

On beginning the study of the tone system of a Dene (Athabaskan) language: Looking back

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In this paper I review the methodology that I used in beginning my early fieldwork on a tonal Athabaskan language, including preparation through reading and listening, working with speakers, organizing data, and describing and analyzing the data, stressing how these are not steps or stages, but intersect and interact with each other.

1. INTRODUCTION. Approaching the study of a tone language is, for many linguists, a daunting prospect. In this paper, I draw on my early experiences of studying a tone language to reflect on the methodology that I developed and how much of this methodology remains relevant today. In particular, I consider the fieldwork that I did in the 1970's on an Athabaskan language, the variety of North Slavey, also called Dene, spoken in Fort Good Hope, Northwest Territories, Canada; this variety is often called Hare in the literature; I will refer to it as FGH Dene.¹

Hyman (2010), in a paper on Oku, a Bantu language, outlines a three-step process for studying tone.

- Determine surface tonal contrasts by considering words in isolation.
- Discover tonal alternations by putting words together or through paradigms.
- Tonal analysis – interpretation to understand how the tone system works.

These steps provide an excellent outline for doing tonal analysis. However, they do not include the preparatory stages involved in doing research on a tone language, and some of the details of methodological issues that arise in studying tone.

In this paper, I discuss fieldwork, addressing working with speakers, organization of data, and stages of elicitation, and also the important points that Hyman discusses, description and analysis. I begin with some brief background, and then present a detailed overview of the methodology that I came to in my early encounters with studying tone, exemplifying the methods with a basic description of the tonal phonology of the language as I came to understand it, and summarizing what I learned. Many of the major points in this article are echoed in other articles in this volume, in particular see the articles by Coupe, Cruz and Woodbury, Mazaudon, and Yu, suggesting that there are some basic points to keep in mind in undertaking work on a language that one suspects might be tonal.

¹ I would like to thank Steven Bird and Larry Hyman for including me in this project, as well as the three reviewers of an earlier version of this paper for feedback that helped to better focus the work. I owe a huge debt of gratitude to the many speakers of FGH Dene whom I worked with and who guided me to an understanding of the tone system. This research is funded by my Canada Research Chair in Linguistics and Aboriginal Studies.

2. PREPARATION FOR FIELDWORK. Having decided to work on a particular language, there is considerable work to be done before beginning fieldwork. Preparation starts with reading the literature available on that language, related languages, and the general topic of investigation. (While one might think that the need for such preparation is obvious, this section is included because it is not always the case that people prepare to the extent that they could before they begin their actual fieldwork.) In terms of my first fieldwork, Fang-Kuei Li had done some work with a speaker of FGH Dene in the 1920's (Li 1929), with a paper based on Li's notes by Harry Hoijer published in the 1960's (Hoijer 1966). There was some work by Robert Howren on the dialect (Howren 1970), although his focus was more on a closely related language.²

Reading the literature on the language and related languages is extremely important in preparing to do fieldwork. At the same time, it is also essential to be careful in how the literature is used. On the one hand, it is important to take the literature seriously, as things that might initially appear to be mistaken in the literature may turn out, with more careful study, to be correct. On the other hand, the language may truly be different than it is described as being in the literature, or than closely-related varieties are described as being, and the fieldworker must be prepared for this.

When I began fieldwork, I had had no exposure to tone languages. I knew from the literature that FGH Dene had tones, and I thus felt that part of my preparation should include listening to tones. I spent many hours listening to the tapes that accompanied the 1968 *Manual of Articulatory Phonetics* by William Smalley in order to tune my ear to hearing tones. This was particularly important at the time that I began this work in the 1970's as we did not have the tools for phonetic analysis then that are so readily available today, nor did we have access to recordings of many languages on the internet. Today it is advisable to prepare in a different and more systematic way. First, beyond reading, it may well be possible to listen to recordings in the language on the internet. Second, it is valuable to know how to use tools such as Praat (Boersman and Weenick 2013) so that it becomes possible to rely on the high quality tools that are now available for acoustic analysis as well as on the ear.

3. AN OVERVIEW OF THE METHODS. In early exposure to a tone language, it is critical to learn to distinguish the tones of the language. I did this through listening; as noted above, today there are many other ways, including instrumental analysis, to become comfortable with a tone system.

My earliest work on FGH Dene was with someone from Fort Good Hope who lived in Toronto, where I was studying. He had not spoken the language for some time, but nevertheless this experience was invaluable for getting acquainted with the sound system, learning some vocabulary, receiving some exposure to the morphology, and so on. Thus when I began intensive fieldwork, I was armed with what I had learned from this preliminary fieldwork as well as from reading. Even though I had spent many hours with the speaker

² When I started fieldwork, the seminal work by Michael Krauss on the historical development of tone (Krauss 1979/2005) was not available; once I received it, it became a treasured resource, in large part because of its extensive word list. The word list in Krauss (2005) includes only nouns, but it presents an extremely helpful starting point for fieldwork on an Athabaskan language.

in Toronto and with the Smalley tapes, it was nevertheless important to tune my ear to the language, especially with respect to the tones. The work that I had done told me that, for me, the tones were not straightforward to hear.

I did this tuning in two ways. For one thing, I made use of the materials available on FGH Dene and on related languages, anticipating that I would generally find regular correspondences between the tones of words in those languages and the tones of words in FGH Dene.

Many of the speakers with whom I worked with found it easy to give minimal pairs with respect to tone (e.g., *sa* ‘bear’ and *sá* ‘beaver’³) and could exaggerate the tonal differences to help me to hear the tones; they also corrected me when I said a word with the wrong tones. In terms of method, working with speakers so that they become consciously aware of the tones provides an excellent way to increase confidence about tones.

It is also important to find contexts in which contrasts between tones are maximally salient. Minimal or near minimal pairs provide one type of contrast. Another context that is useful for identifying tones involves structures with adjacent syllables in which tones can be compared. In a language like FGH Dene, where most stems are single syllables, it was often difficult to tell what tone a noun stem in isolation had, since there was nothing to contrast it with. I searched for contexts in which it was reasonably easy to elicit nouns, and compared the tones on two syllables. For instance, the postposition *k’ε* ‘on’ has a low tone and the postposition *hé* ‘with’ has a high tone. Thus, sets such as the following were very useful, with the tone pattern indicated in the righthand column.

(1)	<i>sa</i>	‘bear’	<i>sa k’ε</i>	‘on a/the bear’	L L
			<i>sa hé</i>	‘with a/the bear’	L H
	<i>sá</i>	‘beaver’	<i>sá k’ε</i>	‘on a/the beaver’	H L
			<i>sá hé</i>	‘with a/the beaver’	H H

The use of contexts allowed me to contrast tones on adjacent syllables as well as contrasting them by looking for minimal pairs. Languages are likely to provide such contexts, although tonal morphophonemics may make them difficult to identify at first.

Just as different linguists bring different strengths to fieldwork, so do different speakers; thus working with multiple speakers when possible is important. It was easier me to distinguish the tones of some speakers than of others, and my experience and reports from other linguists suggest that it is important to become aware of whom to check tones with.

³ I follow common practice in using the standard orthography in general. The symbols <d>, <g>, <dz>, and so on are voiceless unaspirated stops and affricates; t, k, ts, and the like are voiceless aspirated, and <t’>, <k’>, <ts’> are glottalized. <sh> is a voiceless alveopalatal fricative, <j> a voiceless unaspirated alveopalatal affricate, <ch> a voiceless aspirated alveopalatal affricate, <gh> a voiced velar fricative. The raised comma is used for a glottal stop. The acute accent marks high tone; low tone is not indicated. The orthography uses the symbol <e> for a mid front lax vowel and <ə> for a mid front tense vowel, often pronounced with an on-glide in this dialect. I use <ε> for the lax vowel and <e> for the tense vowel. A hook below the vowel represents nasalization. I write final glottal stops; these are predictable, occurring following a high-toned word-final stem (the word ‘beaver’, written *sá*’ here, is *sá* in the orthography).

Listening to tonal languages as much as possible before beginning fieldwork, and continuing this during fieldwork, focusing on listening both to speakers and to recordings, aids in learning to hear tones, as with each listening, something more tends to become clear. As noted earlier, today a tool such as Praat allows one to view pitch tracks and to analyze tones, and thus serves as an aid in learning to hear the tones better. It remains important to learn to hear the tones, and not rely solely on the instrumental analysis.

Beyond learning to hear the tones, it rapidly became evident that organization of data was of the utmost importance. From my earliest fieldwork, I organized the data, and the organizing itself led me to refine strategies of hearing tones. It helped me to see what patterns existed, and where I was inconsistent or still having difficulties. The organization was straightforward in some cases, but more complex in others, as discussed below.

While a study of tones might be the goal of work, it is often impossible to understand tones on their own, without also gaining an understanding of the morphological and syntactic structures of the language. In a language such as FGH Dene, it is critical to gain a good handle on the morphology in order to fully understand the tones. In particular, the tonal morphophonemics in Dene are interesting, with a fair degree of allomorphy due to tonal patterning. In Dene, as in many languages, figuring out the allomorphy attributable to tone leads back to data gathering. The most important lesson is that data gathering, description, and analysis go hand-in-hand, each feeding the other, and I now turn to a more detailed discussion of this.⁴

4. DATA, DESCRIPTION, ANALYSIS, DATA. I knew enough about the complexity of the verb word when I began fieldwork in Fort Good Hope that it was obvious that a study of the tonal system should begin with nouns because they are relatively simple from the perspective of morphology, and I thus focus here on nouns.

Key to description and analysis is organization. I began by organizing the data into lists of noun stems with high tone and noun stems with low tone. From this organization, the need to understand the morphology became apparent. Given what I had learned and the materials that were available on nouns, I had expectations, so I began with some sense of how to organize the data. I expected two levels of tone, high and low, and this contrast was reinforced in the early days of fieldwork. A few word pairs are given in (2). These are typical nouns, being CV(C) in shape. The ‘h’ in parentheses signals that I sometimes heard this consonant, but not always; the hyphen signals that material (in this case, a possessor) must precede the noun.

(2)	Lexical tone			
	low tone		high tone	
	sa(h)	‘bear’	sá’	‘beaver’
	ya	‘sky’	yá’	‘louse’
	w’i(h)	‘mosquito’	-fi’	‘head’

⁴ Phonetic work is clearly also very helpful; as noted above, but this work was not feasible at the time that I am talking about.

When noun stems are possessed through the addition of a suffix, segmental changes are possible in some many Athabaskan languages, and, in some Athabaskan languages, tonal changes also occur. Based on the data collected by Li (1929) and discussed in Hoijer (1966), I expected some tonal changes in suffixed possessed nouns.

This background was sufficient to begin a more systematic study tone in nouns. The first step was to elicit nouns and their possessed forms. As I learned lexical items, it was important to organize them; I did this at the time by making file slips, with both non-possessed and possessed forms included whenever possible. For each noun, I included on the file slip the transcription, the meaning, the date, the person who said the word, and any questions or comments; each time I rechecked the noun, I added that information. Organization by the non-possessed form proved to be valuable, and I put slips with high-tone nouns together and slips with low-tone nouns together. (This was before we had computers with databases; the work done in sorting the 3x5 cards in a variety of ways would be done today using a database with fields including stem, possessed form, meaning, speaker, date, notes.)

Organizing the nouns was very important in raising my awareness of patterns that were present, and recognizing these patterns in turn helped in hearing the tones. The organization pointed to the fact that nouns with high tone ended in a glottal stop; a study of the nouns of the low tone set showed that they did not end with a glottal stop. Thus if a noun ended in a glottal stop in isolation, then it had a high tone and if it had a high tone, it ended in a glottal stop. It was sometimes easier to hear the glottal stops than the tones, so the presence of a glottal stop gave assurance that the surface tone on the noun stem was high. It was important to recognize the cues that were available to sorting out tone patterns. Finding the various cues, be they phonetic, phonological, or morphological, that aid in hearing the language is a valuable step in coming to understand the language.

Overall morphologically simple noun stem tones did not pose an enormous challenge once I felt reasonably confident of my ability to hear them, and of the ability of people I worked with to point out when I was wrong. Things were more challenging with morphologically complex nouns. There are a number of interesting complexities in these nouns, and once I became aware of these, it was possible to plan systematically the kind of data that was required to gain a full understanding of nominal tone. Thus, it is important to combine data gathering with analysis, with each feeding the other.

The noun stems with a high-tone suffix *-é'* that is often called the possessed noun suffix served as a good starting point. The non-possessed form of the noun is shown first in the forms in (3), followed by the possessed form (indicated by a hyphen before the noun stem, as there is an obligatory possessor preceding the noun stem, either nominal or pronominal).

- (3) noun stem + high-tone suffix *-é'*
- a. high tone stem: H + H → H H
só', *-sóné'* 'excrement'
- b. low-tone stem: L + H → H H
tu, *-túé'* 'water'
tʰu(h), *-tʰ'úlé'* 'rope'
- c. high-tone stem: H + H → H H
bá', *-báré'* 'mitts'
mí', *-mílé'* 'net'

- d. overall patterns summarized
- | | |
|------------|------------------|
| L + H → HH | cv(c), -c'v(c)v' |
| H + H → HH | c'v', -c'v(c)v' |

The noun in (3a), 'excrement', is a high-tone stem. When it is followed by a high-tone suffix, the patterning is not surprising; it is worth noting, however, that while the stem in isolation ends in a glottal stop, that glottal stop is not present when the suffix is added.

The forms in (3b), low-tone stems, introduce interesting issues with respect to the patterning of tone. The words for 'water' and 'rope' illustrate that when the high-tone suffix is attached to a low-tone stem, the stem vowel also has a high tone. Thus, before a high-tone suffix, stem tones are neutralized. In order to confirm that this was a true pattern, it was important to elicit the possessive forms of many nouns, and not draw generalizations based on only a small number of forms. In this particular case, this was quite easy, since this possessive suffix is common.

The forms for 'rope,' 'mitts,' and 'net' in (3b, c) reveal another interesting pattern. In these words, a stem-final consonant surfaces when the word is possessed, *r* in 'mitts' and *l* in 'rope' and 'net.' In the low-tone noun 'rope', this consonant surfaces as [h] or is absent if there is not a suffix. In general, while stem-final consonants neutralize to [h] when they are word-final, they show a more direct reflex of their historical form before the vowel-initial suffix. The word *t'u(h)* 'rope' illustrates this neutralization.

The words for 'mitts' and 'net' stand out. Given the patterning of low-tone stems, we might expect that the non-suffixed form of 'mitts' would be *bá(h)* and 'net' would be *mí(h)*, with an optional final [h], parallel to 'rope'. However, if a stem vowel has a high tone, then, when word-final, the stem ends phonetically in a glottal stop. Organizing the data brought out these patterns dramatically, and led me to the conclusion that the glottal stop was predictable, occurring following a high-tone vowel at the end of a word. (Other evidence is available for this conclusion as well.)

That this pattern is actually even more interesting became evident through a study of high-tone stems in more environments. In particular, stems that are consonant final (I use this phrase to mean ending in a consonant other than glottal stop) based on their possessed form and their form when they are not final in the word (i.e., when they function as a possessor or as the first member of a compound) were of particular note. The stem in (4), historically *bár* 'mitts', shows neutralization of the final consonant to [h] when it is non-final. This stem thus has three allomorphs, *bár* before a vocalic suffix, *bá'* when word-final, and *báh* when non-final. The form in (4) is a possessive structure, like those in (3), but with a nominal rather than a pronominal possessor. (There are not pronominal possessors with a lexical high tone.)

- (4) *báh-t'úlé'* 'mitt strings'

This same pattern occurs in other words. For instance, in (5), the stem 'fog' has a final glottal stop, but, when non-final, the stem ends in [h]. This suggested that this stem is consonant final, with the glottal stop in the isolation form being predictable following the high-tone vowel of the stem.

(5)	stem: final position		stem: non-final position	
a.	'á'	'fog'	'áh-shóné'	'misty rain'
b.	w'é'	'sinew'	w'éh-	'sinew', compound form

Thus, in order to understand the tonal patterns, it was important to identify the bare stem, the stem with the possessive suffix, and the stem in non-final position. Updating the data files to add this information was necessary, and this included introducing a new field and another layer of complexity. Through this process, it became evident that the following surface and underlying patterns exist.

(6)	[cv(h)]	/cvc/
	[c'v']	/c'v'/, /c'vc'/
	[cv]	/cv/

For a stem with a surface final [h], the quality of the consonant that might be present in the suffixed form is not predictable without knowing the possessed form; for a stem with a final glottal stop, not only is the quality of the stem-final consonant not predictable, but it is also not apparent if the stem ends in a consonant or in a vowel without finding morphologically related forms. Again, organizing the data helped to reveal these patterns.

In general, then, an understanding of one small bit of the tone system through eliciting, listening, and organizing data led to additional systematic elicitation, which in turn led to further listening and organizing. In terms of organization, it was important to divide the high-tone stems into two sets, those that show a final consonant when suffixed and those that do not; it was also important to add non-final forms to the file cards. Refining the organization in light of new data helped to make this pattern clear.

Seeing the patterns in stems with a high-tone suffix, another question became obvious: what about low-tone suffixes?

While it was easy to systematically elicit data with a high-tone suffix, this was not so with a low-tone suffix. I assumed that words such as those in (7) have a low-tone suffix, -e.

(7)	t'ere	'girl'	'oge	'eddy'	luge	'fish'
	teɛ	'path'	ts'alɛ	'frog'	dzine	'day'

My assumption that these are suffixed rather than monomorphemic bisyllabic stems rested on three observations. First, it is rare to find unambiguous examples of two-syllable non-morphologically complex stems in Slavey, so I assumed that the general shape of the stem is CV(C). Second, these forms derive historically from single syllable stems, with a suffix.⁵ Third, when these forms are possessed and have the high-tone possessive suffix, that suffix replaces the final -e, leading me to think that these forms require a suffix, -e if

⁵ Reconstructions for these forms:

*təŋ^h-e: 'path', *lu:q^h-e: 'fish', *dʒ^he:n 'day' Leer (2005)

*t'e:d 'girl', *u^hq^h 'eddy' (Leer 1996); *tʃ^hat^hg ~ *tʃ^hat^hg 'frog' (Krauss 2005)

non-possessed and *-é* if possessed. While there are alternative ways of analyzing these facts, I present the analysis that I came to.

Unlike the high-tone suffix, the low-tone suffix does not have a clear meaning, nor is its distribution predictable – it basically must be listed as part of the lexical entry with words that occur with it. This made it difficult to do planned elicitation of words with this suffix; there are numerous words with the suffix, but, unlike the possessive suffix, where there is a reasonable chance that the possessed form of the noun will take the possessive suffix (but not always, so this must be checked for each word), it is more happenstance that one comes across nouns with the low-tone suffix since it does not have a clear meaning or meanings.

(8) shows low-tone stems with the low-tone suffix together with their possessed forms. The possessed forms illustrate what has been seen before; in the presence of a high-tone suffix, the vowel of the stem is high toned, assimilating to the tone of the stem.

(8)	Low-tone stem + low-tone suffix		
	non-possessed	possessed	
	luɛ	-lúg'é	'fish'
	dzine	-dzín'é	'day'

The words in (9) are of a different class. They have a low tone on the stem with a low-tone suffix, and a high tone on the syllable before the stem. The forms in (9a, b) illustrate this most dramatically: in these cases the non-suffixed stem has a high tone, while with the low-tone verbalizing suffix *-e* (the function of the suffix is identifiable in this case), the stem has a low tone, and a high tone appears on the pre-stem syllable. In (9a, b), the first word is the stem, the second shows the stem with a low-tone suffix, and the third form is a full word, with the high tone on the prefix. While the forms in (9c, d) do not show such alternations, the pattern is like that of (9a, b). These forms involve postpositions: the first form on each line is the postposition and the second form shows the postposition preceded by a prefix. (3) above shows that with a high-tone suffix, the stem must have a high tone; (9) shows the same pattern for low-tone suffixed words: if there is a low-tone suffix, the stem has a low tone, no matter what its lexical tone is. Moreover, in these forms if the stem has a lexical high tone, then that tone surfaces on the syllable before the stem when the stem is followed by a low-tone suffix.

(9)	High-tone stem + low-tone suffix		
a.	dzé', 'dzε / hǐdzeɛ	'gum, be gummy/it is gummy'	/c'vc+e/
b.	kó', 'kone / hǐkone	'fire/be bright, sparkly/it is sparkly'	/c'vc+e/
c.	'-yige / béyige	'inside O/inside it'	/c'vc+e/
d.	'-wari / séwari	'tongue/my tongue'	/c'vc+i/

These forms too needed to be organized. In this case postpositions are also involved, and verb stems are derived. On the file slips, it was important to note categories as well as stems, suffixed forms, non-final forms, tone patterns, speakers, and so on.

The study of noun stems with high-tone suffixes revealed a pattern that was easy to substantiate. This led to a study of stems with low-tone suffixes, revealing an identical pat-

tern on the suffixed stem: the stem must have the same tone as the suffix.

The forms in (9) show us that a lexical high tone of a stem is preserved when a low-tone suffix occurs. This led to another question. Is a lexical low tone of a stem preserved when a lexical high-tone suffix is present? I had not seen evidence for this, but nevertheless it was important to check explicitly whether the low tone was retained. Thus once I recognized the pattern in (10a), it became necessary to examine with the pattern in (10b):

(10)		pre-stem syllable	stem	suffix		
	a.	L	H	L	→	H L L
	b.	H	L	H	→	? H H

The possessed form (11a) is representative of the pattern in (10b). In this case, the pre-stem syllable (*báh*) has a lexical high tone. This tone is preserved in the presence of the following L+H pattern: it is not replaced by the low tone of the stem (*t'ul*) when the stem takes the tone from the suffix (*-é*).

(11)	a.	bá'	'mitts'	+	t'ul + é	'rope'
		báh t'úlé'	'mitt string'			
		*bah t'úlé'				
	b.	pre-stem syllable	stem	suffix		
		H	L	H	→	H H H

Thus, (10b) can be fleshed out: H L+H is realized as H HH in the possessive construction. Thus the patterning of a high-tone stem followed by a low-tone suffix (as in (9)) is different from that of a low-tone stem followed by a high-tone suffix: the high tone of a stem is retained on the pre-stem syllable, while the low tone of the stem is not.

Nouns do not offer the structure to see what happens with pre-stem tones when the stem tone is displaced to its left and a syllable precedes; while beyond the scope of this paper, such evidence is available from verbs, and prefix high tones are generally retained (appearing on the syllable to their left) while prefix low tones are not. This leads to interesting theoretical questions about the asymmetry in patterning between the two tones, a topic that is beyond the methodology that is the focus of this paper.

The study of stem nouns and their suffixed counterparts led to two conclusions. First, the stem must have the same tone as the suffix. Second, stem high and low tones are asymmetric in their patterning, with stem high tones being displaced to a preceding syllable in the presence of a suffix low tone, but stem low tones not surfacing on a preceding syllable in the presence of a suffix high tone, as summarized in (12).

(12)	Stem	Stem + H suffix	Stem + L suffix
	cvc	c'vc-ǵ'	cvc-v
	c'vc [cǵ']	c'vc-ǵ'	'cvc-v

Once the asymmetry between low and high tone stems was clear, it was possible to

the stem has a high tone which is maintained, surfacing on the syllable before the stem. These high-tone stems with a low-tone suffix thus displace the stem high tone to its left. I came to this analysis once I felt confident that I was hearing the words properly, with the help of speakers, and I considered the patterning that might lead to these unexpected pre-stem high tones.

It then became possible to consider words with high tone on the stem and a high tone on the pre-stem syllable, as in (17).

- | | | | | |
|------|-----------|-------------|-----------|-------------|
| (17) | '-ghé' | 'egg' | séghé' | 'my egg(s)' |
| | sáh tɬ'é' | 'bear gall' | cf. sa(h) | 'bear' |

These forms I analyzed as having high tone stems with a high tone suffix; when the suffix vowel deletes, its tone remains, forcing the stem high tone to surface to its left. These forms strongly suggested that words such as those in (15) do not have the possessive suffix *-é*: if they did, a pre-stem high tone would be expected. They further illustrate that it may not be possible to sort out the tone pattern of the stem without also studying the tone pattern of the pre-stem material. Again, working with speakers and thinking about patterns led to an analysis.

I have spent some time reviewing noun patterns in FGH Dene, summarized in (18).

- | | | | |
|------|------|---------------|----------------------------------|
| (18) | stem | suffixed form | surface pattern of suffixed form |
| | cvc | cvc+v | cvcv |
| | c'vc | c'vc+v | 'cvcv |
| | cvc | cvc+v' | cvcv' |
| | c'vc | c'vc+v' | 'cvcv' |
| | cv | cv+v | cv (non-high vowel stems) |
| | c'v | c'v+v | 'cv (non-high vowel stems) |
| | cv | cv+v' | c'v (non-high vowel stems) |
| | c'v | c'v+v' | 'c'v (non-high vowel stems) |

The details of the analysis are not so important in the context of this paper as is the overall method of approaching the study of the tone system. To summarize, generalizing beyond my own work, it is important to prepare through reading and listening. Working with speakers and recognizing their expertise about their language is of considerable importance in linguistic fieldwork in general. Organization of data is critical, with a flexible database to allow for the addition of new fields as it becomes evident that they are needed. In my case, as I worked with people, I organized the stems by making file slips, sorting them by whether the stem had a high or a low tone when it occurred without a suffix. I included suffixed forms, easily finding words with high-tone suffixes, and coming across many words with low-tone suffixes. Organization of the data is important in helping to uncover patterns; in the case outlined in this paper it led to the discovery of a clear surface pattern: stems must bear the same surface tone as the suffix. These patterns revealed an asymmetry between high and low tone, with high tones preserved on pre-stem morphemes while low tones are not. Throughout fieldwork, it is important to check and recheck data, to add new

data, and to organize and reorganize the data, adding new categories as needed. This helps to make gaps apparent. In a language like Dene, an understanding of the morphology led to a better understanding of the tone; similarly, a better understanding of the tone led to a better understanding of the morphology. Data in and of itself did not lead to understanding the tone system, rather the interaction between data and analysis led to an understanding.

Recall Hyman's three-step method for studying tone in Oku:

- Determine surface tonal contrasts by considering words in isolation.
- Discover tonal alternations by putting words together or through paradigms.
- Tonal analysis – interpretation to understand how the tone system works.

These are necessary steps for analyzing a tonal system, and they represent essentially what I did, adapted to the particulars of the Athabaskan language. I have gone a step back from description and analysis, addressing the need to prepare in advance, to listen to what the people that you work with say, to check and re-check data, to organize the data, and so on, and I have outlined the major steps I went through in description and analysis.

5. VERB WORDS AND THEIR STEMS. In this section I very briefly discuss tones in the verb word. While the methodology is similar to that outlined for nouns, it is worth considering the verb word briefly because it presents challenges in tonal Athabaskan languages for several reasons. First, there are both lexical and grammatical tones associated with verb stems. Thus, one cannot identify a verb stem and work from that, as is possible with nouns – it is necessary to identify the stem form in each of its aspects. Second, some verb prefixes have a segmental allomorph in some contexts, a tonal allomorph in some contexts, and an allomorph with both segments and tone in some contexts, and this is perhaps the major challenge to understanding tones in the verb word. Third, tonal patterning can differ depending on paradigmatic factors. It is thus necessary to elicit paradigms and to find the relevant morphemes in a variety of morphological and phonological contexts. I focus on the problem that was the biggest challenge to me in early fieldwork, verb stem tones.

Again it was valuable to begin with the literature. In looking at previous work on FGH Dene, Fang Kuei Li's research is instructive. Li worked with a speaker of FGH Dene in 1929. In his work verb stem tone is not written (i.e., there are no tones written on verb stems). Hoijer (1966: 503) notes that while verb stem alternations are found in many Athabaskan languages, in FGH Dene few verb stems have more than one allomorph, and, he says, based on Li's data, there are a maximum of two allomorphs, with the allomorphic variants differing only by stem vowel. I thus expected not to hear tonal contrasts on verb stems, and I assumed that this contrast had simply been lost.

It is useful to give a brief overview of the structure of the verb word before addressing the tones. The verb stem is generally the final syllable of the verb word. There are two types of prefixes, traditionally called conjunct and disjunct. Basically the conjunct prefixes are closer to the verb stem and tend to merge with each other, while the disjunct prefixes are further from the stem and tend not to merge.

Some illustrations of verbs with low-tone stems, preceded by different prefix types with different tones, are given in (19). (I presume the analysis here in differentiating low-tone stems in (19) from high-tone stems in (20).)

(19)	Low-tone stems		
	L conjunct + stem	O wε-h-dzo	's/he trapped Object'
		wε-la	'plural are located'
		go-h-de	'I talk'
	L disjunct + stem	O ra-dɔ	's/he drinks another Object'
	H conjunct + stem	yε-h-dzo	's/he trapped it'
	H disjunct + stem	rá-ła	's/he goes fast'
		tá-ła	's/he goes ashore, inland, up the bank'

The abbreviation 'O' indicates that the verb word requires a direct object. With respect to tone, the tones of both the stem and the prefix are preserved in this case, just as with the low-tone nouns.

Things are different with what I will call high-tone stems. Given that Li's notes did not indicate high tone on verb stems, I was not surprised to find neutralization of tones in this context. However, it took me quite some time to hear what was actually going on in the verbs with historical high-tone verb stems. The pattern is shown in (20).

(20)	High-tone stems		
	L conjunct + stem	O wé-h-k'ε	's/he shot Object'
		wé-h-shu	'clothlike is located'
		gó-h-ts'i	'I lie (tell a lie)'
	L disjunct + stem	O rá-'a	's/he eats another Object'
	H conjunct + stem	yé-h-k'ε	's/he shot it'
		Note: ' indicates an extra-high tone	
	H disjunct + stem	rá-ze	's/he hunts'
		O tá-zu	's/he pulls Object ashore, up bank'

The patterns are summarized in (21).

(21) Tone patterns in verbs

		cv stem	c'v stem
conjunct prefix	cv-	cv-cv	c'v-cv
	c'v-	c'vcv	c'v'-cv
disjunct prefix	cv	cv-cv	c'v-cv
	c'v	c'v-cv	c'v-cv

As noted above, my expectation was that verb-stem high tones were lost in FGH Dene. As discussed in Rice (2001), it took a patient speaker some time for me to understand that something very interesting was going on with the verb stems that were historically high tone. The speaker realized that the first vowel in words such as *yεh-dzo* 's/he traps it', *yéhk'ε* 's/he shoots it', and *yé-h-k'ε* 's/he shot it' were not the same. She pronounced these words one after the other several times, pointing to the difference between them, until I was able to hear the tones clearly. Unlike what I expected based on Li's notes, it became evident that the high tone of the stem was still there: it was simply displaced a syllable to its

left under most circumstances. Comparing (19) and (20), and summarized in (21), pre-stem morphemes with low tone in (19) have high tone in (20). The existence of Li's notes, with no high tones on verb stems but without that tone on the pre-stem syllable, served to block me from hearing the displaced high tones, one of those situations where knowledge of the literature was a barrier to hearing properly.

Once I realized what had happened, it was possible to systematically seek out minimal pairs to ensure that words with a low-tone prefix followed by a historical high-tone stem and those with a low-tone prefix followed by a historical low-tone stem were not neutralized, but differed in the tone of the first syllable. It was also important to review all the verbs to understand the patterns fully, seeking contexts with disjunct prefixes with differing tones directly preceding stems and conjunct prefixes with different tones directly preceding stems. Probably most interesting was the realization that there was a third surface tone, the extra high tone, that occurs when the stem high tone falls on a high tone conjunct prefix. Again, the careful guidance of a speaker was essential in reaching the analysis outlined here.

With the verb word then, realizing that there were tones that were lexically associated with verb stems, even though they did not surface on the stem, was eye-opening. Finding verb words that gave the full range of structures required to understand what was going on was sometimes difficult. Determining whether a pre-stem high tone was lexically part of the stem or part of the prefix also took attention, and I devised methods to determine which of these a tone was part of involving finding relevant members of paradigms. This required an understanding of the morphology in order to compare tonal patterning in appropriate forms. With verbs with more prefixes, what happens to tones on the prefixes as the stem tones are realigned became an issue. Thus one question led to another to another.

There are many more questions that one can ask of the verb stem and of the verb word generally, and I was able these to ask once I understood the basic patterns. In this particular case, it became important to consider whether there were contexts where the stem tone is directly evident, or if the evidence is always indirect. There is post-verbal material (tense, aspect, mode material), and this provided a context in which underlying stem tones might surface. In addition, there are intonational high and low tones, and how these affected the verb stem tones is an important question. An examination of these topics is of interest in terms of the language, but the basic methodology is much the same.

6. INTERIM SUMMARY. In terms of fieldwork, description, and analysis, working on tone is essentially no different from working on segmental phonology, although the challenges of hearing tone are often greater than those of hearing segments. In both cases, there are several important methodological things to keep in mind that I learned through doing, and that remain relevant today, including the following.

- Knowing the literature is critical, but can also be misleading.
- Tuning the ear to the language is important. This can be done by starting with 'easy' things – in the case described here, that meant nouns. However, even starting with 'easy' things can be difficult until environments in which tones can be contrasted are uncovered

- Finding the cues to tones – phonetic, phonological, morphological – helps to identify them.
- Organization is essential, as this helps to identify where there might be gaps.
- Checking and rechecking data leads to better analysis.
- Rechecking data and extending data as a consequence of analysis can lead to reorganization, so any organizational system needs to be flexible.
- Developing an understanding of morphology is important in understanding tone in many languages since tone often interacts with morphology.
- Working closely with speakers who are aware of tones will likely lead to a deeper understanding of the system.

While I have presented things as if they happened in a step-by-step fashion, that is not, of course, what really occurs; rather the pieces are interwoven – record data to get started, start in somewhere on the analysis, frame systematic questions to pursue, return to the data, listen again, record new data. Without data, analysis is not possible; without analysis, data is not meaningful.

I have largely ignored the role of instrumental analysis, both because of its general unavailability at the time and because of the questions that drove me. However, it provides a path to hearing tones, and allows for many questions beyond the phonological nature of the system to be asked, and I introduce few of these in the next section.

7. BEYOND PHONOLOGICAL SYSTEMS. Given the resources available at the time I began work on an Athabaskan language, the kind of phonetic work that can inform the earliest of work on tone today was not possible. I learned to hear the tones, working with speakers and with materials from other varieties, as well as through listening to recordings and through analysis. Once I began work on another variety of North Slavey, I became more confident that I had not missed things in Fort Good Hope. The closely related Déline variety is more conservative in some ways; for example, it does not systematically lose suffix vowels in the environments in which they are lost in FGH Dene and it maintains a surface tonal contrast on verb stems. Exposure to this variety showed me that I had indeed not heard tones on verb stems in FGH Dene, and that I had heard displaced stem high tones on the prefix preceding the verb stem, and gave me confidence in continuing to work on tones.

While I have focused on methodology for phonological analysis, there are many interesting questions about the phonetics of tone that can be asked. For instance, is there a relationship between vowel quality and tone or between consonant quality and tone at a sub-phonemic level? What is the range of tone levels? Is there variability in tonal realization? Is there a consistency in tonal realization across speakers? Where is the tone aligned with respect to the syllable? Since I began work on FGH Dene, technological developments have allowed ways to do phonetics in the field that were previously very difficult; see, for example, McDonough (1999, 2003) on Navajo; Gessner (2005) on Dene S̄łiné, Hargus (2007) on Witsuwit'en, and Miller (2013) on Dane-zaa for some examples of instrumental work on Athabaskan languages; see also the Dene Speech Atlas, being developed by Joyce McDonough (<http://www.ling.rochester.edu/DeneSpeechAtlas/>).

I give a single example of a place where phonetic work would be helpful. I observed upstep in some cases (Rice 1989), with a high tone following a high tone being higher.

(Note that that these extra high tones do not derive from the misalignment of a stem high tone.) I have written the upstepped high as a high tone followed by an exclamation mark. Speakers agreed that these vowels did not sound exactly the same.

- (22) shéit̩ [shéi!t̩] ‘we dual ate’
 ’ónédéla [’ónédé!la] ‘s/he gave away pl. object’

One can ask whether this apparent upstep is a real phenomenon. If so, what is its domain? Based on these examples, it looks like the upstepped tone occurs when the first high tone is in a disjunct prefix and the second high tone in a following conjunct prefix, but this needs instrumental confirmation. If this tone is indeed upstepped phonetically, I would then want to look at other environments (e.g., adjacent high tone conjunct prefixes, adjacent high tone disjunct prefixes) where I did not hear upstep to see if it there as well.

8. CONCLUSION. In approaching work on an Athabaskan language, the first question to ask, if no work has been done on the language, is whether the language is tonal or not. Word lists from related languages are valuable in providing a guide for forms that, if they occur, are likely to be distinguished by tone. If the language appears to have tones, it becomes important to gather appropriate data so that a full analysis of the tonal system can be done. This includes questions such as determining the number of contrastive tones as well as the surface tones, examining what types of tonal morphophonemics are present, and identifying whether there are asymmetries in the patterning of the tones, among other things, from a phonological perspective, as Hyman (2010) discusses.

My early experience with FGH Dene helped me to appreciate the complexities of tonal work, and of rich morphology and tonal morphophonemics. In advising people who want to work tone in on an Athabaskan language now, I first try to establish what questions they are interested in. If they are interested in phonological analysis, I suggest that they combine the literature, work with speakers to hear tones, and instrumental analysis; that they investigate the stem-suffix combinations in nouns to see if anything is going on there, and that they pay careful attention to tone within the verb word, focusing on paradigms, especially those that contain prefixes that show interesting tonal patterning in related tonal languages. While the work may begin as relatively unstructured in order to get a sense of the language, one question leads to another, with planned data gathering and concurrent analysis being at the core. Once the system is understood, then it becomes possible to turn to another important topic, tones as they are used in actual speech.

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