['**məŋ**.gəl.]$_\omega$vaaɽ			**	*

(16)

4   Prosodic word wellformedness at mutliple levels of representation

In Majhi Punjabi, there are a number of restrictions on stem shape. One restiction that stands out in particular is the ban on stem-final light syllables. This is notable because I appealed to a constraint against prosodic-word-final light syllables in the analysis of Karuk in section 2. It would be natural to assume that this constraint is also responsible for the Majhi Punjabi restriction. But this runs into an opacity problem: while Karuk prosodic words are subject to the constraint in the *output*, in Majhi Punjabi the restriction is on stems in the *input*. The problem is illustrated in (17). (I have been writing underlying representations as unsyllabified until now, but there was no crucial reason for this. It may also be possible that the issues raised in this section can be reformulated without reference to syllables – I use syllables for convenience.)

(17)   a. *Karuk: word-final light syllables disfavored in the output, but not in the input.*
            /[kun.pa.xee.pa.jaatʃ.ha]$_\omega$/ → [kun.pa.xee.'**pa**.jaatʃ.]$_\omega$ha   (LLHLHL)
        b. *Majhi Punjabi: word-final light syllables disfavored in the input, but not in the output.*
            /[ʃɔ.ʈi.aa]$_\omega$/ → ['**ʃɔ**.ʈi.]$_\omega$aa   (LLH)

One possibility is that this analysis is incorrect – either there is something wrong with the prosodic word edge placement that I have proposed, or the apparent similar status of word-final light syllables in the two languages is actually not a uniform phenomenon. There is another possibility, though, that I would like to briefly explore. We could take (17) as evidence that prosodic word edges exist both in the phonological input and in the phonological output – as I have been assuming without justification in this paper, citing Lee and Selkirk 2022 – and that prosodic word wellformedness constraints are active at both levels. The asymmetry in (17) could emerge if Majhi Punjabi's morphosyntax-phonology interface component ranks the $*\sigma_L]_\omega$ constraint high, but its phonological component ranks it low; whereas Karuk does the opposite.

A possible piece of evidence that prosodic word wellformedness constraints apply in the input and output comes from the closely related Pama-Nyungan languages Arrernte and Alyawarr (which Downing (1998) refers to as Aranda and Alyawarra). Downing (1998) argues that onsetless word-initial syllables are excluded from the prosodic word in these languages. Both languages also show a disyllabic word minimality requirement. In Arrernte, this requirement is respected in the output: in disyllabic words which begin with an onsetless syllable, the initial syllable is not excluded from the prosodic word (i.e. it receives stress). The exclusion of onsetless word-initial syllables from the prosodic word only applies to words with three or more syllables in the input. In Alyawarr, though, this is not the case: onsetless word-initial syllables fail to receive stress even in disyllabic words, suggesting that prosodic word minimality is not respected in the output in this language. To account for this, Downing stipulates that in this case, the initial syllable is not actually excluded from the word, and a separate ad hoc mechanism prevents it from receiving stress. A simpler, unified analysis is possible if we assume the difference between Arrernte and Alyawarr is just that the former language enforces prosodic word minimality in the input and output, whereas the latter language only does so in the input.

Another example is the opaque interaction of word minimality and epenthesis in Kanien'kéha (Iroquoian; a.k.a. Mohawk) verbs. Words must be at least disyllabic. Underlyingly monosyllabic verb roots are augmented with an initial prefix to satisfy word minimality, but this prefix is inserted even when vowel epenthesis occurs to break up a bad consonant cluster, which would have fixed the word minimality problem on its own (Bonvillain 1973). An explanation for this opaque pattern suggests itself: the prefix (which only attaches to verbs, so it is not a purely phonological epenthetic element) is a verbalizer morph whose insertion or not has to be decided early in the derivation – allomorph selection occurs earlier than purely phonological epenthesis. The selection of the overt prefixal allomorph of the verbalizer occurs in the morphosyntax-phonology interface component in order to satisfy input prosodic word minimality.

5   Conclusion

In the Optimality Theoretic analyses of weight-senstive stress that I have come across, there seems to be an unspoken assumption that weight-related constraints cannot affect the size of the prosodic word – all the action must happen at the level of smaller prosodic units such as feet, syllables, and moras. This paper questions this assumption. I have presented a preliminary argument, based on two case studies, that by assuming weight-related constraints can influence the position of the prosodic word edges, we can account for non-canonical weight-sensitive stress systems which are otherwise challenging to explain. This suggests that it may be worthwhile to take the possibility of this type of constraint interaction seriously.

References

Akinbo, Samuel. 2019. Minimality and Onset Conditions Interact with Vowel Harmony in Fungwa. *Proceedings of the 2018 Annual Meeting on Phonology*, edited by Katherine Hout, Anna Mai, Adam McCollum, Sharon Rose, and Matt Zaslansky.

Ararahih'urípih: A Dictionary and Text Corpus of the Karuk Language. A collaboration between the Karuk Tribe and UC Berkeley. linguistics.berkeley.edu/~karuk.

Beguš, Gašper and Peter Jurgec. 2021. Tone, stress, quantity, and quality: prosodic patterns and tonal wug-tests in Žiri Slovenian. Manuscript, UC Berkeley and University of Toronto.

Bonvillain, Nancy. 1973. A Grammar of Akwesasne Mohawk. Ottawa: National Museum of Man.

Dhillon, Rajdip. 2007. Stress in Punjabi. *Proceedings of the Thirty-third Annual Meeting of the Berkeley Linguistics Society*, edited by Thera Crane, Oana David, Donna Fenton, Hannah J. Haynie, Shira Katseff, Russell Lee-Goldman, Ruth Rouvier, and Dominic Yu, 84-95.

Dhillon, Rajdip Kaur. 2010. Stress and Tone in Indo-Aryan Languages. Doctoral dissertation, Yale University.

Downing, Laura J. 1998. On the Prosodic Misalignment of Onsetless Syllables. *Natural Language & Linguistic Theory* 16:1-52.

Keydana, Götz. 2018. Word-final lengthening in Early Vedic. *Journal of South Asian Languages and Linguistics* 5.2:211-240.

Golston, Chris and Christian Paulsen. 2022. Ancient Greek Pitch Accent, Not Stress. *AMP 2022* poster.

Hayes, Bruce. 1995. Metrical stress theory: Principles and case studies. University of Chicago Press.

Lee, Seunghun J. and Elisabeth Selkirk. 2022. Xitsonga tone: The syntax-phonology interface. *Prosody and Prosodic Interfaces*, edited by Haruo Kubozono, Junko Ito, and Armin Mester, 337-373.

Sandy, Clare Scoville. 2017. Prosodic Prominence in Karuk. Doctoral dissertation, UC Berkeley.