A Preliminary Intonational Model of Torres-Martinez Desert Cahuilla

Ray Huaute
University of California, San Diego, USA
ihuante@ucsd.edu

Abstract

This paper presents an analysis of the intonational patterns and phrasal domains in simple declaratives in Torres-Martinez Desert (TMD) Cahuilla, a critically endangered Uto-Aztecan language spoken in Southern California. While the word-prosodic system of Cahuilla has been addressed in previous literature [1], [2], [3], no intonational analysis has been proposed for any Cahuilla variety. Using novel data, I motivate a preliminary intonational model for declarative sentences in TMD Cahuilla within the AM (autosegmental-metrical) framework. Specifically, I analyze TMD Cahuilla as having two distinct levels of prosodic constituency: the Intonational Phrase (IP), which is composed of at least one Accentual Phrase (AP), and the AP, which consists of at least one prosodic word, has an obligatory H^2 pitch accent on the lexically stressed syllable and an L⁴ end tone aligned to the right edge of the phrase. The IP ends in a L⁴ boundary tone, which overwrites the La when they co-occur. Phrase-final lengthening and optional pauses delineate the IP. Given the paucity of intonational research on American Indian languages, this paper contributes to a growing body of cross-linguistic research that tests the ability of an AM-based system of annotation such as ToBI, to model a wide range of intonation systems.

Index Terms: intonation, prosody, Uto-Aztecan languages, Cahuilla, autosegmental-metrical, ToBI

1. Introduction

The goal of this study is to describe the intonational patterns and phrase-level prosody of declaratives in TMD Cahuilla. Although previous studies on Cahuilla have examined its word-level prosody, no analysis of the phrase-level prosodic structure of the language has been undertaken. Following the basic principles and assumptions of the AM framework for intonation originally set forth by [4], [5], and later rearticulated by [6], I describe and analyze intonational data from a single, elderly speaker of the Torres-Martinez variety of the Desert Cahuilla dialect, which I use to propose a tentative intonational tonal inventory and model for TMD Cahuilla. Since this study is focused primarily on the annotation of intonational pitch accents and contours, I leave aside the issue of developing a break indices system for future research. Thus, this study can be considered a first step in the development of a ToBI-like system (as outlined in [7], [8], [9], [10], [11]) for annotating intonational patterns in TMD Cahuilla.

Regarding the analysis and transcription of tones, I followed [12] in using only the simplest annotation labels, unless tones were found to be contrastive, as the aim of this study was to complete a phonological analysis of the intonational system, rather than a phonetic description of f0 contours. This approach is in line with phonological AM transcriptions ([13], [14], [10]), that favor underspecification, in order to avoid overfitting of pitch contours. Thus, only major tonal events were transcribed in terms of significant pitch excursions involving a high (H) or low (L) tonal target (local minima or maxima) with respect to the speaker’s range, as discussed in [5, pp. 68-75].

1.1. Language background

Cahuilla (ISO 639-3: chl) is classified as one of several Cupan languages (along with Cupeño and Luiseño) that fall under the Takic sub-branch of Northern Uto-Aztecan languages. It is a synthetic, agglutinative language with SOV word order. Cahuilla has three documented dialects: Mountain, Desert, and Pass. Currently, there are fewer than five fluent L1 (first language) speakers, all of whom speak the Desert dialect and reside on the Torres Martinez Indian Reservation located near Thermal, California.

1.2. Previous studies

The phonology and morphology of Cahuilla have been well documented ([15], [16], [17], [3], [18], [19], [20], [21], [22]), including several descriptions and analyses on word-level stress and metrical prominence ([11], [2], [3]). However, little has been written about the phrase-level prosody or intonation. In his 1977 grammar, Seiler briefly describes the intonation patterns of interrogatives [3, pp. 25-26], in which he associates word-final prominence normally attributed to a phrase-level pitch accent with that of word-level stress. Furthermore, given that all of Seiler’s examples are of single words uttered in isolation, it is plausible that he could have conflated word-level stress with phrase-level prominence, as noted by [23].

In terms of word-level prosody, Cahuilla has been analyzed as a language in which feet are parsed as moraic trochees, consisting of either two monomoraic syllables or a single bimoraic one [2, p. 133]. This metrical analysis, however, was based exclusively on impressionistic transcriptions of word-level prominence, in which a rhythmic, alternating secondary stress pattern was reported [3]. According to [3], primary stress is fixed and quantity-insensitive but secondary stress is quantity-sensitive. This analysis was based on the observation that primary stress was predictable, invariably landing on the initial syllable of the stem (root plus suffixes), while the alternating secondary stress pattern could be disrupted by heavy, bimoraic syllables. As a result, subsequent studies [1], [2] have focused on Cahuilla’s word-level prosodic system as it relates to metrical stress theory, as well as level ordering of post-lexical stress assignment.
2. Word-level prosody in TMD Cahuilla

2.1. Prosodic words and stress

Prosodic words in TMD Cahuilla must meet two basic criteria. The first is a minimal size restriction that requires all content words, as well as grammatical function words, to have a coda (i.e., minimally be CVC). The second criterion is that they must have at least one syllable that bears lexical stress. This second criterion is what distinguishes content words, which form prosodic words, from unstressed grammatical or function words that do not. Although unstressed function words lack the criteria to be considered prosodic words on their own, they can be grouped with a stressed content word to form a prosodic word.

Every prosodic word in TMD Cahuilla has at least one syllable that bears the highest degree of prominence, relative to other syllables within the same word. In that sense, TMD Cahuilla meets the definitional criteria of a stress language by virtue of stress being both obligatory and cumulative [24]. This generalization applies to all content words but excludes some function words, particularly those that are monosyllabic with short vowels, which lack any perceivable prominence. As of this study, there is only evidence for positing a single level of stress (primary) in TMD Cahuilla.

Aside from its perceptual correlates, stress can also be diagnosed phonologically by differences in vowel quality, with a more peripheral or tense quality showing up in stressed syllables, and a more centralized or lax quality showing up in unstressed syllables. In addition, there are other phonological and morphological processes that make reference to stressed syllables, such as a vowel lengthening process encoding intensification, as well as reduplication processes in verbs. Primary stress in TMD Cahuilla is fixed, predictably landing on the initial syllable of the root or stem. Although previous studies of Cahuilla have reported a rhythmic distribution of secondary stress based on syllable weight, no evidence of secondary stress has been found in TMD Cahuilla. To date, no phonetic analyses of any kind have been undertaken for any language by virtue of stress being both obligatory and cumulative [24].

3. Methods

3.1. Data collection

The data in this study came from a single, elderly female speaker of the Torres-Martinez Desert dialect of Cahuilla. A total of 24 sentences were elicited from the speaker and recorded over several sessions, which included both transitive and intransitive declarative statements. To probe for syntactic effects on intonation, I varied the word order for each sentence so that they appeared in both the canonical SOV order, as well as alternate word orders where either the subject or object appeared post-verbally. Manipulating the word order did not result in any observable changes to the phrasing or f0 contours. In Table 1 below, I show examples of some elicited sentences with various word orderings for both intransitive (a-b) and transitive (c-e) verbs. I exclude verb-initial word orderings for transitive sentences since they were deemed ungrammatical by the Cahuilla consultant.

<table>
<thead>
<tr>
<th>Word order</th>
<th>Cahuilla</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV</td>
<td>hrn- maxa 3PL-baby 3PL-cry-DUR.SG</td>
<td>Their babies are crying.</td>
</tr>
<tr>
<td>VS</td>
<td>hrn- `ŋa-ŋ-wren 3PL-maxa 3PL-cry-DUR.SG</td>
<td>Raccoons are picking up bananas.</td>
</tr>
<tr>
<td>SOV</td>
<td>`ŋajamaː-em 3PL-racoon-PL me-m- hivin-wren 3PL-3PL-take-DUR.PL</td>
<td>Raccoons are picking up bananas.</td>
</tr>
<tr>
<td>OSV</td>
<td>3PL-bananas-PL-ACC 3PL-racoons-PL me-m- hivin-wren 3PL-3PL-take-DUR.PL</td>
<td>Raccoons are picking up bananas.</td>
</tr>
<tr>
<td>SVO</td>
<td>3PL-bananas-PL 3PL-3PL-take-DUR.PL</td>
<td>Raccoons are picking up bananas.</td>
</tr>
</tbody>
</table>

Since TMD Cahuilla has fixed primary stress that aligns to the left-edge of the stem, it was not possible to vary the position of stress within the stem. However, words with prefixation were included, which varied the location of stress across words (e.g., [`ŋa-ŋ-qal] ‘He/she is crying.’ vs. [hrn-`ŋa-ŋ-wren] ‘They are crying.’). Words containing both short and long vowels in a stressed position were also included in order to see whether the duration of syllable nuclei would affect the placement and timing of pitch accents. Careful attention was paid to the “naturalness” of each utterance, as well as the speaker’s rate of speech and register. To avoid list intonation, each sentence was followed by a five second pause before the next sentence was elicited. The speaker was also instructed to speak at a normal rate of speech, and to imagine that they were part of a conversation with another speaker. To ensure smooth and continuous pitch contours, all sentences were constructed using words that contained as many sonorant sounds as possible to keep the f0 track continuous and minimize microprosody [25, p. 494]. Finally, all elicited sentences were recorded using a Zoom Q8 audio and video recorder connected to a Countryman E6 omnidirectional cardioid headset microphone. The audio was recorded in an uncompressed WAV format at a sampling rate of 44.1 kHz with 16-bit resolution.

3.2. Analysis and transcription

Utterances were segmented and annotated in Praat with Textgrid tiers labeled for tones, syllables, and words. As mentioned earlier, only major tonal events were transcribed in terms of a pitch change involving a local minimum or maximum (either high (H) or low (L)) with respect to the speaker’s range [6, p. 44]. Since the perceived degree of juncture between prosodic words or constituents was not included as part of the analysis for this study, a separate tier for break indices was not included.

4. Description of TMD Cahuilla intonation

4.1. Proposed preliminary intonational model

Based on the evidence from the pitch contours presented below, I propose that TMD Cahuilla minimally has two distinct level of prosodic constituency: an intonational phrase (IP) and an accentual phrase (AP). This model is schematized...
in Figure 1 below, followed by an inventory of pitch accents and boundary tones shown in Table 2.

![Proposed hierarchical intonational model for TMD Cahuilla](image)

Figure 1: Proposed hierarchical intonational model for TMD Cahuilla. Tones associated with higher prosodic constituents overwrite tones associated with lower ones (i.e., \( L\% \geq La \)).

As the proposed intonational model suggests, the IP is the largest intonational constituent, followed by the AP. I use this hierarchical model to show that tones which are associated with higher level prosodic constituents may overwrite tones associated with lower-level prosodic constituents. This model also shows that every prosodic word is coterminous with both an AP and IP, and that an IP may be composed of more than one AP, but that an AP can contain no more than one prosodic word. Currently there is no evidence for an intermediate phrase. An inventory of all posited intonational tones in TMD Cahuilla is provided in Table 2 below.

### Table 2: Inventory of intonational tones

<table>
<thead>
<tr>
<th>Pitch Accents</th>
<th>Phrase Accent Tones</th>
<th>Boundary Tones</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H*</strong></td>
<td><strong>La</strong></td>
<td><strong>L%</strong></td>
</tr>
<tr>
<td>Nuclear pitch accent: docks to the primary stressed syllable of every accentual phrase.</td>
<td>Accental phrase tone: aligns with the right edge of accentual phrases.</td>
<td>Low boundary tone: occurs at the end of declarative statements.</td>
</tr>
</tbody>
</table>

#### 4.2. The Accental Phrase

The smallest intonational level in TMD Cahuilla is the AP, which is the domain of pitch accentuation. Every prosodic word forms an AP, which is characterized by the presence of a H\* pitch accent that associates with the lexically stressed syllable, followed by a low-toned target at the right edge of the AP, which I transcribe as La. For single words uttered in isolation or with a significant pause in between words, it is assumed that the low-toned La target of the AP is either not realized phonetically or is overwritten due to overlap by the competing low tone of the L\% boundary tone associated with the IP. Thus, in Figure 2, the low-toned AP edge tone is not transcribed in the predicate or in the noun belonging to the NP, since both are followed by significant pauses indicating an IP boundary. In contrast, the right edge of the independent pronoun [ˈpɛʔɛm] 'them' is marked with an La, to illustrate that it is the first of two APs that form an IP comprised of the NP. I posit an La pitch accent in these cases since there is a steep fall in f0 following the H\* pitch accent. This is inconsistent with a smaller dip in f0 that could be attributed to pitch sag between two H\* pitch accent targets. I also do not transcribe a leading low tone preceding the H\* pitch accent, even though the f0 starts out low over the pretonic syllables in words that contain prefixes. As mentioned in Section 1, I follow [12] in assuming only a simple high-toned target (H\*), in the absence sentences containing a contrastive LH\* pitch contour. But phonetically, H\* pitch accents have a rising contour, followed by a fall attributed to the La.

![Pitch track for 'Them, their babies are crying.'](image)

Figure 2: Pitch track for 'Them, their babies are crying.'

Further evidence for positing an La edge tone associated with the AP comes from examples of morphologically complex verbs that have multiple prefixes and suffixes, for which there appears to be a low target following the H\* pitch accent. This contour is illustrated in Figure 4, where the f0 gradually rises from a mid to low level up towards the H\* before dropping steeply through the second half of the stressed syllable and then plateauing all the way through the remaining syllables towards the L\% boundary tone. This example shows that there is a low target that is aligned to the post-tonic syllable of the verb (which I tentatively transcribe as L in Figure 4).

![Pitch track for 'Yes, their babies are crying.'](image)

Figure 3: Pitch track for 'Yes, their babies are crying.'

![Pitch track for 'They are going to have a feed.'](image)

Figure 4: Pitch track for 'They are going to have a feed.'
Absent this low target, we would expect a more gradual decline over the remaining syllables indicative of a linear interpolation of the f0 between the H* pitch accent and the L% boundary tone. I argue that this low target immediately after the H* could be interpreted as an example of leftward movement of the La edge tone to align with the syllable immediately following the pitch accent.

4.3. The Intonational Phrase

IPs in TMD Cahuilla declaratives are marked by a L% boundary tone on the final syllable, which is often followed by a pause. An IP minimally has one AP, but may contain more than one, as shown in Figures 2 and 3. In Figure 5 below, the pitch track of a single prosodic word uttered in isolation is analyzed as being associated with both an AP, which contains a H* pitch accent, as well as an IP, which is marked by a L% boundary tone. As mentioned in the previous section, since the La of the AP co-occurs with the competing low-toned boundary tone at the right edge of the word, it is not distinguishable in the f0 track. Although APs may be composed of a single content word, they can also be composed of a prosodic word consisting of a content word plus a function word, such as the negation particle [kɪɭ], as shown in Figure 6.

![Figure 5: Pitch track for 'They are crying.'](image)

![Figure 6: Pitch track for 'They are not picking up bananas.'](image)

5. Discussion and conclusions

This paper has provided a preliminary analysis and description of the intonational patterns of declarative sentences in TMD Cahuilla. One of the main goals of this study was to provide a basic description of the intonational patterns and tonal inventory of the language. The intonational data provided in this paper shows that TMD can be analyzed as having two distinct levels of prosodic constituency, the IP and the AP. These two intonational levels can be delineated in several ways. First, in terms of their tonal inventories: the AP is the domain of pitch accentuation, being characterized primarily by the presence of a H* pitch accent, followed by a La edge tone that aligns to the right edge of the AP, while the IP is the domain of boundary tones, being characterized by a L% boundary tone in simple declaratives. Second, IPs may also be followed by a pause. Third, different degrees of phrase-final lengthening could also be used to distinguish the IP and the AP, however, this would require a more careful study such as [26], which is currently beyond the scope of this paper.

I also posited an accentual phrase tone (La), which marks the right edge of APs. As stated earlier, if an La and L% were to co-occur on the same syllable, only one low pitch target would be distinguishable (suggesting overwrite) but more work would be needed to determine this. In Figures 2-4, it is also possible that what is being analyzed as an accentual phrase tone (La) is in fact part of the implementation of the pitch accent H*+L (as an IP-final allotone). Given how early the La target occurs in Figure 4, this hypothesis seems plausible, but would also require further testing. Such questions about whether post-accentual targets are associated with pitch accents vs. phrase accents are also discussed for other languages like English (see [27]).

Furthermore, since the data in this study was limited to sentences that contained declarative sentences, a wider range of possible tonal melodies has yet to be determined for TMD Cahuilla. I also leave as an open question (pending further investigation) whether there are additional units of intonation (i.e., an intermediate phrase) and simply present a preliminary intonational model that will provide the basis for a full model of TMD Cahuilla in the future. This paper contributes to a growing number of intonational studies on smaller, understudied, non-Indo-European languages, which seek to provide a better understanding about the nature of intonation, from a cross-linguistic perspective.

6. Acknowledgments

This research would not have been possible without the assistance of my knowledgeable Cahuilla consultant, Mrs. Christina Morreo of the Torres Martinez Indian Reservation. I would also like to gratefully acknowledge and thank Gabriela Caballero and Marc Garellek for all their valuable comments and feedback.

7. References


