

## **Metrically conditioned pitch accent in Uspanteko**

*Björn Köhnlein (The Ohio State University)*

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### *Abstract*

Uspanteko, a Mayan language spoken in Guatemala, shows a remarkably rich interaction between the location of stress, vowel quality, syllable weight, and pitch accent. Commonly, it is assumed that the language has privative lexical tone. Counter to previous analyses of the facts, this chapter proposes that both the tonal contrasts as well as other relevant interactions can be derived from an opposition between trochaic and iambic feet. No tonal information is stored in the lexicon. While improving the empirical coverage of previous analyses with lexical tone, the current analysis adds little additional machinery since the general distinction between trochees and iambs in Uspanteko has already been motivated on independent grounds. From a broader theoretical perspective, the chapter contributes to ongoing discussions on the phonological nature of tone accent systems, one of the key issues in debates on prosodic typology.

Keywords: contrastive metrical structure; foot structure; tone accent; lexical tone; vowel sonority; word stress

## Metrically conditioned pitch accent in Uspanteko

Björn Köhnlein (*The Ohio State University*)

### 1. Introduction

#### 1.1 Theoretical background: tonal accent and word-level prosodic structure

Recent years witness a reemergence of a debate on the phonological representation of tonal accent, which bears on fundamental questions concerning word-level prosodic structure.<sup>1</sup> In tone accent systems, syllables with word stress can be pronounced with two distinct pitch contours. Arguably, the most intensively studied tone accent systems can be found in North Germanic (Norwegian, Swedish, some Danish dialects). Other examples are, for instance, Franconian (West Germanic; spoken in parts of Belgium, Germany, and the Netherlands), Lithuanian, Scottish Gaelic, or Serbo-Croatian. A famous accent minimal pair from Swedish is the distinction between [¹andən] ‘the duck’ versus [²andən] ‘the spirit’. The two items are segmentally identical but can be distinguished on the basis of their pitch contour. For instance, in Stockholm Swedish, [¹andən] (superscript 1 = Accent 1) is pronounced with a rising-falling (LHL) contour in isolation; [²andən] (Accent 2) has an additional high pitch target at the beginning of the stressed syllable (HLHL), and the rise-fall part occurs later than in Accent 1.

In the theoretical literature, it is commonly assumed that tonal contrasts in tone accent systems derive from the presence of lexical tone. Under such an analysis, at least one of the accents is stored with tonal information in the lexicon. On the surface, these unpredictable lexical tones then combine with predictable intonational tones, yielding the tonal surface contrasts between the two accents. This type of analysis has been proposed repeatedly in the literature on Scandinavian (e.g. Bruce 1977; Riad 1996, 2013; Kristoffersen 2000, 2007; Lahiri et al. 2005, 2006; Wetterlin 2010), Franconian (e.g. Gussenhoven 2000, 2004; Peters 2006; Fournier 2008), Lithuanian (Blevins 1993), Serbo-Croatian (e.g. Zec 1999; Zec and Zsiga 2010), and Scottish-Gaelic (e.g. Ternes 2006); I shall refer to this type of analysis as the *tonal approach*. An important theoretical assumption underlying the tonal approach seems to be that metrically conditioned word-level prominence can only be distinctive at the level of the syllable but not at lower levels of the prosodic hierarchy (say, the level of the mora). The assumption itself is based on the often-cited observation that word-level prominence (or: word stress) seems to be a property of syllables. This ‘mainstream’ view and its implications for the analysis of accentual systems are discussed in detail in some recent overview articles by e.g. Hyman (2006, 2007, 2009) and Van der Hulst (2010, 2011, 2012).

Counter to the mainstream view, there is a growing body of literature suggesting that the tonal approach to such accentual phenomena may not necessarily be the only way to tackle the phenomenon. Instead, proponents of an alternative *metrical approach* argue that at least some tone accent oppositions might better be derived from metrical differences, rather than from lexical tone. The main assumption is that the two accents differ in their word-level metrical representations. One way to derive tonal contrasts from metrical structure is to specify word prominence directly on moras with diacritic accent marks, as recently advertised in work by Van der Hulst (2010, 2011, 2012). Another possibility is to assume that the accentual differences can be surface correlates of diverse metrical constituents, such as two types of feet (for instance monosyllabic versus disyllabic feet). Under this view, the tonal surface differences derive from the association of the same set of predictable intonational tones to these diverse metrical structures. Metrical approaches to tone accent oppositions have been proposed in, e.g., Hermans (2009, 2012), Kehrein (in press), Köhnlein (2011, 2016, in press), Van Oostendorp (in press) for Franconian, Morén (2005) and Morén-Duolljá (2013) for Scandinavian, Iosad (2015) for Scottish-Gaelic, or Kager and Martínez-Paricio (2014) for Ancient Greek.

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<sup>1</sup> For helpful comments and discussion, I would like to thank the editors, two anonymous reviewers and Pavel Iosad. Helpful suggestions also came from participants at the 23<sup>rd</sup> Manchester Phonology Meeting.

Proponents of the metrical approach to accentual patterns commonly share the view that this type of analysis can result in a more elegant analysis of the overall system than can be achieved with a tonal approach. Depending on the language, independent evidence in favor of a metrical analysis has been claimed to exist in, for instance, interactions between tonal accent and segmental properties (e.g. vowel quality / duration, obstruent voicing), certain restrictions on the distribution of tone, or morphological alternations.

If the metrical approach to tonal accent is on the right track for at least some accentual systems, this would imply that word-level metrical structure can be contrastive *below* the level of the syllable, counter to common assumptions that have been held for the past decades. Consequently, the debate around the representation of accentual phenomena touches on some of the most fundamental issues in phonology.

### *1.2 Why Uspanteko is relevant for the debate*

Uspanteko is a Mayan language spoken in Guatemala. It is commonly regarded as having privative lexical tone – some words have tone while others don't. This tone, which is realized as high pitch followed by a pitch fall, occurs only in stressed syllables. Stressed syllables without tone have level pitch throughout (possibly slightly higher than surrounding syllables) and lack a pitch fall. For descriptive purposes, I will refer to syllables with 'tone', i.e., with distinctive high pitch and a subsequent pitch fall, as syllables carrying a *pitch accent*. Syllables that have level pitch and lack a pitch fall will be referred to as syllables lacking a pitch accent.

A very good, concise description of the patterns can be found in Bennett and Henderson (2013; *henceforth* B&H), who also provide a detailed analysis of the facts based on the assumption that the language has lexical tone. Next to data from their own fieldwork, B&H also consult descriptions from Grimes (1971), Campbell (1977), and most and foremost a detailed Uspanteko grammar by Can Pixabaj (2006).

Departing from what has been assumed in previous literature, I will argue that pitch accent in Uspanteko does not derive from the presence of lexical tone but can be attributed to differences between two types of feet, trochees vs. iambs. This foot-based proposal is not entirely novel. In fact, it draws on insights developed in B&H, who convincingly argue that Uspanteko has both iambic and trochaic feet. However, the authors derive the presence of pitch accent from a mix of lexically specified and predictable tone assignment. I hope to show that postulating lexical tone is superfluous as its distribution is largely derivable from metrical constituency, for which we have independent evidence. In other words, Uspanteko has a prosodic system in which the occurrence of pitch contrasts is merely one of various phonological phenomena that make reference to the foot as a metrical constituent.

With its remarkably rich interaction between word stress, lexically distinctive pitch contours, syllable weight, and vowel sonority, the language features a variety of elements that play an important role in the typology of prosodic systems. Furthermore, the privativity of the pitch accent contrast and the close connection of pitch accent and word stress establish a typological link to tone accent systems, where similar distributional restrictions apply. This makes Uspanteko an ideal test case for studies on the nature of word-level prominence.

Due to space restrictions, I mainly focus on the discussion of monomorphemic words (bare roots). In line with B&H, I will sometimes refer to roots with the term 'prosodic word'. In their paper, B&H demonstrate that affixation (prefixes, suffixes) can affect word-level metrical structure, as well as the distribution of pitch accent. Very roughly, this is somewhat comparable to the influence of different types of affixes on stress assignment and phonotactics in Germanic languages (such as stress-neutral, stress-shifting, and stress-attracting suffixation). In general, I do not think that the patterns in morphological complex words challenge the foot-based analysis proposed in this chapter, as is briefly discussed in section 5.2. A more detailed treatment of the matter, however, must be left to future work.

The chapter is organized as follows. Section 2 introduces the basic facts. In section 3, I provide a metrical analysis of the patterns. Section 4 discusses some crucial aspects of the tonal analysis in B&H, arguing that the tonal approach to the facts is conceptually problematic and less elegant than the metrical alternative. Section 5 briefly addresses two additional aspects of Uspanteko phonology: the representational status of glottal stops, as well as accentuation in morphologically complex words. Section 6 concludes the chapter.

## **2. The basic facts: stress, pitch accent, and vowel quality in monomorphemic words**

In Uspanteko, word stress, pitch accent, syllable weight, and vowel sonority interact in intriguing, often complex ways. The basic generalizations for monomorphemic words are summarized in Table 1. If present, pitch accent is marked with an acute accent; stress is indicated by underlining; dots indicate syllable boundaries. The first column from the left states the number of the respective generalization (GEN I-X). Column two states the generalization. The third column whether the generalization in question is phonologically predictable or unpredictable. The fourth column illustrates the general pattern, while accompanying examples are provided in the rightmost column. The data in Table 1 are taken from B&H and translated from Mayan orthography into a phonemic IPA transcription. All generalizations are discussed in detail in B&H, possibly with the exception of GEN IX. B&H only mention it in fn. 30 of their paper, but an inspection of Can Pixabaj (2006) confirms that the generalization seems to be robust; the grammar provides various relevant forms, and I have not found a counterexample.

As established by B&H, two types of syllables count as heavy: syllables with a long vowel (VV), and syllables with a short vowel followed by a glottal stop and another consonant (V?C; the representational status of the glottal stop will be further discussed in section 5.1). Following B&H, I regard such syllables as bimoraic, as opposed to monomoraic, light syllables. While most generalizations in Table 1 seem relatively straightforward in themselves, GEN VI and GEN VII may require some further explanation: as GEN VI states, pitch accent is restricted to the penultimate *vocalic* mora of the word. This not only excludes pitch accent on light final stressed syllables and the second mora of heavy final syllables (GEN VI), but also in words with a moraic glottal stop (GEN VII). In such cases, the penultimate vocalic mora would be the antepenultimate mora in total, since the moraic glottal stop is not a *vocalic* mora. Since word-final heavy syllables must be stressed, and since pitch accent is restricted to stressed syllables, words with a moraic glottal stop, which are always stressed according to GEN II, cannot have a pitch accent.

As the patterns in Table 1 indicate, the functional load of pitch accent is low: it is contrastive *only* in monosyllabic words with long vowels (GEN X) but otherwise predictable on the basis of the location of the stressed syllable. The position of stress, in turn, is usually determined by an interplay of syllable weight, word length, and vowel sonority – with the exception of disyllabic words with two light syllables and vowels of equal sonority (GEN IV), where the position of stress is not predictable (the occurrence of pitch accent, however, *is* predictable in this context along the lines of GEN VI and GEN VIII).

Table 1. Ten basic generalizations (GEN I-X) on the placement of stress and pitch accent in Uspanteko monomorphemic words.

Nr.	Generalization	Predictability	General pattern	Examples
<b>Stress and syllable structure (pitch accent ignored)</b>				
I	Stress falls on one of the last two syllables	Predictable	$\sigma.\underline{\sigma}$ $\underline{\sigma}.\sigma$ $\sigma.\sigma.\underline{\sigma}$ $*\underline{\sigma}.\sigma.\sigma$	[tʃu.k <u>ex</u> ] ‘cramp’ [á.nim] ‘woman’ [lə.xo.ri] ‘today’ *[lə.xo.ri]
II	Heavy syllables – VV(C), V?C – are restricted to the final syllable and always receive stress	Predictable	$\sigma.\sigma.\underline{\mu\mu}$ $*\sigma.\underline{\sigma}.\mu\mu$ $*\sigma.\mu\mu.\sigma$	[alk. <u>waal</u> ] ‘son’, [ku.wa?j] ‘horse’ *[álk <sup>?</sup> waal], *[kú.wa?j] *[aalk <sup>?</sup> waal], *[kuu.wa?j]
III	In disyllabic words with two light syllables, the vowel with the higher sonority ( $\sigma+$ ) receives stress	Predictable	$\underline{\sigma+}.\sigma-$ $\sigma-.\underline{\sigma+}$ $*\sigma+.\underline{\sigma-}$ $*\underline{\sigma-}.\sigma+$	[á.nim] ‘woman’ [tʃu.k <u>ex</u> ] ‘cramp’ *[a.nim] *[tʃú.kex]
IV	If vowels in disyllabic words with light syllables have equal sonority ( $\sigma=$ ), either syllable can be stressed	Unpredictable	$\underline{\sigma=}.\sigma=$ $\sigma=.\underline{\sigma=}$	[í.wir] ‘yesterday’ [o.kof] ‘mushroom’
V	In words with more than two syllables, stress is always final	Predictable	$\sigma.\sigma.\underline{\sigma}$ $*\sigma.\underline{\sigma}.\sigma$	[lə.fo.ri] ‘today’ *[lə.fo.ri]
<b>Pitch accent (stress patterns always included)</b>				
VI	The occurrence of pitch accent is restricted to the penultimate vocalic mora of a word in a stressed syllable	Predictable	$\underline{\mu\mu}$ $\underline{\mu}.\underline{\mu}$ $\mu.\underline{\mu}$ $*\underline{\mu\mu}$ $*\mu.\underline{\mu}$ $*\underline{\mu}.\underline{\mu}$	[kúuk <sup>?</sup> ] ‘squirrel’ [í.wir] ‘yesterday’ [o.kof] ‘mushroom’ *[kuúk <sup>?</sup> ] *[i.wír] *[í.wir]
VII	Words with a moraic glottal stop never have a pitch accent	Predictable	$\underline{\mu\mu}^?C$ $*\underline{\mu\mu}^?C$	[kaʔn] ‘animal’ *[káʔn]
VIII	If stress is on the penultimate syllable, the stressed syllable always has a pitch accent	Predictable	$\underline{\sigma}.\sigma$ $*\underline{\sigma}.\sigma$	[í.wir] *[í.wir]
IX	Long vowels in polysyllabic words do not have a pitch accent	Predictable	$\sigma.\underline{\mu\mu}$ $*\sigma.\underline{\mu\mu}$	[tu.kuur] ‘owl’ *[tu.kúur]
X	Long vowels in monosyllabic words sometimes have a pitch accent	Unpredictable	$\underline{\mu\mu}$ $\underline{\mu\mu}$	[kúuk <sup>?</sup> ] ‘squirrel’ [tʃuun] ‘lime (mineral)’

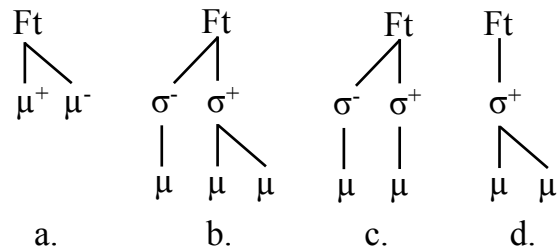
### 3. A metrical analysis of the facts

In this section, I provide a metrical analysis of the patterns. As we shall see, my metrical approach makes it possible to account for the interaction of stress, syllable weight, vowel sonority, and pitch accent in a unified way. I first discuss my metrical representations in 3.1. In 3.2, I present an optimality-theoretic analysis of the facts. In 3.3, I discuss the pitch accent contrast between the two types of feet in more detail. In 3.4, I provide a Hasse diagram of the established constraint rankings and summarize the main insights of my analysis.

#### 3.1 Metrical representations: two types of feet

In line with B&H, I propose that Uspanteko has iambic and trochaic feet. I further assume that (at least trochaic) feet can be built on moras or syllables, following Kager (1993). To be more concrete, I claim that Uspanteko contrasts moraic trochees and syllabic iambs, which are commonly considered to be the prototypical quantity-sensitive feet (Hayes 1995). Consider the corresponding representations in (1); foot heads are indicated with superscript pluses, foot dependents with superscript minuses. First of all, note that the moraic trochee in (1a) does not display syllable structure, which is not meant to imply that trochaic words lack syllables; it merely indicates that trochaic feet are built directly on moras. The foot structure of moraic items will thus be identical for monosyllabic bimoraic feet (two moras in one syllable) and for disyllabic bimoraic feet (one mora each in two syllables). The precise shape of syllabic iambs depends on the structure of the word: (1b) shows a disyllabic iamb with a bimoraic final syllable; (1c) displays a disyllabic iamb with a monomoraic final syllable; lastly, (1d) shows a monosyllabic iamb.

(1) Moraic trochee (a) and syllabic iamb (b, c, d) in Uspanteko



Since the position of stress and the occurrence of pitch accent are largely predictable from the context (e.g. number of syllables, vowel sonority), it is not easy to decide which of the two feet is the marked or the unmarked one, respectively. In what follows, I shall assume that iambs are the unmarked foot type (following B&H), but the patterns could also be expressed by assuming unmarked trochees. What concerns the distribution of pitch accent, I will stipulate, for now, that pitch accent is a property of trochaic feet only, but does not occur in iambic feet. I will discuss the issue in more detail in 3.3. For the time being, we can think of it as a high-ranked constraint requiring trochaic heads to carry a pitch accent:

(2) TR=PA: A Trochaic foot head has a pitch accent (to be further discussed in 3.3)

It should be noted that at least some of the patterns could in principle be captured by assuming moraic iambs – i.e., iambs built on moras – instead of syllabic iambs. While moraic iambs are typologically rare anyway, the choice for syllabic iambs can also be motivated on the basis of evidence from (optional) vowel reduction / syncope. As discussed in B&H (2013:625-628), these processes affect the weak branch of the foot in Uspanteko. I will give a few syncope examples: according to B&H, a trochaic item like [wálib] ‘my sister-in-law’ can optionally be produced as [wálb], while iambic items with final stress can show pretonic reduction, as in [simiin] ~ [smiin]

‘ginger’, or [rəqan] ~ [rqan] ‘his leg’. Crucially, these examples show that iambic syncope occurs in syllables preceding a long vowel as well as in syllables preceding a short vowel. If Uspanteko iambs are indeed syllabic, this can be explained straightforwardly, as the pre-tonic syllable is the weak syllable of the foot. If Uspanteko iambs were moraic, then the first [i] in [simi:in] would be located outside of the foot, and it would be more difficult to express the generalization. Furthermore, in longer items with final stress, such as [inətʃəpeʔ] ‘Grab me!’, syncope optionally deletes the pre-final vowel in the weak syllable of the iambic foot, [inətʃpeʔ], but never the first or the second vowel, (\*[nətʃəpeʔ], \*[intʃəpeʔ]). This pattern confirms that syncope does not affect just any unstressed vowel but only the vowel in the pre-tonic syllable, which can most easily be expressed as the weak branch of a syllabic iamb.

### 3.2 Grammar I: The interaction of foot structure, syllable weight, and vowel quality

I will address each of the generalizations provided in Table 1. I begin with GEN I, the two-syllable window at the right edge of the prosodic word. I derive the window in the same way as B&H (2013:610). They argue that Uspanteko has one foot per word that has to be aligned with the right edge of the prosodic word. This can be formalized with an undominated constraint ALL-FT-R:

- (3) ALL-FT-R: A foot is aligned with the right edge of a prosodic word

ALL-FT-R must outrank PARSE-σ, which requires all syllables to be parsed in a foot (4). The ranking ensures that there is maximally one foot per prosodic word, located at the right edge.

- (4) PARSE-σ: A syllable is parsed in a foot

In my approach, weight sensitivity and the non-occurrence of non-final bimoraic syllables (GEN II) can be accounted for by a) prohibiting uneven iambs of the type  $*(\mu^-\mu^-\underline{\mu}^+)$ , which I take to be a universally dispreferred iambic foot, and b) prohibiting trochaic feet of the shape  $*\mu(\underline{\mu}^+\mu^-)$ , i.e., feet whose head is the second mora of a pre-final heavy syllable, to the exclusion of the first mora in that same syllable. The foot structure  $*(\underline{\mu}^+\mu^-).\mu$ , with a bimoraic foot followed by an unfooted final mora, is ruled out by high-ranked ALL-FT-RT. In terms of OT, a general way to prohibit  $*\mu(\underline{\mu}^+\mu^-)$  would be a constraint enforcing syllable integrity (Rice 1988, Kager 1993). For reasons of economy, however, I will employ a constraint that requires foot heads to coincide with an edge of the prosodic word. As we shall see, this regularity accounts for GEN V and GEN IX in the same general way. I formalize this as EDGEMOST (5), a classic OT constraint adopted from Prince and Smolensky (1993). In Uspanteko, EDGEMOST has the effect that in moraic trochees, the head *mora* must be located at a word edge. In words with syllabic iambs, on the other hand, the head *syllable* must coincide with a word edge. Similar to ALL-FT-RT, EDGEMOST is undominated.

- (5) EDGEMOST (FT-HD; PW): A foot head is located at an edge of the prosodic word

Before we can evaluate the crucial role of EDGEMOST in the Uspanteko system in detail, it is important to first discuss sonority effects in disyllabic words with two light syllables. Recall that in these contexts, the vowel with the higher sonority receives word stress (GEN III). This regularity can be attributed to general principles in the interaction of stress and sonority – the higher the sonority of a vowel, the more likely it will receive stress (e.g. Kenstowicz 1997; de Lacy 2002b). For the purposes at hand, I refer to the relevant OT constraint as SONORITY (for more sophisticated OT implementations consider the referenced works by Kenstowicz / de Lacy):

- (6) SONORITY: Stress the vowel with the highest sonority

In words like [á.nim], high-ranked SONORITY favors the first vowel, since [a] has higher sonority than [i]; this results in pre-final stress and a trochaic foot, as shown in the OT tableau in (7). Since we have established iambs as the unmarked foot type, this also implies that a constraint enforcing iambs (IAMB) must be lower-ranked than SONORITY. To capture the relative markedness of trochees, IAMB itself must outrank TROCHEE, which prefers feet to be trochaic (although, admittedly, the ranking argument cannot be derived from the tableau itself).

- (7) Penultimate stress (trochaic footing) enforced by vowel sonority: SONORITY >> IAMB >> TROCHEE

	anim	SONORITY	IAMB	TROCHEE
a.	→ (á̇.ni̇m)		*	
b.	(ȧ.ni̇m)	*!		*

In a word like [tʃu.kex] the second vowel receives stress ([e] has higher sonority than [u]), which leads to an iambic foot. This is shown in (8):

- (8) Final stress (iambic footing) enforced by vowel sonority: SONORITY >> IAMB >> TROCHEE

	tʃukex	SONORITY	IAMB	TROCHEE
a.	→ (tʃu̇.kėx)			*
b.	(tʃú̇.kėx)	*!	*	

As stated in GEN IV, both final and penultimate stress are possible in disyllabic words with two light syllables iff the vowels have equal sonority. Since this is one of the few instances where word stress is not predictable, one of the patterns has to be marked in the lexicon. Given that iambs have been regarded as unmarked, I assume that unpredictable trochaic feet are stored as bimoraic foot templates, which results in trochaic lexical stress.<sup>2</sup> In order to surface despite the ranking IAMB >> TROCHEE, the trochaic template must be protected by faithfulness. To capture this, I assume that a constraint HEAD-MATCH (FT) (e.g. McCarthy 1995, 2000; Köhnlén 2011, 2016, in press), as defined in (9), outranks IAMB. (10) shows how this ranking leads to penultimate stress on relevant items with an underlying trochaic template.<sup>3</sup> Note that HEAD-MATCH (FT) must be lower-ranked than SONORITY, since we would otherwise wrongly predict penultimate stress on forms with rising sonority and a trochaic template.

- (9) HEAD-MATCH (FT): An underlying foot head has to be preserved on the surface.

<sup>2</sup> Alternatively, one might also assume that a mora is marked with a diacritic accent / stress marker, which would have to be translated into a foot head in the surface form. Since I generally try to avoid diacritics, I opt for the templatic approach.

<sup>3</sup> For this analysis, I thus assume that penultimate stress / pitch accent in disyllabic words with short vowels of equal sonority is exceptional. With regard to this issue, B&H (2013:617) state that “tone [= penultimate stress; BK] also appears if both syllable nuclei in a bisyllabic word are of equal sonority”; that is, they regard final stress as exceptional in such items. To motivate their claim, B&H quote a list of words from Can Pixabaj (2006:59), viz. [é.tse] ‘evil’, [ó.xor] ‘a long time ago’, [tú.kun] ‘blackberry’, [lé.kex] ‘up’, and [ts̄ú.nun] ‘hummingbird’. Note, however, that Can Pixabaj (2006:59) lists these items with penultimate stress as “excepciones” ‘exceptions’. Indeed, there certainly are various relevant items with final stress: in B&H’s paper, we find e.g. [te.le] ‘shoulder’ (p. 602), [o.ke] ‘entry’ (p. 610), [o.ko] ‘mushroom’ (p. 611), or [ju.fun] ‘some’ (p. 626). Furthermore, Can Pixabaj’s (2006) chapter on phonology (pp. 9-72) contains items such as [e.kem] ‘down’ (p. 25), [k<sup>o</sup>.xo] ‘achiote’ (p. 33), [mi.q̄in] ‘hot’ (p. 44), [xo.no] ‘someone’ (p. 54), [i.kim] ‘down’ (p. 61), or [ku.ku] ‘clay pot’ (p. 61). Independent of how this specific issue should be treated, recall that my ‘decision’ to regard iambs as unmarked throughout the system is not crucial for the analysis – the truly important insights about Uspanteko grammar are to be found elsewhere.



An OT tableau for [i.wir] ‘yesterday’, which is stored with a trochaic foot, is provided in (10):

- (10) Marked trochaic footing in light disyllables with short vowels of equal sonority:  
 SONORITY >> HEAD-MATCH (FT) >> IAMB >> TROCHEE

	iwir + ( $\mu^+ \mu^-$ )	SONORITY	HEAD-MATCH (FT)	IAMB	TROCHEE
a.	→ ( <u>i</u> <sup>+</sup> .wi <sup>-</sup> r)			*	
b.	(i.wi <sup>+</sup> <u>r</u> )		*!		*

In disyllabic equal-sonority items without a trochaic template, such as [o.ko] ‘mushroom’, the output has default final stress due to the ranking IAMB >> TROCHEE, as shown in (11):

- (11) Unmarked iambic footing in light disyllables with short vowels of equal sonority:  
 SONORITY >> HEAD-MATCH (FT) >> IAMB >> TROCHEE

	okoʃ	SONORITY	HEAD-MATCH (FT)	IAMB	TROCHEE
a.	( <u>o</u> <sup>+</sup> .ko <sup>-</sup> ʃ)			*!	
b.	→ (o <sup>-</sup> . <u>ko</u> <sup>+</sup> ʃ)				*

Notably, the analysis works in the exact same way for monosyllabic items with pitch accent contrasts, such as [kúuk<sup>2</sup>] ‘squirrel’ vs. [tuun] ‘lime (mineral)’. [kúuk<sup>2</sup>] is stored with a trochaic template and is computed in the same way as [i.wir] in (10); [tuun] corresponds to [o.ko] in (11). This accounts for Gen X, the unpredictable placement of pitch accent in monosyllabic words with long vowels.

Let us now move on to GEN V, the last generalization that is mainly about stress placement (all other generalizations crucially involve reference to pitch accent): roots that are longer than two syllables always receive final stress, independent of vowel sonority. Consider, for instance, trisyllabic [lə.fo.ri], where stress is on final [i] instead of penultimate [o], in violation of SONORITY. Such patterns illuminate the crucial role of EDGEMOST in the Uspanteko system (similar to GEN IX, which will be discussed below): since EDGEMOST requires that a foot head be located at an edge of a prosodic word, stress on the second syllable in words like [lə.fo.ri] would be irregular: the foot head would be located in word-*medial* position (\*[lə.fo.ri]). This implies that edge alignment in Uspanteko overrides sonority restrictions, thus EDGEMOST must outrank SONORITY.

The interaction is implemented into OT in (12): candidate b, the ‘sonority candidate’, is out since the word-medial moraic foot head would violate high-ranked EDGEMOST. Candidate c with antepenultimate stress satisfies EDGEMOST but still loses because it violates ALL-FT-R (and SONORITY – the foot is not aligned with the right edge of the word. Lastly, candidate d with full parsing (two feet) loses since it also violates ALL-FT-RT. Generally speaking, the interplay of ALL-FT-RT and EDGEMOST ensures that stress in monomorphemic words longer than two syllables is always final, even if this leads to violations of SONORITY.

- (12) No word-medial foot heads in words with more than two syllables:  
ALL-FT-R, EDGEMOST >> PARSE- $\sigma$ , SONORITY

	ləʃori	ALL-FT-R	EDGEMOST	PARSE- $\sigma$	SONORITY
a.	→ lə(ʃọ <sup>-</sup> .ri <sup>+</sup> )			*	*
b.	lə(ʃó <sup>+</sup> .ri <sup>-</sup> )		*!	*	
c.	(lə <sup>+</sup> .ʃọ <sup>-</sup> ).ri	*!		*	*
d.	(lə)(ʃọ <sup>-</sup> .ri <sup>+</sup> )	*!			

Let us now look at GEN IX, which prohibits pitch accent on final long vowels in polysyllabic words. Interestingly, the constraint interaction established so far makes it possible to capture GEN IX in the same way as GEN II (no non-final long vowels) and, crucially, GEN V (final stress in words longer than two syllables). If we follow the assumption that pitch accent is a property of trochaic feet only (to be discussed in more detail in 3.3), GEN IX can be attributed to a combined effect of ALL-FT-R and EDGEMOST.

Take trimoraic roots as an example: it does not matter whether a root divides three moras across three syllables ( $\mu.\mu.\mu$ ), as in [lə.ʃọ.ri], or across two syllables ( $\mu.\mu\mu$ ), as in [i.maam]. In both cases, the word-medial mora cannot be a foot head because this would violate EDGEMOST. Since ALL-FT-RT rules out foot heads on the word-initial, antepenultimate mora, only a word-final foot head, i.e., the second syllable in a right-aligned iambic foot, can satisfy EDGEMOST and ALL-FT-RT at the same time. An OT tableau for the form [i.maam] is provided in (13).

- (13) No word-medial foot heads in words with more than two moras: ALL-FT-R,  
EDGEMOST >> PARSE- $\sigma$ , SONORITY

	i.maam	ALL-FT-R	EDGEMOST	PARSE- $\sigma$	SONORITY
a.	→ (ị <sup>-</sup> .má <sup>+</sup> .a <sup>+</sup> m)				
b.	i.(má <sup>+</sup> .a <sup>-</sup> m)		*!		
c.	(i <sup>+</sup> .ma <sup>-</sup> )am	*!			*

As we have seen, the interplay of EDGEMOST and ALL-FT-R accounts for several generalizations in Uspanteko that are, in fact, one larger generalization about the location of foot heads. This is summarized schematically in Table 2 (the table also includes GEN II, but the arguably more important parallel is between GEN V and GEN IX). This novel generalization about Uspanteko makes it possible to unite various facts that were previously treated as independent phenomena. Crucially, however, this new generalization only emerges if we recognize the importance of contrastive foot structure, and particularly the role of moraic vs. syllabic foot heads for the distribution of word stress and pitch accent in Uspanteko.

Table 2. Combined effects of high-ranked EDGEMOST and ALL-FT-R in Uspanteko

Generalization	Example	EDGEMOST	ALL-FT-R
GEN II	[á.nim] ( $\mu^+.\mu^-$ )	*[aa.nim] * $\mu(\mu^+.\mu^-)$	*[aa.nim] * $(\mu^+.\mu^-).\mu$
GEN V	[lə.ʃọ.ri] $\mu.(\mu^+.\mu^-)$	*[lə.ʃó.ri] * $\mu.(\mu^+.\mu^-)$	*[lə.ʃọ.ri] * $(\mu^+.\mu^-).\mu$
GEN IX	[i.maam] ( $\mu^+.\mu^+.\mu^+$ )	*[i.máam] * $\mu.(\mu^+.\mu^+)$	*[i.maam] * $(\mu^+.\mu^+).\mu$

### 3.3 Grammar II: The interaction of foot structure and pitch accent

In 3.1, I have stated that pitch accent is a property of trochaic feet but not of iambic feet. While the general phonological patterns of accentuation are, by now, well described, detailed phonetic data are still relatively scarce (as pointed out in B&H). Consequently, it is not possible to fully assess the phonetic properties of the system, which means that in principle, different analytical approaches to the detailed analysis of pitch accent may be conceivable. Subsequently, I will discuss two general ways to account for the interaction of foot structure and pitch accent in a formal way, a ‘maximal’ approach in 3.3.1 (where I shall assume that the tonal differences derive from a diverse mapping of two phonological tones), and an alternative ‘minimal’ approach in 3.3.2 (where the differences are attributed to the phonetic implementation of foot structure). A choice between different options will become easier once more extensive phonetic research on Uspanteko has been conducted.

#### 3.3.1 A ‘maximal’ approach

Under a maximal approach, the observed pitch differences can for instance be attributed to the interplay of two postlexical phonological tones, a high prominence tone (H) and a low (boundary) tone (L) that marks the right edge of the prosodic word. Note that the occurrence of the tones themselves is entirely predictable, comparable to what we find in so-called ‘intonational languages’ like English. In other words, the tones are postlexical; yet they map onto the two foot types in distinct ways, which creates the tonal contrasts. In line with B&H, I regard the vocalic mora as the TBU in Uspanteko. Pitch accent (high pitch followed by a pitch fall) in trochaic feet vs. neutral / slightly raised level pitch in iambs can be accounted for by making reference to two proposals in the literature. First of all, I assume that tonal prominence can interact with metrical structure, as argued in, e.g., de Lacy (2002a). De Lacy shows that high tones and metrically strong positions (such as foot heads) tend to attract each other across languages, as do low tones and metrically weak positions (such as non-foot heads). Of relevance here will be a constraint that bans low tones from foot heads, \*FT-HD-L (de Lacy 2002a):

(14) \*FT-HD-L: Do not associate a low tone with a mora in the domain of a foot head

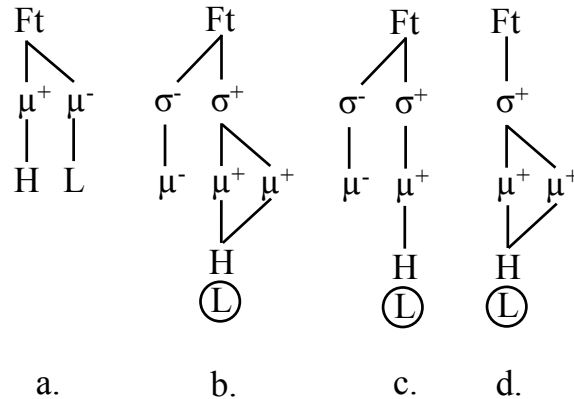
Note that the constraint definition in (14) contains the notion ‘domain of a foot head’, which is adopted from work by Köhnlein (2011, 2016, in press). This notion captures the assumption that foot heads create *head domains* (or, if you wish, *licensing domains*): the domain of a foot head contains a metrical head (e.g. the head syllable of a syllabic foot, or the head mora of a moraic foot) as well as metrical structure that it dominates, such as the mora(s) dominated by the head of a syllabic foot. With regard to Uspanteko, this has the following consequences, as depicted in (15). In a moraic trochee (15a), the first mora is the foot head (strong), and the second mora is the foot dependent (weak). No other mechanisms are at work. In syllabic iambs with a monomoraic stressed syllable (15c), the foot head is the right syllable. The only mora in the head syllable is metrically strong as well, since it is dominated by the foot head. In other words, it receives its metrical strength from the mother node, the syllabic foot head. To indicate metrical strength at the mora level, I extend the use of superscript pluses to moras dominated by a syllabic foot head in iambs. (These superscripts are purely notational devices; all relations between different nodes follow from the structure of the metrical tree.)

The principle works in similar ways for syllabic iambs with a bimoraic head syllable (15b, d). The two moras in the stressed syllables are licensed by the foot head, the syllable node, and therefore strong. Crucially, the differences in headedness between syllabic iambs and moraic trochees lead to a structural ambiguity between bimoraic stressed syllables in syllabic iambs (two strong moras, (15b, d)) and moraic trochees (one strong and one weak mora; (15a)).

With this difference in mind, let us now take a look at the tonal mapping in Uspanteko. Undominated \*FT-HD-L prohibits the association of low tones to foot heads and units licensed by foot heads (‘strong’ moras at the foot level). In Uspanteko, this requirement has an important

effect on the tonal mapping in trochaic vs. iambic feet. Since trochaic feet in Uspanteko always contain a sequence of one strong and one weak mora, the high prominence associates with the first, strong mora, while the weak second mora is a suitable host for the low word-final boundary tone. This mapping, as depicted in (15a), applies to disyllabic bimoraic trochees (two light syllables) and monosyllabic bimoraic trochees (one heavy syllable) in the same way. Therefore, this tonal mapping also accounts straightforwardly for the obligatory presence of pitch accent in trochaic items with penultimate stress.

(15) Tonal mapping in trochaic feet (left side) and iambic feet (right side)



Matters are less straightforward in iambic feet, since syllabic iambs do not end in a *weak* mora but in a *strong* mora. Since \*FT-HD-L prohibits low tone on strong moras, L cannot associate with the word-final mora, unlike in trochees, and it remains floating on the surface; in (15b, c, d), the floating tone is indicated with a circle. In the phonetic implementation, floating L lowers the pitch of the preceding high tone in the word-final syllable. Neutral or slightly raised level pitch in stressed iambic syllables can therefore be understood as the combined effect of associated H and floating L, which lowers the pitch of the high prominence tone. In (15), I represent this by positing the floating L below H. On the tonal tier, L is ordered after H, which means that it can never precede H. I furthermore assume that the high tone spreads to the second mora (although this may not necessarily be crucial for the validity of the analysis).

To sum up, the differences between obligatory pitch accent in trochees (all disyllables with penultimate stress, some monosyllabic items) and the absence of pitch accent in iambic feet are, essentially, the result of a diverse mapping of a low word-final boundary tone. Due to the influence of high-ranked \*FT-HD-L, the low tone *can* associate with a TBU when the final mora of a foot is weak, as we find it in moraic trochees. It *cannot* associate with a TBU when the final mora is strong, which is a general property of iambic feet. This is formalized in OT in (16) for trochees, and in (17) for iambs. In trochees, both tones can be associated (candidate a in (16)), so leaving L unassociated / floating (candidate b) leads to a fatal violation of a constraint against floating tones (e.g. Yip 2002). In iambic feet, the pressure to avoid low tone in prominent positions leads to the mapping in (17) – although the winning candidate (17b) violates a constraint against floating tones, \*FLOAT, this violation is not fatal, since satisfying \*FT-HD-L is more important.

(16) Pitch accent in moraic trochees: \*FT-HD-L, \*FLOAT

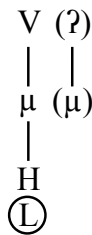
	$(\mu^+ \mu^-)$ HL	*FT-HD-L	*FLOAT
a. →	$\begin{array}{c} (\mu^+ \mu^-) \\   \quad   \\ H \quad L \end{array}$		
b.	$\begin{array}{c} (\mu^+ \mu^-) \\ \diagdown \quad   \\ H \quad L \end{array}$		*!

(17) No pitch accent in syllabic iambs: \*FT-HD-L >> \*FLOAT

	$(\mu^+ \mu^+)$ HL	*FT-HD-L	*FLOAT
a.	$\begin{array}{c} (\mu^+ \mu^+) \\   \quad   \\ H \quad L \end{array}$	*!	
b. →	$\begin{array}{c} (\mu^+ \mu^+) \\ \diagdown \quad   \\ H \quad L \end{array}$		*

Note that this analysis of the tonal mapping easily extends to the non-occurrence of pitch accent on word-final light syllables (GEN VI) and word-final sequences of vowels and moraic glottal stops (GEN VII). If we assume that glottal stops cannot bear tone due to their low sonority (a common restriction across languages), a word-final heavy syllable with a moraic glottal stop, such as [kaʔn] ‘animal’, will have only one TBU, a strong mora: consequently, L will have to remain floating and lower the preceding H – thus the absence of pitch accent on such words. The same reasoning holds for monomoraic, stressed word-final syllables, such as [o.koʔ] ‘mushroom’. The obligatory ‘floatingness’ of low tones in stressed word-final syllables with one vocalic mora is depicted in (18); the optional presence of a moraic glottal stop is indicated by brackets.

(18) Tonal mapping in word-final stressed syllables with one vocalic mora (either monomoraic or with a moraic glottal stop)



### 3.3.2 A minimal alternative

A more ‘minimal’ analysis of the interaction between pitch accent and foot-type might be possible if we are willing to exploit the Iambic-Trochaic Law (e.g. Hayes 1995, Hyde 2011) to its extremes. The Iambic-Trochaic Law states that, at least prototypically, we expect different primary correlates of word stress in trochaic and iambic systems. In prototypical trochaic systems, differences in prominence should be primarily based on intensity, which will be higher on foot heads than on foot dependents; duration as a cue to stress should play a minor role. In prototypical iambic systems, on the other hand, we would expect relatively long duration to be

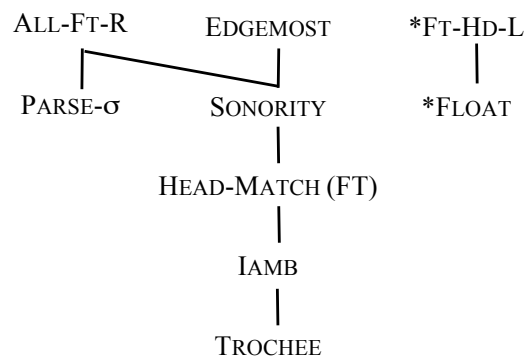
the main cue in signaling the contrast between stressed and unstressed syllables; intensity-related phonetic parameters should be less important.

If we assume that relatively high pitch can also be an exponent of intensity-related trochaic prominence (a positive relation between pitch and intensity has been documented as early as Stevens 1935), we might regard pitch accent in trochaic words in Uspanteko as one of the correlates of trochaic prominence; duration as a cue should then be less important. Conversely, iambic feet should be characterized by durational differences between stressed and unstressed syllables, while pitch / intensity differences between stressed and unstressed syllables should be less prominent. Interestingly, B&H (2013: fn. 33) document that disyllabic trochaic feet in Uspanteko “show prominence asymmetries in both pitch and intensity”, unlike iambic word-final light syllables. This would indeed be in line with the ‘minimal’ approach to pitch accent in Uspanteko, which might thus result in a very elegant and simple analysis of the patterns. Further phonetic investigations are needed, however, to see whether the approach is feasible. For instance, we would expect for word-final heavy syllables with long vowels that trochaic syllables should show an intensity drop throughout the vowel, and that such intensity drops, if present, should be less prominent in corresponding iambic syllables. Furthermore, we would expect that word-final bimoraic iambic syllables should generally be phonetically longer than bimoraic trochaic syllables.

### 3.4 Summary of the metrical analysis

The combined constraint rankings for the analysis of monomorphemic words in Uspanteko are given in the Hasse diagram in (19). As we have seen, the seemingly complex interactions can be accounted for on the basis of a few general principles. In summary, the most important message is that it is certainly possible to provide a metrical analysis of pitch accent in Uspanteko, and that it is not necessary to refer to lexical tone. As I hope to show in section 4, however, the metrical approach is not merely an empirical alternative to a tonal approach, but provides a more principled account of the facts than the competing tonal analysis provided in B&H.

(19) Hasse diagram for Uspanteko



## 4. A comparison to the tonal approach

In this section, I compare my metrical approach to the tonal alternative proposed in B&H. First, section 4.1 discusses some problematic aspects of B&H’s (2013) tonal analysis of monomorphemic words in Uspanteko. With these problematic aspects in mind, section 4.2 provides a more general comparison of virtues and challenges for the tonal and the metrical approach to Uspanteko. Crucially, this comparison is by no means intended to reduce the importance of B&H’s paper, which contains not only a concise description of the facts but also some very important generalizations about the prosodic structure of the language. Without B&H’s observations, the current analysis would not have been possible.

#### 4.1 Some problematic aspects of the tonal approach

B&H's OT analysis relies on two main representational assumptions: first of all, they argue convincingly that Uspanteko has both trochaic and iambic feet, a view that I have adopted. Furthermore, they assume that the language has a lexical high tone (H), unlike my approach. Since the notion 'lexical' tone suggests that the occurrence of tone should tend to be *unpredictable*, postulating lexical tone poses the challenge to account for *predictable* occurrences of tone. As we have seen in sections 2 and 3, this mainly concerns a) the distribution of pitch accent in words with only light syllables, most evidently the obligatory *presence* of pitch accent in roots with penultimate stress, as well as b) the obligatory *absence* of pitch accent in roots with more than two moras. As I intend to demonstrate, it is exactly these predictable distributional requirements that turn out to be problematic for any account which assumes that Uspanteko has lexical tone, thus also for B&H.

In their analysis, B&H account for several predictable patterns with *one* complex OT constraint, PERFECTPROSODICWORD (PPW). Their definition of PPW is provided in (20):

(20) Perfect Prosodic Word (PPW)

Assign one violation mark for every prosodic word  $\omega$  that does not meet all of the following criteria:

- (i)  $\omega$  is coextensive with a single foot F.
- (ii) The head syllable of F ( $\sigma_s$ ) bears tone.
- (iii) F is bisyllabic.
- (iv) The nucleus of  $\sigma_s$  is at least as sonorous as the nucleus of  $\sigma_w$ , the syllable occupying the weak branch of F.

PPW is designed to take care of GEN III, GEN IV, GEN V, GEN VIII, and GEN X at the same time. Clause (i) guarantees that the constraint only applies to prosodic words with exactly one foot, thereby singling out words with more than two syllables (GEN V). Clause (iii) ensures that this foot (and thereby the perfect prosodic word) has to be disyllabic, to avoid the predictable insertion of tone on monosyllabic words with heavy syllables (GEN X). Clause (iv) prohibits the insertion of tone on disyllabic words with rising sonority, which indirectly derives sonority-driven stress (GEN III, IV). Lastly, clause (ii) enforces the insertion of a high tone on the pre-final vocalic mora of all prosodic words that satisfy clause (i), (iii), and (iv), which accounts for GEN VIII.

It seems obvious that due to its particular complexity, PPW should not be a preferable OT constraint. B&H acknowledge that "[s]ince OT derives its predictive power from constraint interaction, we should prefer an account with many separate constraints over an equivalent account that has one constraint with many clauses" (B&H 2013: 622). Crucially, however, they also discuss in length that PPW seems to be inevitable to account for the facts (B&H 2013:622-625) – at least, one might add, in an approach that relies on the assumption that the language has lexical tone. B&H point out correctly that constraints of the type PPW have been used before (e.g. Zec 1999, Ito & Mester 2011), but it should be noted that B&H's specific version is considerably more complex than PPW in the referenced works. In sum, PPW (as used in B&H) is conceptually at least debatable. (A reviewer adds that PPW in B&H also seems problematic from a typological perspective and raises learnability issues.)

Aside from conceptual and typological considerations, PPW also seems to make some problematic empirical predictions with regard to the analysis of Uspanteko. I provide two examples. First, the constraint itself predicts that tone should be inserted in disyllabic words with a light and a (stressed) heavy syllable ( $\mu.\underline{\mu\mu}$ ) iff vowel sonority is equal or rising – a relevant example is [imaam] 'grandchild' (Can Pixabaj 2006:48). According to PPW, [imaam] should have a high tone on the penultimate mora, thereby incorrectly resulting in \*[imáam]: the item can be parsed as one iambic foot (satisfying clause i), it is disyllabic (clause iii), and the sonority of

the nucleus in the stressed syllable is higher than in the unstressed syllable (clause iv) – so tone should be inserted to satisfy clause ii. As stated in GEN IX, however, such words do *not* receive tone. B&H briefly address the issue in fn. 30; they “assume that the relative markedness of tonal [. . . CVVC#] syllables in Uspanteko masks PPW effects in such words.” This dispreference is later expressed with a constraint against tone on final syllables, NONFIN (T,  $\sigma$ ).

Yet there are, of course, various bimoraic monosyllabic words with pitch accent, such as [kúuk] ‘squirrel’. Thus, the question emerges why pitch accent is prohibited in polysyllabic words with bimoraic final syllables but freely occurs in bimoraic monosyllabic words. In fact, the constraints NONFIN (T,  $\sigma$ ) and PPW both militate against tone on monosyllabic words with a heavy syllable – PPW because it generally favors disyllabic words, NONFIN (T,  $\sigma$ ) because it penalizes tone on final syllables. Yet only PPW militates against tone on the second syllable of trisyllabic words with only light syllables. In that sense, tone on the second syllable of trisyllabic words should be less ‘costly’ than tone on monosyllabic words with a heavy syllable; the data indicate, however, that tone is absent on trisyllabic words, but not on monosyllabic words with a heavy syllable. As shown in section 3, my metrical analysis provides a principled explanation for all of these patterns, as a combined effect of EDGEMOST and ALL-FT-RT; no comparable explanation is available in the current tonal approach.<sup>4</sup>

A second empirical problem related to PPW that I would like to discuss concerns the absence of tone on some light disyllables with even sonority, like [o.koʃ] ‘mushroom’. Let us first look at the word [i.wir] ‘yesterday’ and see how B&H derive penultimate stress and pitch accent. An OT tableau is given in (21); the tableau is based on relevant constraints and their respective rankings, as provided in B&H (2013:625).

(21) Deriving penultimate stress with PPW

	/iwir/	NON-FIN (T, TBU)	PPW	IAMB	DEP-T
a.	→ i.wir			*	*
b.	i.wir		*!		
c.	i.wir		*!		
d.	i.wir	*!			*

Candidate a in (21) is optimal because it satisfies high-ranked PPW, and only violates the low-ranked constraints IAMB (which enforces iambic footing), and DEP-T (which militates against the insertion of tone). Candidates b and c are out because they violate clause (ii) of PPW – they surface without tone. Candidate d satisfies PPW but violates NON-FIN (T, TBU), which prohibits tone on the last vocalic mora.

With this ranking in mind, consider a word with equal sonority and final stress: on page 611, B&H argue that [o.koʃ] is derived from underlying /okof/ and shows “default stress placement”; crucially, however, the interaction is formalized *before* PPW is introduced on page 619. If, however, we take PPW into account and rank it according to B&H’s constraint hierarchy on page 625, the predicted surface form is \*[ó.koʃ] with penultimate stress and high tone, similar to the evaluation of [i.wir]. Consider the tableau in (22), where the wrongly selected candidate a (indicated with skull and crossbones) is more optimal than the desired winner, candidate b (indicated with a sad smiley):

<sup>4</sup> B&H do not discuss the ranking of PPW, NONFIN (T,  $\sigma$ ), and Max (T), a faithfulness constraint preserving underlying tone, but I do not think that the issues in question could be resolved without additional machinery.



## (22) Problems in deriving final stress with PPW

	okof	NON-FIN (T, TBU)	PPW	IAMB	DEP-T
a.	☞ ó.kof			*	*
b.	☹ o.kof		*!		
c.	o.kof		*!	*	
d.	o.kof	*!			*

As we can see, B&H incorrectly predict penultimate stress for light disyllables with even sonority that are in fact stressed on their final syllable. To solve this ranking problem, we would thus have to ensure that, despite the influence of PPW, stress in forms like [o.kof] would be correctly assigned to the final syllable. As far as I can see, the most straightforward way to achieve the desired result would be to specify lexical stress on the final syllable, and to rank faithfulness to stress placement above PPW. But if we would need to specify foot structure in addition to tone anyway, there is little, if any, reason to stick to lexical tone. In summary, PPW, which carries the major load in the tonal analysis of Uspanteko, is not only conceptually undesirable but also makes some incorrect empirical predictions.

#### 4.2 A more general comparison

With the conceptual and empirical issues surrounding PPW in mind, let me compare the two approaches in a more general way. Table 3 repeats the generalizations provided in Table 1, and briefly indicates what approach the two competing analyses take to resolve the issue. Note that there will be some redundancy with regard to the discussion of PPW in 4.1, but I believe that the complexity of the facts justifies this choice for the sake of clarity.

Since I have adopted B&H's proposal that Uspanteko has iambic and trochaic feet, it is not surprising that some of the stress-based facts are analyzed in a similar fashion. For instance, GEN I is implemented in the same way in the two approaches, viz. by making reference to right-alignment of feet (plus the possibility to have iambic or trochaic footing). GEN II is accounted for in B&H by assuming a constraint against uneven trochees. I have no objection to this solution; my account derives the outcome in a slightly different way, viz. by assuming that foot heads must coincide with the edge of a prosodic word (EDGEMOST). As to GEN III: given that B&H's PPW is conceptually and empirically problematic, I argue that my (fairly straightforward) analysis of the sonority patterns is preferable to the alternative approach. With regard to GEN IV, I have demonstrated in 4.1 that the current tonal approach does not offer a solution for unpredictable cases of stress placement. Unlike the tonal approach, my analysis provides a solution for these cases. In the tonal approach, GEN V is derived from the workings of PPW, although it is not entirely clear to me how the approach accounts for the fact that trisyllabic words never have tone, but monosyllabic bimoraic words can have tone (section 4.1 for further discussion). In contrast, my approach successfully derives the relevant facts by making reference to EDGEMOST, a constraint that also accounts for other aspects of the Uspanteko grammar (GEN II, IX).

With regard to GEN VI and GEN VII, the restrictions on pitch accent placement, both approaches successfully account for the set of facts, but use different approaches to get there. In my analysis, the solution is based on the interaction of diverse metrical structures and predictable, postlexical tone, plus the assumption that glottal stops cannot bear tone in Uspanteko. The tonal approach relies on the same TBU restriction, and furthermore invokes a constraint that penalizes tone on final vocalic moras. (For the constraint to work, it is important that it can see a difference between vocalic and non-vocalic moras since otherwise, vowels before moraic glottal stops could show a tonal contrast.)

To account for GEN VIII, the predictable interaction of penultimate stress and tone, the tonal approach again has to make reference to undesirable PPW. In my approach, the fact that penultimate stress implies tone follows from the fact that penultimate stress implies the presence of a trochaic foot. With regard to GEN X, we have another situation where both approaches derive the same outcome in different ways. In my approach, foot structure is stored, which influences the mapping of predictable tones; in the tonal approach, lexical tone is stored. In combination with GEN IX, however, I would like to argue that my approach is preferable to the current tonal approach. In my approach, the absence of tone on long vowels in polysyllabic words follows, once more, from EDGEMOST. A constraint against tone on final syllables, as suggested in B&H, however, should in principle also militate against tone in monosyllabic words, which is contradicted by the facts.

In sum, I am convinced that the metrical approach outlined in section 3 provides a more principled analysis of the basic facts than the competing tonal approach. I would dare to claim that it offers preferable analytical solutions several generalizations, at least GEN III, IV, V, IX, and X. Notably, the current tonal approach offers no solution at all for GEN IV, and is therefore in need of revision anyway. It seems to me that the only ‘principled’ counterargument against the metrical analysis provided here would be the fact that it accounts for distinctive pitch contrasts by assuming foot-based metrical differences *within* syllables, counter to the ‘mainstream’ view outlined in the introduction. But, as I have pointed out, assuming metrical contrasts within syllables is not an isolated proposal but placed in the context of ongoing research on the interaction of postlexical tone and metrical structure.

Table 3. Schematic comparison of my analysis and the analysis proposed by B&H.

Nr.	Generalization	Predictability	My analysis	B&H’s analysis
<b>Stress and syllable structure (pitch accent ignored)</b>				
I	Stress falls on one of the last two syllables	Predictable	ALL-FT-R	ALL-FT-R
II	Heavy syllables – VV(C), V?C – are restricted to the final syllable and always receive stress	Predictable	EDGEMOST	*UNEVEN TROCHEE
III	In disyllabic words with two light syllables, the vowel with the higher sonority ( $\sigma^+$ ) receives stress	Predictable	SONORITY	PPW
IV	If vowels in disyllabic words with light syllables have equal sonority ( $\sigma=$ ), either syllable can be stressed	Unpredictable	Lexical foot structure	No solution available
V	In words with more than two syllables, stress is always final	Predictable	EDGEMOST	PPW
<b>Pitch accent (stress patterns always included)</b>				
VI	The occurrence of pitch accent is restricted to the penultimate vocalic mora of a word in a stressed syllable	Predictable	Pitch accent in trochaic feet only	No tone on final vocalic mora
VII	Words with a moraic glottal stop never have a pitch accent	Predictable	Glottal stop is not a TBU	Glottal stop is not a TBU + no tone on final vocalic mora

VIII	If stress is on the penultimate syllable, the stressed syllable always has a pitch accent	Predictable	Pitch accent in trochaic feet only	PPW
IX	Long vowels in polysyllabic words do not have a pitch accent	Predictable	EDGEMOST	No tone on final syllable
X	Long vowels in monosyllabic words sometimes have a pitch accent	Unpredictable	Lexical foot structure	Lexical tone

## 5. Some additional considerations

### 5.1 *The representational status of glottal stops*

As stated at various points throughout this chapter, glottal stops in final syllables can contribute to syllable weight, but only when they are followed by another consonant. That is, glottal stops will be moraic in words like [ku.waʔj] ‘horse’, which implies that such final syllables always have stress (\*[kú.waʔj], see Table 1). When a glottal stop occurs as a singleton coda, however, it does not contribute to weight. A relevant example is [áx.tʃeʔ] ‘matazano (species of tree)’ (B&H: 601), which has penultimate stress – if the glottal-stop-final syllable would count as heavy, we would expect final stress.

It has been observed that consonant moraicity can be limited to specific types of segments across languages (e.g. Morén 2001 for discussion) – a case comparable to Uspanteko is discussed in Gutiérrez (2016), who argues that in Niva’le, glottal stops are the only consonants that can be moraic. Similarly, in Cahuilla, syllables with long vowels (VV) or with short vowels plus glottal stops (Vʔ) count as heavy (Hyde 2011, and references therein). In that sense, moraicity of glottal stops in Uspanteko is not an atypical phenomenon. The question remains, however, why glottal stops are only moraic when they are followed by another coda consonant. One possible explanation of this pattern might be found in word-final consonant extrametricality. If we regard word-final consonants as extrametrical, it follows that [j] in [ku.waʔ<j>] is extrametrical (extrametricality of [j] is indicated with pointy brackets). Accordingly, the glottal stop is not extrametrical. It can hence be moraic and contribute to the weight of the final syllable, thereby making it heavy. In [áx.tʃe<ʔ>], on the other hand, the glottal stop is word-final, which makes it extrametrical. This in turn means meaning that it will be disregarded for the computation of stress – consequently, the final syllable in [áx.tʃeʔ] will be treated as light.

Another interesting aspect concerning the distribution of glottal stops in Uspanteko is that sequences of glottal stops and consonants are the only complex codas the language tolerates. Along the lines of the argument developed here, one might assume that the language only allows for one non-moraic coda consonant per syllable. Since, among consonants, only glottal stops can have a mora, this would account for the fact that only (moraic) glottal stops can be followed by another coda consonant.

A reviewer wonders whether the glottal stop might be a prosodic feature of Uspanteko rather than a segmental one, which would make the phenomenon similar to, e.g., Danish stød. Judging on the basis of the available data, however, it seems to me that the glottal stop should best be treated as a segmental feature of the language. For instance, as discussed in B&H and Can Pixabaj (2006: 29), the glottal stop is not restricted to codas. First of all, it also predictably occurs at in pre-vocalic position at the beginning of words or intervocalically, i.e., it provides onsets for syllables that would otherwise be onsetless. Furthermore, it can sometimes also occupy the second position in an onset, as in the word [ʃʔé.lik] ‘went out’. Such occurrences suggest that, although glottal stops obviously strongly interact with prosodic structure, they have segmental status, rather than being a purely prosodic phenomenon. Lastly, if the glottal stop were a prosodically conditioned phenomenon, it would be hard to understand why it should contribute to weight only if it is followed by another coda consonant.

## 5.2 Morphologically complex words

As indicated in the introduction, morphologically complex words sometimes violate certain restrictions on accent placement that are active in monomorphemic words. I will briefly discuss some general patterns, but leave a formal analysis of the facts to future work.

On the one hand, there is a set of functional morphemes that can trigger the presence of pitch accent on the penultimate mora of a word in some words that do not have pitch accent in their bare form (B&H, section 2.3). For instance, some possessive prefixes (first and second person) tend to introduce pitch accent on the roots they attach to; yet the resulting surface patterns are not fully predictable but differ between roots. As an example, consider the different outcomes for roots with a long vowel that do not carry pitch accent in isolation. (23) shows three possibilities: in (23a), pitch accent is realized on a word-final heavy syllable with a long vowel; in (23b), no pitch accent is realized. Lastly, in (23c), we find penultimate stress with pitch accent and vowel shortening (vowel shortening ensures that there are no unstressed heavy syllables, in line with GEN II).

- (23) a. [oox] ‘avocado’      [a.wóox] ‘your avocado’  
b. [tfoo] ‘godmother’      [in.tfoo] ‘my godmother’  
c. [teem] ‘chair’      [ín.tem] ‘my chair’

B&H (p. 605) account for such patterns by assuming that first- and second-person possessors trigger the insertion of a high tone. In their analysis, whether and how this tone is realized depends on what nominal co-phonology certain items belong to. The tonal requirements can easily be translated into my analysis as a trochaic template, and the co-phonological analysis would work in the exact same way. At a more general level, one might of course wonder whether working with a potentially unlimited number of nominal co-phonologies is a desirable analytical device. After all, such analyses are hard to challenge empirically (if that is possible at all), and accordingly run the risk of losing empirical content (see Bermúdez-Otero 2012 for detailed discussion of this issue). I share such concerns; for the time being, however, I will not address this issue with regard to the Uspanteko facts, and leave open the question as to whether it might be possible to provide a more restrictive, representational analysis of these patterns.

The position of stress and the presence pitch accent can also be influenced by suffixes. (24) shows two singular-plural alternations where the singular has final stress and no tone, and where the plural forms are followed by the plural suffix [-iβ]. The plural forms still have root-final final stress, which is now penultimate in the word, and they also acquire a pitch accent (B&H:602). Note that in (24b), the long vowel, which is in the final syllable of the word in the singular, shortens in the plural form when it occurs in penultimate position.

- (24) a. [ax.k<sup>2</sup>aj] ‘seller’      [ax.k<sup>2</sup>á.j-iβ] ‘sellers’  
b. [ax.tfaak] ‘worker’      [ax.tfá.k-iβ] ‘workers’

B&H (602) analyze the plural suffix as carrying high lexical tone, which triggers penultimate stress. Again, lexical H in B&H’s approach could be translated into my approach as a trochaic template. It should be noted, however, that [ax.tfá.k-iβ] ‘workers’ in (24b) violates the constraint EDGEMOST, as stress does not coincide with the edge of a prosodic word. Recall that such violations do not occur in monomorphemic forms. One way to implement this would be to assume that faithfulness to prosodic templates introduced by the morphology are ranked higher in Uspanteko than general faithfulness to metrical templates, i.e., HEAD-MATCH (FT, AFFIX) >> EDGEMOST >> HEAD-MATCH (FT).

There is also a group of suffixes that do not affect the phonological make-up of bare roots at all. B&H (639-640) treat these suffixes as clitics, an analysis that I adopt. A relevant example is the plural enclitic [=aq]. As can be observed in example (25a), [=aq] fails to trigger vowel shortening when it attaches to bare roots – that is, in such cases, long vowels can appear in non-final syllables, although Uspanteko commonly does not allow such structures. Furthermore, [=aq]

also fails to trigger pitch accent in the plural form, although penultimate stress usually implies the presence of a pitch accent (GEN VIII). As (25b) shows, antepenultimate stress is possible as well when a word ends in [=aq], which is typically disallowed (GEN I). If we assume that, by virtue of being clitics, these affixes do not attach to the prosodic word node, as it has been defined here, but to some higher-level constituent (either a higher-level projection of the prosodic word, such as a maximal prosodic word, or a phrasal node), it follows that they will not impact word stress and phonological processes triggered by foot structure.

- (25) a. [poot<sup>2</sup>] ‘blouse      [j-poo.t<sup>2</sup>=aq] ‘their blouses’  
 b. [i.jim] ‘corn’      [w-i.ji.m=aq] ‘my corn-pl.’

## 6. Conclusion

The general purpose of this chapter was to show on the basis of Uspanteko that contrastive pitch accent patterns in languages need not necessarily be derived from tonal specifications in the lexicon. This is the case particularly for languages in which tonal contrasts are restricted to stressed syllables and interact with other properties of the grammar (as we observe in many tone accent languages). In Uspanteko, proposing a contrast between two types of feet is sufficient to account for the pitch accent alternations in question, as well as for weight effects, stress windows, and interactions of foot structure and vowel sonority. Crucially, in various cases, constraints on the position of word stress and on the presence / absence of tone follow from the same principles (recall, for instance, the interaction of EDGEMOST, ALL-FT-R, and SONORITY). It seems to me that the insightful observations established in B&H (2013) are still present in my analysis, and that some new insights could be added. Furthermore, my metrical analysis avoids some conceptual and empirical problems of the tonal approach (most obviously with regard to the constraint PPW). Consequently, any competing future tonal analysis of the facts would have to demonstrate that it can account for the Uspanteko patterns in a more straightforward way than my metrical approach. Alternatively, we might simply accept that metrical structure *can* be contrastive in so-called tone accent / pitch accent systems, counter to the (still) prevailing majority view in the field.

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