The Prosody of Interrogative and Focus Constructions in Navajo

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Abstract:

This paper is an instrumental documentation of the tonal contours of two types of pragmatic constructions in Navajo to investigate observations by native speaking linguists (Willie p.c., Austin-Garrison p.c.) that Navajo has no tonal intonation, and the predictions made by syntacticians (Jelinek 1989, Hale, Jelinek & Willie 2001) who have claimed that the lack of focus intonation is predicted by the features of Navajo's argument structure. We found no systematic pitch perturbations that differentiate Yes/No questions and Focus constructions from their declarative counterparts. The evidence lays open the question of the relationship of the tonal prosody to syntactic features that generate the pattern and to the parameters of intonation, accentuation and metrical structure.

1. Introduction

1.1 Prosody and argument structure

I consider in this paper the question of the tone prosody of Navajo and the relationship of this prosody to its syntactic features. I take as a starting point observations by native speaking linguists (Willie p.c., Austin-Garrison p.c.) that Navajo has no tonal intonation. Jelinek (1989) Hale, Jelinek & Willie (2001) claim that the lack of focus intonation is predicted by the features of Navajo's argument structure. The main section of the paper is an instrumental documentation of the tonal contours of various

constructions in Navajo to support this prediction. There are no systematic pitch perturbations that differentiate these constructions. The evidence lays open the question of the relationship of the tonal prosody to syntactic features that generate the pattern and to the parameters of intonation, accentuation and metrical structure.

While the interdependence of syntax and prosody is well known (Selkirk 1984, Beckman 1986, Venditti et.al. 2001), and a type of dependence where the syntax determines features of accentuation has been discussed in the literature on prosody (Bollinger 1986, Ladd 1996, Halle and Vergnaud 1987), systematic demonstrations of this dependence are exceptional, and the dependence is supported by mainly theoretical arguments, with few instrumental studies to back it up. The second part of this paper examines the relationship between syntactic and prosodic typology in Navajo, and some predictions it makes about the kind of variation found among other languages of the Athabaskan family

1.2 Intonation and focus

The distinction between declaratives and interrogative and focus constructions is among the most universal characteristics of intonation. We normally associate a fall in pitch with the end of declaratives indicating finality, a rise for interrogatives indicating continuation, and the presence of local pitch excursions on focused words¹.

Beckman (1986) Pierrehumbert & Beckman (1989), Ladd (1996), Laniran (1992) and others have adopted models where there is no fundamental distinction between tones associated to lexical items in tone languages and those assigned by postlexical constraints, such as the association of a pitch accent to a focused word in an utterance or the association of a rising or H edge tone in a interrogative construction. Both kinds of tones, lexical and postlexical, are indicated by the presence of a tonal specification on a particular syllable or at a boundary, with this consisting of a string of tones, serving as an input to the implementation algorithm. Ladd (1996) points out that in this theory (AM or autosegmental metrical), the phonology distinguishes between core tones and edge ('boundary') tones, and not between lexical and postlexical specifications. The phonology provides a string of tones to the implementation system, and all languages are equally open to intonational modifications, differing only in the density of their tonal specification at the phonological level. Languages with lexical tone are as likely as those without it to mark intonation by pitch excursions, and to have a distinction between core and boundary tones. This viewpoint increases the appeal of intonational universals.

However several studies have indicated that despite their pervasiveness these general properties of intonation are not universal (Connell & Ladd 1990, Laniran 1992).

De Jong and McDonough (1992) and McDonough (1999) presented evidence that while Navajo is a tone language in that every syllable has a tonal target, there is little evidence for the presence of boundary tones. In addition, the evidence from studies of Navajo is in contrast results from other Athabaskan languages, such as reports on Minto (Northern Athabaskan) by Tuttle and Kaisse (1996), on Tanana and Salcha (Northern Athabaskan) by Tuttle (1994, 1998) and the work of Hargus (1986) on Sekani (Northern Athabaskan). These studies, which are not instrumental studies, report the existence of stress and metrical structure in Northern Athabaskan. McDonough (1990, 1996, 2000a, 2000b) has argued that metrically based structure has no presence in Navajo, and phenomena explained as metrical in Northern Athabaskan are the result of exclusively morphological imperatives in Navajo.

In the first section of this paper, I present data from an instrumental study of Navajo focus and yes/no questions (YNQ's) for evidence of tonal intonation or a distinction between core and edge tones. I use AM theory, where the surface pitch contours (the pitch trace) are records of the implementation algorithm of a language's phonological specification of H and L tones; including implementation of any tonal intonation.

I then relate these results to recent work on the syntax of topic and focus positions in Navajo (Hale, Jelinek and Willie 2001) which distinguishes Navajo from other Athabaskan language in terms of the pronominal argument hypothesis. Insofar as this correlation between intonational structure, focus intonation and syntactic typology is correct, then both a language's use of intonation and, arguably, the distinction between core and edge tones may be associated to its syntactic typology. Since tonal structure often governs the realization of phonemic contrasts (Fougeron and Keating 1997, Klatt 1976, Culter and Dahan 1997) this implicates a confluence of syntactic features and phonetic detail.

1.3 Tone in Navajo

Many of the Athabaskan languages have been characterized as tone languages, although with a great deal of variation among the types of tone systems. Comparative work on Athabaskan such as Leer 1979, Krauss & Leer 1976, propose that the reconstructed proto-language had no tonal contrasts; these arose from the incorporation of segmental material from the suffixes into the stem. While this is controversial (Kingston 1990, McDonough 2001), it points to a basic fact about Athabaskan; tone often plays a significant role in the lexicon.

Navajo has been classified as a tone language with a tone specified for each syllable (Sapir-Hoijer 1967, Young and Morgan 1987). There is an asymmetric distribution of tonal contrasts among the morphemes, with L tone being the default and the most common tone (the use of a default tone, either H or L, is typical in the family). Characterizations of the tonal system, such as the description of the ‘underlying tonelessness’ of several morphemes in the word and the variety of the reports on tone, stress and metrical structure across the family, undermine the notion that tone has a purely contrastive function in Athabaskan.

The instrumental study of McDonough (1999) provided evidence that there are tonal targets on each syllable of the word in Navajo, as reported by Young and Morgan 1987. It was further argued that morphological structure puts distinct pressure on the function of tone according to the domain a morpheme is in; this pressure shapes the role of tone in the lexicon, and the tone typology. Only in the stem domain does tone function contrastively -- significantly the rightmost content morpheme in the verb in an SOV language. (The stem domain is the rightmost of three domains in the verb: disjunct-conjunct-stem respectively.) In the conjunct domain, tonal contrast is neutralized; the morphemes in this domain were characterized as ‘underlyingly toneless’, arguably due to the epenthetic alternations many of the vowels exhibit as well as the widespread neutralization of segmental contrasts that occur in that domain. Both of these facts reflect the syntactic type of the morphemes in the conjunct domain as functional or inflectional, a class of morphemes characteristically associated with reduced phoneme inventories and simple syllable structure. Because of the cross-Athabaskan similarity of morphological structure, this fact about the interaction of the function of tone (as contrastive or not) and the morphology is likely to be true of Athabaskan in general and likely to affect the tonal typology. Nevertheless, despite the vagaries of Athabaskan inflectional morphology, tonal contours in Navajo indicated tonal targets were present in every syllable in the verb, and the default specification for these morphemes is L. This being the case, Navajo has the tonal density of a tone language, if not the contrastive tone function of one. This depiction of the tonal typology is much in keeping with Sapir’s (1925) comment that tone in Athabaskan is phonetically simple but morphologically complex, due to the various roles tone plays in the lexicon. For the purpose of this investigation, I accept the hypothesis that Navajo has the tonal density of a tone language, with a tone target specified on each syllable.

2. Data

2.1 Navajo interrogatives and focus constructions

I examined two sets of constructions in Navajo; Yes/No questions (YNQ's) and Focus constructions. In both sets, I contrasted them to a default declarative construction. In Navajo YNQ's are marked by one or both of two particles: initial *da* and -'ish (*ash*) after the noun. In the data below, the first sentence is a declarative statement, followed by three YNQ's: one with each particle, and one with both. To see if constructions differ in the tones at the end of utterances depending on their tones, the two sets of sentences below are constructions that end with H and a L tone respectively. (Low tone is unmarked, high tone is marked with a grave accent.)

(1) Statement vs. YNQ's, High tone final:

Statement:	nich'i yą	hóló	'You have food'
	your-food	3 rd -exists	
Yes/no:	da' nich'i yą'ish	hóló	'Do you have food?'
	Q your-food-Q	3 rd -exists	
Yes/no:	da' nich'i yą'	hóló	'Do you have food?'
	Q your-food	3 rd -exists	
Yes/no:	nich'iyą'ish	hóló	'Do you have food?'
	my-food-Q	3 rd -exists	

(2) Low tone final:

Statement:	nimá	hoozdohdi	bighan.
	your-mother	Tuscon	3 rd -lives
	'Your mother lives in Tucson.'		
Yes/no	da' nimáásh	hoozdohdi	bighan?'
	Q your-mother-Q	Tuscon	3 rd -lives
	'Does your mother live in Tucson?'		
Yes/no	Nimáásh	hoozdohdi	bighan?'
	your-mother-Q	Tuscon	3 rd -lives
	'Does your mother live in Tucson?'		
Yes/no	da' nimá'	hoozdohdi	bighan?'
	Q your-mother	Tuscon	3 rd -lives
	'Does your mother live in Tucson?'		

We expect a perturbation in the realization of the f0 of the final tones in the utterances to mark the intonation differences between declarative/interrogative constructions in some manner consistent with a falling/finality and rising/continuance hypothesis.

Contrastive focus in Navajo can be marked with the *ga'* particle after the focused noun (Young and Morgan 1987, Willie 1991, 2000,

Willie and Jelinek 2000, Hale, Jelinek and Willie 2001), in constructions that are equivalent to a cleft, as you can see in the constructions below. Again two sets of constructions were used, H and L tone final.

(3) Focus constructions: High tone final

Statement:	shich'iyą	hóló		'I have food.'
	my-food	3 rd -exists		
Focus:	shich'iyą ga'	hóló		'It's food that I have.'
	my-food-F	3 rd -exists		

(4) Low tone final

Statement:	sitsilí	hoozdohdi	bighan
	little.brother	Tuscon	3 rd -lives
	<i>"My little brother lives in Tuscon."</i>		
Focus:	sitsilí ga'	hoozdohdi	bighan
	little.brother-F	Tuscon	3 rd -lives
	<i>"It's my little brother who lives in Tucson."</i>		

We expect a local f0 perturbation associated with the focused word in the focus constructions. If there is intonational focus, then it ought to appear as consistent, systematic and measurable differences in the implementation of the f0 targets between these two utterances, preferably on or around the focused noun.

Focus construction in Navajo raise special problems regarding semantic constraints on syntactic structure and cross-linguistic variation. It has been convincingly argued that the pronouns, not the NP's, in Navajo are in argument positions. NP's cannot be focused syntactically, because the NP's aren't in argument position, though they do mark a topic/focus ordering in information structure. As stated in a recent paper by Hale et. al. (2001): "Intonation is not used to mark Contrastive Focus in Navajo, as it is in English". This is an empirical issue with clear predictions for intonational phonology: there are no local or global f0 perturbations associated with focus constructions or YNQ's.

To investigate the claim that there is no focus intonation in Navajo, I used sets of sentences listed in (3) and (4) consisting of pairs with and without the *ga'* particle. Two sets of focus constructions are reported on in this paper: H and L tone final.

2.2 Methods

A list of utterances exhibiting the desired constructions were prepared in consultation with Mary Willie at the University of Arizona and Ms. Martha Austin-Garrison of Dine College, Shiprock, New Mexico in January 2001. These utterances were then recorded as careful speech.

Periods of silence (1000ms) were spliced into the sound track after each item, resulting in an instrument suitable for prompting oral responses². Native bilingual Navajo speakers listened and were asked to repeat the utterances after the individual prompts. 16 speakers were recorded in this way.

For the purpose of this study, 7 speakers were selected from the data. The high (f0 maxima) or low (f0 minima) f0 turning points on each syllable were measured from the pitch contours of the utterances in (1) - (4). In the case of a steady state contour, a mid-point was measured. Figure 1 below demonstrates a pitch contour and gives examples of the alignment of f0 minima, maxima and a steady state. The late alignment in the syllable of the f0 minima and maxima is characteristic of the data in all instrumental studies on Navajo tone.

Figure 1: A characteristic spectrogram and pitch trace of *nimá hoozdohdi bighan*. "Your mother lives in Tucson".

In addition to the core tones associated to the syllables, pitch perturbations at edges were recorded if they were found after the last vowel. These perturbations usually consisted of f0 traces in postvocalic, utterance-final sonorants. These are marked 'final t' in the charts below. If a speaker paused during the recitation, the pitch at the edge of the pause was recorded (see figure 5 and discussion). Though speakers were not asked to speak carefully, most speakers tended to use careful speech. because of the deliberate nature of the prompts

In this paper, the AM model as elucidated in Ladd (1996) is assumed. The lexical items with tonal specifications are submitted to the phonology, where word formation processes and phonological constraints

modify the lexical representations, including the tonal specifications, resulting in a phonological tone pattern. I assume the output of this process is a word, a verb form marked for tone. Thus the lexical output for the verb form *yídzìis* 'I drag it' would have a H and L tone associated to the first and second syllable respectively. This output is submitted to phonetic implementation processes. Here, basic pitch rules assign a frequency scale (f0 targets) and time alignment (position in utterance) to the tonal targets, basically assigning an f0 value to the H and L tones, and aligning them to the text. The tone targets can be seen in the surface contours as local f0 turning points.

The targets are interpolated by context dependent implementation mechanisms such as grid lines (which set the pitch range), any boundary tones, and any adjustments or constraints which increase or decrease the basic realization of f0 (such effects as upstep, declination or downstep). I follow Gårding and Bruce (1982), Beckman and Pierrehumbert (1986), (Ladd 1996) and others in defining surface pitch contours as the sum of the factors that interpolate these f0 targets. Implementation also includes adjustments to pitch at the utterance level, such as possible sentence level intonation patterns, like pitch range expansion. Thus the surface pitch contours that I examine are records of the fundamental frequency of the voice as it rises and falls to meet the high and low targets which have been specified by the phonology, plus the full set of pitch implementation rules. Crucially, any intonational tone marking will be observable as systematic perturbations in the surface contours associated with the appropriate constructions.

2.3 Results

2.3.1 Interrogatives and focus constructions

Here I consider the question of whether there are f0 contours and implementation rules associated with YNQ's and Focus constructions in Navajo; whether there is systematic evidence for the presence of edge tones; and whether the focus particle is associated with phrasal domain or local effects. The claim is: due to properties of the syntactic typology of Navajo, no intonation will be found.

Figure 2: A graph of the f0 peaks and valleys for the yes/no versus statement utterances with final high tone. The individual F0 points are plotted, with the averages for statements and questions.

Figures 2 and 3 are graphs of the f0 targets of the syllables in the statement versus interrogative constructions representing H (as in 1) and L (2) tone final sentences sets respectively. If there are pitch perturbations in the intonation contours of YNQ's versus statements, we expect to see them in the differences in the way the f0 is implemented in statements versus the interrogatives in either or both the H and L tone final utterances. In particular, I was looking for localized pitch perturbations at the right edge of the word, such as but not limited to a falling f0 for the declaratives and rising for the interrogatives. Or we might suppose that the Q particles themselves carry either recognizable f0 prominence, or that they cause perturbations on the f0 of nearby syllables.

For each sentence set ((1) and (2)) there are 7 speakers, with 4 sentences in each set. One of these sentences is a declarative statement; the other three are variations of YNQ's, as discussed in the last section. Thus each graph represents 28 utterances over 7 speakers: 7 declaratives and 21 YNQ's utterances. The question words/morphemes in the utterances are the initial *da*, and the *'ish* (*'ash*) after the first noun. The declarative utterances have neither of these morphemes; the YNQ's have one of the two, or both. Thus for the non-question words and morphemes (the statements) there are 28 f0 tokens for each syllable target. For the question words/morphemes, *da*, and *'ish* (*'ash*), there are 14 data points each. These are plotted in the charts as data points on each syllable.

Figure 3: A graph of the f0 peaks and valleys for the yes/no versus statement utterances with final L tone.

These data point graphs were then overlaid with the average f0's for the statement and the YNQ's separately. The black circles represent the averages f0's for each syllable of the YNQ's, the squares represent averages for the statements. Points marked 'final t' represent an f0 measurement taken after the last vowel in an utterance. Pitch traces after the last vowel tended to show up in final words that ended in sonorants, such as *bighan*.

The data is striking. In these utterances, there is very little, if any, evidence for a fall or rise in pitch at the end of the sentences in either the YNQ's or the statements. As we can see from the graphs, the declarative and YNQ's have near identical contours, regardless of whether the utterance is H or L final. The two averages (circles and squares) fall nearly on top of one another. Furthermore, little evidence of any perturbations in f0 associated to either of the YNQ particles. No systematic patterns of intonation can be construed for these utterances. Of particular interest is category final tone 't', since perturbations in the f0 of this position may indicate the existence of edge tones. In a pattern characteristic of all the data, we find very little f0 movement from the preceding point, which can be taken as indicating a lack of edge tones.

In the second set of examples (figures 4 and 5) are data from the focus construction sets. The focus particle is *ga'*.

Figure 4: A plot of the f0 targets for the focus versus statement constructions and averages, H tone final utterances. The 'ga' morpheme is the focus marker.

In these utterances we are looking for local pitch perturbations on or around the focused NP, which could be used to indicate a difference between the plain and focused constructions. The perturbations may be indicated in the f0 value of the focused item, a local effect, or they may be more global, affecting the contour of the utterance following the pitch contour. Focus might be indicated by the presence of another tone, or in the alignment of the tone. We are looking for any significant differences in the pitch contour between the two type utterances. As with the previous set, this graph represents a graph of the individual data points overlaid with a plot of the averages for the statement (square) versus focus (circle) constructions. The statement versus focus constructions consisted of two sentences, one focus and one statement, for 7 speakers. Thus there are approximately 14 data points for each target, with 7 data points for the *ga* particle. As we can see, as with the previous it is hard to construct any evidence of f0 perturbation associated with focus constructions, the f0 contours for the Focus and statements fall on top of each other. As Hale et. al. predict there is no focus intonation in Navajo.

Figure 5: A plot of the f0 targets for the focus versus statement constructions and averages, L tone final utterances.

As with the YNQ's above in Figures 2 and 3, there are no systematic final tone differences that could be used to indicate a phrasal boundary marking.

2.3.2 Phrasal tones

Prosodic organization is primarily cued by the prosodic phrasing at boundaries, and the tone types used to mark these boundaries. In addition to the utterance final phrasal boundary, one place to look for evidence of prosodic marking at boundaries is at the juncture of an NP and a verb. In our data, I did not control for prosodic grouping, I simply asked our subjects to repeat what they'd heard presented to them. In the data there are several instances where a subject paused at what could be reasonably proposed as a natural boundary likely to be marked by the prosody, at the edge of an NP followed by a verb.

The example we see below is indicative of the pattern found in our speakers' data. The data in figure 6 and 7 come from two interrogative utterances of one of the female speakers (from (1)). The utterances are *da nichí ya' hółq* and *nichí ya ísh hółq*, "Is this your food?: two instances of a yes/no question with single interrogative particles *da'* and *'ísh*, respectively. In the first one, the speaker paused 291ms after the noun *nich'ya* 'your food', before beginning the verb *hółq*. The f0 measurement was taken at the last f0 minima in the noun, which carries a L tone specification and falls at the right edge before the pause (Figure 6). In the second (figure 7), there was no pause after the NP *nich'ya*. In addition, the NP in the second utterance is suffixed by the question particle *ísh*. Therefore, the comparison in these figures is between a L tone aligned to a

syllable before a 293 ms pause (*nich'ya'* -LLL#) and a tone on the same lexical item that occurs inside a word boundary (*nich'iya'ísh* -LLLH#). A 291ms pause represents a strong boundary with enough time to stop and reset articulatory parameters. If there is prosodic phrasing marking a NP juncture, this is the likely place to find it. There should be some evidence of the implementation of the tone at this point in the two utterances; it ought to be realized as differences in the f0 values of these two tokens. The order of the repetition was as follows: auditory prompt – first utterance- auditory prompt –second utterance, clearly a case of non-causal speech.

Figure 6: Spectrogram and pitch trace demonstrating an f0 minima on a low toned syllable before a 291ms. pause.

I have presented a waveform, pitch trace and spectrogram for both of these utterances to demonstrate this data (figure 6 and 7). The L toned *ya'* syllable is the syllable in question. It is closed by a glottal stop in both utterances, as we can see in the spectrogram and waveforms. The f0 value was measured at the lowest edge of the fall on this syllable, the f0 minima.

Figure 7. Spectrogram and pitch trace demonstrating f0 minima on the low toned syllable in (figure 6) when it is inside a morpheme boundary.

The f0 value for the first utterance (figure 6) was 189Hz, for the second (figure 7) 191Hz, a difference of 2 Hz. A phrasal tone such as we find in English would result in some pitch perturbation associated with this juncture, possibly raising the pitch after the f0 minima to indicate continuance. Insofar as these examples are representative of what a native Navajo speaker produces at this type boundary, this is quite clear evidence for the failure of phrasal prosody to be marked by edge tone at an internal juncture in Navajo.

2.4 Summary

No evidence of any pitch perturbations or special pitch-related implementation rules associated with interrogatives or focus constructions is found in this data. No pitch perturbations associated with edge tones at phrasal boundaries are found in this data. There is no differences in the implementation of the L tone at the edge of a potential phrase boundary (NP Pred) and the L tone inside the word (figures 6 and 7).

Because edge tones are associated to levels in the prosodic hierarchy rather than syllables, insofar as this data is representative of a native Navajo speaker, there is no evidence that prosodic levels in Navajo are systematically defined by tonal prosody. There is no apparent distinction between core and edge tones in this data.

This begs the questions: what determines whether a language does or does not implement intonation distinctions? Is there a parametric variation between languages that do and do not have a distinction between core and edge tones? What is the relationship between argument structure and accentuation that predicted this pattern in Navajo?

3. Discussion

3.1 Issues

In this section I present a brief discussion and outline of the issues that this data raises, and submit some ideas for future work.

The issues examined in this paper concern the role of structure and parametric variation in accounting for prosodic phenomena with claims to universality such as the presence or absence of intonation and tonal accentuation to mark semantic contrasts. We have seen that there is no clear evidence for intonation or accentuation contrasts between statements and yes/no questions, and no evidence of pitch perturbations on focused nouns in focus constructions. We also have little evidence that marking of phrasal boundaries by tonal contours exists. It is impossible to prove the lack of the presence of phenomena, especially in the face of arguments for its universality. However, the data we have seen shows that, if there is tonal marking in Navajo of this sort, it is not obvious or overtly systematic, and we might look elsewhere for an explanation of the patterns we do find. There is argument to be made that such explanations do exist, and, in fact, they predict the types of phenomena exhibited by Navajo.

3.2. Accent and arguments

The argument here hinges on the relationship between accentuation, argument structure and hypothesized parameters of accent placement. It has been observed in the literature that many accentuation patterns depend on a distinction between arguments and predicates (Bollinger 1986, Halliday 1967, Halle and Vergnaud 1987, Valluduci 1990, Ladd 1996, others). Some of these observed patterns include the differentiation of definite and indefinite NP's, accent differences on yes/no questions, focus constructions and intonation in general (see Ladd 1996, Chapter 6 for a discussion of these facts). Bollinger (1986) has noticed that there is general pattern cross linguistically for accent to appear on arguments over predicates.

As Navajo has been argued to be a pronominal argument (PA) language, there are no NPs in argument positions (Willie 1991, Jelinek 1984, 1989, 1997, Willie and Jelinek 2000, Hale et. al. 2001). The arguments are part of the predicate. Navajo does not have a shifting

accent. There is no focus accent in Navajo. We've seen the data supports this hypothesis.

In conjunction with these patterns of accent placement, a parameter of variation has been proposed by several researchers. It's been proposed that there are two kinds of languages, those that have accent on the rightmost content word in a sentence and those where it may appear earlier in the sentence. We refer to this parameter as [+rightmost] after Halle and Vergnaud (1987) and following Ladd (1996). A full discussion of these ideas is well beyond the scope of this paper and I refer the reader to the literature on this subject. What is important to the present discussion, however, is the idea that in rightmost languages, accent is structurally determined (occurring on the rightmost content word), and is independent of the argument/ predicate distinction for its placement. This predicts that in PA languages like Navajo, if there is any 'accent' in the language, it's not shiftable, it is not used to focus particular NP's, and it is realized on the rightmost content morpheme by default.

3.3 Prominence and SOV languages

Turn for a moment to the notion 'prominence' as a phonetic phenomena. Although the realization of accentuation is language specific, it is commonly accepted that a word carrying stress or accent exhibits phonetic characteristics commonly associated with prominence. These are generally some combination of the amplification of duration, intensity and local pitch perturbances such as a pitch range expansion on the prominent word.

If a bundle of accentual phenomena is tied to the differentiation of arguments and predicates, the prediction is that languages that are both SOV and PA may not have accentuation, intonation or edge tones. Thus the prediction works both from the syntax to the prosody and vice versa.

With respect to the [rightmost] parameter, in [+rightmost] languages, a default accent specification falls on the rightmost content word in a sentence. This accent is not tied to an argument/predicate distinction and is not used to flag pragmatic information. Relevant to the present discussion, in an SOV language that is also a PA language, pragmatic use of accent is barred because NP's aren't in argument positions. The rightmost content word is the V; the default specification falls on the verb. If [rightmost] is a parameter of variation, we predict the verb to carry the [rightmost] accent and to exhibit the phonetic properties of prominence.

Navajo, an SOV- PA language, presents an interesting case for testing this hypothesis. The instrumental data presented in part bears this view out. Though it may or may not be possible for a [+rightmost] language to have metrical structure, it is not possible for accent to be assigned on any but the rightmost morpheme. Navajo can only be a

[+rightmost] language. Furthermore, given the prefixal nature of the Navajo verb, we may predict that the rightmost content morpheme in the verb, the verb stem, which carries rich semantic and aspectual information, is likely to be phonetically prominent. This seems to be the case. Instrumental studies indicate that the verb stem has many of the properties commonly associated to prominence: longer durations, pitch range expansion, semantic salience (McDonough and Ladefoged 1993, McDonough 1999). Recent work on the phonetic structure of Navajo has shown that the verb stem has up to two to three times the duration of morphemes of the conjunct domain (McDonough 2002). The stem is the only place in the word where the full set of phonemic contrasts occurs.

As Hale et. al. (2001) have pointed out, several Northern Athabaskan languages (such as Slavey, Witsuwit'en) are not PA languages. In these languages, we thus expect to find evidence of topic/focus and interrogative implementation rules, word formation rules sensitive to foot structure (which Navajo does not) and edge tones to mark phrasal boundaries. We expect these languages to be open to the development of stress systems, tonal intonation, and the delimitative use of pitch. All studies indicate that this is so. The details of these relationships and the details of the patterns of accent and metric structure and syntactic type beg investigation backed by the empirical work of instrumental analysis.

4. Conclusion

In this view, a language's intonational features such as boundary tones, focus and accent placement, and its phonetic implementation system are tied to its general typology by a cluster of structural relationships around the argument/predicate distinction and the prosodic hierarchy. Laying out the particulars and full predictions of this theory is beyond the scope of this paper and awaits further work, including instrumental work and the modeling that a theory of parameters requires. But the theory indicates that varying one parameter, such as the language's predicate type, results in systematic changes in accentuation because these changes are inherently tied to its argument structure. Navajo's SOV-PA status predicts its lack of intonation, forces it to default to [+rightmost] – argued to predict the prominence of the verb stem. Navajo's lack of metrical structure is at least related to lack of the play of the prosodic hierarchy in the grammar. This also implicates a regulated relationship between structural features and phonetic implementation algorithms. Furthermore, we may predict this stem prominence, which is a striking feature of Navajo verb, may not exist in related languages with more accent type systems, and with different argument structures. The variation across the Athabaskan languages, such as the pitch accent type system Kaisse and Tuttle report on in Minto, may

lend insight into the development of accent systems and into the development of the language's phonetic structures, as these changes relate to changes in the status of the argument structure.

Because all the Athabaskan languages are closely related and have similar syntactic features, and because they exhibit systematic differences in their argument structure and, by report, systematic differences in their prosodic structure, this family of languages provides an important testing ground for these hypotheses, backed by instrumental studies an undertaking that serve to further our understanding of human grammar.

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¹ These phenomena have usually been associated with systems that have metric stress, such as English, and but they have also been shown to operate in languages with pitch accent (Japanese, Poser 1984, Pierrehumbert & Beckman 1986, Serbo-Croatian, Lehiste and Ivic 1986) and lexical tone (Thai, Abramson 1962, Hausa, Lindau 1986).

² Since Navajo is an oral culture, I considered oral prompts more appropriate than text.)