Linguistics of the Tibeto-Burman Area
Volume 25.1 — Spring 2002

THE SOUNDS AND TONES OF FIVE TIBETAN LANGUAGES OF THE HIMALAYAN REGION

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1 INTRODUCTION

In this paper I describe the sounds and tones of five Tibetan languages: Dzongkha, Lhomi, Sherpa, Dolpo Tibetan, and Mugom Tibetan.[2]

In characterizing these sounds, I describe first, using digital oscillograms, the intersegmental voicing coordination of the onset consonant in the various dialects. This is important as an initial step in the study of pitch because it demonstrates the extent to which the complexity of the WT syllable canon is still evident in onset phonation, and the extent to which these onsets are contrastive. The laryngeal states of the onset for the Tibetan dialects often exhibit a rare complexity, which gives evidence for the complexity of the WT syllable. In Dzongkha, there is a seven way contrast in the phonatory/articulatory interaction on onsets, and a six way contrast for the other languages studied here.

Second, I describe pitch on monosyllables, using graphs of fundamental frequency. In this characterization, I will show the way in which pitch can be predicted on the basis of the onset phonation with obstruents and some sonorants, and rhyme type. In addition to a salient high and low register contrast, there is a level/falling contrast that corresponds to short and long open syllables. Sometimes the pitch contrast is not one of level vs. falling but one of sharply falling vs. postponed falling, or in rare cases the contrast between pitch melody heights within a register. The same basic facts on the monosyllable are true for each of the five dialects documented in this paper. One of the interesting findings of this study is that pitch between registers is sometimes contrastive not by beginning or end points, but by the route the pitch travels between beginning and end point.

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1 I am grateful to the Central Department of Linguistics at Tribhuvan University for the support they provided during the period it took to do the research for this article.

2 The dialect of Dzongkha described here is spoken in Pasakha, West Bengal, India just south of the Indo-Bhutan border. Lhomi is spoken in Sankhuwa Shabha district of Eastern Nepal, near the Nepal-China border. The dialect of Sherpa examined in this paper is the Solu dialect as spoken near Phaplu, Solu Khumbu District of Eastern Nepal. The dialect of Dolpo Tibetan examined here is that spoken in Dolpo district of West Nepal. The variety of Mugom studied here is that of Mugu village, Mugu district of West Nepal.

Third, I will show that while each of the dialects shares a common register pitch system on the monosyllable, they differ from one another in multisyllabic words. My data for the languages here points to three systems: a word tone system that parallels that described for Central Tibetan (Mazaudon 1986); a word tone system like that described for Tamang (Hari 1970); and a syllable based system not described in the published literature for these languages. Fourth, in the Appendix, I illustrate the correspondence between Written Tibetan (WT) and the attested spoken forms in the different dialects.

1.1 Significance of this research

The Tibeto-Burman languages which belong to Shafer's (1955) Bodish branch (i.e., the Tibetan languages) constitute fertile ground for the investigation of the relationship between laryngeal and tonal features. Proto-Tibetan is regarded as having no tones (Benedict 1972). The daughter languages of proto-Tibetan, however, are at various stages of tonal development ranging from toneless to fully tonal (Sun 1995). These stages have to do with how closely pitch correlates with the laryngeal states of onset and coda consonants. A relevant question to ask, then, is whether these languages fit into the classification of tonal languages or not. As Sprigg (1966:186) so pertinently asks, "...are languages in which pitch features are relatable to such other features as breath force and vowel duration to be classified as tone languages, the associated breath-force and vowel duration features being at least to that extent subordinated to pitch, or are they to be classified as stress languages or as quantity languages, with regularly associated pitch features?"

Basic agreement in the description of the Tibetan tonal systems (where they exist) lies in the claim that they have a high/low pitch contrast. The disagreement seems to lie in three principal areas: 1) how closely pitch is associated with the phonation of the onset and vowel; 2) whether or not there are tonal contrasts within high and low register; and 3) the domain of tone (i.e., syllable, morpheme, or word).

Little has been done for the Tibetan languages in the area of acoustic research to investigate these areas of dispute. Many of the Tibetan-type languages of the Himalayas are reported as having some of the more fully developed tonal systems on the Tibetan tonality continuum, with fully contrastive tones. As will be seen in this paper, however, this characterization is inaccurate. This paper, then, seeks to provide answers to some of the areas of dispute for the southern Tibetan languages, and to provide an acoustic account, and hopefully a more accurate description of how "tone" works in this group of languages.

1.2 Research methodology

This paper is based on a phonological and acoustic analysis of each language. Before conducting acoustic analysis I developed a basic understanding of the phonological system of each language using a phonemic analysis based on a corpus of approximately 1,200 elicited words. Acoustic analysis was conducted using CECIL and PRAAT, and the methodology prescribed in those computer software programs. This is based on recordings of between 250 and 400 words in each language. These words were selected as representatives of the pitch, register, and vowel length contrasts with several different points and manners of articulation in the onset (i.e. pa, paa, ta, taa, sa, saa, ma, maa, etc..) These words were recorded in isolation four times each, and in different frame drills. I was able to get between two and three different speakers from each language to make these recordings, with the exception of Sherpa for which I have recordings from only one speaker.

1.3 Written Tibetan comparisons

When eliciting and making recordings of words, I was careful not to have recourse to Written Tibetan spellings. My intent was to avoid any influence that Central Tibetan and "Chos skad" (the higher register) pronunciation might have on these words. Most of my language consultants were illiterate.

2 PHONATIONAL AND ARTICULATORY COORDINATION

2.1 Voicing

In each of the languages studied, there is a four way contrast in voicing in the obstruents. These four contrasts are: voiceless without aspiration, voiceless sometimes with slight aspiration and followed usually by breathy voice (devoiced), voiceless with heavy aspiration (followed by modal voice), and voiced (voiceless preceded by voicing). Among sonorants, there is a potential three way contrast, as in Dzongkha, and at least a two way contrast in the other languages. These three sonorant contrasts in Dzongkha are voiced, prevoiced voiced, and preaspirated voiced; and in the other languages: voiced and preaspirated voiced. I begin with a discussion of the obstruents.

2.1.1 Obstruents

The four way contrast in obstruents is illustrated with the recordings taken from Sherpa. The same phenomenon can be illustrated from the other languages studied in this paper with little variation from language to language. (In fact, I wonder whether the variation found in the oscillograms are as much a product of dialect variation as it is the variation in idiolects between speakers.) The four words illustrated here are [dɐ] 'arrow', [tɐ] 'horse', [p^{h}ɐ̤] 'wool', and [thɐː] 'loom' in the oscillograms in Figures 1-4. Each oscillogram captures the brief moments before and after the pronunciation of the beginning consonant of the word. More precisely, the oscillograms capture 0.20 milliseconds before the articulation of the vowel, and 0.05 milliseconds into its articulation. Each figure, then, can be compared visually for the differences among the different onsets.

In Figure 1, the word [dɐ] 'arrow' begins with a brief period of voicing with little amplitude and then tapers off to almost a complete silence, and is followed by the voiceless release of the plosive [t]. This is then followed by the voicing of the vowel [a]. It is more accurately transcribed as [dtɐ]. The articulation of the sound [d] is unlike that of the articulation of a voiced stop in most languages of the world, where the voicing is carried throughout the articulation of the sound, or begins with initial devoicing. Here in Sherpa, and in many of the Tibetan dialects of the Himalaya, the voicing stops before the release of the sound, and at the point it is released it is a voiceless sound. For lack of a better term, I have referred to this manner of voicing as "prevoiced" to make a contrast with an articulation that is fully voiced. There are no languages studied in this paper that make a phonemic contrast between "voiced" and "prevoiced" in the obstruent class. In this sense, the "prevoiced" series can be viewed as phonologically voiced for obstruents, although voiced sonorants are fully voiced. For some speakers this obstruent series is pronounced as fully voiced, as it would be in English or French. In word medial position, this series is sometimes fully voiced, even by speakers who pronounce it as "prevoiced" word initially.

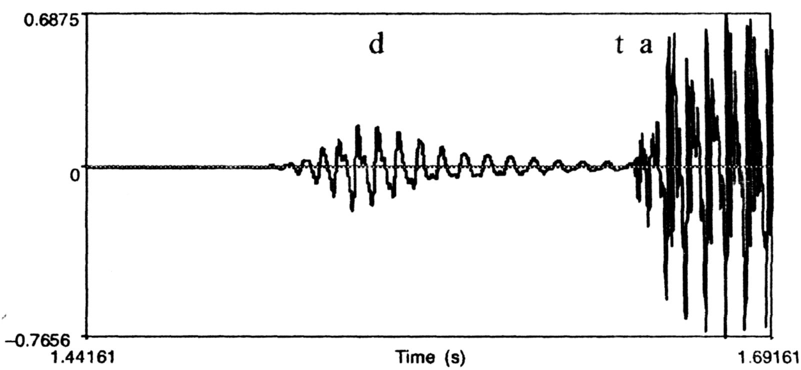

Figure 1. Oscillogram of Prevoiced Obstruent.

While there is only a single series of voiced obstruent in the Himalayan dialects studied for this paper, Edmondson (personal communication) reports that a dialect of Amdo makes a contrast between something like the "prevoiced" series in the Himalayas, and a "prenasal" series. The reported difference between them is one of difference in amplitude of the sound waves prior to the release of the stop. The "prevoiced" series has a small amplitude that tapers off before the release of the sound, and the "prenasal" series has an amplitude much like that of a nasal consonant, which is followed by a voiced plosive release.

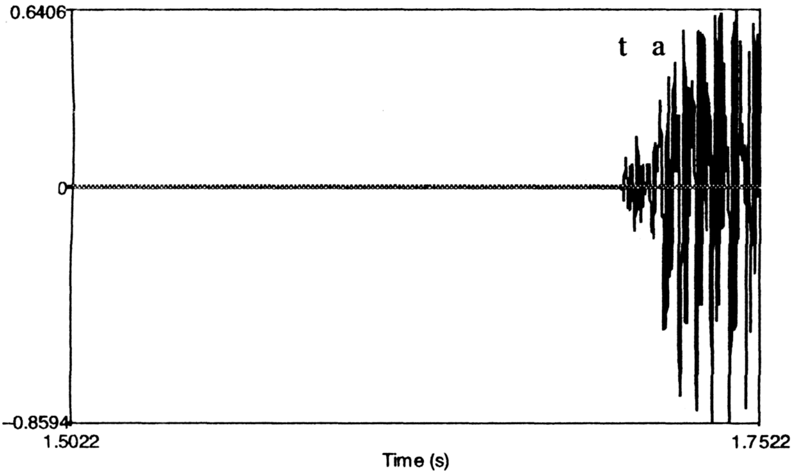

Figure 2. Oscillogram of Voiceless Obstruent.

The waveform of the word [tɐ] 'horse' is illustrated in Figure 2 It looks much like the word [dtɐ] 'arrow', but without the "prevoiced" articulation at the beginning. It begins immediately with the waveform typical of a voiceless plosive, and then transitions into that of a vowel. This onset series is voiceless, and transitions into the articulation of the vowel quickly by comparison with the other plosive series.

A third type of plosive in the Tibetan dialects is the so-called "devoiced" series.[3] It is characterized by a slightly longer voice onset time (VOT) than the voiceless unaspirated series, and is accompanied sometimes by a small degree of aspiration. This aspiration is by no means consistently articulated, and when

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3 This series of sounds is referred to as "devoiced" by Tibetanists because it derives historically from a voiced obstruent, as attested by Written Tibetan. In the modern Himalayan languages, it usually does not carry voicing in the initial position of a word, but will sometimes carry it word medially.

not articulated, is indistinguishable in waveform from its voiceless unaspirated counterpart. However, in Figure 3 it can be seen with a slightly longer articulation (accompanied by aspiration) than [tɐ] 'horse' in Figure 2. The variation in the degree of aspiration in the "devoiced" series is not phonemic, and appears to be an acoustic characteristic of this series.

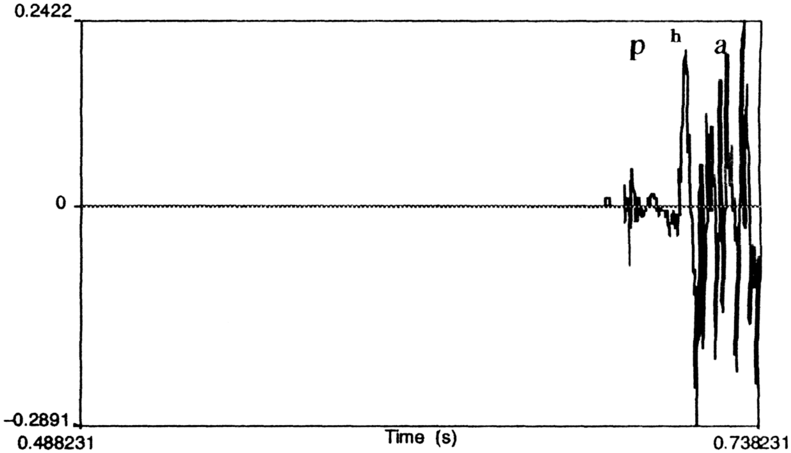


Figure 3. Oscillogram of Devoiced Obstruent.

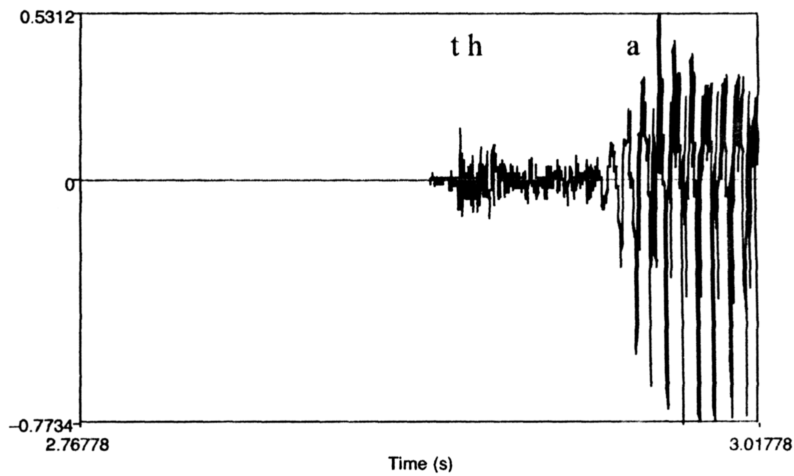


Figure 4. Oscillogram of Aspirated Obstruent.

The fourth type of onset plosive is the voiceless aspirated series. This series is heavily aspirated by contrast with the "devoiced" series, which is sometimes slightly aspirated. The aspiration can be seen in the short oscillations of the sound wave between the initial articulation of the stop and the articulation of the vowel in Figure 4.

In summary, there are four types of obstruent onsets: voiceless unaspirated, voiceless slightly aspirated (sometimes), voiceless heavily aspirated, and prevoiced. These voicing contrasts have been illustrated with data from Sherpa.

2.2 Sonorant Consonants

Aside from the voiced sonorant consonants (i.e. voiced nasal stops and laterals), I find two less common types of sonorants. The first is a voiceless sonorant, better described as a pre-aspirated sonorant, which is found in all of the languages in this paper. The other is a "pre-voiced" sonorant stop in Dzongkha. Oscillograms of these onsets are given in Figures 5-7 .

In Figure 6, the wave form of the /l/ in [ləp] 'hand' begins smoothly from silence and continues in a strong wave form until it transitions into the vowel. In Figure 5, the wave form of /ll/ in /lləp/ 'say' begins with an articulation accompanied by a sound wave with little magnitude, falls off to silence, and then continues with the voicing of /l/ just as in the word /ləp/ 'hand'. (I have transcribed [lləp] 'say' with two /l/s to contrast it with the more conventional /l/ of /ləp/ 'hand'. It is apparent from the oscillogram that 'say' is not composed of two /l/s, but for lack of a better convention I have used this to transcribe the "pre-voiced" sonorant.)

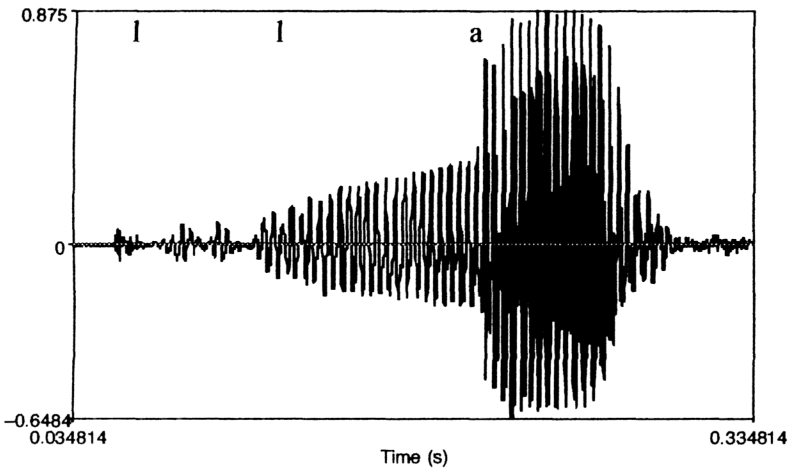


Figure 5. Oscillogram of /hləp/ 'say'.

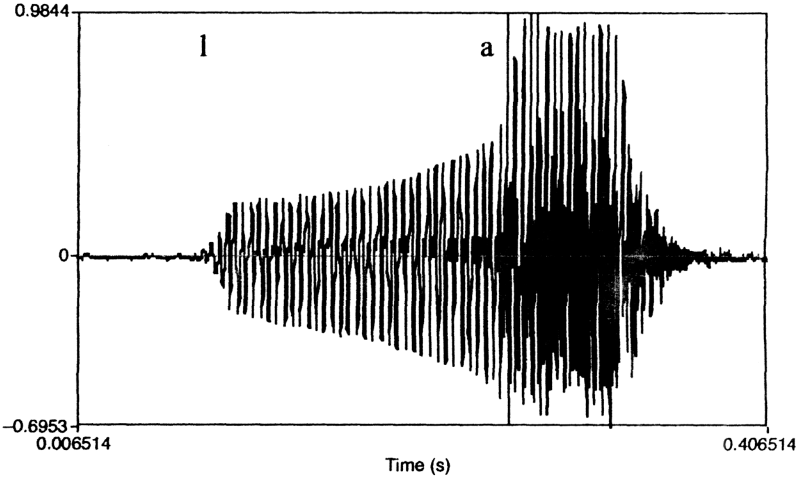


Figure 6. Oscillogram of /ləp/ 'hand'.

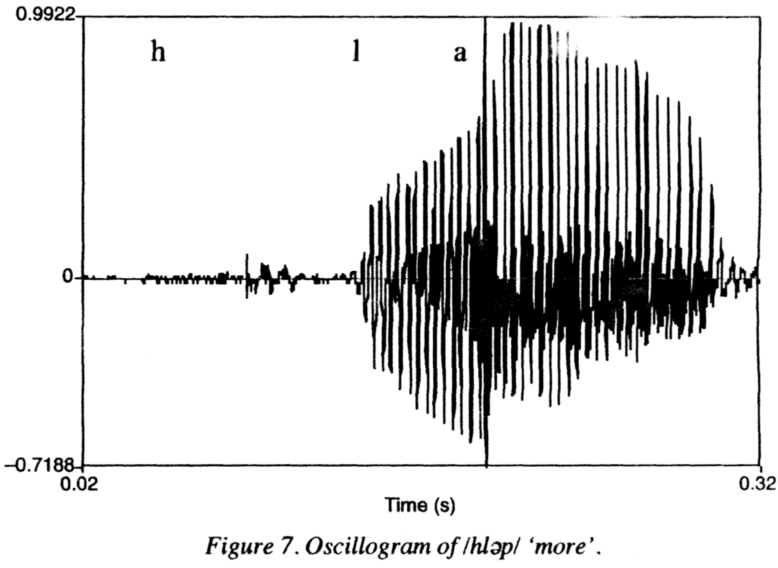


Figure 7. Oscillogram of /hləp/ 'more'.

In Figure 7, I illustrate the acoustic waveform of the pre-aspirated sonorant. It begins with a period of brief aspiration, followed by a period of silence, and thereafter the voicing of the sonorant.

The oscillograms of the three Dzongkha words /llәp/ 'say', /lәp/ 'hand', and /hlәp/ 'more' illustrate three manipulations of the phonatory and articulatory systems. Dzongkha is unusual among the world's languages for its seven way intersegmental coordination in the phonatory and articulatory systems of onset consonants. In Dzongkha, I find the following series of sounds in obstruents and sonorants: fully voiced (sonorant), "pre-voiced" fully voiced (sonorant), pre-aspirated (sonorant), "pre-voiced" (obstruent), "devoiced" (obstruent), voiceless unaspirated (obstruent), and voiceless aspirated (obstruent). The other languages have a six way contrast (without the "pre-voiced" voiced sonorant).

2.3 Coordination of the phonatory/articulatory systems

There is another way of viewing the contrasts in onset consonants among the different Tibetan dialects than the apparent differences in the oscillograms. This is through the notion of *intersegmental co-ordination*, specifically the timing of voicing with relation to the articulation of the segments. The control of voicing is physiologically independent from the movement of the mouth (the phonatory system is physiologically independent of the articulatory system). This independence gives rise to variation among languages and dialects as they coordinate these systems differently.

Figure 8 illustrates the coordination of voicing and mouth movement in onset consonants. The prevoiced obstruent begins with early voicing (or initial voicing) in the medial phase, but tapers out before reaching the overlap phase. Voicing resumes again in the overlap phase as it anticipates the vowel which follows. The prevoiced obstruents are pronounced as fully voiced sounds throughout the medial phase by some speakers in some dialects. Fully voiced and initially voiced stops are not contrastive. The prevoiced obstruent, however, is contrastive in phonation/articulatory coordination with the fully voiced sonorant.

The pre-articulated sonorant is similar to the prevoiced obstruent in that both have minimal onset voicing. The difference lies in where this voicing comes in relation to the different phases of a sound. In the case of the prevoiced obstruent, the initial voicing comes during the medial phase, but then resumes to voicing in the overlap phase. In the pre-articulated sonorant, the voicing comes before the medial phase of the sonorant. I have ascribed this initial voicing to the onset phase until more is understood about this sound.

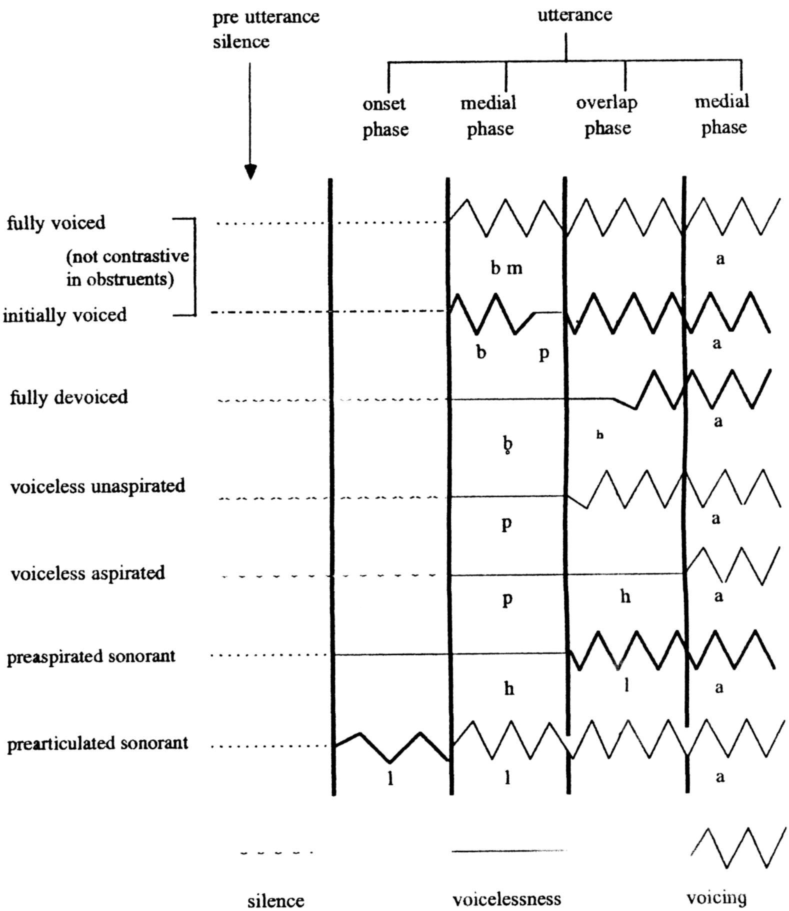


Figure 8. Intersegmental Coordination in Tibetan dialects.

The fully devoiced onset obstruent begins with complete voicelessness which is followed by a short period of aspiration. The period of aspiration is much shorter than it is for the voiceless aspirated sound. The aspiration is sometimes voiced even before the vowel is in its medial phase.

The voiceless obstruent sounds (both unaspirated and aspirated) are voiceless throughout the medial phase, the difference between them being that the aspirated sound is voiceless in the overlap phase.

The pre-aspirated sonorant is voiceless in the initial medial phase of the sound, but then begins to be voiced in the overlap phase as it transitions to the vowel. Viewed in terms of coordination of voicing and movement of the mouth, there are differences in time between when articulation begins and voicing begins. On a scale of time from long to short, voiceless aspirated sounds have the longest period of voicelessness, followed by fully devoiced, voiceless unaspirated, and initially voiced.

3 WRITTEN TIBETAN AND MODERN PHONOLOGICAL SYSTEMS

The southern Tibetan dialects are regarded as some of the more phonologically innovative ones in the full Tibetan continuum. They are considered to have reduced the complexity of the WT clusters to a considerable degree, yielding modern reflexes with increasing tonal complexity. This is true to a certain extent. However, the resulting consonantal reduction is not to a simple voiced/voiceless contrast or a voiceless unaspirated/aspirated contrast. As can be demonstrated for Dzongkha, there is a seven way contrast in the phonational articulatory coordination of the onsets. In other dialects there is a six way contrast.

It is clear that some features of the old syllable persist, manifesting themselves in "phonation debris" in the onset. This "phonation debris" gives evidence of a complex older syllable, but by means of synchronic articulations that are not attested in other languages (to my limited knowledge). Particularly *interesting* are the pre-articulated series in both plosives and sonorants (i.e. prevoiced obstruents and prevoiced sonorants).

WT	*Dzongkha*	
/PHA/	'cow'	[pʰɐ̤˧]
/MDA'/	'arrow'	[dtɐ]
/BO/	'call'	[pʰo̤˧]
/SBO/	'swell'	[bpo]
/SLAP/	'say'	[llɜp]
/RMA/	'wound'	[mmɐʰ˦]
/LHAGP/ (WDz)	'more'	[hlɜp]
/SNA PA/	'nose'	[hnɐ:p]

The fact that consonantal bulk has not been completely reduced opens up the possibility that tonal reflexes are not as transparent in this cluster of languages as originally reported in the literature, or at least not as manifest as some literature is inclined to suggest.

4 PLACES OF ARTICULATION IN THE TIBETAN DIALECTS

Thus far, I have discussed the phonational/articulatory coordination in the obstruent and sonorant series, where the five languages studied here have shown remarkable similarity. There is little variation among them. I now turn to a discussion of the places of articulation in the Tibetan dialects. It is in this area that the dialects exhibit more variation from one another. I first give a chart of all of the phonemes found in all of the dialects. Phonemes which do not occur in every dialect are noted in parentheses. A discussion of the places of articulation in each manner follows.

Phoneme Chart of the Tibetan Dialects

	Bilabial		*Alveolar*		*Postalveolar*		*Retroflex*		*Palatal*	*Velar*	
Plosive	p	b	t	d			ʈ	ɖ		k	g
	ph	p	th	t^h			ʈh	$ʈ^h$		kh	k^h
Fricative	[ɸ]	[β]	s	z	ʃ	ʒ	(ʂ)		(ç)	[x]	[ɣ]
			(s^j)								
Affricate			ts	dz	tʃ	dʒ			(tç)		
			(ts^j)								
			tsh	ts^h	tʃh	$tʃ^h$					
			(tsh^j)								
Bilabialized Affricate					(ptʃ)	(bptʃ)					
					(ptʃh)	($ptʃ^h$)					
Nasal	m		n	(hn)					ɳ	ŋ	
Approximant			l	hl							
			ɾ	(hɾ)					j	w	

Sounds in () parentheses do not occur in every dialect.
Sounds in [] brackets are phones, but are included to illustrate that it is in the fricatives and affricates that the greatest diversity in places of articulation occurs.

4.1 Obstruents

There is a four way articulatory contrast in obstruents: bilabial, alveolar, retroflex (alveolar with a rhotic articulation), and velar. There seems to be little variance among languages in this area.

Bilabial		*Alveolar*		*Retroflex (rhotic)*		*Velar*	
p	b	t	d	tɹ	dɹ	k	g
ph	pʰ	th	tʰ	thɹ	tʰɹ	kh	kʰ

4.2 Sibilants/Affricates

While the same basic phonational system occurs in each of the dialects, and there is uniformity in point of articulation in the obstruents and nasal sonorants, there is a considerable degree of variation in the articulatory system among the fricatives and affricates. The inventoried fricatives are given in Table 1.

	Bilabial		*Alveolar*		*Postalveolar*		*Retroflex*	*Palatal*	*Velar*	
Fricative	[ɸ]	[β]	s	z	ʃ	ʒ	[ʂ]	ç	[x]	[ɣ]

Table 1. Articulatory positions of fricative phones.

Sounds which are not phonemes (not contrastive) are indicated in square brackets. The velar fricatives [x], and [ɣ] are variants of /k/ and /g/ in intervocalic position, and are found in Dolpo Tibetan, although the process of lenition also seems to occur to a certain extent in other dialects. Similarly, [ɸ] and [β] are variants of /p/ and /b/ in intervocalic position. These are quite frequent in Dolpo Tibetan, and less frequent in other dialects.

/sʲ/ only occurs in Sherpa, and in fact the whole matter of the palatal offglide after fricatives and sonorants is quite thorny. It is difficult to hear whether the pronounced sound is /sʲ/ or /ʃʲ/. /ʂ/ only occurs once in my data in Diaspora Tibetan: /ʂɐŋ˥ ʂɐŋ˥/ 'single'. /ç/ only occurs in Dolpo Tibetan where it is contrastive with /ʃ/, as illustrated in Table 2 below.

		ç	ʃ	
ɐ	meat	çɐ˥	ʃɐ re^j tsu wɐ	deer
	day (twenty-four hour time period)	çɐŋ˧ mɐ	ʃɐ̃ũ˥	mushroom
	east	çɐɾ˥	ʃɐŋ tʃi mi	narrowness
	rip	çɐː˧	ʃɐŋ ts^{j}o pu	broad
ɛ e	take [honorific]	çɛ̤ː	ʃe˥	know
	yam	çel˧ lɐ		
i	fruit	çîn˥ tɔ˥	ʃi̤m˧ bu	tasty
	four	çi̤^{h}˧	ʃi̤˧ nup˧	three days ago
	field	çi̤ŋ˧	ʃi˥	die
	farmer	çi̤ŋ˧ lɛ˧	ʃje̤p tʃi phul˩˥	serve [honorific]
	louse	çik˥		
æ	shoes	ç^{j}æ̤ː˧ dzen˧	ʃ^{j}æl	jackal
o	yoghurt, curd	ço̤˧	ʃo̤m ne dɐŋ˧	invite
	comb hair	ço˥ gen dɐ	ʃok˥ neː dɐŋ˧	call
	wing	çok˧ pɐ	ʃom˥ bɐ	rice (unhusked)

Table 2. Palatal/alveopalatal contrast in Dolpo Tibetan.

4.3 Affricates

The affricates seem also vary to a considerable degree both in point of articulation and coarticulation. The affricates have the same contrast in phonational articulatory coordination as the obstruents. Thus, for example, /tʃ/ is also contrastive with /dtʃ/, /tʃh/, and /tʃ^h/. The affricates which occur in these dialects are shown in Table 3.

	Alveolar		*Postalveolar*		*Palatal*		*Bilabialized Postalveolar*	
Affricate	ts	dz	tʃ	dʒ/dtʃ	tç		ptʃ	bptʃ
	tsh	ts^h	tʃh	tʃ^h	tçh		ptʃh	ptʃ^h

Table 3. Affricates.

/tç/ and /tçh/ occur in Dolpo Tibetan and are contrastive with /tʃ/ and /tʃh/, similarly to the contrast illustrated in Table 2 above. The complex bilabialized postalveolar affricates occur only in Dzongkha.

bptʃ		ptʃ		ptʃ/ptʃʰ		ptʃh	
Gloss	*Voiced*	*Gloss*	*Vless*	*Gloss*	*Devoiced*	*Gloss*	*Aspirated*
disappear	bptʃẽː˧	hang	ptʃẽː˥	bird	ptʃɐ̤˧	clean	ptʃhɐːʔ˥
honey	bptʃẽː˧	monkey	ptʃɜ˥	cliff	ptʃɐːʔ˧	polish	ptʃhɐːʔ˥
lose	bptʃẽː˧			hen	ptʃɜm˧	broom	ptʃhɐːm˥
rice (unhusked)	bptʃɐːʔ˧						
				sand	ptʃʰem˧	rosary	ptʃhem˥
						half	ptʃheːʔ˥
fill	bptʃo̤˧			buckwheat	ptʃoː˧		
pour	bptʃo̤˧			flee	ptʃoː˧		
grain	bptʃṳ˧					rich	ptʃhup˥

Table 4. Bilabial alveopalatal afficates contrastive for four manners (Dzongkha).

4.4 Sonorants

4.4.1 Nasal

The nasal sonorants, like the obstruent series, vary little from dialect to dialect with regard to place of articulation: bilabial, alveolar, palatal, and velar.

Bilabial	*Alveolar*	*Palatal*	*Velar*
m	n (hn)	ɳ	ŋ

There is an aspirated nasal /hn/ in some dialects of Dzongkha, otherwise aspirated nasals are not encountered.

4.4.2 Approximants

There are six possible approximants in this group of languages, although not all six are evident in each language:

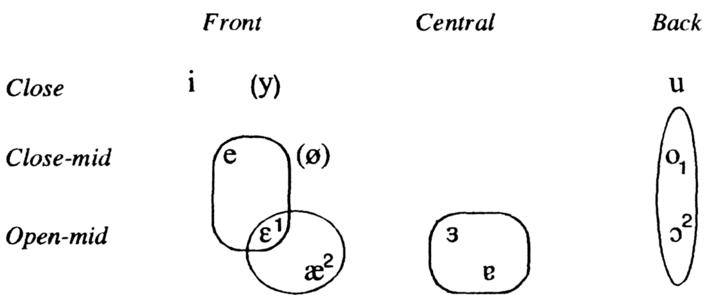
Alveolar	*Palatal*	*Velar*
l hl	j	w
ɾ (hɾ)		

The aspirated approximant /hɾ/ does not occur in every dialect.

4.5 Vowel phonemes

Tone systems are the focus of this study. As such I have not applied the same rigor to the study of vowels as I have to the study of pitch and its interrelation with onset and coda consonants. The exact acoustic quality (i.e. the formant values) of certain sets of vowels is often quite elusive, and without rigorous acoustic study, one cannot be fully sure of what one is hearing. Bearing this in mind, I suggest the following vowels for each of the dialects.

Vowel Chart of the Tibetan Dialects



I have used several notations in the vowel chart. I have enclosed the close front rounded vowels in parentheses to indicate that they do not occur in every dialect. That is, these vowels are a central part of the vowel contrasts everywhere but in Sherpa, where they seem to occur only in words that are borrowed from Central Tibetan. These vowels occur most frequently in Diaspora Tibetan and Dzongkha, and to a lesser extent in the other dialects.

Vowels that are encircled with an oval or circle are those for which an allophonic relationship can be demonstrated, and this holds true for each of the dialects. In no dialect is the second vowel of the vowel pair a vowel phoneme.

Vowels that are boxed with a square with rounded corners are problematic in each of the vowel systems. Thus for example, it isn't always clear whether the vowel is /e/ or /ɛ/ in short vowels, and as such whether or not /ɛ/ occurs only in long vowels where it is clearly heard as such. Similar distinctions are also difficult to hear between /ɜ/ and /ɐ/, and /ɜ/ and /o/. See Figure 5.

	English Gloss	Dzong -kha	Tibetan Diaspora	Sherpa	Lhomi	Dolpo Tibetan	Mugu Tibetan
i	field	ʃi:˧	ʃiŋ˧	ʃiŋ˧	ʃi̤ŋ˧ gɜ	çi̤ŋ˧	çi̤ŋ˧
	die	ʃi˦	ʃi˥	ʃi˦	ʃi˥˩	çi˦	ʃi˦
y	decay	ry:˧	ry˩		ry˧		
	cry		ŋy˥			ny̤˩˧	
e	spirit	sem˦	sem˥	sʲem˧	sim˦		sem˦
	know	ʃe:ʔ˦	ʃe˦	sʲeu˦	ʃe:˦	çe˦	ʃe˦
e ɛ æ	eight	ŋke:ʔ˧	kʲeʔ˩	ŋkʲɛ̤˧	dʒeʔ˧	gʲæ̤ʔ˧	gʲæ̤t˩˧
ø	blemish	kø:n˦	kʲøn˥	kʲon˦	tʃøn˦	kʲøn˦	kʲøn˦
ɜ	leg (hon.)	ʃɜp˧	ʃɐp˩	ʃɜp˧	ʃɜ̤b˧	çɐ̤p˧	
ɐ	eat	sɐ̤˧	sɐ˩	sɐ̤p˺˧		so̤ʰ˧	sɐ̤n˥
	meat	ʃɐ˦	ʃɐ˥	ʃɐ˦	ʃɐ	jɐ˦	ʃɐ˦
	earth, ground	sɐʰ˦	sɐ˥	sɜ˦	sɐ˦		sɐ
	east	ʃɐ:˦	ʃɐr˥	ʃʲaɾ˦	ʃʲɐr	çɐr˦	çɐɾ˦
u	body	zu:ʔ˧	suk˩ po	dzʲṳ	sy̤˧ bu	sṳk˧ wo˧	lṳ˧
	three	sum˦	sum˥	sum˦	sum˦	sum˦	sum˦
o	yoghurt, curd	ʃo̤˧	ʃo˩	ʃo˧	ʃo̤˧	ço̤˧	ço̤˧
	tooth	soʰ˦	soʰ˥		so˧	so˦	so˦
ɔ	pluck	pɔ:ʔ˦			kɔʔ˦		
	neck (front)			dʒi̤ŋ bi ɔk	ʔɔk˺˦ mɜ	ʔɔʔ˦ lʲæ˧	

[ɔ] is not a phoneme, but I have included it to illustrate its occurrence in syllable final position preceding a glottal stop or unreleased [k]. [e] [ɛ] and [æ] are obviously not a single phoneme, but the pronunciation of 'eight' nicely illustrates the variance between dialects, which is also true for the variation within a single dialect. More work needs to done on the front open vowels.

Table 5. Vowel contrasts.

4.5.1 Contrastive vowel length

Vowel length is contrastive in certain environments. For all of the dialects studied here, vowel length is contrastive in words which are monosyllabic and open. This is illustrated in Table 6.

	Gloss	Short	Long	Gloss
Dzongkha	distance	thɜ˥	thɐː˥	pass by
	cow	pɜ̤˧	pɐː˧	rapids
Tibetan Diaspora	word	kɐ˥	kɐː˥	pillar
	ghost	ɳʈe˧	ɳʈeː	rice
Sherpa	horse	tɜ˥˩	tɐː˥˩	sign
	wheat	ʈɜ˧	nʈɐ	rice
Lhomi	die	ʃi˥˩	ʃiː˥	learn
	drunk	si̤˧˩	ʃe̤˧	receive
Dolpo Tibetan	meat	çɐ˥˩	ʃɐː˥	deer
	cow	pʰɐ˩˥	pʰɛ̤ː˧	wool
Mugu Tibetan	body hair	pu˥˩	phuː˧	cliff
	mask	bɐ˩˥	bɐː˧	goitre

Table 6. Short vs. long contrasts in open monosyllables.

The dialects differ in other possible environments where length is contrastive. Dzongkha and Sherpa are distinct in that they exhibit a length contrast in closed monosyllables. This is illustrated by the contrastive pairs in Table 7.

	Short	Gloss	Long	Gloss
Dzongkha	phɜm˥	parents	phɑːm˥	female pig
	ʈhɜm˥	to cross	ʈhɑ̃ːm˥	honest one
	kɜm˥	dry	kɑːm˥	foot
Sherpa	sʲeɾ˥	hail	sʲeːɾ˧	white
	lɜŋ˥ bu	elephant	lɐːŋ˥	cow
	mɜɾ	down	mɐːɾ˧	butter

Table 7. Short vs. long contrast in closed syllables in Dzongkha.

In other dialects, a length contrast is apparent in the first syllable of a disyllabic word. Dolpo Tibetan would appear to be unique in that the second syllable can also be contrastive for length (i.e. [tɐ˥ t̪eː˥˧] 'mule' and [tee˦ kɐ˥˧] 'saddle'; this happens through morphological processes).

4.5.2 Differences in vowel length between registers

I need to insert a parenthetical note here about vowel length. I find that vowel length is a phonological phenomenon and not an acoustic one. There is a decreasing difference in acoustic length between syllables of certain types from high to low register. The greatest difference in length is between syllables in high register. Thus in Sherpa, closed syllables have an average length difference of 2X (n=32) in high register, and open syllables of 1.6X (n=40). In low register the average difference of length between short and long open syllables is 1.33X (n=45).

For many words in low register, the difference between short and long is overlapping. In fact, it would seem that what is described as a length difference by mother tongue speakers is more accurately described as a difference in vowel quality, not quantity. Thus, /da/ 'arrow' is regarded as short, and /thaa/ 'loom' as long. Under the scrutiny of acoustic analysis, however, the vowels of both words are approximately 200 ms in length. The distinction between them, based on my transcription, is one of vowel quality. /da/ 'arrow' is more accurately transcribed as [dtɜ˨] 'arrow', and /thaa/ 'loom' is more accurately transcribed as [thɐ̤ː˨]. This vowel quality difference is perceived as a vowel length difference by mother tongue speakers. The perception is acoustically accurate in high register in words like [tɜ˥˧] 'horse' and [tɐː˥˧] 'sign', but not so for low register.

5 TONE AND SUPRASEGMENTAL PHENOMENA

In the previous sections I have described the major segmental characteristics of the five Tibetan languages studied for this paper. This description will now serve as a basis for the study of register and tone.

The diachronic route by which tone has developed in the Tibetan languages through the neutralization of a voicing contrast in the onset is less common among the Tibeto-Burman languages found in Southeast Asia or in languages from other linguistic families. In such languages, it is believed that tones were already in the language before the loss of voicing multiplied them. After voicing neutralization, the number of tonal contrasts available to the language significantly increased, depending on what phonations were neutralized. It will be remembered that Tibetan as it was written in the seventh century was an atonal language, and as such did not have pre-existing tones. As the complex WT onsets are neutralized, the modern synchronic systems are different than what might be encountered in a language that already had pre-existing tones.

The evidence in this paper corroborates that the Southern Tibetan languages are only just emerging from a state where voicing and other features were contrastive on the initial consonant, and pitch contrasts within a register can be correlated with rhyme contrasts, and not a pre-existing tone.

In the following discussion, I describe the basic typology that is shared by each language. These languages share a common register pitch system on the monosyllable. However, they differ from one another in the kind of system at work in polysyllabic words. I will first describe the system as it works on the monosyllable, using Lhomi as an example. I will then turn to a discussion of each of the languages as they fall into different patterns of word tone.

5.1 Register and tone on the monosyllable (an example from Lhomi)

In my view, tone in Lhomi and the other languages is best described as emergent tone accompanied by phonational and length contrasts. There is a high/low pitch contrast on monosyllables that is accompanied among other things by a phonational register difference. In keeping with the correlation between pitch and voice quality, it has become standard to refer to the two registers as high and low register, and this convention is followed here. The following is a summary of the major phonetic features which characterize high and low register in Lhomi (and the other languages studied here).

High register "tense":

- modal voice on the vowel
- glottal stop on vowel-initial syllables
- strong aspiration
- plain stops and affricates are voiceless

Low register "lax":

- absence of above
- often breathy voice on the vowel
- voiceless stops and affricates vary between slight and no aspiration
- vowels are longer than their high register counterparts; vowel quality contrasts are maintained rather than vowel length contrasts

5.2 The interaction of phonation and pitch on monosyllables

5.2.1 Onset phonation and pitch are contrastive; voice quality is not (dt/t)

As indicated above, a breathy voice quality does not always accompany monosyllables in low register. This is particularly true for monosyllables which begin with voiced obstruents. While the pitch which accompanies modal voice is characteristically high, syllables which begin with a voiced obstruent (and modal voice) are always followed by low pitch (there are no syllables which begin with voiced obstruents which are high in pitch). The FØ traces of a syllable which begin with a voiced onset are illustrated in Figure 9. (In figures 9-12 I have followed the convention that FØ traces of short syllables are given in solid lines, and long syllables in dotted lines. The FØ traces of high and low register syllables are distinguished by the color of the lines: grey represent FØ traces of high register and black lines low register.)

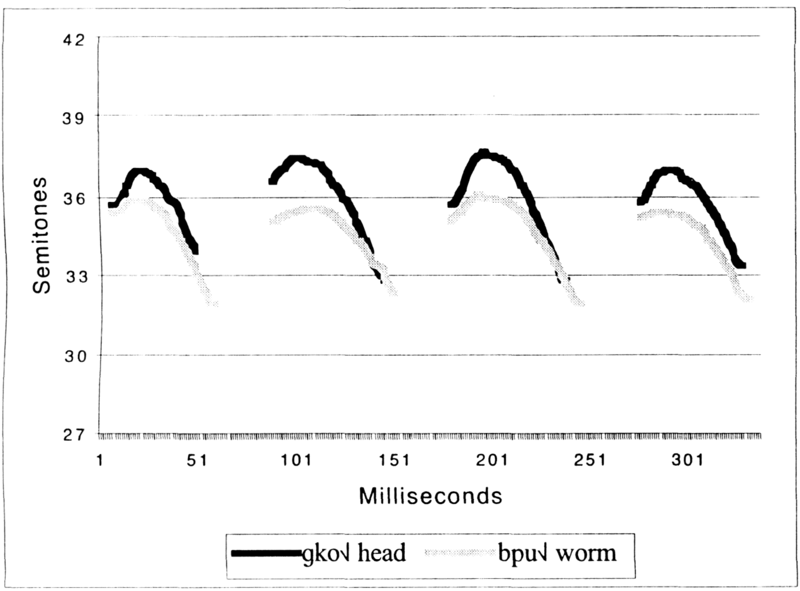


Figure 9. The Pitch traces of syllables that begin with prevoiced obstruents.

Plain voiceless unaspirated obstruents are always followed by high pitch, and the voice quality of the vowel which follows is modal. The pitch traces of these syllables are illustrated in Figure 10.

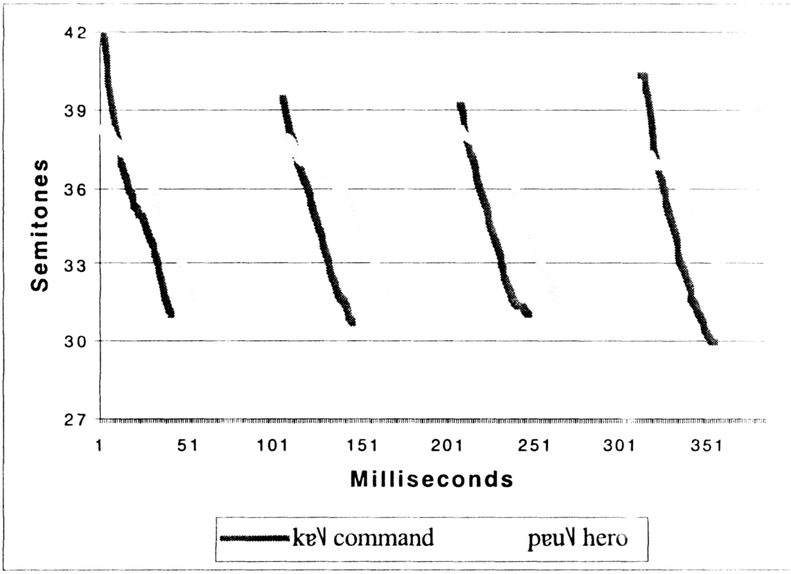


Figure 10. The pitch traces of syllables that begin with voiceless obstruents.

The words [gko] 'head' and [kɐ˥˩] 'command' are illustrative of the fact that pitch is contrastive in modal voice when the phonation of the onset (voiceless vs. voiced) is also contrastive. Here we see evidence for the fact that voicing produces a "lowering" effect on the pitch of a syllable.

5.2.2 Pitch and voice quality are contrastive; voicing is not (th/t)

As noted above, aspirated stops in high register are strongly aspirated, and stops in low register lack this forcefulness, varying between slight aspiration and none at all. It will be remembered that this slightly aspirated consonant is known among Tibetanists as a "devoiced" consonant. While both onsets are voiceless, the pitch and voice quality which follows them is different: monosyllables which begin with strongly aspirated onsets are followed by modal voice and high pitch, while the "devoiced" onsets are followed often by breathy voice and always by low pitch. The pitch traces of these monosyllables are illustrated in Figure 11.

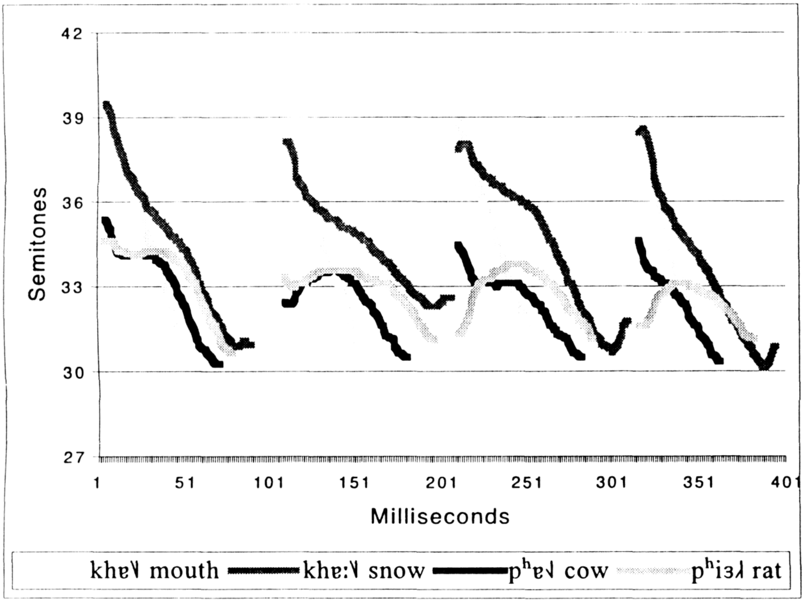


Figure 11. *Pitch traces of syllables that begin with voiceless aspirated and devoiced obstruents.*

Pitch and voice quality can also be the sole contrasting features for words which begin with sibilants. It is in the devoiced series that we see voicing neutralization, so that pitch and voice quality carry a more salient role in this part of the phonological system.

5.2.3 Pitch and voice quality are contrastive; onset phonation is not (n)

Pitch and voice quality are contrastive in monosyllables that begin with sonorants. It is among syllables that begin with sonorants where we see that pitch and voice quality are the sole contrasting features between registers. There is no contrast in voicing or phonation in the onset (with the exception of Dzongkha, which has the prearticulated series). The pitch traces of monosyllables that begin with sonorant stops are illustrated in Figure 11.

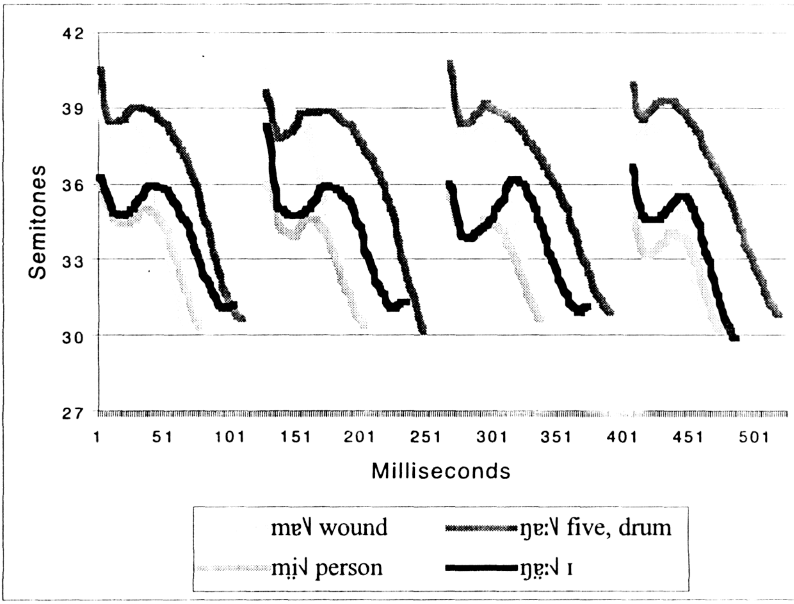


Figure 12. Pitch traces of syllables that begin with plain voiced sonorants.

The geometry of the pitch traces given in Figure 12 is essentially the same in both high and low register: rising-falling. The geometry of the pitches that follow obstruents in high and low register are different from one another: sharply falling in high register, and much more leveled in low register. This is evidence that when the syllable begins with a nasal stop, onset phonation does not affect the following pitch, and that the pitch and voice quality have acquired contrastive salience in the phonological system.

In Dzongkha, the "pre-articulated" sonorant (i.e. [ll3p] 'say') is always pronounced with a high tone, so that pitch is predictable on the basis of the onset phonation. The pitches of the high register sonorant, prearticulated sonorant, and the low register sonorant in Dzongkha are illustrated in Figure 13.

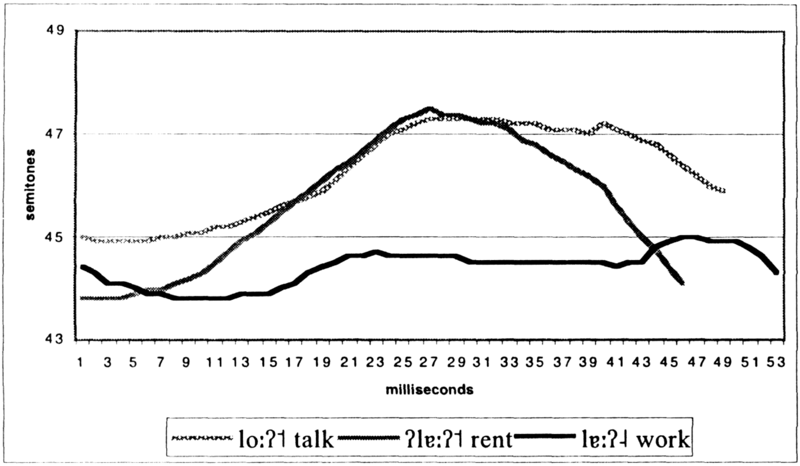


Figure 13. Pitch traces of syllables with 3 sonorant onset phonations in Dzongkha.

5.2.4 Variability in Pitch Height

The FØ traces illustrated in Figures 9-12 represent the normative pitch contrast between high and low register. However, sometimes pitch height is not contrastive, and this can be true regardless of the onset type. This overlap in pitch height can be illustrated in syllables beginning with voiceless and 'devoiced' stops in Dzongkha, as illustrated in Figure 14. The beginning FØ value for the low register word [tɐ:˧] 'flag', in the initial position of an utterance begins at a level where high register pitch begins. The initial pitch height of the high register syllable [tɐ:ʔ˥] 'tiger' begins at the same height as the word [tɐ:˧] 'flag', with the result that the two pitches overlap in initial pitch height.

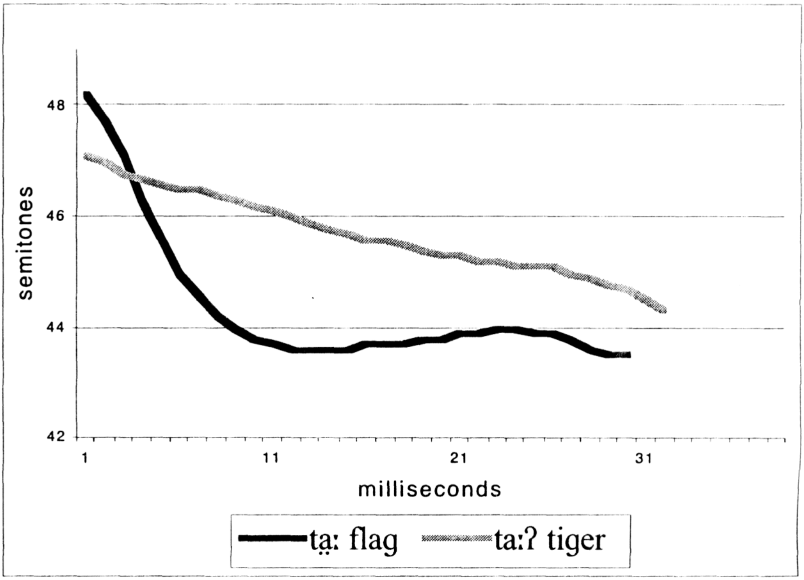


Figure14. Overlapping beginning and end points in high and low register in a single utterance.

While the initial pitch of [tɐ:˧] 'flag' is 48 semitones, within the first fifty milliseconds it drops to 44 semitones, and then maintains a level pitch for the duration of the word before dropping off slightly at the end. The word [tɐ:ʔ˥] 'tiger', on the other hand, begins at over 47 semitones, but instead of dropping off quickly makes a prolonged descent at a constant rate to the same end point of [tɑ:˧] 'flag' at 44 semitones. The pitch tracks of the two syllables have roughly the same beginning and end point, but markedly different ways of 'traveling' between the two end points.

In his classic study of tone, Pike raises the possibility that "contours may differ in characteristic other than direction of glide" (1948:9). This would include such things as rate of fall or rise, "correlations between the time and distance of rise", and even "differences in correlation with glottal stop". Although Anderson (1978) agrees that this might be a theoretical possibility, he concludes that since no serious studies had been cited in the literature to confirm Pike's notion, any tone can be distinguished phonetically by specifying just the beginning and end point. The various differences between contours, then, can be taken as differences between beginning and end points, and the phonetic implementation of pitch in traveling between these two points. The tone literature with which I am familiar has adopted Anderson's point of view, and as far as I know, there have been no challenges to it.

In Dzongkha (and the other languages studied here), however, there are patterns like the one illustrated in Figure 14 that corroborate just the representations that Pike (1948) posits as theoretical possibilities. The contrast between the pitch values of the two syllable types is not quantitative but qualitative.

The situation presented here is analogous to what is found in the Wu dialects of Chinese. As reported by Cao et al. (1989), there is disagreement on the issue of whether observed phonation type differences in syllables beginning with 'voiced' and 'voiceless' consonants stem from an inherent property of the consonants themselves, or of the following vowels, or of the entire syllable. The position taken by Cao et al. is that "the contrast of 'voiced' consonants and voiceless consonants...is more related to a difference in glottal adjustment which causes a more breathy phonation to follow the 'voiced' consonants than to the actual presence or absence of voicing....Phonologically this property is *inherent in the consonants but its clearest phonetic manifestation is in the onset to the vowel*" (1989:158).

Like Wu Chinese, the clearest phonetic manifestation of the difference between breathy and modal (i.e., devoiced and voiceless) syllables in Dzongkha is in the onset to the vowel, where there is a definite contrast in pitch height which is not necessarily found in the onset of the syllable. The voiceless and 'devoiced' syllable are neutralized in voicing with the result that initial pitch height can be high in syllables beginning with 'devoiced' onsets. The difference between them is apparent, however, in the transition between consonant and vowel where voice phonation begins. These are clear indications of the effect of voice quality on FØ, which as in Wu Chinese, "may be a more powerful influence on pitch than plain voicing is" (1989:157).

The variant pitch pattern illustrated here by the word [tɐː˧] 'flag' is indicative of a qualitative difference between the registers. Pitch is not always just high or low but affected by "characteristics other than direction of glide"; specifically pitch in these languages is affected by the various features which make up the phonation bundle of a register. Similar phonation types in the onset can lead to a situation where initial pitch is also similar, but a contrast in pitch is maintained where voice quality differences are apparent. This has the unusual effect that pitch differs in shape rather than height.

5.3 *Pitch contrasts within a register*

5.3.1 Nouns

In Figures 9-12 there is some difference in pitch between short and long syllables (noted as solid and spotted lines, respectively). The pitch of a short syllable in high register can be characterized as "sharply falling" while the pitch of a long syllable as "postponed falling" in comparison to the short syllable. The pitch of long monosyllables in low register is in some instances "rising-falling". Put another way, the difference between short and long syllables can be described as a contrast between an immediate fall and a postponed fall.

As with the variability of pitch height between registers, a similar thing happens with the pitch of short and long syllables. The pitches of both syllables begin their falls and end them at roughly the same place, but the route by which the pitches travel are different. Again, this has the unusual effect that pitch differs in shape and not by the beginning or ending point of the pitch of the syllable.

5.3.2 Verbs

While the contrast in pitch between short and long syllables is washed out in nouns (to which few suffixes are added), this contrast is readily apparent in monosyllabic verbs with suffixes. The pitch contrast in each register is one of "sharply falling" vs. "slightly rising". The FØ traces of short and long syllables are illustrated in Figure 15, and the glosses of these words are given below (again illustrative data is from Lhomi).

[ʃi˥˧ soŋ˥˩]	'he died'	[s̤i̤˧˩˨ soŋ˧˩˨]	'he got drunk'
[ʃi:˥ soŋ˥˩]	'he learned'	[ʃe̤˧ soŋ˧˩˨]	'he received it'

While pitch is contrastive within a register, the pitch is not contrastive for a single syllable type: sharply falling pitch correlates with short syllables, and level pitch correlates with long syllables.

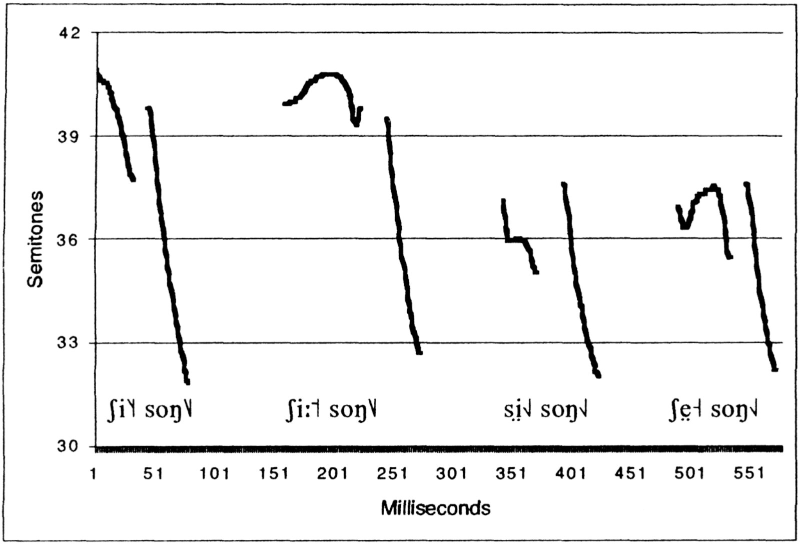


Figure 15. Contrastive pitches within a register.

5.3.3 Pitch levels within a register

In this paper I have shown that the level/falling contrast within a register reported for Tibetan languages of the Himalayas is somewhat inaccurate. In the case of monosyllabic nouns (with little affixation), the contrast is better described as quickly falling or a postponed falling in high register, and mid falling or mid rising-falling in low register. In the case of monosyllabic verbs (with affixation), there is a distinct level contrast in both registers, and this pitch contrast correlates with short and long syllables.

There are a few pairs of words for which there is a pitch contrast within a register, but the contrast is not one of level/falling. Rather, the contrast seems to lie in a distinction of height. For example, speakers of the Solo dialect of Sherpa make a pitch difference between [sʲeɾ˥] 'hail' and [sʲeːɾ˧] 'gold' in high register, and between [dʒi̤˨] 'onyx' and [dʒi˧] 'four' in low register. The difference in pitch is illustrated in Figure 16.

The difference between [sʲeɾ˥] 'hail' and [sʲeːɾ˧] 'gold' is also one of length. This seems to be another way that length correlates with pitch distinctions: short syllables are high and long syllables are low within a register. In the case of Sherpa 'gold' and 'hail', the pitch of [sʲeːɾ˧] 'gold' is in the lower ranges of high register, while the pitch of [sʲeɾ˥] 'hail' lies in the upper ranges of high register.

An analogous contrast happens in low register, but the mechanism by which it is realized is not vowel length, but rather voice quality. The word [dʒi̤˨] 'onyx' is breathy and [dʒi˧] 'four' is modal, and they are contrastively pronounced at the lower and upper ranges of pitch in low register.

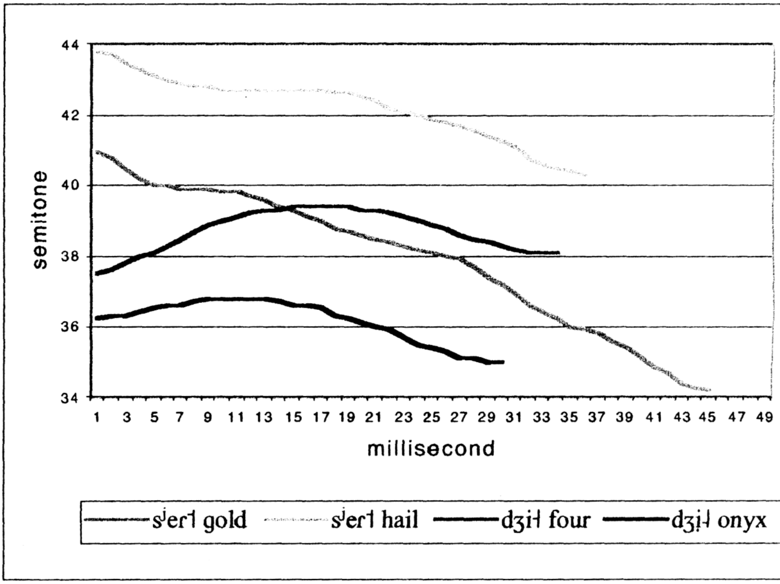


Figure 16. Three Pitch levels evident in Sherpa.

The difference between pairs of words illustrated in Figure 16 suggests the existence of a three level tonal system for a limited set of words, where there is a contrast between high and low melody in both the high and low registers. The low melody of high register and the high melody of low register overlap in pitch, as illustrated in Table 8.

Register	*Melody*	*Chao Number*
High	H	42
	L	33
Low	H	33
	L	22

Table 8. Overlapping pitch of high and low register.

However, most words do not separate into contrastive tone levels. Rather, the pitch level at which words are uttered can vary a great deal within a single register, which makes it impossible to establish any kind of distinctive pitch height levels. Normally, the acoustic space between registers leaves little room for distinctive pitch height levels at all. And yet, I have demonstrated here two mechanisms (operative only in a few select examples in Sherpa) by which pitch levels are established within a register: contrastive syllable length (short/long syllables), and contrastive voice qualities (modal vs. breathy voice).

5.4 Summary of the basic tone typology on a monosyllable

In summary, it is possible to have four contrastive pitches in certain phonological and syntactic environments. In monosyllabic suffixed verbs these are high falling, high level (slightly rising), mid falling, and mid rising-falling. In monosyllabic nouns these are high sharply falling, high postponed falling, middle falling, and rising-falling.

The "falling" and "level" contrast within a register is predictable on the basis of the length of the syllable. This is illustrated in Table 9.

	Noun		*Verb*	
	Short	*Long*	*Short*	*Long*
High Register	high sharply falling	high postponed falling	high falling	high level (slightly rising)
Low Register	mid falling	rising-falling	mid falling	mid rising-falling

Table 9. Predictability of level/falling contrast based on syllable length.

These four pitches, in most cases, can be derived from certain phonational and segmental clues. I summarize the correlation between onset phonation and register in Table 10 below. Only in the case of the plain voiced sonorant is register unpredictable. It may be either high or low.

Consonant Class	*Register*	*Predictable*
Plain Obs, Aff, Fri	High	Yes
Aspirate Obs, Aff, Fri, Lateral	High	Yes
Prearticulated Sonorant	High	Yes
'Devoiced' Obs, Aff, Fri	Low	Yes
Prevoiced Obstruent	Low	Yes
Voiced Fricative	Low	Yes
Plain Sonorant	High, Low	No

Table 10. Predictability of register based on onset phonation type.

6 THE DOMAIN OF TONE

In the previous section, I illustrated the basic tonal typology which is shared by all of the dialects. This basic typology is descriptively accurate for a monosyllabic word. Beyond the monosyllable, however, the languages differ considerably from one another, according to the domain or purview over which tone extends.

The acoustic data studied for this paper point to three kinds of tone systems within the general Himalayan tone typology: *syllable based tone*, as in Lhomi and Dzongkha; *word tone templates*, as in Dolpo and Mugom Tibetan; and *word tone* where one particular tone pattern extends over the whole word, as in Sherpa. Each of these types will be looked at in turn, but first a word of explanation about syllable tone. The syllable based tone in this group of dialects differs from some other Tibeto-Burman languages which are highly tonal in nature, where the tonal features are one of the primary distinguishing marks of the syllable. Rather, in these Tibetan dialects each syllable tone has a distinctive shape that is conditioned by the onset, voice quality of the vowel, and rhyme shape. But as such, it is predictable from these phonetic clues, and not contrastive. This is different from the word tone systems of some other languages studied in this paper, where there are at most only four pitch patterns. Pitch in the syllable domain languages can take on numerous phonetic shapes depending on the segmental and phonational qualities on which it is superimposed.

6.1 Word tone

6.1.1 Tone templates (Lhasa Tibetan)

I begin by looking at word tone systems of two types: one where there are four shapes on the monosyllable, and one which is similar to the word tone of Lhasa Tibetan (templatic) system. I first consider the tone template system. Mazaudon (1977) summarizes this system nicely for modern Lhasa Tibetan, as reproduced in Table 11 below. For an autosegmental account of this same phenomenon see Yip (1993).

monosyllable	disyllable	trisyllable	three +
55	55 55	55 55 55	55 55 55..55
22	22 55	22 55 55	22 55 55..55
52	55 52	55 55 52	55 55 55..52
21	22 52	22 55 52	22 55 55..52
(adapted from Mazaudon 1977:82)			

Table 11. The tones of modern Lhasa Tibetan.

In the Lhasa system, only a monosyllable is distinctive for the four contrastive pitches. The non-initial syllable in polysyllabic words is not contrastive for pitch height (or voice quality) and is always overlaid with a high pitch, regardless of its pitch in isolation or citation form. A syllable which is falling in isolation is also falling when it is the final syllable of a polysyllabic word, otherwise it also loses its contrastiveness for level or falling melody. When a word ends in an unstressed syllable, the penultimate syllable carries the level/falling contrast.

6.1.2 Dolpo Tibetan (and Mugom)

Like the other languages of the region, Dolpo Tibetan exhibits a four way pitch contrast on the monosyllable. The Dolpa pitch system is the most similar to the Lhasa system of the other dialects studied for this paper. As in Lhasa Tibetan, there is no contrast for height in the non-initial syllables, but unlike Lhasa Tibetan, the final syllable does not carry a contrast for level vs. falling. This can be illustrated in Table 12, which follows the same conventions as those where Lhasa Tibetan is exemplified. Pitch on the final syllable of a Dolpo Tibetan word is always "high falling". This syllable pattern is further illustrated in the pitch traces in Figures 17 and 18 below.

monosyllable	disyllable
55	55 52
52	55 52
22	24 52
132	24 52

Table 12. The tones of Dolpo Tibetan.

In Figures 17 and 18, the same basic pitch pattern is present in the second syllable of each word, regardless of the phonation of the onset or the shape of the rhyme. The pitch of disyllabic words which begin with high register phonation is level or rising, with a fall at the end. In words which begin with low register phonation, the pitch is rising, also with a fall at the end. The second syllable is high, regardless of the citation form of the second syllable. Thus, in a word that begins in high register, the jump up in pitch to the second syllable is hardly noticeable. Pitch in disyllabic words in high register is level or slightly rising. A word that begins in low register has a much larger pitch gap to overcome in reaching the height of the second syllable, and the phonetic output is a rising pitch (see Figure 18).

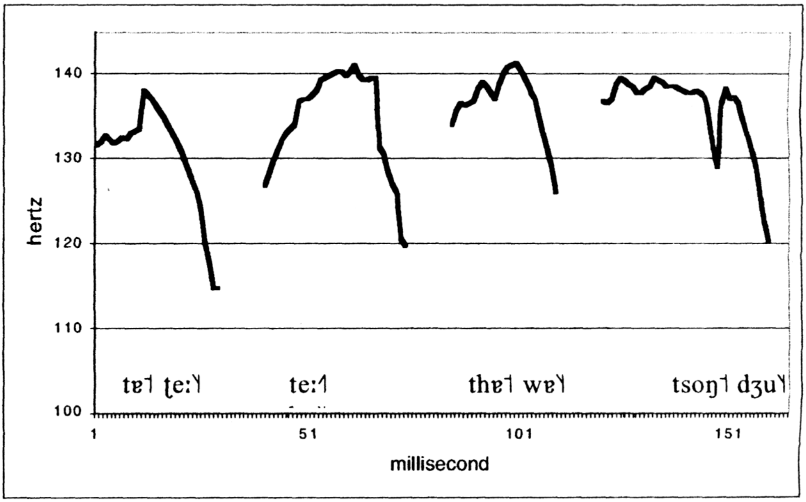


Figure 17. Pitch in Dolpo Tibetan when the first syllable is High Register.

Although in monosyllables a high level pitch is associated with a long rhyme, and a falling pitch is associated with a short rhyme, neither of these patterns holds true for polysyllabic words. Thus for example, in the word [tɐ˥ ʈeː˥˩] 'mule', the first syllable is short and level, and the second syllable is long and falling; the first syllable in the word [thɐ˥ wɐ˥˩] 'dust' is short and rising. This is especially unexpected since the second syllable is unstressed and begins with a voiced onset, phonetic conditions that induce a falling tone in other syllable tone languages like Lhomi and Dzongkha (i.e. Lhomi [thu˥˩ wɐ˧˩] 'dust'). The rising pitches of [wɐ˩˧ wɐ˧˥] 'frog' or [dɐ˩˧wɐ˧˥] 'moon' in the low register are similarly unexpected when compared with the syllable based pitch languages for the same word e.g. Dzongkha [dɐ˧wɐ˧˩] 'month'.

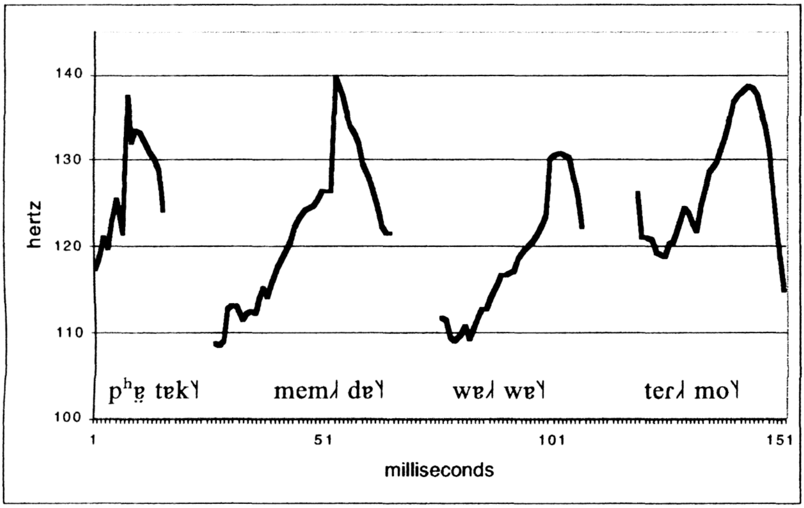


Figure 18. Pitch in Dolpo Tibetan when the first syllable is Low Register.

The pitch pattern in disyllabic words is like a template. Each syllable must fit into the template regardless of its characteristics in citation form (or underlying form). The non-initial syllable carries high pitch, with no designation for register. Similarly, it does not carry any designation for level/falling. It is always high falling.

In transcribing disyllabic words, I find that a helpful auditory clue is listening for a perceived stress on the second syllable (high register) and a jump up in pitch to the second syllable (low register). By following these two clues, I can accurately note which of the two patterns the word belongs to.

6.1.3 Polysyllabic words in Dolpo

Our analysis of pitch in words with more than two syllables is severely limited, since it would require extending this study to include a morphological analysis. However, a limited set of data on compounding suggests that the tonal domain extends no further than two syllables. In the case of trisyllabic compounds the extra syllable carries its own tone, while in the case of a quadrisyllabic compound, both pairs fit into either the high or low register pattern for disyllabic words. These patterns are given in the Figures below.

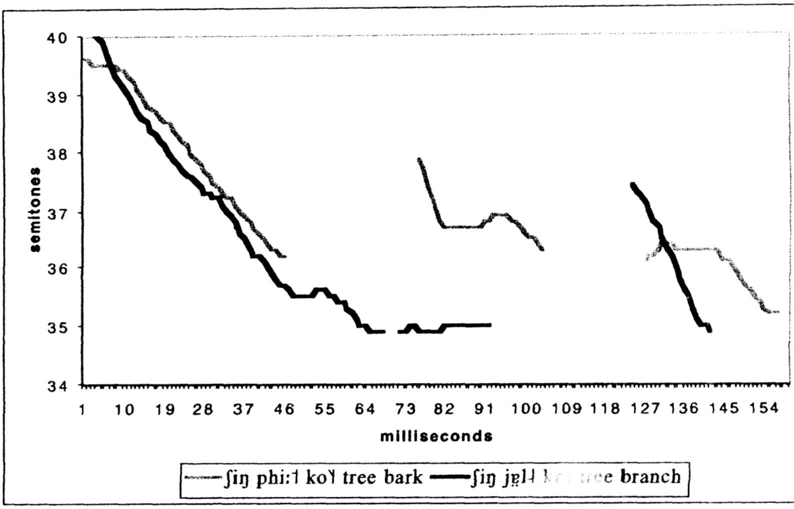


Figure 19. *Distinctive pitches in derivational compounding with the word "tree".*

In Figure 19, the words [phi:˥ ko˥˩] and [jɐ̤l˧ kɐ˥˩] both follow [ʃiŋ˥˩] 'tree' to derive the words 'tree bark' and 'tree branch', respectively. The word [phi:˥ ko˥˩] follows the high register pattern and [jɐ̤l˧ kɐ˥˩] the low register pattern. I presume that if these words were to follow the Lhasa tone template, they would both have similar pitches. However, it is clear that both words carry the pitches they would have in isolation, i.e. they both carry the pitch that is normally assumed by words which begin with high and low register, respectively. Pitch does not extend beyond two syllables.

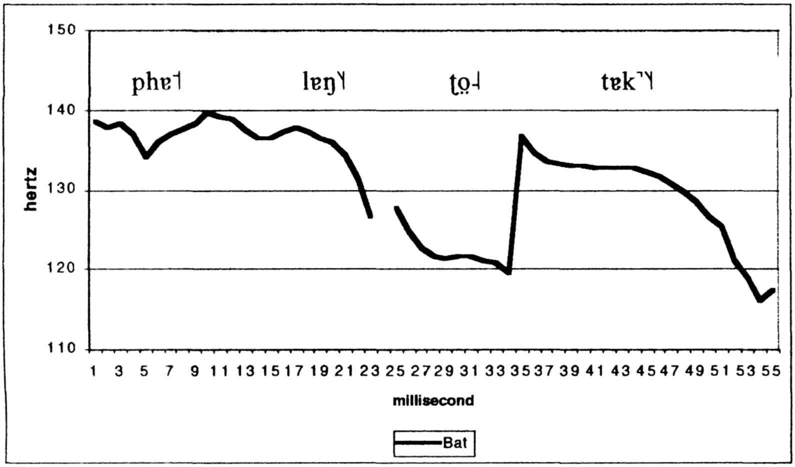


Figure 20. *A four syllable word with pitch patterns of both low and high register.*

In Figure 20, I illustrate the pitch trace of the compound [phɐ˥ lɐŋ˥˧ t̪o̤˧ tɐk˺˥˧] 'bat'. While the word is one morpheme in English, it is at least two morphemes in Dolpo Tibetan, and perhaps three, depending on whether or not [t̪o̤˧] 'move' and [tɐk˺˥˧] '??' should be thought of as separate morphemes. In either case, the four syllables pattern as two pairs: the first pair assuming a high register disyllabic pitch pattern, and the second pair assuming a low one.

I wonder how this compares with a word of similar derivation in Lhasa Tibetan. Does it follow the pattern in Table 11, as given by Mazaudon (1977), or does it break apart into two pitch patterns as in Dolpo Tibetan?

6.1.4 Word tone (Sherpa)

In the preceding section I described the word tone template system as it appears in my data for Dolpo Tibetan. The word tone system in Sherpa, however, is different. The four tones which are in evidence on a monosyllable extend across the length of a word (including its affixes). These characteristics are illustrated in the following discussion.

The level/falling contrast is most apparent in words where both onsets of a disyllable begin with a sonorant (and as such are not predictable indicators of the inherent pitch of a syllable), as in [mi˥ lam˧] 'dream' and [mɐ˥ li˥] 'earring'. The pitch of the first syllable in both words is basically level, although the pitch of the first syllable in [mi˥ lam˧] falls slightly and the pitch of the first syllable in [mɐ˥ li˥] rises slightly to meet the pitch of the second syllable. This is illustrated in Figure 21.

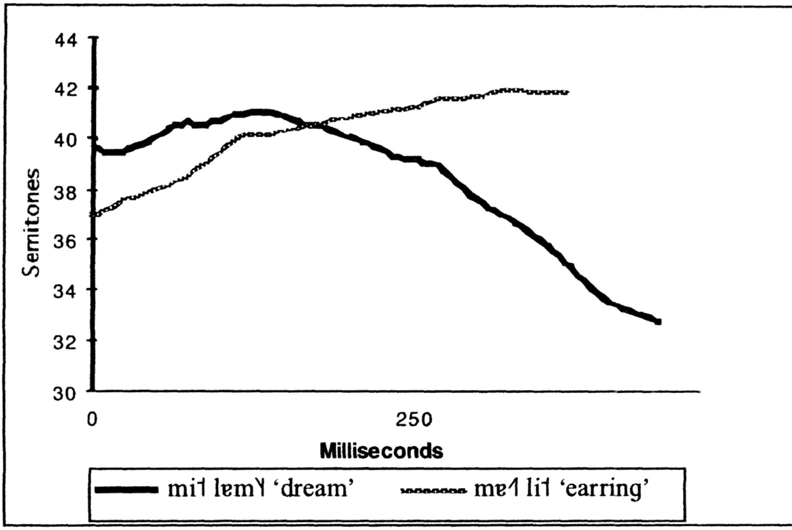


Figure 21. *Pitch in Sherpa disyllabic words when the onsets of both syllables are sonorants.*

The pitches of the second syllable, however, are clearly dif ferent: [mɐ˥ li˥] is slightly rising, and [mi˥ lam˧] is falling. A similar pitch pattern is evident in the words [te˥ rup˧] 'give' and [te˥ ri˥] 'all' in high register, and [pɐ̤˨ lɐŋ˨] 'cow' and [pɐ̤˨ pup˧] 'descend' in low register, as in Figure 22.

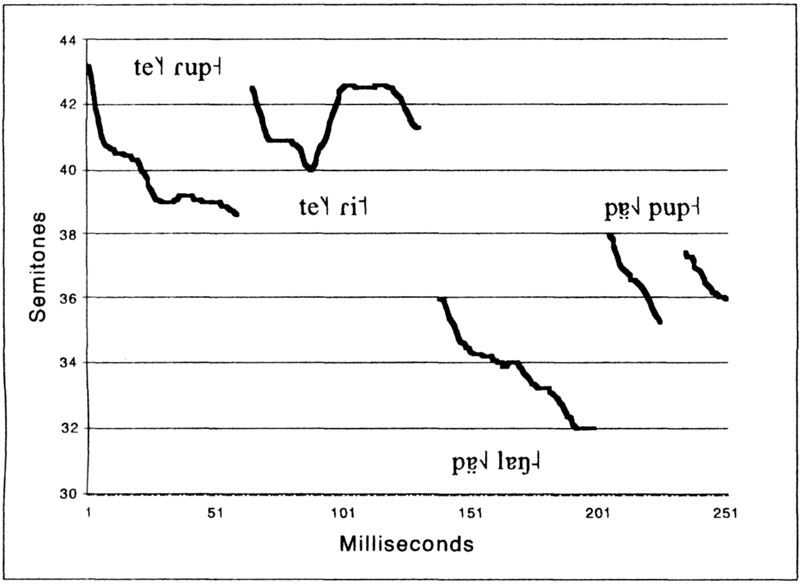


Figure 22. Four Pitch shapes in Sherpa disyllabic words.

There are parallels between the pitch heights of the second syllable, and the three pitch levels in Sherpa monosyllables. The second syllables of the four words in Figure 22 are contrastive for three pitch levels. The second syllable of [te˥˧ ri˦˥] 'all' is the highest of the pitches (high register, high melody), the second syllable of [te˥˧ rup˧] 'give' (high register, low melody) is pronounced at a mid level pitch along with the second syllable of [pɐ̤˨˩ pup˧] 'descend' (low register, high melody), and finally the second syllable of [pɐ̤˨˩ lɐŋ˨] 'cow' is at the lowest pitch level (low register, low melody).

While Figures 21 and 22 illustrate that pitch can be contrastive for height and melody on the second syllable (quite unlike Dolpo or Lhasa Tibetan), words which are high in the second syllable are in fact rare. Of the 1,000 words studied for this paper less than forty fit into this category. The majority of words are falling in pitch throughout the word.

6.2 Syllable tone (Dzongkha and Lhomi)

6.2.1 Potential patterns in nouns

I now turn to a discussion of pitch when it is in the domain of the syllable, as in Dzongkha and Lhomi. The pitch pattern in disyllabic nouns for these two languages is considerably more complex than in monosyllabic words. I illustrate this discussion, again, with data from Lhomi.

Vowel length is contrastive on the first syllable of disyllabic words, but not on the second syllable. When the first syllable is long it attracts stress, or perhaps it is because this syllable is stressed that it is lengthened. In any case, this syllable is "heavy" in comparison to the one which follows it. When the first syllable is short, the first and second syllables seem to be of equal "weight" in terms of quantity and "stress." The following illustrates this syllable pattern:

'CVV	CV
CV	CV

The pitch which overlays the "heavy" syllable is level or somewhat rising. The pitch which overlays a "light" syllable is sharply falling. The pitch pattern of a disyllabic word is not unlike the pitch pattern found in monosyllabic verbs followed by a suffix. The pitch of long verb stems is level, slightly rising until it reaches the suffix, at which point it falls, and the pitch of a short stem followed by a suffix results in two successive falling pitches:

Syllable Pattern	'CVV	CV
Pitch Pattern	level/rising	falling
Syllable Pattern	CV	CV
Pitch Pattern	falling	falling

In addition, the pitch height which correlates with register must also be factored into this equation. The pitch height (i.e. high or low) of syllables in disyllabic words is roughly analogous to pitch height in monosyllables. In general, the incipient pitch of the first syllable sets the general pitch height of the full word. The onset of the second syllable would seem to have some effect on its pitch height, although this seems to be somewhat mitigated by the effects of the first syllable. Combining the syllable pattern and the incipient pitch height determined by the onset syllable, there are eight syllable/phonation patterns, illustrated below (where superscript "h" refers to high register and subscript "l" refers to low register).

C^hV	C^hV
C^hV	C_lV
$'C^hV$ V	C^hV
$'C^hV$ V	C_lV
C_lV	C^hV
C_lV	C_lV
$'C_lVV$	C^hV
$'C_lVV$	C_lV

The pitch height interacts with the direction of pitch to produce a number of different pitch patterns. I enumerate these patterns below, along with illustrations of the FØ.

6.2.1.1 First syllable high register.

In words that begin with high register syllables (voiceless onset, modal voice or sonorant, modal voice), I find the following pitch patterns:

Syllable Pattern		**Pitch Pattern**		**Illustrative Word**	
1st syllable	*2nd Syllable*			*Lhomi*	*gloss*
CV	C^hV	high falling	high falling	khi˥˩ si˥˩	'cheap'
CV	C_lV	high falling	mid falling	thu˥˩ wɜ˧˩	'hammer'
'CVV	C^hV	high level	high falling	pɐː˥ ti˥˩	'palm'
'CVV	C_lV	high level	mid falling	kheː˧ mɐ˧˩	'kidney'

Table 13. First syllable high register.

These four possibilities are illustrated in the four pitch tracts of the words (from left to right) in Figure 23. The two pitch tracts furthermost to the right in Figure 23 illustrative of words where the second syllable begins with a sonorant. These are [thu˥˩ wɜ˧˩] 'hammer' and [kheː˧ mɐ˧˩] 'kidney' from left to right. In the word [kheː˧ mɐ˧˩], the first syllable is lengthened with a characteristic level pitch on the first syllable (a prolonged falling). In the word [thu˥˩ wɜ˧˩] the first syllable is not lengthened and the pitch falls sharply throughout the word (compare this with Dolpo Tibetan in Figure 17.

In the word [khi˥˩ si˥˩], the first syllable is sharply falling, and likewise the second syllable is sharply falling from the same height as the first syllable. In the word [pɐː˦ ti˥˩], the first syllable is long, and has the characteristic prolonged fall until it reaches the second syllable, at which point it falls sharply. The pitches of the two words on the left are predictable on the basis of the segmental content of the syllable. This is not entirely true of the two right-most words (i.e. [thu˥˩ wɜ˧˩] and [kheː˧ mɐ˧˩]), since both words share the same general phonation class for the onsets in each syllable.

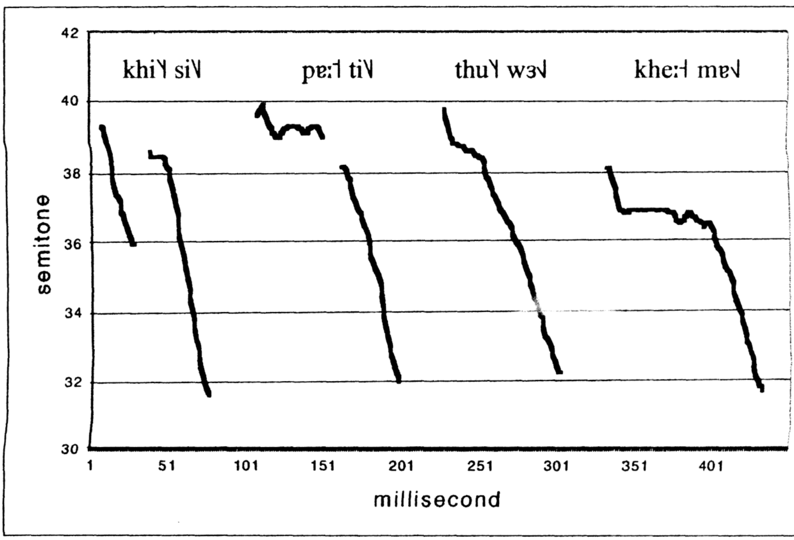


Figure 23. Pitch in Lhomi when the first syllable is High Register.

The influence of the phonation of the onset consonant and a similar pattern of "heavy"/"light" pairs can be found for words uttered in the low register pitch range. However, the pitch shapes in some cases are distinctly different than their high register counterparts. These patterns are enumerated in the paragraphs below.

6.2.1.2 First syllable low register.

In words that begin with a low register onset and a short first syllable, pitch is essentially sharply falling (and at a lower level than high register), as in [dɐ˦˨ tʃɐʔ˦˨] 'moon'. Two short syllables are overlaid by two successive falling pitches, with a step up to the next falling pitch. When the first syllable is long the pitch is either rising or level depending on the pitch height of the syllable which follows: rising when the following syllable is high register, as in [dɐm˨˦ tʃʲɐʔ˦˨] 'slap', and level/slightly rising when the following syllable is low register, as in [doː˨˧ le˧˨] 'monkey'. Words which have a long first syllable, then, have a distinct rising-falling pitch contour. As for high register, there are four different possibilities for pitch shapes in disyllabic words uttered in the low register. These pitch traces are illustrated in Figure 24, and the patterns are given in Table 14.

Syllable Pattern		Pitch Pattern		Illustrative Word	
1st syllable	*2nd syllable*			*Lhomi*	*gloss*
CV	ChV	mid/high falling	high falling	dɐ˦˨ tʃɜ/˦˨	'moon'
CV	ClV	mid falling	mid falling	dɐ˧˨ wɐ˧˨	'month'
CVV	ChV	mid rising	high falling	dɐm˨˦ tʃʲɐ/˦˨	'slap'
CVV	ClV	mid level	mid falling	doː˨˧ le˧˨	'monkey'

Table 14. Lhomi first syllable low register.

The rising-falling nature of pitch in words like [dɐm˨˦ tʃʲɐʔ˦˨] and [doː˨˧ le˧˨] is due in part, I suggest, to the stress given to the first syllable. In low register, the influence of stress manifests itself as a rising pitch. In high register, stress induces a level pitch, and is probably not rising since the pitch is already at the upper levels of the pitch range.

The two rightmost words, [dɐ˧˨wɐ˧˨] 'moon' and [doː˨˧ le˧˨] 'monkey', are contrastive in analogous environments for pitch and stress. Pitch is not predictable in these two words on the basis of onset phonation, unlike [dɐ˦˨ tʃɐʔ˦˨] 'moon' and [dɐm˨˦ tʃʲɐʔ˦˨] 'slap'.

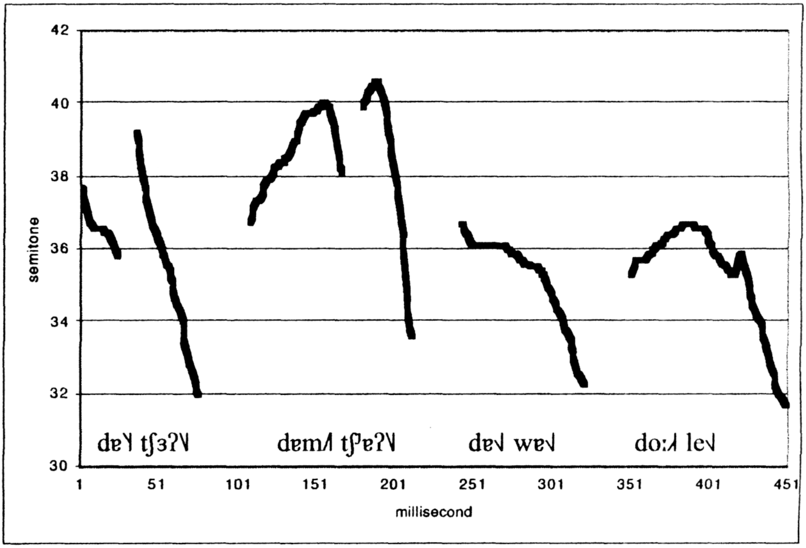


Figure 24. Pitch in Lhomi when the first syllable is low register.

6.3 Summary of tonal attributes

In this section I have looked at pitch in disyllabic words. The data show that there are three different word tone systems in the Tibetan languages studied here: tone template, word tone, and syllable tone. In the tone template languages (Dolpo and Mugom Tibetan), the four monosyllabic patterns are reduced to two disyllabic pitch patterns, and these patterns are derived from the register of the first syllable. The first syllable carries the contrastive pitch, and the non-initial syllable exhibits the predetermined characteristics of the template rather than its inherent or underlying characteristics. In the word tone languages (Sherpa), the four tones evident on a monosyllable are extended over an entire word. This four way contrast gives rise to a three pitch height distinction that is reminiscent of the three pitch heights sometimes evident in monosyllables. In the syllable tone languages (Lhomi and Dzongkha), the pitch of a syllable is derived from its segmental characteristics, both from the quality of the onset and the weight of the rhyme. As such there are eight possible pitch patterns for this type of language. These syllable pitches, however, are not phonologically contrastive but derive largely from the segmental qualities of the syllable over which they lie.

7 VOICE QUALITY

Thus far, I have examined the pitch characteristics of these languages. I turn now to a brief acoustic study of modal and breathy voice on monosyllabic words. It has been successfully demonstrated in a number of studies that for any given vowel, relative energy levels of the fundamental frequency and the second harmonic correspond to differences in phonation type. Relative lower levels of energy in the second harmonic correspond with a breathy phonation, while higher levels correspond with modal phonation. Like tone, values for breathy and modal voice are not absolute but vary between languages. The difference between relative energy levels for breathy phonation in one language may be positive, while in another language it may be negative. Similarly, the values for modal voice differ between languages. Thus, it is not necessary for positive values to correspond to modal voice and negative values to correspond to breathy voice. What is important is that the language employs the difference between the two phonations (whatever they are) to mark a lexical contrast (Maddieson et al. 1985, 1986).

A study of voice quality using Maddieson's technique provides fruitful results in these languages. The data were obtained by measuring the difference in amplitude between the fundamental frequency and the second harmonic of words that have the vowel /ɐ/ or /ɜ/, and comparing the values for syllables which begin with three distinct phonation types in obstruents: voiceless (plain and aspirated), 'devoiced', and prevoiced. Measurements for each phonation type were taken from between 16 to 20 tokens for each language. The results of this study are illustrated in Figure 25.

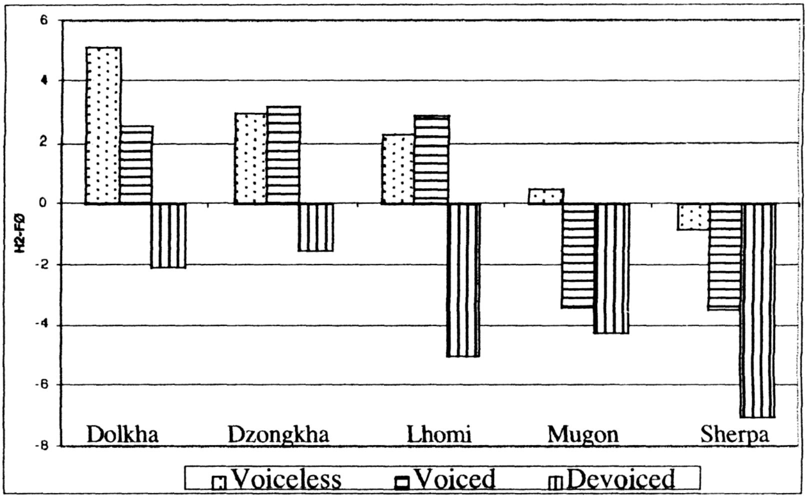


Figure 25. Comparison of voice quality using H_2-FØ measure.

The mean value for H_2-FØ for vowels following voiceless consonants (plain and aspirated) is positive in all of the languages except Sherpa, where it is slightly negative. The mean value for H_2-FØ for vowels following prevoiced consonants is positive in all of the languages except Mugom and Sherpa. In Mugom and Sherpa, the voice quality following prevoiced consonants is distinctly breathy in comparison to that following plain and aspirated voiceless consonants. In all languages, the mean value for H_2-FØ for vowels following 'devoiced' consonants is negative.

The relative values of positive and negative correspond with modal and breathy voice, respectively. This pattern corresponds well with my own auditory judgments for voiceless and 'devoiced' syllables. Negative values in Mugom and Sherpa and positive values in Dolkha, Dzongkha, and Lhomi following the voiceless and voiced/prevoiced series illustrate the relative values of the difference in energy levels from language to language.

The distinctive behavior of the 'devoiced' segments, as compared with the 'voiceless' segments is statistically significant in each of the languages, as evaluated by a paired data t-Test assuming unequal variances, illustrated in Table 15. This verifies that the voice qualities following the voiceless and the devoiced series are distinct from one another in each language.

Dolkha	**voiceless**		
	$p < 0.1$	**prevoiced**	
	$p < 0.00001$	$p < 0.01$	**devoiced**
Dzongkha	**voiceless**		
	$p < 1.0$	**prevoiced**	
	$p < 0.00001$	$p < 0.00001$	**devoiced**
Lhomi	**voiceless**		
	$p < 1.0$	**prevoiced**	
	$p < 0.0000001$	$p < 0.000000001$	**devoiced**
Mugom	**voiceless**		
	$p < 0.000000001$	**prevoiced**	
	$p < 0.00001$	$p < 1.0$	**devoiced**
Sherpa	**voiceless**		
	$p < 0.0001$	**prevoiced**	
	$p < 0.0000001$	$p < 0.001$	**devoiced**

Table 15. Statistical evidence for the distinctiveness of breathy voice.

Table 15 also illustrates that voice quality following the voiced/prevoiced series in Dolkha, Dzongkha, and Lhomi is the same as the voiceless series. That is, modal voice follows the voiceless and prevoiced series in these three languages. In Mugom and Sherpa, however, the voice quality following the voiced/prevoiced series matches with the 'devoiced' series. This suggests that the voice quality in Mugom and Sherpa following 'devoiced' and voiced is breathy.

The H_2-FØ for vowels following the nasals series is odd in comparison with the obstruents. There is no statistical difference in energy levels between modal and breathy voice following nasal onsets. Furthermore, in several of the languages the H_2-FØ measurements have extreme negative values (-15). I don't understand why this is the case.

8 CONCLUSIONS

The laryngeal states of the onset in many Tibetan dialects exhibit a rare complexity. In Dzongkha, there is a seven way contrast in the phonational/articulatory interaction on onsets, and a six way contrast for the other languages studied here. This complexity gives evidence for older WT complex onsets, but in synchronic articulations that are not commonly attested in other languages. It is clear that some features of the old syllable are still around and manifest themselves in "phonation debris" in the onset.

The Tibetan languages examined in this paper share a common tonal typology on the monosyllable. This shared typology is the intersection of phonation register with pitch, that potentially creates a four way contrast on a monosyllable. The phonation register serves to articulate different onsets, contrastive voice qualities, and corresponding pitch height distinctions. In some instances, these pitch height distinctions are lost, and pitch differs in shape rather than by beginning or end point. Long and short syllables serve as the environment in which a level/falling contrast has developed. Sometimes the pitch is not one of a level/falling contrast but one of sharply falling vs. prolonged falling, or in rare cases the contrast between pitch melody heights within a register (i.e. Sherpa).

While these languages share this common typology on a monosyllable, they differ from one another in the domain over which tone lies. For the Tibetan dialects studied here, there are three systems: Sherpa which is much like Tamang where the four monosyllabic patterns extend over a word; Dolpo and Mugom Tibetan where the four monosyllabic patterns are reduced to two pitch patterns, derived from the register of the first syllable; Lhomi and Dzongkha which exhibit syllable based characteristics, and produce eight phonetic pitches. These syllable pitches, however, are not phonologically contrastive but come largely from the segmental qualities of the syllable over which they lie.

I suggest that the syllable as the domain of tone is a newer system, and that there is a general drift towards word tone whereby syllables and morphemes are forced to give up some of their distinctiveness when tones collide and come into conflict. It is the extent to which languages have done this that makes them different from one another within a shared typology on the monosyllable.

In the Appendix which follows, I illustrate the correspondence between the WT form and the spoken form. I find that the generalizations that Tibetan grammarians and linguists have noted for the sound changes between Old Tibetan and the spoken languages generally hold true, but my data point to many exceptions as well.

APPENDIX

Correspondences between WT and the spoken languages

In the tables below, I give data that further illustrate the correspondences in the onset consonants between WT and the spoken languages. This data illustrates what has long been recognized by Tibetan grammarians and linguists: 1) WT consonant classes correspond consistently to certain spoken consonant classes; 2) WT letters in combination with some "root" consonants are redundant; and 3) some WT letter combinations give clues about the phonation of the onset and the register of the syllable, even if the modern spoken onset cluster is significantly reduced from the WT onset cluster. These generalizations are illustrated in the examples below.

WT voiceless obstruents (unaspirated and aspirated) are realized as spoken voiceless consonants irrespective of the WT consonant cluster (rule 1). The "prefixed" consonant is redundant with no manifestation in the spoken language.

1. $(C)C_{voiceless}V \rightarrow C_{voiceless}V$

WT voiced obstruents are realized as spoken devoiced consonants when they derive from simple WT onsets (rule 2), but as spoken prevoiced/voiced consonants when they are derived from complex WT onsets (rule 3). The "prefixed" consonant is not redundant, but denotes a spoken contrast between voicing and voicelessness.

2. $C_{voiced}V \rightarrow C_{devoiced}V$
3. $(C)CC_{voiced}V \rightarrow C_{voiced}V$

WT simple onset sonorants are realized as simple sonorant onsets with concomitant low register characteristics on the syllable. WT complex onset sonorants are realized as sonorant onsets with concomitant high register characteristics. In addition, these complex onset sonorants are articulated in Dzongkha as "pre-articulated" or "prevoiced" sonorants.

4. $CV \rightarrow C_{low}V$
5. $CCV \rightarrow C_{high}V$

	WT	Dzongkha	Diaspora Tibetan	Sherpa	Lhomi	Dolpo Tibetan	Mugu Tibetan
skin	PAGS PA	pɜk˥ ko˥	pɐk˥ pɐ		pɐ˥ bok˺	pɐk˥ βo˧	
camera	DPAR CHAS	pɐ:˥ ʃe˥	pɐr˥ tʃʰe˥			pɐɾ˥ tʃʲæ˥	
picture	DPAR	pɐ:˥	pɐr˥	paɾ˥	pɐɾ	pɐɾ˥	pɐr˥
father	PA LAGS			ˈpɐ˥ pɐ˧	pɐ˥ bɜ		

Table 16. Bilabial voiceless unaspirated onsets.

	WT	Dzongkha	Tibetan Diaspora	Sherpa	Lhomi	Dolpo Tibetan	Mugu Tibetan
toward over there	PHAR	phɐ:˥	phɐ˥ gi	phɜɾ˥	phɐ˥ lɜ	phou˥	phɐɾ˥
bag for grains	PHAD RTSI	phɛ:˥ tsɐ˥			phɐ˥ dzi	pʰɐ̤˧ dze˧	phɐ̤˧ dze
parents	PHA MA	phɜm˥	pʰɐ˥ mɐ	ˈphɜ̤m˧ mɐ˧	phɐ˧ mɜ	phɐ˥ mɐ	phɐ˥ mɐ
pig	PHAG PA	phɜp˥	phɐk˥ pɐ	ˈphɜk˥ pɐ˥	phɐk˥ pɜ	phɐk˥	phɐk˺˥
yeast (brewing)	PHAB		pʰɐp˥	pha̤p˧	phap˥	phɐ:p˺˥	phɐu˥

Table 17. Voiceless aspirated bilabial onsets.

	WT	Dzongkha	Diaspora Tibetan	Sherpa	Lhomi	Dolpo Tibetan	Mugu Tibetan
wool	BAL	pɛ:˧	pe˩	pa̤l˧	pʰɐ̤˧	pʰɐ̤:˧	pɐ̤l
cow	BA	pɜ̤˧	pʰɐ˩ mo		phɜ̤˧	pʰɐ̤˧	pɐ̤˧ lɐŋ˧
descend	BABS	pɜp˧	pɐp˩	pɐ̤˧ pṳp˧	phɜ̤p˧ kup		
frost	BA MO		pʰɐ˩ mo	ˈpɜ̤˧ mɜ̤k˧	phɜ̤˧ muk˺	pʰɐ̤˧ mo˧	phɜ̤ũʎ

Table 18. Devoiced bilabial onsets.

	WT	Dzong-kha	Diaspora Tibetan	Sherpa	Lhomi	Dolpo Tibetan	Mugu Tibetan
burn	BAR	bpɐː˧	b̰ɐr˩	bɜr up			
frog	SBAL PA	bpɛp˧	b̥ɛl pɐ	bɜl wɐ			bɐl pɐ
mask	BAG	bpɜp˧	b̥ɐk˩	bɜ̤k˧ pɐ		bpɐ̤k̚˧	b̥ɐk̚˧
goitre	LBA BA	bpou˧	b̥o˩ wɐ	bpa̤˧	bpɐ		bʷɐ̤ʎ
hide	SBAS	bpɐ̤˧	phe˩	bpɐ̤˧ kup˧	be˧ ken		be̤nʎ

Table 19. Prevoiced/voiced bilabial onsets.

	WT	Dzong-kha	Diaspora Tibetan	Sherpa	Lhomi	Dolpo Tibetan	Mugu Tibetan
earth, ground	SA	sɐʰ˥	sɐ˥	sɜ˥	sɐ˥	sɐ t̯o	sɐ
earthquake	SA YOM	sɐ˥ jum˥	sɐ˥ yom˥	sɜ ji˧	se˧ re	sõ˥ gu	sõ gol
new	GSAR PA	sɐːp˥	sɐr˥ pɐ	sɜm˥ pɐ˧	sɐm˥ pɜ	sɐ̃m˥ bɐ	sɐɾ˥ pɐ
seed	SON	søːn˥	søn˥	sʲen˧	søn˥	sɐ˥ ŋøn˧	men˥ nɐ˧
thought; opinion	BSAM	no˥ sɜm˥	sɐm˥ lo˥	ˈna˥˩ sɜm˧	sɐm˥ lo	sɐm˥ lo	sɐm˥ lo
bridge	ZAM PA	sɜm˧	sɐm˩ pɐ	sam˧ bɐ	sɜ̤m bɜ	sɐ̤m˧ bɐ	sɐ̤m˧ bɐ
copper	ZANGS			sa̤˧	sɐ̤ŋ˧	sɐ̤̃ː˧	sɐ̤̃ː mɐ˧
restaurant	ZA KHANG	sɐ˧ khɐ̃ː˥	sɐ˩ kʰɐŋ˥	ˈsɐ˧ khɐ̃ŋ		sɐ̤˧ khɐŋ˧	sɐ̤˧ khɐŋ˧
leopard	GZIG	ziːʔ˧	sik˩	dʒʲi̤k	si̤k̚˧	si̤k̚˧	dzik̚˧
bow (archery)	GZHU	ʒṳ˧	ʃu˩		ʃṳ˧	çṳ˧	dʒṳ˧
body	GZUGS PO	zuːʔ˧	suk˩ po	dzʲṳ	sy̤˧ bu	sṳk˧ wo˧	lṳ˧
eat	BZAS	sɐ̤˧	sɐ˩	sɐ̤p̚˧	so̤˧ ken	so̤ʰ˧	sɐ̤n˥

Table 20. Sibilant onsets.

	WT	Dzong-kha	Diaspora Tibetan	Sherpa	Lhomi	Dolpo Tibetan	Mugu Tibetan
low	DMA' PO	mmɐʰ˦	mɐ˥ po		mɐ		mɐuʎ
red	DMAR PO	mmɐːp˥	mɐr˥ po	m̤ɜɾ˧ ɾu	mɐ˥ pu	mor˥ ru˦	m̤ɐɾ˧ pu
wound	RMA	mmɐʰ˦	mɐʰ˥	mɐ̆ʰ˦	mɐ˦	mɐʰ˦	mɐ˦
not	MA	mɐʰ˦	mɐ˧	mɐ˧		m̤ɐ˧	m̤ɐ˧
bridegroom	MAG PA	mɜp˦	mɐk˩ pɐ	m̤ɐk pɐ	mɐk̚˦ pɜ	mɐk˧ pɐ˧	
butter	MAR	mɐː˧	mɐr˩	maɾ˧	mɜr˧	m̤ɐɾ˧	m̤ɐɾ˧
nose	SNA	n̥ɐp˦	nɐ˥	nɜu˦	nɐ˦ tɔk̚˦	nɐ˦	nɐ˧
sky	GNAM	nɜm˦	nɐm˩ khɐ˥	nam˦	nɐm˦	nɐm˦	
bride	MNA'MA	nnɐm˦	nɐ˥ mɐ˥	nɐ˦ mɐ˧		nɐ˦ mɐ˧	nɐ må
pus	RNAG	nnɐːʔ˦	nɐk˧˥˧	nɜk̚˦	nɐk̚˦	nɐk˦	nɐk˧
sick	NA	n̤ɐ˧	nɐ˥	n̤ap̚˧	nɜ guk	n̤ɛː	nɐ
when	NAM	nɜm˧		n̤ɜm˧	nɜm˦	n̤om˧	nɐm˦
sleep	NYAL	ɲɛː˧	ɳel˩		nɐ˧ gen	ɲ̤ɐː˧	ɲeː
fish	NYA	ɲɐ˧	ɲɐ˧	ŋʲɐ˧	nɐ˧	ɲɐ˧	ɲ̤ɐ˧
drum	RNGA	ŋŋɐʰ˦	ŋɐ˥	ŋɐ̆˦	ŋɐ˦	ŋɐ˦	ŋɐ
five	LNGA	ŋŋɐʰ˦	ŋɐ˥	ŋɐ˦	ŋɐ˦	ŋɐ	ŋɐ
give (hon.)	GNANG	nɐ̃ː˦	nɐŋ˥		nɐŋ˦	nɐŋ˦	nɐŋ˦
sweet	MNGAR MO	ŋŋɐːm˦	ŋɐr˥ mo	ŋɐn˦ mu˧	ŋɐ˦ mu	ŋɐr˦ wo	ŋɐɾ˦ pu
first person	NGA	ŋ̤ɐ˧	ŋ̤ɐ˧	ŋ̤ɐ˧	ŋɐ˧	ŋɐ˧	ŋɐ˧

Table 21. Nasal onsets.

Consistency between WT and the spoken languages

While the generalizations in rules 1-5 are evident in many examples, there are many cases where these principles are not borne out. In the tables below, I tabulate the consistency between WT and spoken form using the 1100 item word list as my corpus. These tables are not meant to be exhaustive with every WT onset type or point of articulation, but only to illustrate the extent to which there are exceptions. Some have suggested that I have missed something in the exceptions, and that there are in fact principled sound laws at work that cause these exceptions. I have tried long and hard to establish a pattern between WT and the spoken exceptions, but in vain.

I have compiled the spellings for each of the Dzongkha and corresponding diaspora Tibetan words (the languages in this study for which there is an official written language). Where the Dzongkha and Tibetan words are the same or similar to the words in the other languages, I am able to make a comparison between the spoken and written form (and presumably an older archaic spoken form).

In Table 22, WT complex onsets with the root letter /b/ are counted for the corresponding spoken phonation. The data demonstrate that Dzongkha and Tibetan are somewhat inconsistent, but that there is a consistency in the remaining languages (although the comparisons available are few).

	# of WT Spellings	*Voiced*	*Voiceless*	
Dzongkha	11	8	3	
Tibetan Diaspora	8	6	2	
Sherpa	5	5	0	
Lhomi	2	2	0	
Dolpo Tibetan	4	4	0	all [w]s
Mugom Tibetan	8	8	0	

Table 22. WT (C)CBV(C) goes to [bp] and [p/p^h].

In Table 23, WT /kh/ onsets are compared with the corresponding Sherpa pitch. Whereas in the other languages, WT voiceless aspirated onsets have a corresponding high pitch, they are articulated with a mid, or sometimes, low pitch in Sherpa.

	# of WT Spellings	*MID*	*HIGH*
Sherpa	17	7	10

Table 23. WT (C)KH goes to Sherpa [kh˧] and [kh˥].

WT complex /m/ onsets are compared with the corresponding register in Table 24. All the languages demonstrate a mismatch between the anticipated register and the actual spoken register.

	# of WT Spellings	*LOW*	*HIGH*
Dzongkha	17	9	8
Tibetan Diaspora	27	21	8
Sherpa	17	15	2
Lhomi	16	9	7
Dolpo Tibetan	22	16	6
Mugom Tibetan	18	14	4

Table 24. WT CM goes to [ma˥] and [ma˧].

In Table 25 below, I tabulate the Written Dzongkha (WDz) consonant codas and their correspondence with the 4 modern Dzongkha monosyllable types. A quick glance at this chart illustrates, again, that the correspondence between the written and spoken form is not absolute. Rather, the WDz form represents a form which holds true most of the time. For example, in the data used for this tabulation, a WDz word that ends in /g/ results in a syllable which is short 18 times, a long syllable 23 times, a nasal syllable once, and a glottal syllable 98 times. Clearly, the glottalized syllable is the most common reflex. And yet, it must be acknowledged that it is not a one to one correspondence. Other WDz codas result in similar patterns.

When going from the written language to the spoken language, clear tendencies are observable. When going in the opposite direction, from the spoken language to the written language, arriving at the correct written form is difficult.

WDz Coda	**short**	**long**	**nasal**	**glottal**
G	18	23	1	**98**
NG	3	3	**156**	
D	16	29		**68**
N	1		**17**	
B	4	3		2
M		1		
‘	**29**	11		5
R	5	**70**		
L	7	**77**		1
S	17	38		52
vowel	**420**	70	4	17

Table 25. Numbers of correspondences between WDz consonant codas and modern syllable types in open syllables.

Some observations on sound changes from WT to Dz

The written forms used to establish a relationship between the written and spoken forms of Dzongkha for Table 25 are not true WT forms. Most notable have been the changes in spelling which have occurred in the process of writing modern Dzongkha. Like Central Tibetan, this has involved an interesting process of adapting an archaic grapheme-based orthography to a language which has undergone sweeping phonological changes.

Michailovsky (1988b) reports that Dzongkha was a uniquely spoken language until 1961, at which time the corresponding official written language was Classical Tibetan known in Bhutan as Chokey (WT /chos skad/). Dzongkha was first written by Bhutanese grammarians educated in the classical Tibetan tradition. Michailovsky (88) reports that the standard which is used in Modern Literary Tibetan in Tibet and Tibetan refugee communities is not used in Bhutan, but Modern Central Tibetan pronunciation is used as the conventional pronunciation used in reading Chokey texts. Michailovsky observes that Chokey pronunciation is no closer than is modern Dzongkha pronunciation to the actual pronunciation that was current in Tibet when the Chokey orthography was first developed.

Michailovsky observes: "The basic principles of modern Dzongkha orthography were first established in 1971 by Lopon Pemala in his New method Dzongkha handbook (Naro et al. 1985) written in Chokey and (with minor differences) illustrated in the Dzongkha dictionary (Bhutan 1986). Dzongkha orthography makes concessions to Dzongkha pronunciation in cases where this is strikingly different from modern Central Tibetan pronunciation, but otherwise it sticks to Chokey spellings as far as possible, preserving graphs which are redundant from the point of view of Dzongkha phonology, and differentiating graphs whose pronunciations have merged. This is not seen as a defect in Bhutan, as the Dzongkha grammarians explicitly intend written Dzongkha to serve as a bridge to Chokey." (1988b: 298)

Michailovsky refers to preserving graphs which are redundant from the point of view of Dzongkha phonology (for example preinitials on voiceless consonants), and differentiating graphs whose pronunciations have merged. He documents some of those changes.

In cases where Dzongkha pronunciation has diverged uniformly from Central Tibetan, but without merging with another Central Tibetan pronunciation, WT orthography has been preserved. This is illustrated in Dz [bptʃɐ] /bya/ < WT /bya/ [tʃʰɐ̤] 'bird' where WT /by/ sequences have uniformly diverged from standard CT pronunciations and are now pronunced [bptʃ]. However, where the Dzongkha pronunciation of a WT graph differs from the CT pronunciation and corresponds to the CT pronunciation of a different WT spelling, Dzongkha orthography has been modified to reflect this change (see Michailovsky, op. cit.:299 88: 299 for an interesting example of this).

Michailovsky reports that reflexes of WT subfixed /ra/ (in clusters following velar and bilabial initials) have often merged with those of medial subfixed /ya/:

Dz [bptʃɐː] 'standing paddy', WDz ['bya], WT /'bras/, CT [ʈeː]

Dz [tʃɐ] 'hair, WDz /skya/, WT /skra/, CT [ʈɐ]

In some cases it has simply been dropped:

Dz [bpyː] 'snake', WDz /sbul/, WT /sbrul/, CT [ʈʊː].

Incorporating the second syllable when it is the WT nominalizer to be the coda of the Dzongkha monosyllable is another significant change in WDz from WT. This process and its concomitant reflexes have been well documented in Mazaudon & Michailovsky (1988).

While WDz is different than WT, the changes are not radical. The changes in the spelling system capture the fact that the changes which have occurred from WT to CT and the generalizations which can be drawn from this are used to write similar phonological processes in Dzongkha, though there is nothing etymological to suggest the changes which are being introduced in WDz.

Again, taking an example from Michailovsky, there is a general rule in CT and Dzongkha pronounciation that all sonorants are low tone except when the WT form has a written prefix. A sonorant with a written prefix is pronounced with a high tone.

WT /rnga/	CT /ŋɐ˥/	Dz /ŋɐ˥/	'drum'
WT /lnga/	CT /ŋɐ˥/	Dz /ŋɐ˥/	'five'
WT /nga/	CT /ŋɐ˧/	Dz /ŋɐ˧/	'I'

However, the WT form /nag po/ 'black' is now pronounced [nɐːp˥] in Dzongkha (and not [nɐk⅄ po˧˩] as in CT). A high tone with a sonorant is unexpected with regard to the general observation that high tone sonorants have etymologies in syllables with written prefixes. In an attempt to accommodate this general tendency, Dzongkha grammarians have begun to spell WT /nag po/ 'black' as WDz /gnag po/. Observe also Dz [yː˥] 'region', WDz /gyul/, WT /yul/, CT [yː⅄]. The archaic representations of words pronounced in a new way are based on phonological processes which have already been established in relationships between WT and spoken Dzongkha. This is emerging as a new WDz.

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