Prosody as a genre-distinguishing feature in Ahtna

A quantitative approach*

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This article is a quantitative examination of the function of prosody in distinguishing between the genres of oral performance and expository discourse in Ahtna, an Athabascan language of south-central Alaska. Within the framework of the *intonation unit* (e.g., Chafe 1987) I examine features of prosody related to both timing (intonation unit length and duration, pause duration and distribution, and syllable pacing) and pitch (pitch reset, boundary tones, and intonational phrasing). I show to a statistically significant degree that most of the prosodic burden of distinguishing genre is carried by a particular intonation contour that is associated with Ahtna oral performance and causes several measurable distinctions between genres.

1. Introduction

1.1 Prosody and genre

Prosody is a general notion in the study of spoken language that covers a range of suprasegmental phenomena including intonation or pitch, rhythm, duration or tempo, voice quality, and pausing. Especially in interactional language, prosody functions beyond serving the lexical stress requirements of a language and begins to distinguish between discourse-level categories. Couper-Kuhlen (1986) identifies six meaningfully contrastive functions of intonation that can reasonably be extended to all prosodic effects working in concert:

- informational contrast, which distinguishes new from given information (e.g., *my SISTER is the bar manager* versus *my sister is the bar MANAGER*);
- sentence-type contrast, e.g., differing contours on yes-no versus *wh*-questions in English

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- illocutionary contrast, such as the difference in *why don't you have the roast beef* as a question or a suggestion;
- attitudinal contrast, such as the expression of sincerity versus perfunctoriness in *that's great news*;
- textual coherence, including isotony and list intonation across multiple sequential clauses;
- indexical functions, which link speakers to social groups and distinguish episodes of discourse as instances of a particular genre.

The first four of these can be identified by the introspection of exemplars produced in isolation, without need for reference to the full text or the social setting of the utterance. Textual coherence and indexicality, however, are heavily reliant on contextual knowledge. We need access to the text in its entirety to identify the former, and some knowledge of the sociocultural and performative circumstances in which the sample was uttered for the latter.

That prosody plays a role in distinguishing performance genres comes as no surprise. Linguists have examined the issue (e.g., Crystal 1975a, 1978; Gumperz 1978; Tench 1991; Auer *et al.* 1999; Wennerstrom 2001), and to members of language communities, tune and rhythm make up the very fabric of speech. Prosody alone is enough to tell a listener whether she is an audience member at, for instance, an academic lecture or a poetry slam. Likewise the role of professor or poet is relegated to some degree to those who "sound the part". But what exactly are listeners hearing? What are the (presumably language-specific) acoustic properties of timing and pitch that contribute to our perception of prosodically distinct discourse genres?

In this article I am concerned with these questions in Ahtna, a northern Athabascan language spoken by fewer than one hundred people in Alaska's Copper River region. The data considered here, described in detail in Section 1.2 below, are two monologues of different genres that display dissimilar prosody.[1] One narrative is the performance of traditional lore; the other is an expository ethnohistorical description of societal practices. It is clear to even the casual listener that the narratives are prosodically distinct, and the goal of this article is to identify and describe the differences within a quantitative and statistical framework. Despite the noteworthy perceptual differences of the two stories, I show that contrary to impression nearly all measurable timing-related features of prosody are virtually identical across the stories. Instead, the difference in genre can be clearly linked to features of pitch and the association of a particular tonal sequence with the performance genre. Additionally, it appears that speakers and listeners attend to intonational structures larger than the *intonation unit* (see Section 1.4 below) to distinguish genre and, ultimately, the interactive function of two distinct speech acts.

1.2 The data

The two monologues analyzed here come from a single recording of Ahtna made in 1982 by Martha Jackson with linguist James Kari in Fairbanks.[2] Mrs. Jackson was a skilled storyteller and a respected elder in the Ahtna community. She was known as a *kuy'aa* 'female chief', a role in which she was responsible for upholding cultural practices (James Kari, p.c.). As mentioned above, the monologues are of different genres, and it is immediately apparent upon hearing the recording that the two narratives are of markedly distinct prosody. For this article I take each story to be representative of its respective genre.

The first story is a rendition of *Bac'its'aadi* 'the one who is highly regarded', a traditional moralistic narrative known colloquially as the 'salmon boy' story. The story is part of the inherited oral culture of the Ahtna, and is a locally well-known piece of folklore that serves to instruct listeners, especially children, in proper modes of behavior. In the story, a boy is disrespectful to the remains of the salmon catch, and is himself turned into a salmon, destined to return each year to be caught by his kinsmen. The rendition of *Bac'its'aadi* falls into the category of oral performance (Hymes 1981) or ritualized performance (Chafe 1981, 1993b; Du Bois 1986), and while the story is not necessarily religious or ceremonial in nature, one has the impression from prosody alone that Mrs. Jackson has told the story before (see also Woodbury 1985, 1987 on rhetorical structure, performance, and prosody in another Alaskan language). She sounds practiced: the intonation is regular and repeating, and the tempo is rhythmic. Words seem to come in short, regularly paced spurts with few false starts and little repair. The recording is not completely free of prosodic variety in the way Chafe (1981, 1993b) describes for Seneca ritual speech, but Mrs. Jackson does exhibit a degree of intonational and temporal regularity that is not usually found in informal speech.[3] An excerpt of *Bac'its'aadi* is found in (1). The transcription here and in example (2) below is based on prosody — rather than on, say, clauses or some other syntactic criteria — according to the methodology discussed in Section 1.4 below. Details about transcription and translation conventions, as well as a link to an online sound file, are found in the Appendix.

(1) (*Bac'its'aadi*, 00:21.075–01:15.640. Speaker: Martha Jackson)

1 *Yeni^dan'a nahwghol`nicde 'a`dii.*
'I will tell an old-time story now.'

2 *Łuk^'ae,*
(2.4)

3 *'adii Bac'its'^aadi kon`iiyi gha nahwghol`nicde.*
'I will tell the story of the salmon that is called *Bac'its'aadi*, 'the one that is highly regarded."

(2.7)
4 *Yeni^daa_ł-,*
5 *łuk^’ae,*
(2.2)
6 *koht^’aenen,*
(2.0)
7 *!koht^’aene tsaa,*
(0.6)
8 *^tsaa xu nate`daasen.*
‘Anciently the salmon man was going back and forth to the cache.’
(1.5)
9 *’U^dii na^keyteł’`aas `tsaa.*
(5.9)
10 *Tsaa t’aa ^ba’ nalyaes.*
‘All the time they were sending him to the cache; he was bringing dry fish from the cache.’
(1.6)
11 *^Ba’ nal`yaes su.*
‘He was bringing back dry fish.’
(1.5)
12 *Cu ^taaxu nates`dyaayi łu.*
(1.4)
13 *Hwt’ae’,*
(0.6)
14 *°uk’edi`ghae’ł u^kol.*
‘He went there again for the third time, there was no one, he was gone.’
(0.3)
15 *Kiic’a’ tez^yaayi_ł-.*
(1.3)
16 *Łtcen`tsaa ^t’aa łu’.*
(0.4)
17 *K’ay’° u^k’ay’ ## udat^cezi yaen’ dat`satnini`’ax.*
‘They went away from him, and there in the log cache, it was full of bundles (of dried fish) tied with willows.’
(1.8)
18 *Koht^’aene_łdu’ u’eł kust`na’ ’oox.*
‘But the (salmon) man had disappeared out there.’
(0.4)
19 *!Dina`c’iighił^taen dae’.*
(0.2)
20 *Dae’,*

(0.8)
21 *dina`c'iighił^taen dae'.*
'Someone had put him inside (the dipnet), thus someone had put him back inside.'
(1.3)
22 *Łuk^'ae yuyuz`niic.*
'Thus the salmon had taken him (back into the water).'

The second story under consideration is an example of expository discourse. *Tikeyaasde* 'when they go out' is an ethnohistorical description of traditional girls' puberty rites. This monologue is less of a recitation and more of a prompted monologue about the sequestration of Ahtna girls upon menarche. That *Tikeyaasde* is conversational in nature is reflected in the colloquial prosody, which sounds less constrained and more innovative and varied than that of *Bac'its'aadi*. Spurts, which are impressionistically longer than those in *Bac'its'aadi*, are of irregular length and come at irregular intervals. False starts and repair tactics are common. The sense here is that the monologue is "off the cuff", created on the fly in response to a question. The telling of *Tikeyaasde* requires no less expertise than that of *Bac'its'aadi*, but the latter requires an element of performance that the former does not. In *Bac'its'aadi* Mrs. Jackson reveals her skills as a storyteller, while in *Tikeyaasde* she shows her position as a bearer of knowledge about Ahtna life-cycle rituals. An excerpt from *Tikeyaasde* is found in (2).

(2) (*Tikeyaasde*, 06:35.920–06:58.300. Speaker: Martha Jackson)
53 *Sna^kaey kaka`dzet tike`yaas de.*
'When children have reached the time (of puberty) they go out.'
(0.5)
54 *Ał^ts'en:,*
(0.9)
55 *ałts'eni u^k'edi yi'* (0.3) *ku'eł nahwde`zet den,*
(1.2)
56 *yi tihghi^yaas: ts'u`tsaede.*
'When they had reached 15 years of age, they would go out, anciently.'
(2.0)
57 *Tike^yaa:s ba`'aaxe.*
'They would go out nearby.'
(3.6)
58 *Tsi^kał kugha_l`tsiis.*
(0.2)
59 *Cu tsi^c'uudze % 'l`tsiis,*
(0.5)
60 *!tsi^kał hwt'e' u'dighi`'a'.*

'A hood was made for them and a hat was made, the hood was called head-*kał*.'

61 °*Dae' xu^k'e,*
(0.3)
62 *uk'e ^hwt'ae',*°
(2.0)
63 *del`zaay' xu^k'et,*
(1.9)
64 *`hwt'e' del`zaay' xu^k'et del°nen.*°
'In this way on them, on her really, were rattles, rattling objects were placed on them.'
(0.8)
65 *Kii 'eł ti^yaas łdu' ba`'aaxe hwt'e de^lzaay' xu' t'ae,*
(0.9)
66 *kedahwdat^nesi gha % kiighi`siin'.*
'As they went out with these to the outdoors they fixed the rattles to be heard.'
67 *^Yiin ^del-,*
(0.7)
68 *xuni'dat^'aas dze'.*
'They were put on them.'
(1.0)
69 *^Yuu:ghe 'ele' kanał`'aen,*
70 *yuugh kunał^'aeni `yii c'a `'uyeh.*
'They did not look about, for them to look about was a no-no.'

1.3 Previous work on prosody in Ahtna and neighboring Dena'ina

We already have considerable understanding of word-level prosody in Ahtna, which is discussed summarily in Tuttle (2008). Closure duration for stops and affricates has been found to vary according to morphological position in the Ahtna verb template, with longer segments at the left edge of main and incorporated stems, and directly to the right of incorporated stems (Tuttle 2002, 2008). Spontaneous discourse data has shown that stress and intonation are distinct in Ahtna: while stressed vowels were found to be longer than unstressed vowels, they were not differentiated by higher or lower pitch. Tuttle did not find a significant length difference for stem vowels in (intonational) phrase-final vs. non-phrase-final position, but these syllables did exhibit significantly lower pitch (Tuttle 2003, 2008).

Recent work by Tuttle & Lovick (2007) moves above the word and undertakes to describe the discourse-level acoustic correlates of "narrative units" in Dena'ina, Ahtna's nearest genetic and geographic neighbor. They found rhyme lengthening and lowered F0 at the ends of units, and their findings suggest a relationship between the occurrence of a pause and unit boundary. No similar study of discourse-level prosody has yet been made for Ahtna.

1.4 Methodology

My underlying assumption is that while prosody is communicative in function and ultimately a perceptual matter, the tools of laboratory phonetics can help us understand the factors that contribute to our perception of the subtleties of the speech signal. Hence the approach here combines perceptual observation with acoustic measurements and quantitative analysis.

Before measurements can be taken and analyzed, however, the speech stream needs to be divided into units for coding purposes. The subdivision of the data here is based on the notion of the *intonation unit* (henceforth IU), which for several decades has been recognized as an analytical tool for studying the ebb and flow of discourse. Early research by Chafe (1979, 1987, 1993a, 1994) showed the IU to be the locus for analysis of the relative cognitive activation state of referents and the level at which certain kinds of linguistic information are presented in discourse for ease of processing. Later work on the IU located it as, among other things, the basic unit for dialogic engagement and syntactic resonance (Du Bois 2001, 2007), the site of interlinguistic code-switching (Shenk 2006), and the basis for turn-taking sequences in interactional communication (Ford *et al.* 2002).

The IU is a discourse-level linguistic unit fundamentally defined by prosodic rather than syntactic or semantic characteristics. It follows, then, that the precise acoustic and perceptual cues that shape IUs need to be carefully defined for a given language. Chafe (1979, 1987, 1993a, 1994) laid the groundwork for the study of the acoustic and perceptual characteristics of English IUs, which include changes in pitch and duration, changes in intensity (e.g., loudness), patterns of pausing, changes in voice quality, and changes in speaker turn. Later work by Schuetze-Coburn *et al.* (1991), Schuetze-Coburn (1994), Du Bois *et al.* (1992, 1993), and Du Bois (2006, 2008) built on Chafe's foundation to develop a systematized method for identifying and transcribing IUs, referred to as *Discourse Transcription* (henceforth DT). DT has been applied to other languages, and we now have descriptions and analyses of IUs in Korean (e.g., Kim 1996; Park 2002), German (e.g., Schuetze-Coburn 1994), Japanese (e.g., Matsumoto 2000), Mandarin (e.g., Iwasaki & Tao 1993), Dolakhā Newar (Genetti & Slater 2004), Ahtna and Coast Tsimshian (Mulder & Berez in preparation), and Wardaman (Croft 2007), to name but a few.

Du Bois (2006) provides a series of perceptual cues that can be used in concert to diagnose the presence of IUs in connected speech. The cues are grouped into

Table 1. Intonation unit cues (after Du Bois 2006)

Cue	Locus	Definition
Lag	Boundary	Tempo lag or prosodic (non-lexical) lengthening
Rush	Boundary	Rapid tempo in unstressed syllables
Boundary Tone	Boundary	Boundary (non-)continuity tone
Pitch Reset	Boundary	Noticeable pitch change resulting in return to baseline
Pause	Boundary	Absence of speech by discourse participants
Breath	Boundary	Audible inhalation
Tune	Unit	Coherent intonation contour perceived as a holistic gestalt for the IU
Isotony	Unit	Repeated intonation contour across sequence of intonation units
Accent Count	Unit	IU size in primary accents
Register	Unit	Overall shift in pitch or amplitude

two loci. Those that indicate where one IU ends and another begins are called, appropriately, *boundary cues*, while those that describe the units themselves are called *unit cues*. It should be noted that although the term *IU* implies that units are based solely on intonation or pitch, in reality IUs are prosodic units, identified by cues based on features of timing (e.g., duration) as well as those of pitch.[4] The cues are summarized in Table 1.

Boundary cues are about "minding the gap": they tell us where in the speech stream IUs are by helping to identify where the IUs are not. The unit cues, on the other hand, concern the stuff of the IUs themselves — the prosodic features that take place between the beginning and ending boundaries. In practice researchers usually look for the former in order to study the latter, but in cases where the boundary cues are ambiguous, the unit cues can be invoked. The cues together present an especially powerful heuristic for identifying IU boundaries, although Du Bois takes care to note that IUs are "characterized by prototype structure, in which some (prototypical) exemplars are marked by a full complement of well-defined cues. Some [IUs] have weaker boundaries, marked by a reduced complement of cues" (2008: 10). With training a researcher can become adept in identifying IUs, including those without the full set of cues, even in languages other than her own. For Ahtna, the cues that tend to cluster at IU boundaries are *rush*, *pitch reset*, and *pause* (Mulder & Berez in preparation).

After verifying the original transcripts of both texts with speakers of Ahtna, I retranscribed them according to the DT framework. My adaptations resulted in 143 IUs, the corresponding sound streams of which were then coded for a range of variables. These include duration in milliseconds (ms.), length in syllables, and boundary tone.[5] Using a waveform in conjunction with a time-aligned spectrogram, the 866 individual syllables were coded for (among others) rhyme duration (including non-modal phase) in ms., position in IU, length of the nuclear vowel, morpheme type, and fundamental frequency in 10 millisecond intervals over the sonorous portion of the rhyme. Rhyme duration was calculated from the beginning of the nuclear vowel until the onset of the next syllable (in cases with no following pause) or until the end of non-modal phonation (in cases with a following pause). It is understood for this article that references to syllable duration and fundamental frequency measurements refer to the rhyme and the sonorous portion of the rhyme respectively. Pauses over 100 ms. were coded for duration and position. Statistical analysis on the database of more than 30,000 data points was done with R 2.8.0 (R Development Core Team 2008).

Below I present the findings, divided for ease of presentation into discussions of first temporal features and then pitch features. In Section 2 I discuss the differences between the temporal features of intonation across the two genres. These include IU length and duration, the distribution and duration of pauses, and intra-IU syllable pacing. In Section 3 I discuss the differences in features related to pitch, including pitch reset, the linking of IUs into larger units based on the pitch found at the boundaries of IUs, and the identification of a particular intonation contour that is pragmatically marked for oral performance. Section 4 contains concluding remarks.

2. Looking for genre differences in temporal features

2.1 IU duration and length

I begin the discussion of temporal features with one of the impressionistically salient differences in rhythm between the two stories, that of overall "size" of IUs. The perception is that the IUs in *Tikeyaasde* sound somehow longer than those in *Bac'its'aadi*, either in length (the number of syllables uttered) or in duration (the span of time across which IUs were spoken).

Acoustic measurement shows that this is in fact not the case: Mrs. Jackson uses neither IU length nor duration to mark a difference in genre. Figure 1 shows box plots of the lengths and durations of IUs in each story.

As for IU length in syllables, a *U*-test shows no significant difference between the median for *Bac'its'aadi* (5.5, $IQR = 4$) and the median for *Tikeyaasde* (6, $IQR = 5$) ($W = 2253$, $p = 0.6367$). Likewise, a *U*-test shows no significant difference between the median duration in ms. of *Bac'its'aadi* (1286, $IQR = 839$) and that of *Tikeyaasde* (1320, $IQR = 1215$) ($W = 2392$, $p = 0.9115$). Despite what our ears may tell us, IU length and duration are not being used to mark a difference in genre.

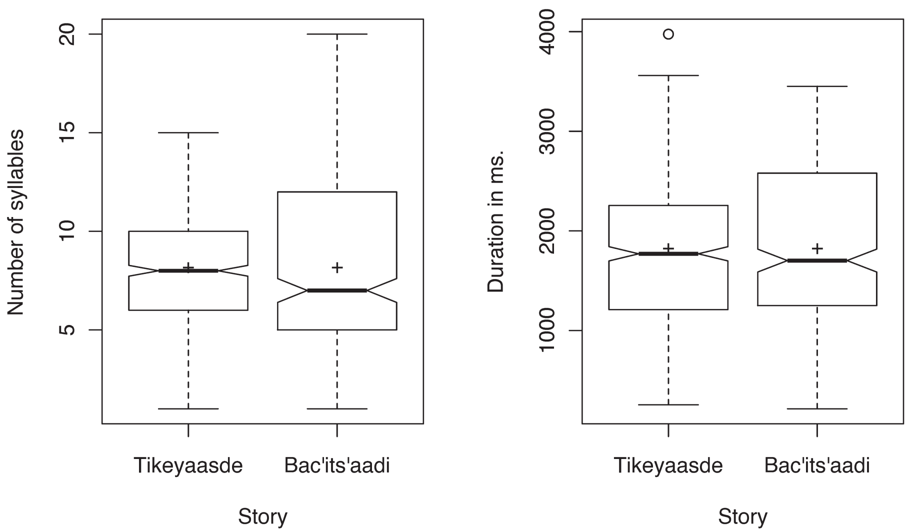

Figure 1. IU Length in syllables (left) and duration in ms. (right)[6]

2.2 Pause distribution and duration

The Ahtna data exhibits an overwhelming tendency for pauses to occur between the boundaries of two IUs. Across both stories, only four of the 126 measurable pauses occur IU-internally. With such a high correlation of pause to IU boundary, the distribution of pauses is not expected to vary between genres. There are simply not enough non-boundary pauses in the data to even potentially cause a perceptual difference (which a chi-square test for independence confirms: $\chi^2 = 0.6459$, $df = 1$, $p = 0.4216$).

The uniform distribution of pauses does not rule out the possibility that a difference exists in pause duration between the two stories, but a *t*-test shows no significant difference between mean pause length in *Bac'its'aadi* (1079 ms., $sd = 683$) and mean pause length in *Tikeyaasde* (1103 ms., $sd = 777$) ($t = 0.222$, $df = 102.2$, $p = 0.824$).[7] Neither pause distribution nor pause duration marks a difference in genre.

2.3 Intra-IU syllable pacing, or lag/rush

Intra-IU syllable pacing is a function of the relative durations of the individual syllables that make up an IU and corresponds to the cues of *lag* and *rush* in Table 1. The expectation is that syllables earlier in an IU will display quickening or shortened duration, and those later in an IU will display slowing or lengthened duration. Perceptually, the change in tempo is often the clearest evidence of an IU boundary in English in the absence of a pause.

A bird's-eye view of syllable pacing in the entire data set is shown in Figure 2. The graph is read as follows: each panel represents all IUs of a particular length greater than one syllable, i.e., all two-syllable IUs in the lower left panel, all three-syllable IUs in the next panel to the right, etc. The *x*-axes show the linear position of each plotted syllable as a discrete value calculated from the end of the IU, and the *y*-axes show syllable duration in milliseconds. In other words, in the lower left panel, the first column of points shows the durations of all the first syllables in all two-syllable IUs in the dataset, and the second column shows the durations of all the second syllables in all two-syllable IUs in the dataset (likewise, the columns of points in the lower right panel show the durations of all the first, second, third, fourth, and fifth syllables, from left to right, in all five-syllable IUs). Each panel is summarized with a nonparametric smoother.

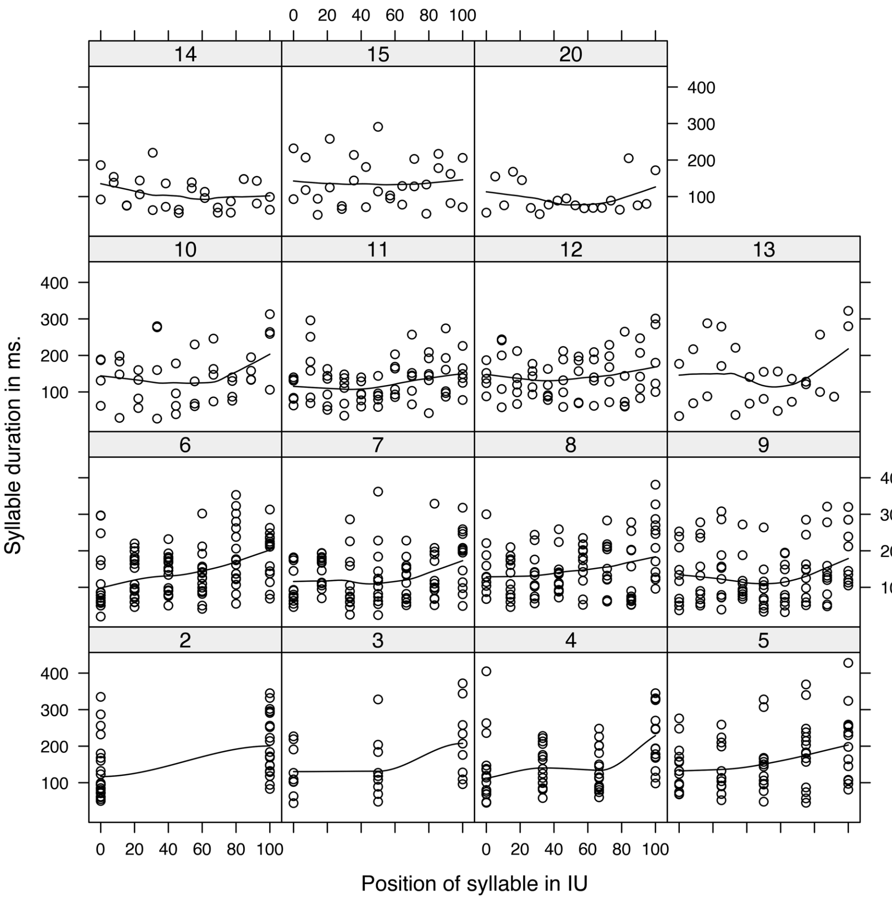

Figure 2. Syllable duration in ms. by position in IU, plotted for all values of IU length, both stories

With the exception of the longest IU lengths, i.e., fourteen to twenty syllables, the Ahtna data clearly display lag: syllable durations lengthen toward the end of IUs. The weakened effect in the longer IUs is an expected limitation of breathing as the speaker tries to finish the utterance before running out of breath. Note that the data do not show rush consistently in IU-initial position; I do not investigate that topic further here.

Caution must of course be heeded when simply considering raw syllable duration values. In addition to genre as a variable that possibly influences syllable pacing, there are language-specific confounds in Ahtna that may interfere with an accurate representation. Lag/rush is a multifactorial matter, and so the confounds that are particular to Ahtna phonology, morphology, and syntax must be taken into account.

The first potential confound is phonemic vowel length. Ahtna vowels are contrastive for length: /i, e, a, o, u/ contrast respectively with /iː, æ, aː, oː, uː/. Unstressed short vowels are realized as [ə], giving rise to a three-way phonemic and phonetic length distinction of reduced vs. short vs. long.

The second potential confound is morpheme type, which can affect syllable duration in two ways. First, within Ahtna's fusional polysynthetic verb, certain morphemes have already been shown to be generally more prosodically prominent than others. Stem morphemes, which occur at the far right edge of the verb save very limited suffixation, are known in Athabascan languages to be phonetically prominent. Tuttle shows Ahtna stem-initial consonants to be longer than those in prefixes or suffixes, and stem syllables are usually the main stress domain of the word. Morphemes in pre-final positions (referred to in Athabascanist literature as the *disjunct* and *conjunct* prefixes) are generally of weaker prominence than those in final position, where stems are most expected to reside (Tuttle 2002, 2008).

The second potential effect of morpheme type is distributional. Ahtna's canonical verb-final word order and its stem-final verbs may conspire to locate prominent syllables at the ends of IUs. However, as we see in Table 2, a simple text

Table 2. Morphemes in IU-penult and -final positions

	Penult	**Final**
Verb stems	**23**	**41**
Non-verb stems	**66**	**48**
Disjunct verb prefix	4	2
Conjunct verb prefix	39	0
Verb suffix	2	10
Other	21	36
Total	**89**	**89**

count shows that while stems are the most frequent morpheme type to occur IU-finally in the Ahtna data, the morpheme in both penult and final position is in fact likelier to be something other than a stem.

Fortunately, statistical methods allow us to account for multiple contributing variables. To gain insight into syllable durations in light of the potential confounds of vowel length, morpheme type, and genre, an ANOVA was performed with the log of syllable duration as the dependent variable, and STORY, PHONEMIC LENGTH of the nuclear vowel, syllable POSITION as a discrete value from the end of the IU, and MORPHEME TYPE as independent variables. None of the three-way interactions were significant, nor were some of the two-way interactions. Non-significant interactions were removed stepwise from the model. The data met all relevant assumptions of the ANOVA.

The results of the ANOVA are highly significant ($p < 0.001$) and explain 40% of the variance in the data (adjusted $R^2 = 0.4005$; $F = 27.05$; $df_1 = 22$; $df_2 = 836$; $p < 0.001$). The results for the predictors remaining in the final minimal adequate model are summarized in Table 3.

Summarily, final syllables are longer in duration than those in other positions, and syllables in *Tikeyaasde* are slightly longer than those in *Bac'its'aadi*. Neither outcome is *ipso facto* however; rather, the interactions between variables contribute meaningfully to intra-IU syllable pacing. I discuss these interactions in turn below.

The interaction between PHONEMIC LENGTH and POSITION has a significant effect on syllable duration: syllables with nuclear vowels of all three lengths are of longer duration at later positions in the IU than in earlier positions. Figure 3 shows the interaction. Each panel shows all syllables of a particular length of nuclear vowel (reduced, short, and long). The *y*-axis shows the log of syllable duration. The *x*-axes are identical to those of Figure 2 above.

Table 3. ANOVA results

Predictor	*F*	*df*	*p*	η^2
STORY	14.28	1	<0.001	0.018
PHONEMIC LENGTH	6.23	2	<0.001	0.015
POSITION	0.00	1	0.002	<0.001
MORPHEME TYPE	0.13	4	0.980	<0.001
PHONEMIC LENGTH:POSITION	4.38	2	0.013	0.010
PHONEMIC LENGTH:MORPHEME TYPE	2.44	8	0.013	0.023
POSITION:MORPHEME TYPE	2.40	4	0.048	0.011

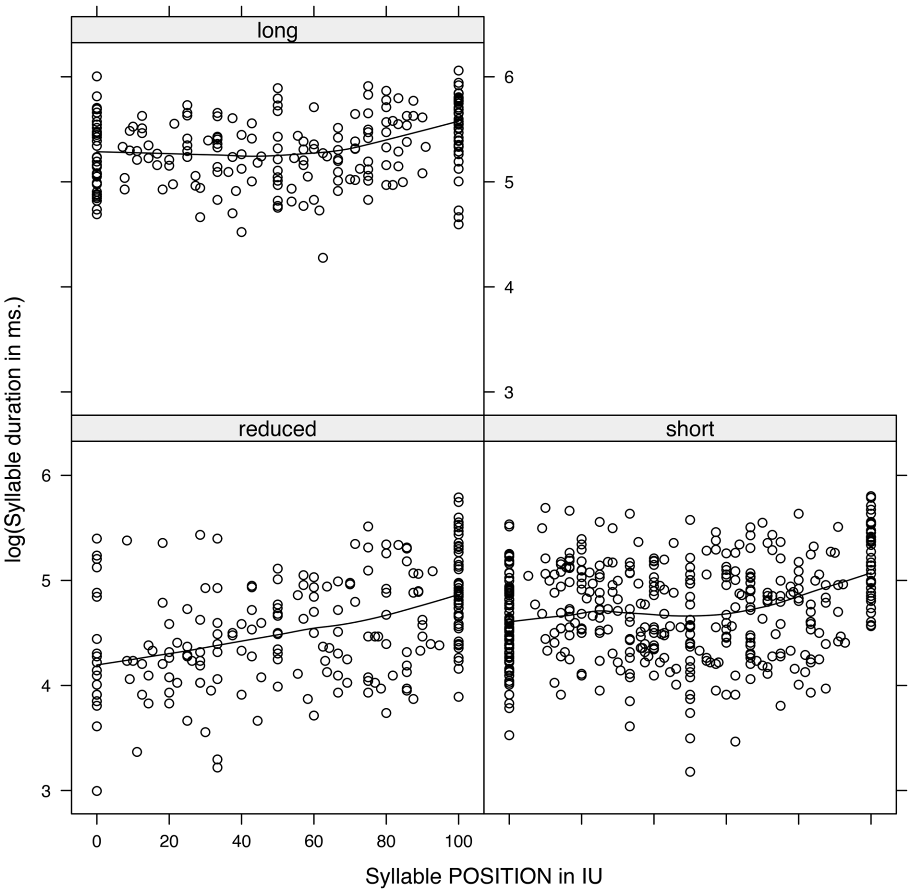

Figure 3. Syllable duration by POSITION and PHONEMIC LENGTH, both stories

Table 4. Means of log(syllable duration) by vowel length and morpheme type

	Conjunct (Conj)			**Disjunct (Disj)**			**Stem**		
	mean	***sd***	***n***	**mean**	***sd***	***n***	**mean**	***sd***	***n***
Reduced	4.68	0.5	43	4.35	0.4	33	5.40	0.3	6
Short	4.80	0.4	64	4.67	0.4	57	5.15	0.4	28
Long	5.33	NA	1	5.28	0.3	16	5.42	0.3	73

	Verb suffix (Vsfx)			**Other**		
	mean	***sd***	***n***	**mean**	***sd***	***n***
Reduced	4.45	0.6	9	4.54	0.5	119
Short	4.69	0.8	15	4.67	0.5	267
Long	5.89	NA	1	5.29	0.3	134

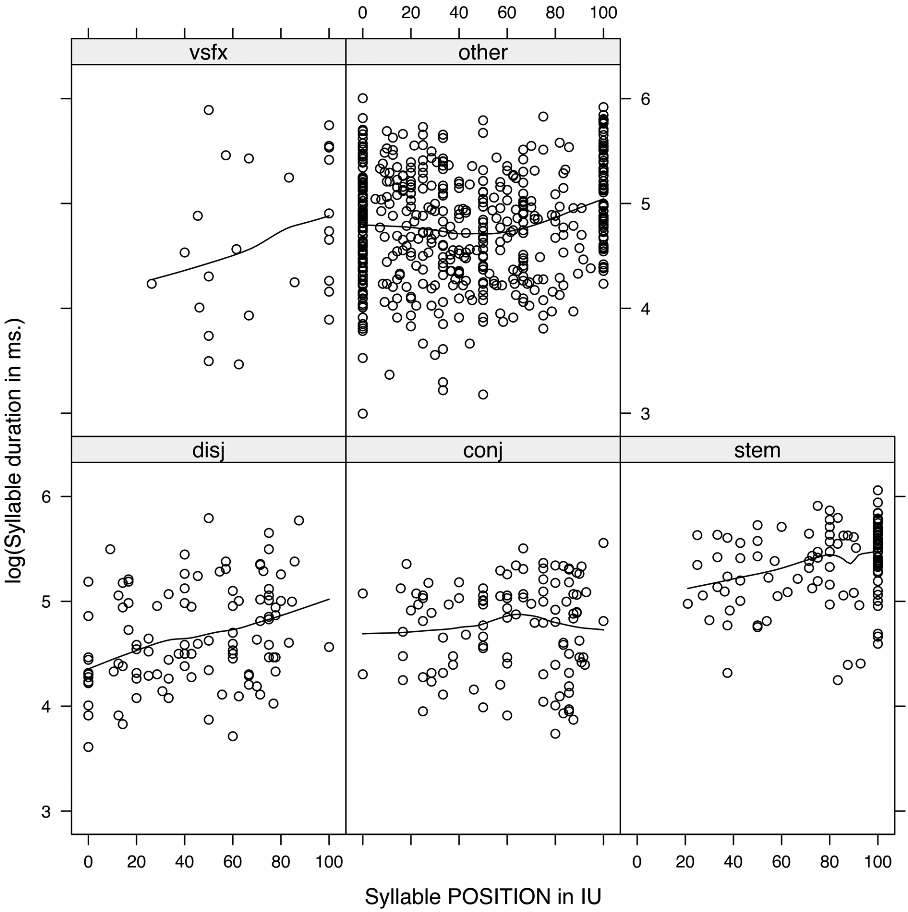

Figure 4. Syllable duration by POSITION and MORPHEME TYPE, both stories

The interaction between POSITION and MORPHEME TYPE also has a significant effect on its duration, shown in Figure 4.

With the exception of conjunct morphemes, all morpheme types are of significantly longer duration towards the end of the IU. The downward slope of the nonparametric smoother in the conjunct panel of Figure 4 can be explained by the presence of only two data points in the final position of an IU. In both cases these were truncated IUs in which Mrs. Jackson abandoned her intonation contour and began again.

The interaction between PHONEMIC LENGTH and MORPHEME TYPE also significantly affects syllable duration, as shown in Figure 5.

The noteworthy morpheme types are the stems, in which short nuclear vowel syllables are of shorter duration than reduced vowel syllables, and verb suffixes, for

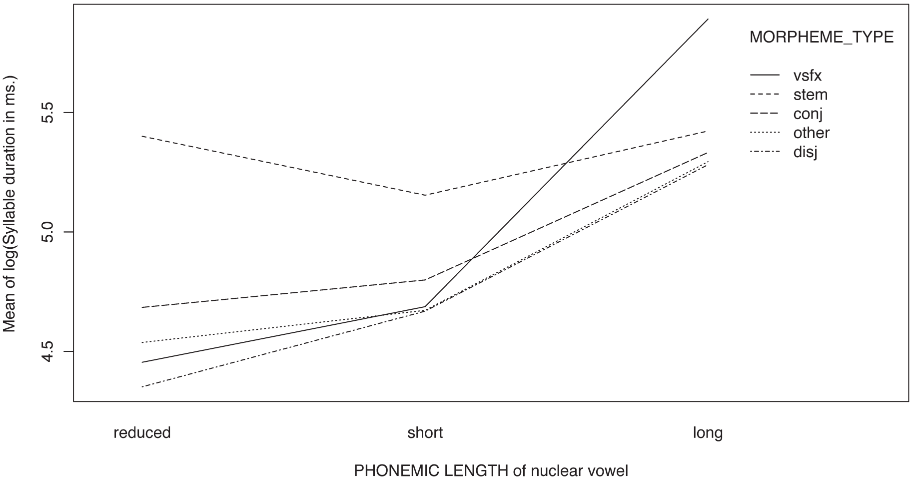

Figure 5. Syllable duration by PHONEMIC LENGTH and MORPHEME TYPE, both stories

which the single case of a long nuclear vowel is very much longer than long vowels in other morpheme types. This interaction showed the greatest effect size of all predictors, nearly twice as great as that of the other two interactions.

STORY is the final independent variable to be analyzed for its effect on intra-IU syllable pacing, which is shown in the box plot in Figure 6.

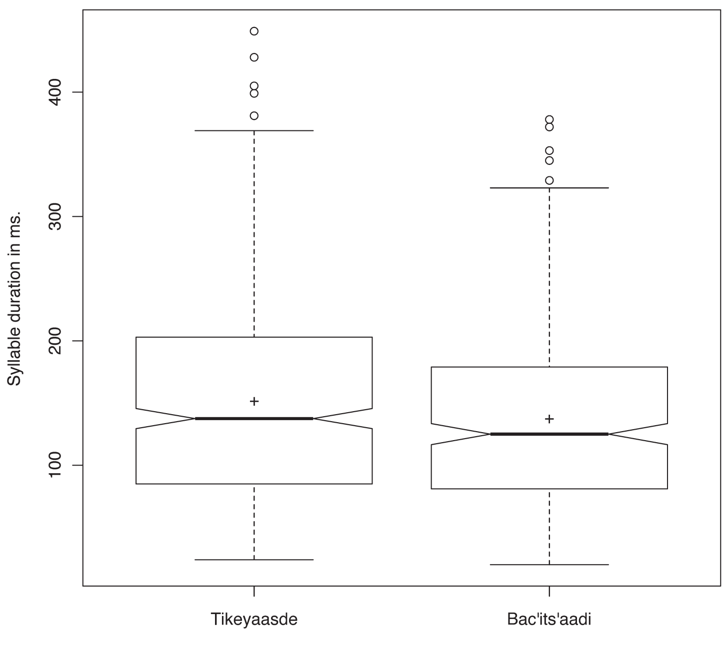

Figure 6. Syllable duration by STORY

The mean syllable duration for *Tikeyaasde* is 151.4 ms. (*sd* = 80) and the mean syllable duration for *Bac'its'aadi* is 137.1 ms. (*sd* = 70). Story has a significant effect on syllable duration, although the effect size is not very big.

2.4 Interim summary of temporal features

An examination of the temporal features of Ahtna intonation units shows that most of the features considered here do not vary by genre. Despite impressions to the contrary, mean IU duration in ms. and length in syllables do not serve to distinguish genre; nor do the distribution of pauses or pause duration. Intra-IU syllable pacing exhibits a small but statistically significant difference between narratives. Interactions between three of the independent variables (phonemic length by position, morpheme type by position, and phonemic length by morpheme type) have marginally significant effects on syllable duration.

3. Looking for genre differences in pitch features

The results thus far, while providing a description of the temporal features of Ahtna intonation, do not yet satisfactorily answer the question of how Mrs. Jackson is using prosody to differentiate between genres. A more rewarding explanation is found in the pitch-related features of intonation, which include pitch reset, boundary tones, and larger intonational chaining.

3.1 Pitch reset

Du Bois (2006) defines the boundary cue of *pitch reset* as a return to a "baseline pitch." Perceptually, however, pitch reset manifests as a change in pitch between two adjacent syllables, either upward or downward, that sounds like a larger excursion than the series of changes between pairs of adjacent syllables immediately preceding or following it.

Before looking specifically at resets, let me briefly consider pitch transitions in general. I compared transitions between the mean value of F0 in Hz in all adjacent syllables. The mean pitch transition across the entire data set is −0.024 Hz (*sd* = 17.4). I found no difference in mean adjacent-syllable pitch transition distance between the two stories. The mean transition is −0.072 (*sd* = 18) for *Bac'its'aadi* and −0.076 (*sd* = 17) for *Tikeyaasde.* A *U*-test shows their medians to be identical.

Since mean syllable-to-syllable pitch transitions do not vary across stories, let us examine more closely where the largest of those — the resets — fall in the discourse. Figure 7 and Figure 8 show a timeline of all adjacent-syllable pitch changes for the entire data set by story.

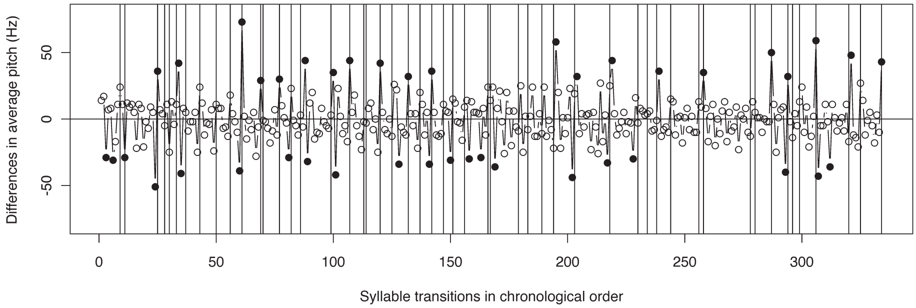

Figure 7. Differences in average pitch in adjacent syllables, *Bac'its'aadi*

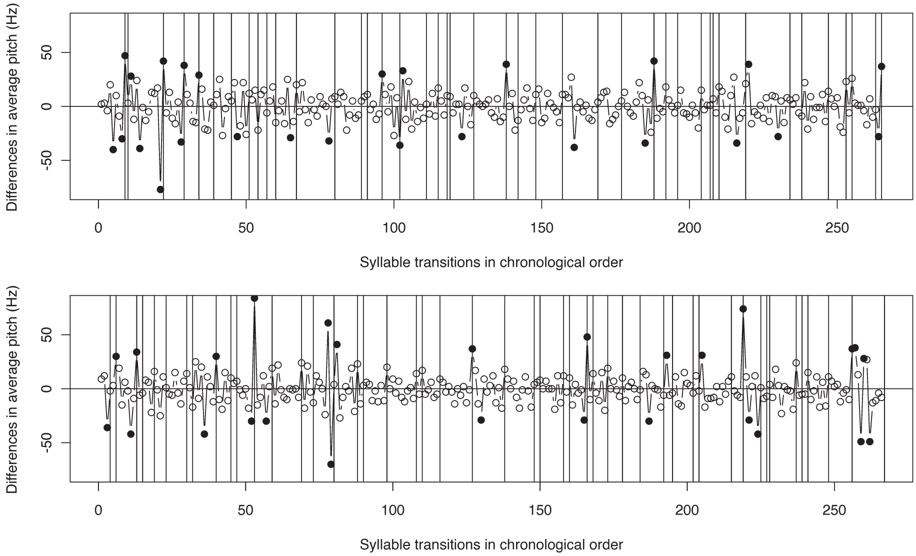

Figure 8. Differences in average pitch in adjacent syllables, *Tikeyaasde* (first half: upper; second half: lower)

The *x*-axes in these figures show chronological ordering of syllable transitions. The *y*-axes show a scale indicating an upward (positive) or downward (negative) difference between two adjacent syllables' mean pitch in Hz (note that the *y*-axes do **not** show F0 values). Plotted points represent the value of the difference in pitch from one syllable to the next: those above the horizontal line represent an upward shift in pitch (i.e., a syllable with higher pitch than the previous one), while those below the horizontal line represent a downward shift in pitch. Darkened points represent the upper 5% of all pitch changes. These are the most extreme pitch excursions, which here I take to be the resets. Vertical lines represent IU boundaries.

It is immediately apparent on visual inspection that the majority of pitch resets occur within one syllable of an IU boundary. In fact, 61 of 89 resets are marking

IU boundaries, a significant majority at $p < 0.001$ ($\chi^2 = 12.23$, $df = 1$). The figures also reveal that pitch reset varies between the two stories: the density of darkened points in *Bac'its'aadi* (31 out of 52 IU boundaries) is greater than the density of darkened points in *Tikeyaasde* (30 out of 91). A chi-square test for independence shows the difference to be significant ($\chi^2 = 8.55$, $df = 1$, $p = 0.003$). These findings confirm the validity of pitch reset as an IU boundary cue for Ahtna, since they preferably occur at the edge of IUs. Furthermore, the distribution of pitch reset is a distinguishing characteristic between the two stories.

3.2 Boundary tones and intonational chaining

Pitch reset is of course not an independently occurring phenomenon. Rather, it is a relic of either a low final fall or a high final rise at the end of an IU, and as such reset is tied to larger prosodic phrasing that goes beyond the scope of individual units. Speakers neither conceive of nor produce IUs in isolation; instead, IUs typically occur as links in larger chains defined by the nature of the intonation at the end of each IU. Any number of IUs with non-final intonation link together until the chain is ended by an IU with final intonation.[8]

This intonational chaining is implicit in DT methodology in the transcription of *boundary tones*. Du Bois (2006) gives these tones four values: *continuative*, signaling that the next IU is projected to be a continuation of the current chain; *terminative*, signaling the speaker has reached the end of the current chain; *truncated*, signaling the abandonment of a projected intonation contour; and *appeal*, a rising intonation which in English is often, but not always, associated with questions and which can itself be either terminative or continuative. Continuative, terminative, and truncated boundary tones are found in the Ahtna data.

The pitch of terminative tone falls well below that of continuative tone, and thus one would expect that stretches of discourse with longer intonational chains would have fewer extreme pitch resets. Applying this reasoning to the Ahtna data we find that indeed the story with fewer pitch resets, *Tikeyaasde*, is the story with longer chains. The 53 IUs in *Bac'its'aadi* are distributed across 34 chains, ranging from one to five IUs in length, while the 91 IUs in *Tikeyaasde* are distributed across 43 chains of one to seven IUs in length. A *U*-test for independence shows that the difference in the allocation of IUs into larger intonational chains between the two stories is significant ($W = 909$, $p = 0.043$; *Bac'its'aadi* median = 1, $IQR = 1$; *Tikeyaasde* median = 2, $IQR = 2$). *Tikeyaasde* contains longer strings of IUs joined together by continuative boundary tone before one with terminative boundary tone than *Bac'its'aadi*, a finding that may account for the perception that prosodic units in the former are somehow longer than those in the latter. In other words, IUs are not of significantly different length or duration between the two stories, but the length of chains of multiple IUs is significantly different, and the difference is impressionistically salient.

3.3 Use of multi-peak downstep intonation

Why should *Bac'its'aadi* contain overall shorter intonational chains than *Tikeyaasde*? The answer can be found in considering intonation contour, the tonal gestalt that is realized over the duration of an IU. The stories exhibit a range of different contours, some of which can be grouped together as types according to their similar shapes (e.g., Bolinger's (1986) *profiles*). In particular I am concerned with Mrs. Jackson's frequent use of a *multi-peak downstep* intonation contour. The contour is characterized by a series of continually lessening high pitch peaks and ends near or at the bottom of the pitch range. This contour is far more frequent in *Bac'its'aadi* (nearly one in three IUs) than in *Tikeyaasde* (one in seven), and I believe the conspicuous rhythmic quality of the rendition of *Bac'its'aadi* is due in no small part to the repetition of this contour.

Identifying and classifying intonation contours with any degree of certainty is challenging. Making pairwise auditory comparisons raises questions of subjectivity, as local differences in (e.g.) baseline pitch and length or duration of an IU may block recognition of a particular contour's similarity to another. Even the pitch trace visualizations available from phonetic analysis software can be difficult to interpret. Consider Figure 9, which contains pitch traces of two IUs from *Bac'its'aadi*.

Based on the traces alone it would be difficult to either group them together as two tokens of a single contour type, or to split them as instances of different types. The traces are messy: they are faithful to tiny variations in the sound stream, and even after magnifying the vertical range of the traces by shortening the graphs along their *x*-axes, it is challenging to find commonalities.

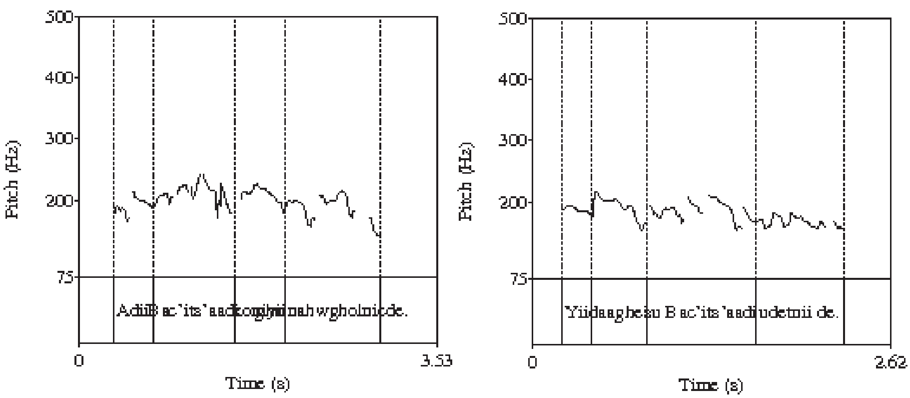

Figure 9. Pitch traces of two IUs from *Bac'its'aadi*: IU 3 (left) and IU 29 (right)

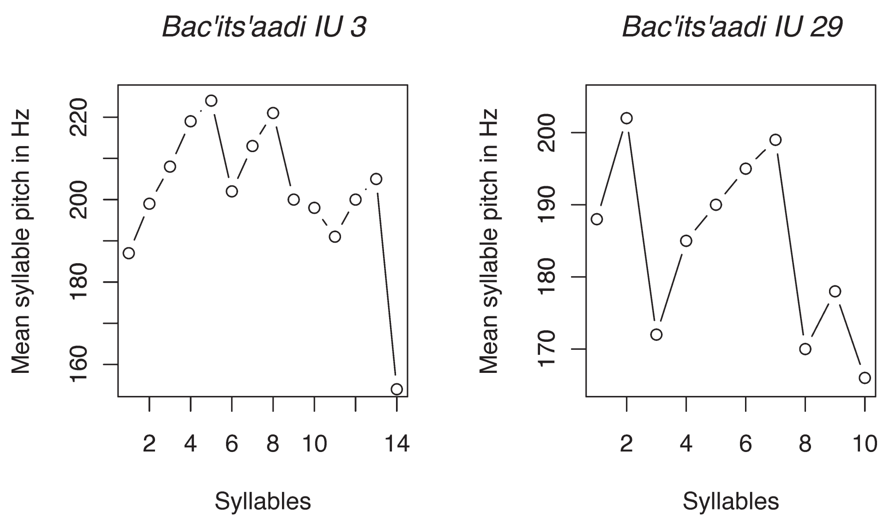

Figure 10. Abstracted pitch plots from *Bac'its'aadi*: IU 3 (left) and IU 29 (right)

To overcome these difficulties I plotted for each IU the mean pitch for each syllable in a graph containing no temporal information except sequentiality. These abstracted pitch plots allow basic contour shapes to be identified and classified. Figure 10 shows the abstraction of the two IUs from Figure 9. The IUs can now both be identified as having the multi-peak downstep contour despite the difference in their details. Listening to the clips confirms their similarity.

Inspection of all graphs shows that 15 of 53 IUs in *Bac'its'aadi* have the multi-peak downstep contour, in contrast to only 12 of 91 IUs in *Tikeyaasde*. The frequency of this contour in the traditional narrative has implications for how genre is distinguished prosodically in Ahtna. Recall that impressionistically *Bac'its'aadi* is comprised of shorter prosodic structures than *Tikeyaasde* (Section 2.1 above). I have already shown that it is not the IUs themselves, but rather the chains of IUs, that are shorter in *Bac'its'aadi*. I have also shown that pitch reset is more frequent in *Bac'its'aadi* than in *Tikeyaasde*. Now we can examine the causal relationship between chain length, pitch reset, and the multi-peak downstep intonation contour.

In fact chain length and pitch reset are inextricable from the presence of this particular contour. The contour always ends very near the bottom of the pitch range, meaning that terminative tone is inherent. As explained above, terminative tone both ends the current chain — in this case, likely to be a single link in length — and causes a following pitch reset. Here we find the clearest explanation for why the prosodic structures of the two genres sound different. The multi-peak downstep intonation contour is, in a sense, a "complete package" containing within itself a distinctive tune, a terminative boundary tone, the terminus of the current chain, and the opportunity for a following pitch reset. It is a self-contained prosodic unit, one that is salient (at least on some level) to listeners and speakers, and that functions to signal that *Bac'its'aadi* is a pragmatically marked speech act, the recitation of tribal lore.

4. Conclusion

Even in the 1970s, Crystal argued for the indexical functions of prosody, stating, "in fact the basis of most sociolinguistic distinctiveness in speech is phonological in character, and non-segmental phonological in particular" (Crystal 1975a: 97). He placed the burden of differentiating between speech varieties — including different genres — on the shoulders of the "paralinguistic" features of language, which include prosodic considerations like pitch and duration (Crystal 1974, 1975b). His (1975a) study of four genres of English liturgical speech shows that prosody is the sole feature to distinguish between them; lexis, syntax, and segmental phonology played no role in differentiating between unison prayer, individually-read liturgical prayer, biblical reading, and sermon.

Likewise, prosody in Ahtna is an important pragmatic device for marking the performance of a traditional narrative as distinct from expository discourse. By quantitatively investigating the individual IU cues that make up the DT system, I have shown to a statistically significant degree that most of the prosodic burden of distinguishing genre is carried by a particular intonation contour associated with Ahtna oral performance. This contour causes several measurable differences from expository discourse; in particular, the contour's low final fall causes both a pitch reset and a terminus of intonational chaining. These differences contribute to the salient rhythm of the oral performance as well as the impression that prosodic units in *Bac'its'aadi* are shorter than those in *Tikeyaasde*.

Finally, on a methodological note, quantitative analysis can contribute meaningfully to our understanding of complex perceptual phenomena in real-time speech. Discourse-level prosodic units are emergent, and unlike much of phonetics and segmental phonology, the variables of which they are comprised are often below the level of the conscious awareness of speakers and listeners.

Discourse prosody has been frequently inspected though a qualitative lens (e.g., Chafe 1979, 1987, 1993a, 1994; Du Bois 1986, 2007; Ford *et al.* 2002), so that quantitative analysis of individually measured prosodic features may at first appear to be an overly disjointed approach to the study of such an intricately layered and nuanced aspect of linguistic behavior. In fact prosody is a multifactorial matter and is thus fruitfully subject to statistical analysis. In the present study, it is the individual analysis of particular IU cues that **reveals** the nature of the interconnected causal relationship between the various timing- and pitch-related features. That Ahtna oral performance has "a particular tune" may be obvious to the ear, but the intertwined relationship between tonal sequence, pitch reset, and chain length is not.

Similarly, qualitative research methods can often be adapted and expanded for quantitative use: DT was developed to be a tool for the qualitative analysis of prosody, but its core principles can be operationalized for quantitative work as well. Because much of discourse-level language use is inherently multifactorial, I would encourage the continued integration of quantitative and statistical methods into discourse-functional analyses of complex and subtle questions about the nature of spontaneous speech.

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Notes

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1. Like O'Connor (1990), I take genre to encompass "Hymes's notion of discourse genre (1974), Bakhtin's notion of speech genre (the linguistic and compositional structures of utterances, seen as the product of the specific nature of the particular sphere of human activity and communcation) (1986: 60), Gumperz's notion of speech activity (1982), and Fillmore's discussion of types of discourse (1976). While each of these differ in their emphasis, if not strictly in their extension, they share the goal of characterizing the ways that grammar and lexicon are deployed in the service of larger communicative acts". (O'Connor 1990: 377–378 n3)

2. The recording, transcript and translation were generously provided by Kari. They were checked for accuracy by the author in collaboration with speakers of Ahtna.

3. An anonymous reviewer points out that perhaps *Bac'its'aadi* had been memorized by rote, and that this is the main reason for the prosodic effects. There is no indication that Mrs. Jackson memorized the story word-for-word in this way, and in fact this is not a characteristic of Ahtna storytelling in general. Storytellers are free to interpret the story lines of traditional narratives into their own words.

4. The term *intonation unit* originally comes from Chafe (1987), and here I continue the tradition of using that name although the concept of the IU has grown over the years to encompass all aspects of discourse-level prosody, not just pitch.

5. The initial approach to the data here is somewhat different from Tuttle & Lovick's (2007) study of Dena'ina narrative units. In that study, a fluent speaker with no linguistic training was asked to segment an audio recording into units. A second transcript from a published source was included that "marks both pause units and narrative units suggested by [that author's] consultant" (2007: 306). Because linguistic knowledge is procedural knowledge (e.g., Bybee 2001), much of language use lies below the level of cognitive awareness, and thus hearing converging IU cues separately from syntactic cues presumably takes training. Here the goal of studying IUs is to develop a model for the prosodic armature upon which speakers build discourse, so it is essential that intonation not be conflated with semantics or syntax in the early stages of the analysis. This is more difficult than it might seem, especially for one's native language.

6. A box-and-whisker plot (or box plot) summarizes numerical data and is read as follows: the box shows (approximately) the interquartile range; the bold horizontal line shows the median; the plus sign (+) shows the mean; the whiskers represent the smallest and largest values that are not more than 1.5 interquartile ranges away from the box; points represent outliers; notches on the sides of the boxes are a heuristic for determining significant difference such that if notches from two boxes overlap along the *y*-axis, they are not likely to show a statistically significant difference (but note that this is not diagnostic).

7. Tuttle & Lovick (2007) report a positive correlation between the duration of pause and duration of the preceding syllable. I found no such correlation for the Ahtna data ($r^2 = 0.00983$).

8. This is similar in form to Yule's (1980) notion of *minor and major paratones*, although I do not (yet) assert a relationship to speakers' topic as he does.

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Appendix: Transcription conventions (from Du Bois 2006) and glossing

17	IU number
(2.4)	Pause length in seconds
,	Continuing boundary tone

.	Terminative boundary tone
-	Truncated word
_	Linked words
:	Non-lexical segment lengthening
%	Non-lexical glottal stop
^	Primary IU accent
`	Secondary IU accent
!	Boosted primary IU accent
°	Piano speech between two instances of symbol
#	Inaudible syllable

I have chosen to provide only free translations of the Ahtna examples because word and morpheme level glosses are not relevant to the discussion of IUs here; furthermore, because Ahtna is a polysynthetic language, glosses can quickly become cumbersome to the reader and may obscure transcription conventions. Free translations are provided at points in the transcript at which a reasonably non-truncated English sentence is possible. For the sake of illustration, sound files of excerpts from the data can be found at http://dx.doi.org/10.1075/fol.18.2.03ber.audio.

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