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A preliminary phonology of Brokpa

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ABSTRACT

A preliminary synchronic analysis of Brokpa phonology finds eleven vowel phonemes, including two degrees of vowel length; 35 consonant phonemes; and three tonal values (level low, level high, and contour falling). Based on a sample of 134 words, the phonological description is supported by a phonetic analysis investigating the acoustic correlates of phonemic distinctions: formant values for vowel quality, length measurements for vowel length, pitch measurements for tone, and voice onset time for aspiration in plosives and affricates. A presentation of the basic phonotactic patterns of the language concludes the sketch. Some noteworthy features of Brokpa phonology include its developing tonal system; the relative lack of open vowels, front rounded vowels, and voiced fricatives; the presence of five series of plosives; and some archaic consonant clusters.

KEYWORDS

Brokpa, Tibetic languages, phonological sketch, tone, phonotactics

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*A preliminary phonology of Brokpa**

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1 Introduction

The study at hand is concerned with establishing the segmental phonology and phonotactics of Brokpa and reports the basic phonemic contrasts found.¹ The phonological analysis is supported by a range of phonetic data — formant values for vowel qualities, length measurements for vowel length, pitch values for tone, and voice onset time for aspiration contrasts in plosives and affricates. The analysis is largely confined to synchronic observations, and the reader is referred to Rüfenacht and Waldis (this issue) for a discussion in diachronic terms.

Previous phonological descriptions can be found in Dondrup (1993: 1-5) and Bodt (2012: 309-311). Data come from a single male native speaker in his late 20's living in Bern, Switzerland. The speaker has additional knowledge of Dzongkha, Tshangla, and Dakpa, as well as English through schooling, and some German. Data collection was carried out in English.

The present analysis is based primarily on a sample of individual words (n=134), which were restricted to having a CV syllable structure to insure straightforward comparability. The sampled words are mostly nouns, as they were easier to elicit: their word forms are easier to isolate than those of verbs and sound more natural in isolation. The imperative forms of verbs might present further suitable targets, though they remained still underanalyzed at the time of recording and have thus not been examined. The words were recorded embedded in a sentence with five tokens per word (n=670), and subsequently processed and analyzed with Praat. The following carrier phrases with the target word embedded in the middle were employed in elicitation.

- (1) Carrier phrases used for elicitation
- a. *ne* __ *laɸi*
 ne __ *lap-pe*
 1SG.AGT __ say-NMLZ.PST
 'I said __.'

* Thanks must go to Leki, who kindly shared his language with us in the most patient and professional manner; to fellow students of Brokpa, Corinne, Sara, and Sereina; and to Pascal and Selin for their supervision of this project. Two anonymous reviewers at the University of Bern and an anonymous reviewer for *Himalayan Linguistics* made important contributions to shaping this work into its present form. Any remaining shortcomings will have to be taken up with the author.

¹ For general information about the Brokpa language and the Brokpa Documentation and Description Project as well as for the list of abbreviations and the transliteration of Written Tibetan used in this issue, see Gerber & Grollmann (this issue).

- b. *k^he* __ *lasoŋ*
k^he __ lap-soŋ
 2SG.AGT __ say-PST.SEN
 ‘You said __.’

A full transcription of the sample is given as an appendix of this paper. The word list totals 140 entries, which includes six additional words which were excluded from the phonetic analysis (i.e. the formant, length, pitch, and VOT measurements), though they appear throughout: one word not recorded separately but as part of the carrier phrase (*ne* ‘I (1SG.AGT)'), and five words realized with fronted vowels (*c^hu* ‘group of animals’, *ɲu* ‘wealth’, *tɛ^hu* ‘water’, *ɛú* ‘bow’, *lú* ‘song’), see Section 2.1 for discussion. Also, some of the words have no really satisfying translation yet, so their labels serve rather mnemonic purposes.

The current analysis proposes eleven vowel phonemes, including two degrees of vowel length; 35 consonant phonemes; and three tonal values: a low register tone (unmarked), a high register tone (marked by acute accent), and a falling contour tone (marked by circumflex). The vowels will be surveyed first (Section 2), paying special attention to vowel quality and vowel length. Next, the consonants are considered (Section 3), presenting plosives, fricatives, affricates, nasals, and liquids and approximants in turn. Tone is discussed in Section 4. Section 5 lays out the basic phonotactic patterns. Finally, Section 6 concludes with a summary of open questions in need of further study.

2 Vowels

Under the analysis proposed here, Brokpa has eleven vowel phonemes, one of which is considered marginal (Table 1). Vowel length is phonemic, resulting in five pairs of short and long vowels. Both members of each pair share the same vowel quality, with the exception of the pair of central vowels, where a short schwa /ə/ and a long a-schwa /ɛ:/ contrast. The status of /i:/ is somewhat uncertain, as there are no examples in the present sample and so far only one has been found, *i:* ‘grandmother’.

In contrast, both Bodt (2012: 310) and Dondrup (1993: 1) propose a simple five-vowel system /i e a u o/, and neither mentions long vowels. Also note that the relative closedness of the central vowels (particularly the short one) makes for a somewhat compressed vowel space lacking open vowels. This is possibly a Bhutanese areal feature, as similar phenomena are also found in Gongduk and Black Mountain Mönpa (Gerber 2020).

	Front	Central	Back
Close	i i: (y)		u u:
Close-mid	e e:		o o:
Mid		ə ⟨a⟩	
Near-open		ɛ: ⟨a:⟩	

Table 1. Vowel inventory

Table 2 gives the metadata of the sample organized by vowel quality. No data for the marginal phoneme /y/ have been collected, since only one word has been found which could be included in the sample, viz. *ly* ‘fertilizer’.

	Words	Token
/i/	15	75
/e/	23	115
/ə/	28	140
/ɐ/	18	90
/u/	16	80
/o/	34	170
Total	134	670

Table 2. Metadata of the sample by vowel quality

Vowel quality is discussed in detail in Section 2.1, and vowel length in Section 2.2.

2.1 *Vowel quality*

The ten non-marginal vowel phonemes represent six distinct vowel qualities, falling into three series of vowel backness and four levels of vowel height (cf. Table 1 above).

- (2) Qualitative description of vowels
 - a. /i/ close front unrounded vowel
 - b. /e/ close-mid front unrounded vowel
 - c. /ə/ mid central unrounded vowel
 - d. /ɐ/ near-open central unrounded vowel
 - e. /u/ close back rounded vowel
 - f. /o/ close-mid back rounded vowel

Regarding acoustic correlates, the formants F1 for vowel height and F2 for vowel backness have been measured at the midpoint of each vowel token. Table 3 shows the median formant values from the sample. F1 is ~300 Hz for the close vowels /i/ and /u/; ~350 Hz for close-mid /e/ and /o/; ~450 Hz for mid /ə/, and ~600 Hz for near-open /ɐ/. F2 is ~2150 Hz for the front vowels /i/ and /e/; ~1500 Hz for central /ə/ and ~1250 Hz for central /ɐ/; and ~950 Hz for the back vowels /u/ and /o/.

	F1	F2
/i/	296	2195
/e/	361	2119
/ə/	433	1519
/ɐ/	618	1262
/u/	304	989
/o/	356	936

Table 3. Median formant values of the sample

Figure 1 below presents the formant plot for the whole sample (n=670), with the labeled boxes occupying the median positions from Table 3 (all figures drawn with ggplot2 in R).

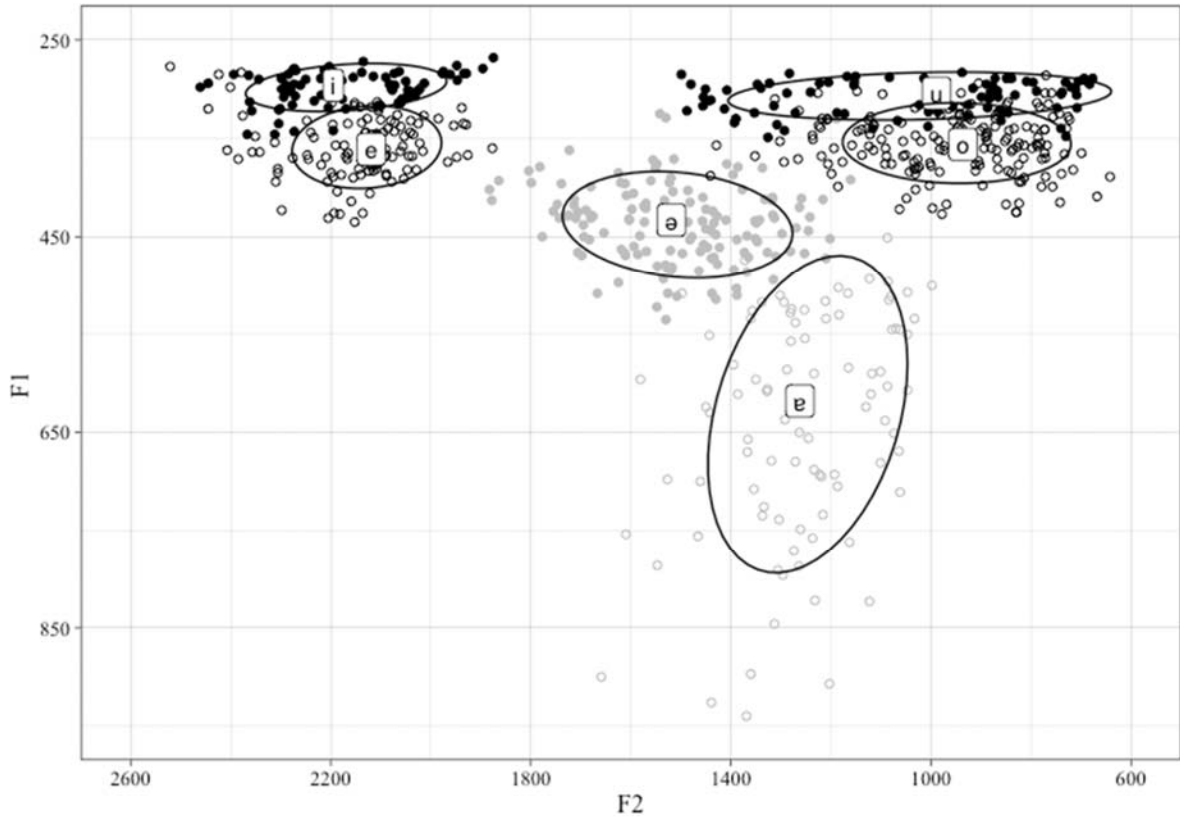


Figure 1. Formant plot for vowel qualities

Table 4 gives a selection of minimal pairs for the short vowels, and Table 5 for the long vowels.

	/i/	/e/	/ə/	/u/	/o/
/k ^h /	<i>k^{hi}</i> ‘you’ (2PL)	<i>k^{he}</i> ‘potato’	<i>k^{ha}</i> ‘mouth’	<i>k^{hu}</i> ‘sperm’	<i>k^{ho}</i> ‘he’ (3SG.M)
/ɕ/	<i>ɕi</i> ‘four’	<i>ɕe</i> ‘penis’	<i>ɕa</i> ‘meat’		<i>ɕo</i> ‘yoghurt’
/tɕ ^h /	<i>tɕ^{hi}</i> ‘outside’	<i>tɕ^{he}</i> ‘powder’	<i>tɕ^{ha}</i> ‘pair’	<i>tɕ^{hu}</i> ‘water’	
/m/	<i>mi</i> ‘person’	<i>me</i> ‘fire’	<i>ma</i> ‘wound’		<i>mo</i> ‘she’ (3SG.F)
/r/	<i>ri</i> ‘mountain’		<i>ra</i> ‘goat’	<i>ru</i> ‘horn’	<i>ro</i> ‘corpse’

Table 4. Minimal pairs for short vowels

	/e:/	/ɛ:/	/u:/	/o:/
/n/	ne: ‘barley’	na: ‘forest’		no: ‘younger brother’
/ɾ/	re: ‘thin cloth’		ru: ‘snake’	ro: ‘husband’
/p ^h /			p ^h u: ‘small container’	p ^h o: ‘bird chest’
/t/		ta: ‘moon’		to: ‘luggage transport’
/t̪/	t̪e: ‘mule’			t̪o: ‘suggestion’
/s/	se: ‘son’ (HON)			so: ‘butter container’
/ɛ/	ɛe: ‘mouth’ (HON)	ɛa: ‘swamp deer’		

Table 5. Minimal pairs for long vowels

Non-back rounded vowels are marginally present, and may represent loan phonemes (cf. Bodt 2012: 311). At least in some cases, back rounded /u/ may be allophonically realized as central rounded [ɯ], observed e.g. in *tɛ^hu* ‘water’, *lú* ‘song’, *ɛú* ‘bow’, *c^hu* ‘group of animals’, and *ju* ‘wealth’. Beyond that, a number of words are consistently realized with front rounded [y], e.g. *ly* ‘fertilizer’, *dyn* ‘seven’, *tɛy^se* ‘clock’, *gylin* ‘trade’, *ty* ‘drag’; hence /y/ is adopted here as a marginal phoneme.

Additionally, close-mid central rounded [ø] has been observed as an allophonic realization of back rounded /o/, e.g. *tɛ^hø* ‘religion’ may also be realized as [tɛ^hê].² A close-mid front rounded vowel [ø̞] is so far attested only in place names like *jɔnp^hula*, and therefore not considered a phoneme. Further potential vowel allophony has not been studied systematically yet, though candidates for allophonic variants include [ɪ ɛ ʊ ɔ ʏ] for /i e u o y/.³

2.2 Vowel length

Vowel length is phonemic, distinguishing five pairs of short and long vowels. Phonetically, long vowels last roughly 0.2 s (median 193 ms, n=180), as opposed to short vowels, which converge around 0.1 s (median 84 ms, n=385); i.e. long vowels are about twice as long as short ones. Table 6 shows a selection of minimal pairs from the sample.

	Short	Long
/ɛ/ vs. /e:/	ɛe ‘penis’	ɛe: ‘mouth’ (HON)
/ə/ vs. /ɛ:/	pa ‘cow’	pa: ‘wool’
/u/ vs. /u:/	ru ‘horn’	ru: ‘snake’
/o/ vs. /o:/	do ‘stone’	do: ‘friend’

Table 6. Minimal pairs for vowel length

Additionally, vowels carrying falling tone are longer than short vowels (see Section 4), occupying an intermediary position halfway towards long vowels at around 1.5 s (median 146 ms,

² Otherwise *tɛ^hø* ‘religion’ is homophonous with *tɛ^hø* ‘side’, which has not been observed with a fronted vowel.

³ One further phenomenon not discussed here is the occurrence of voiceless vowels in word-final open syllables; see Rufenacht and Waldis (this issue) for a discussion in areal terms. For diphthongs, see Section 5.

n=105). The data for both short and long vowels are illustrated in Figure 2, together with the data for vowels carrying falling tone for comparison.

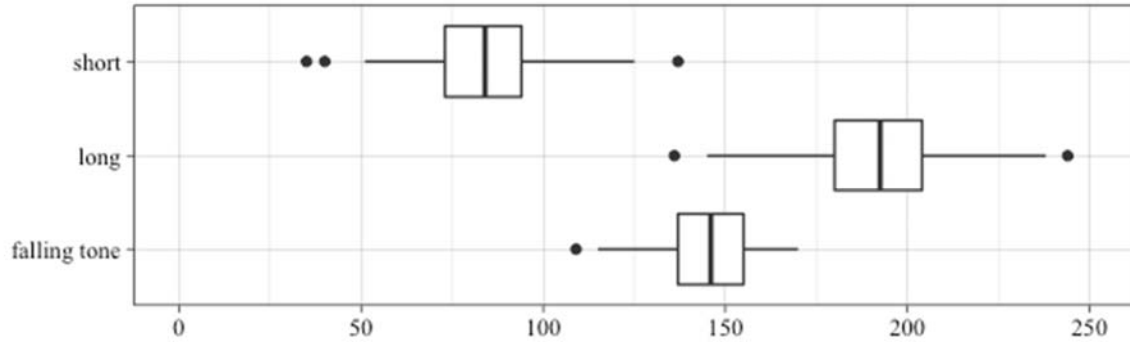


Figure 2. Vowel length in the sample (ms)

While falling tone syllables do not distinguish vowel length, both low and high tone syllables do, resulting in a five-way contrast between tone and length. A complete set of minimal pairs is shown in Table 7.

	Short	Long
Low	<i>so</i> ‘yak hybrid’	<i>so:</i> ‘butter container’
High	<i>só</i> ‘tooth’	<i>só:</i> ‘brown rice’
Falling	<i>só</i> ‘spring’	

Table 7. Illustrating the combined set of contrastive length and tone

3 Consonants

There are 35 consonant phonemes, two of which are considered marginal: the glottal plosive /ʔ/ and the voiceless velar fricative /x/. Some notable features include a three-way laryngeal contrast at five places of articulation for plosives and the (almost) complete lack of voiced fricatives and affricates.

Bodt (2012: 309) recognizes 32 consonants, including a series of voiced fricatives and affricates /z z dz/. Conversely, Bodt does not recognize the palatal plosive series /c^h c j/, the retroflex fricative /ʂ/, the voiced glottal fricative /ɦ/, and the voiceless velar fricative /x/. Dondrup (1993: 1) postulates 27 consonants, including the voiced fricatives and affricates /z dz/, as well as /dz/, but not the palatal and retroflex plosive series; the glottal plosive /ʔ/; the retroflex, the velar, and the voiced glottal fricative; or the voiceless lateral approximant /ɹ/.

Table 8 gives the consonant inventory according to IPA conventions.

	Bilabial	Alveolar	Retroflex	Palatal	Velar	Glottal
Plosive	p ^h p b	t ^h t d	tʰ ṭ ḍ	c ^h c ɟ	k ^h k g ⟨g⟩	(ʔ)
Fricative		s	ʂ	ɕ	(x)	h ɦ
Affricate		ts ^h ts		tɕ ^h tɕ		
Nasal	m	n		ɲ	ŋ	
Tap		ɾ ⟨r⟩				
Lateral approximant		ɭ l				
Approximant	w			j		

Table 8. Consonant inventory

3.1 Plosives

Making up almost half of the consonant inventory, there are five series of plosives: bilabial, alveolar, retroflex, palatal, and velar (Table 9). Note that the alveolar plosives /t^h t d/ might alternatively be considered dental.

	Bilabial	Alveolar	Retroflex	Palatal	Velar
Aspirated			tʰo ‘angry divine expression’	c ^h o ‘you’ (2SG)	k ^h o ‘he’ (3SG.M)
Voiceless	pa: ‘wool’	ta: ‘moon’			ka: ‘pillar’
	pú ‘body hair’	tú ‘vagina’			kú ‘body’ (HON)
Voiced	ba ‘tree burl’	da ‘arrow’	ɖa ‘enemy’	ɟa ‘wild goat’	ga ‘saddle’
	bu ‘insect’			ju ‘wealth’	gu ‘nine’

Table 9. Minimal pairs for place of articulation in plosives

All five series exhibit a three-way laryngeal contrast between aspirated, voiceless, and voiced (Table 10).

	Aspirated	Voiceless	Voiced
Bilabial		pa ‘cow’	ba ‘tree burl’
		pa: ‘wool’	ba: ‘goiter’
	p ^h â ‘Gho pocket’	pâ ‘curry’	
Alveolar	t ^h a ‘endpoint’	ta ‘now’	da ‘arrow’
	t ^h o: ‘hammer’	to: ‘luggage transport’	do: ‘friend’
Retroflex	tʰi ‘throne’	ṭi ‘knife’	
Palatal	c ^h u ‘group of animals’		ju ‘wealth’
Velar	k ^h a ‘mouth’		ga ‘saddle’
	k ^h a: ‘snow’	ka: ‘pillar’	
	k ^h o ‘he’ (3SG.M)	ko ‘head’	go ‘door’
	k ^h u ‘sperm’		gu ‘nine’

Table 10. Minimal pairs for laryngeal contrasts in plosives

The voiceless palatal plosive is represented in the sample with *ce*: ‘gift’. Retroflex plosives might acoustically be realized with considerable friction, making them sound somewhat like affricates.⁴

As acoustic correlate for laryngeal contrasts is voice onset time. VOT is at least twice as long for aspirated plosives as for unaspirated voiceless ones (Figure 3). The median VOT for voiceless plosives in the sample is 28 ms (n=125); this includes a significant difference between bilabial and dental plosives (median VOT 22 ms, n=70) on the one hand, and velar, palatal, and retroflex plosives (median VOT 50 ms, n=55) on the other hand. The median VOT for aspirated plosives is 93 ms (n=94). Note here that 11 out of 20 tokens of the aspirated bilabial plosive /p^h/ are not included, as they had been realized as either [ϕ] or [pf].

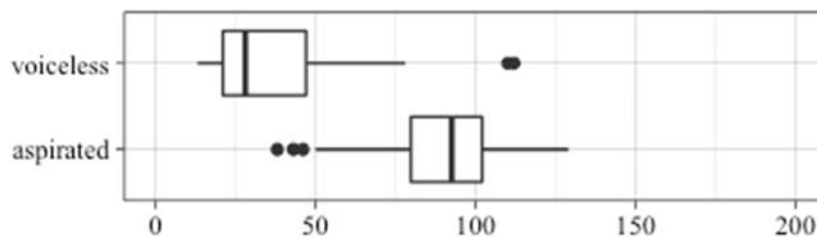


Figure 3. Plosive VOT in the sample (ms)

No VOT measurements for voiced plosives have been made, as they would be expected to either have a VOT of zero or be prevoiced; though some exploratory measurements of voiced plosives seem to indicate that at least some instances might be realized with a positive VOT in the same bandwidth as voiceless plosives, hence VOT may not be the only phonetic cue distinguishing voiced from voiceless plosives.

For some plosives, there is noticeable allophonic variation. Bilabial aspirated /p^h/ is frequently realized as a voiceless bilabial fricative [ϕ] in onset position and intervocally, e.g. virtually always in the carrier phrase with the past allomorph *-p^he*. In onset position, it is sometimes also attested as a voiceless bilabial-labiodental affricate [pf]. Similarly, velar voiceless /k/ has the homorganic fricative [x] as allophonic variant in coda position and intervocally, e.g. the verb *dok* ‘arrive’ is frequently realized as [dox].

At the same time, there are also a number of instances where [x] is not an allophone of /k/, since the speaker consistently realizes the segment as [x] and does not accept [k], e.g. *bux* ‘breath’, *teux* ‘yak cow’, *alax* ‘branch’, *peax* ‘slope’, *teexa* ‘bird feces’. As it occurs in only few words and is in contrast to most other phonemes restricted to non-initial positions, /x/ is included as a marginal phoneme.

In a similar vein, there is also evidence for the glottal plosive /ʔ/ as a marginal phoneme, since it is only attested in non-initial positions as well. It occurs in coda position in the present tense egophoric suffix *-coʔ* (PRS.EGO), where it forms a minimal pair alternating with zero with the future tense suffix *-co* (FUT). Moreover, one can find words otherwise consisting of an open syllable, which phonetically may have an optional coda [ʔ], or are perhaps glottalized, though this realization is never consistent. Examples in the sample for which this has been observed include *sā* ‘small bamboo’ and

⁴ See also Rüfenacht and Waldis (this issue) for a discussion of retroflex plosives in historical terms.

tɛ^há ‘arm, hand’ (HON), as well as the copulas *jo* COP.EX.EGO and *me* COP.EX.NEG.EGO. This phenomenon is difficult to ascertain, so there may be more examples in the sample. Note also that it is not restricted to the glottal plosive, other example may include *ɛú(k)* ‘strength’, *tɛi(x)* ‘what’, *ta(h)* ‘now’, or *la(h)* ‘mountain pass’.

3.2 Fricatives

There are fricatives at four places of articulation: alveolar, alveolo-palatal, retroflex, and glottal (Table 11). Most importantly, there is no evidence for contrastive voicing (except marginally for glottal fricatives). However, /s ɣ/ are often realized as their voiced counterparts in connected speech, hence one can postulate free variation [s~z] and [ɣ~ʒ]. The retroflex fricative /ʂ/ also has an allophonic variant [ʂ̥], a voiceless alveolar tap, which is in free variation as well.⁵

Alveolar	Alveolo-palatal	Retroflex	Glottal
<i>sa</i> ‘fruit seed’	<i>ɛa</i> ‘meat’	<i>ʂa</i> ‘head hair’	
<i>se:</i> ‘son’ (HON)	<i>ɛe:</i> ‘mouth’ (HON)		
<i>si</i> ‘dzi bead’	<i>ɛi</i> ‘four’		
<i>so</i> ‘yak hybrid’	<i>ɛo</i> ‘yoghurt’		
<i>só</i> ‘tooth’	<i>ɛó</i> ‘dice’		
<i>sú</i> ‘who’	<i>ɛú</i> ‘bow’		<i>hú</i> ‘small teapot’

Table 11. Minimal pairs for fricatives

There is a single voiced fricative, glottal /fi/, which has so far been found word-initially before /o/, e.g. *fi:o:* ‘under’. Further examples include *fi:o:ma* ‘milk’, *fi:opaj* ‘floor’, and *fi:opteujdonkar* ‘red panda’.

3.3 Affricates

There are four affricates at two places of articulation: alveolar /ts/ and alveolo-palatal /tɕ/; both voiceless and aspirated. As in the case of the fricatives, voiced affricates are not attested phonemically, but occur allophonically as [ts~dz] and [tɕ~dʒ] in free variation. The following minimal pairs illustrate the contrast in place of articulation as well as laryngeal contrast (Table 12).

Alveolar		Alveolo-palatal	
Voiceless	Aspirated	Voiceless	Aspirated
	<i>ts^he</i> ‘life’		<i>tɕ^he</i> ‘powder’
<i>tsé</i> ‘top’		<i>tɕé</i> ‘tongue’	
		<i>tɕé:</i> ‘rat’	<i>tɕ^he:</i> ‘fangs’
	<i>ts^ha</i> ‘salt’	<i>tea</i> ‘tea’	<i>tɕ^ha</i> ‘pair’
		<i>tɕá</i> ‘iron’	<i>tɕ^há</i> ‘arm, hand’ (HON)

Table 12. Minimal pairs for affricates

⁵ See also Rüfenacht and Waldis (this issue) for a discussion of its origins.

Voice onset time for affricates is longer than for plosives — since the fricative phase of the affricate is included in the measurement, as it cannot be distinguished from aspiration in the spectrogram — and about 1.5 times as long for aspirated affricates as for unaspirated voiceless ones. The median VOT in the sample is 84 ms (n=35) for voiceless affricates, and 132 ms (n=60) for aspirated affricates (Figure 4).

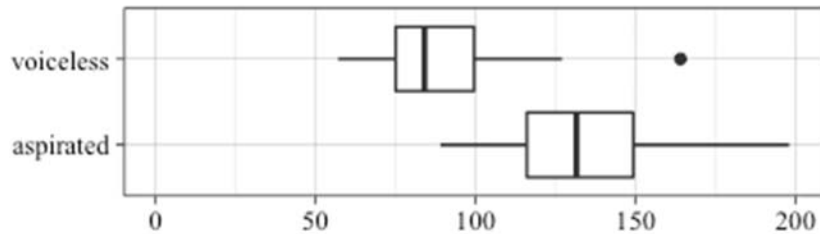


Figure 4. Affricate VOT in the sample (ms)

3.4 Nasals

There are nasals at four places of articulation: bilabial, alveolar, palatal and velar. The full series is attested with the central vowel /ə/ (Table 13). While the velar and the palatal nasal are contrastive before e.g. /ə/ (*ŋa* ‘I’ (1SG) vs. *na* ‘fish’), /ŋ/ is not attested before the front vowels /i e/; note the contrast between *ŋa* ‘I’ (1SG) and *ne* ‘I’ (1SG.AGT).

Bilabial	Alveolar	Palatal	Velar
<i>ma</i> ‘wound’	<i>na</i> ‘nose’	<i>na</i> ‘fish’	<i>ŋa</i> ‘I’ (1SG)
<i>me</i> ‘fire’		<i>ne</i> ‘I’ (1SG.AGT)	
	<i>ne:</i> ‘barley’	<i>ne:</i> ‘thigh’	

Table 13. Minimal pairs for nasals

3.5 Taps and Approximants

Lastly, Brokpa has one tap, two lateral approximants, and two approximants. There are both a voiced and a voiceless lateral approximant, and the single tap is alveolar /ɾ/ ⟨r⟩. A corresponding voiceless tap [ɽ] only occurs as an allophone of the retroflex fricative /ʂ/ (see Section 3.2 above). Table 14 shows some minimal pairs for the tap and lateral approximants.

Tap	Voiced lateral approximant	Voiceless lateral approximant
<i>ra</i> ‘goat’	<i>la</i> ‘mountain pass’	
<i>ro</i> ‘corpse’	<i>lo</i> ‘year’	
	<i>lá</i> ‘rhododendron leaf’	<i>lá</i> ‘god’

Table 14. Minimal pairs for taps and lateral approximants

Finally, the two voiced approximants are palatal /j/ (represented in the sample with *jo* COP.EX.EGO, *já* ‘yak’) and labial-velar /w/ (represented by *we* ‘starlight’).

4 Tone

There is evidence for three tonal values, two level tones and one contour tone.⁶ Dondrup (1993: 2) mentions a binary contrast between level and rising tone, while Bodt (2012: 311) recognizes a contrast between high and low tone.

For the level tones, there is an opposition between high (marked by acute accent) and low (unmarked). Phonetically—for this speaker—high tone clusters around 150 Hz (median 148 Hz, n=160), and low tone at 120 Hz (median 120 Hz, n=290), resulting in a difference of about 30 Hz between tones. Both short and long vowels can carry high tone. The single contour tone is a falling tone (marked by a circumflex), which starts at a regular high tone and drops to a low tone. As seen in Section 2.2, vowel length for vowels carrying falling tone is generally somewhere between those for short and long vowels (perhaps because the contour lengthens an otherwise short vowel), i.e. there are no long vowels with falling tone, and so no length distinctions for falling tone (cf. Table 7 above). Furthermore, falling tone interacts with vowel quality in central vowels, where the two members of the pair distinguished by vowel length also have different vowel qualities: a central vowel carrying falling tone is always near-open [ê], never mid [â]. This is probably correlated to vowel length, as vowels with falling tone are longer than short vowels and the long member of the central vowel pair is also [ê].⁷

Table 15 shows all minimal pairs from the sample.

	Low tone	High tone	Falling tone
/i/		<i>kí</i> ‘dog’	<i>kî</i> ‘language’
		<i>ɲí</i> ‘we’ (1PL.EXCL)	<i>ɲî</i> ‘two’
/e/	<i>me</i> ‘fire’		<i>mê</i> ‘buttocks’
/e:/	<i>ɛe:</i> ‘mouth’ (HON)	<i>ɛé:</i> ‘glass’	n.a.
	<i>ɲe:</i> ‘thigh’	<i>ɲé:</i> ‘snare trap’	n.a.
/ə/	<i>pa</i> ‘cow’		<i>pâ</i> ‘curry’
	<i>ta</i> ‘now’	<i>tá</i> ‘horse’	<i>tâ</i> ‘tiger’
	<i>tea</i> ‘tea’		<i>teâ</i> ‘iron’
	<i>sa</i> ‘fruit seed’	<i>sá</i> ‘soil’	<i>sâ</i> ‘small bamboo’
	<i>ma</i> ‘wound’		<i>mâ</i> ‘war’
	<i>ɲa</i> ‘I’ (1SG)	<i>ɲá</i> ‘five’	
	<i>la</i> ‘mountain pass’	<i>lá</i> ‘rhododendron leaf’	
/o/	<i>so</i> ‘yak hybrid’	<i>só</i> ‘tooth’	<i>sô</i> ‘spring’
	<i>ɛo</i> ‘yoghurt’	<i>ɛó</i> ‘dice’	
	<i>lo</i> ‘year’		<i>lô</i> ‘light’
/o:/	<i>so:</i> ‘butter container’	<i>só:</i> ‘brown rice’	n.a.
	<i>to:</i> ‘luggage transport’	<i>tó:</i> ‘water container’	n.a.
/u/		<i>ɛú</i> ‘bow’	<i>êú</i> ‘strength’

Table 15. Minimal pairs for tone

⁶ See also Rüfenacht and Waldis (this issue) for a discussion of tonogenesis.

⁷ In the phonetic data on formant values, words with central vowels and falling tone are thus included with /ɛ/, not /ə/.

Regarding pitch measurements, those for falling tone (n=105) are parallel to those for level tones. There is a drop of roughly 30 Hz between initial pitch (median 148 Hz) and final pitch (median 115 Hz). Figure 5a and Figure 5b illustrate the distribution of the data.

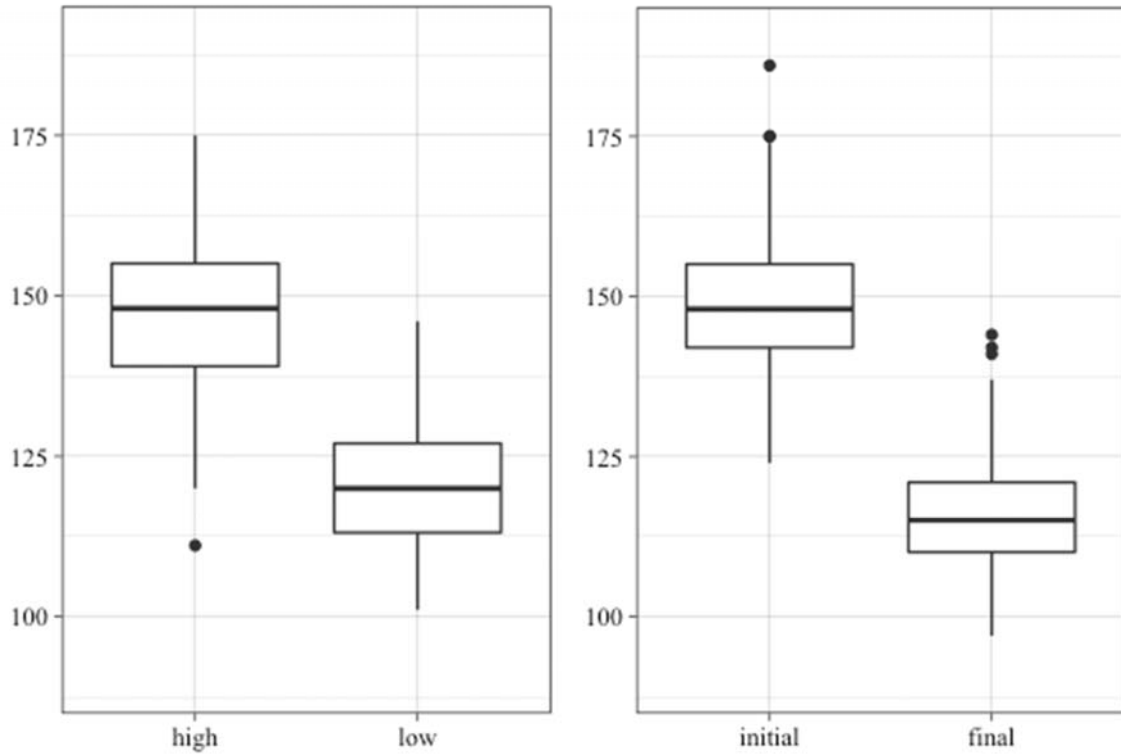


Figure 5. Pitch of three contrastive tones

Figure 5a. (left) High vs. low tone (Hz)

Figure 5b. (right) Initial and final pitch of falling tone (Hz)

Pitch tracks of the tonal minimal pairs *so* 'yak hybrid', *só* 'tooth', and *sô* 'spring' are shown in Figure 6 and Figure 7. All five tokens of each word have been included to illustrate the variation found in the sample (on the recordings, early tokens tend to be higher in pitch than later tokens for high as well as low and falling tones).

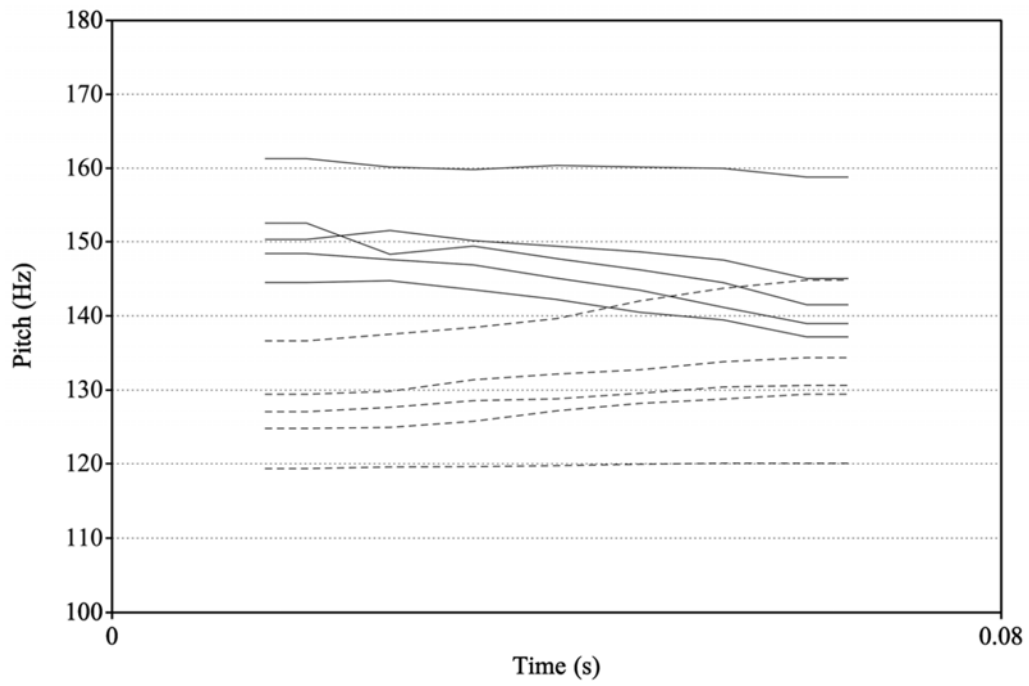


Figure 6. Pitch tracks of high tone *sô* 'tooth' (solid) and low tone *so* 'yak hybrid' (dashed)

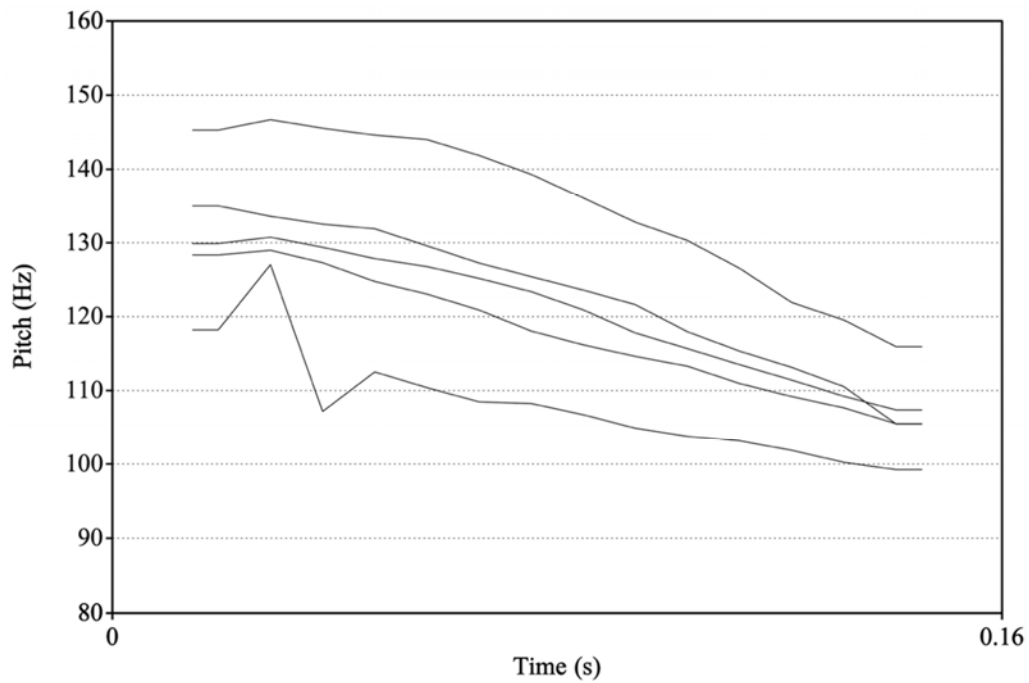


Figure 7. Pitch tracks of falling tone *sô* 'spring'

Level tone contrasts are attested following obstruents as well as sonorants, specifically nasals and liquids. Regarding the interaction of tone and consonant voicing, plosives show a three-way contrast between low-tone voiced, low-tone voiceless, and high-tone voiceless. Low tone following voiceless obstruents is also associated with breathiness, though this phenomenon has not yet been studied systematically. Fricatives and affricates lack a voicing distinction, so there one finds a binary contrast between low-tone voiceless and high-tone voiceless. This state of affairs is exemplified in Table 16.

	Plosives		Fricatives	
	Low	High	Low	High
Voiceless	<i>ta</i> ‘now’	<i>tá</i> ‘horse’	<i>sa</i> ‘fruit seed’	<i>sá</i> ‘soil’
Voiced	<i>da</i> ‘arrow’	n.a.	n.a.	n.a.

Table 16. Voicing and tone in obstruents

There is no contrast between level tones postulated following aspirated plosives and aspirated affricates; partly because tonogenesis through devoicing of obstruents would not be expected to affect aspirated obstruents, partly because no actual minimal pairs have been found. There are however examples of falling tone following aspirated plosives or affricates, such as *p^há* ‘Gho pocket’, *t^hí* ‘bottom’, *t^hú* ‘mind’ (HON), *t^há* ‘blood’, *ts^hé* ‘date’, and *tɛ^hô* ‘side’. This is to be expected, as falling tone is not affected by devoicing of onset plosives, but the loss of codas.

Finally, an unresolved issue regarding tone is the possible presence of a rising contour tone. There is a group of acoustically distinct words with an intermediate vowel length as observed for falling tone, but without falling pitch contour. Their pitch contours tend to rise, but only very marginally (about 10 Hz), so it remains uncertain whether this does constitute a fourth tonal value, or how these examples could otherwise be analyzed. Table 17 indicates some potential minimal pairs.⁸

Low tone	Falling tone	Rising tone?
<i>pa</i> ‘cow’	<i>pá</i> ‘curry’	~ <i>pǎ</i> ‘mask’
<i>lo</i> ‘year’	<i>ló</i> ‘light’	~ <i>lǒ</i> ‘again’
<i>ko</i> ‘head’		~ <i>kǒ</i> ‘vulture’
<i>ɛa</i> ‘meat’		~ <i>ɛǎ</i> ‘overnight stay’

Table 17. Potential minimal pairs for rising tone

5 Phonotactics

The maximal syllable structure is (C)(C)V(C). The most common syllable types are open and closed syllables with a simple onset, i.e. CV and CVC. Beyond that, there are also syllables with

⁸ Further words in the same group include ~ *kǎ* ‘border between pasturelands’, ~ *pǒ* ‘Tibet’, ~ *jě* ‘eight’, ~ *lě* ‘karma’, and ~ *jǔ* ‘village’.

a complex onset (CCV and CCVC), and syllables with no onset (V and VC). Some of the latter are shown in Table 18.

Syllable type	Examples
V	<i>a.pa</i> ‘father’, <i>a.ma</i> ‘mother’, <i>e.ɛen</i> ‘good’, <i>o.ne</i> ‘and then’
VC	<i>om.so</i> ‘sock’, <i>ek.pa</i> ‘crow’, <i>aŋ.ko</i> ‘bladder’, <i>un.la</i> ‘previously’

Table 18. Syllables without onset

Additionally, there are also full words consisting of a single vowel-only syllable, which may be short or long, or carry falling tone; e.g. *u* ‘head’ (HON), *i:* ‘grandmother’, *o:* ‘son’, or *é* ‘right’.

Brokpa also has a number of complex clusters in the onset.⁹ The best attested are the series consisting of a bilabial plosive and a liquid (/br, pr, p^hr/ as well as /bl, pl/).¹⁰ Table 19 gives some examples.

Cluster	Examples
/br/	<i>brokpa</i> ‘pastoralist’, <i>bro</i> ‘pastureland’, <i>bro:</i> ‘buckwheat’, <i>bruk</i> ‘dragon’
/pr/	<i>pru</i> ‘grain’, <i>pre</i> ‘measure container’, <i>pre:</i> ‘uncooked rice’, <i>pra</i> ‘cliff’
/p ^h r/	<i>p^hre</i> ‘meet’, <i>p^hrugu</i> ‘child’
/bl/	<i>bluk</i> ‘explode’, <i>blas</i> ‘dust’
/pl/	<i>ple</i> ‘roll down’

Table 19. Initial clusters

Additionally, there are a few instances of clusters formed with the approximants /j, w/ and diverse initial consonants, though their status is uncertain. As the attested clusters ending in /j/ all precede the vowel /u/ (*pju* ‘young yak’, *dju:* ‘bullet’, *tɛju* ‘small bird’, *ɟju* ‘monkey’), they might also be analyzed as another diphthong, /iu/; and so far only a single instance of the cluster /kw/ has been observed (*kwe* ‘yak crossbreed’).

While all 33 non-marginal consonants occur as onsets, only a subset of eight consonants are observed in coda position. These include the plosives /p, t, k/, the liquids /s, r/, and the nasals /m, n, ŋ/. Some examples are given in Table 20.

⁹ See Rüfenacht and Waldis (this issue) for diachronic comments.

¹⁰ Bodt (2012: 311) recognizes 10 clusters: /br pr p^hr/ and /bl/; as well as /gɟ kj k^hj/, which are here analyzed as the palatal series /ɟ c c^h/; /gr k^hr/, which have not been observed; and /hr/, which is here analyzed as the retroflex fricative /ʂ/ and its allophonic variant, the voiceless alveolar tap [ɽ].

Coda	Examples
/p/	<i>t^hap</i> ‘fireplace’, <i>nup</i> ‘west’, <i>lap</i> ‘say’
/t/	<i>ɛot</i> ‘jump’, <i>nat.pa</i> ‘patient’, <i>tsit.pa</i> ‘yak down hair’
/k/	<i>tɛik</i> ‘one’, <i>luk</i> ‘sheep’, <i>mik</i> ‘eye’
/s/	<i>k^hus</i> ‘load’, <i>lus.pa</i> ‘body’, <i>rus.pa</i> ‘bone’
/ɕ/	<i>mar</i> ‘butter’, <i>nor</i> ‘cattle’, <i>sér</i> ‘gold’
/m/	<i>sum</i> ‘three’, <i>c^him</i> ‘house’, <i>ɛam</i> ‘hat’
/n/	<i>gun</i> ‘winter’, <i>lo.pon</i> ‘teacher’, <i>men.to</i> ‘flower’
/ŋ/	<i>nan</i> ‘inside’, <i>tan</i> ‘yesterday’, <i>k^hoŋ</i> ‘they’ (3PL)

Table 20. Permissible coda consonants

Marginally attested codas include /ɛ/ (*k^huɛ.tɛik* ‘once’) and /l/ (*ɛel* ‘face’ (HON)); as well as the two marginal consonant phonemes /x/ (*alax* ‘branch’) and /ʔ/ (-*co?* PRS.EGO), which do not occur in onset position at all.

Various other final consonants or consonant clusters may occur due to elision of vowels in connected speech. Otherwise, there are no phonologically complex codas, with the exception of some marginal final clusters which have so far been observed in individual words: *o.tɛins* ‘thus’ is the most common one; *lanp.tɛ^he* ‘elephant’¹¹ and *tɛydr* ‘lips, beak’ also resist vowel epenthesis, leading to possible candidates for complex codas like /ns/, /ŋp/, and /dr/.

Diphthongs in general are rare, and only two are well-established: /au/ and /ea/ (Table 21).¹² The /au/ diphthong occurs only in open syllables, with no coda following; the /ea/ diphthong always precedes a velar coda. It should be noted that in the case of /ea/, monophthongization to /e/ is common and both variants seems to be in free variation; while /au/ might instead be analyzed as having an approximant coda /w/.

Diphthong	Examples
/au/	<i>au</i> ‘older brother’, <i>gau</i> ‘happy’, <i>kau</i> ‘difficult’, <i>lau</i> ‘easy’
/ea/	<i>tean</i> ‘plain’, <i>prean</i> ‘hut’, <i>leaka</i> ‘work’, <i>peax</i> ‘slope’

Table 21. Diphthongs

There are some further, marginally attested diphthongs: /eo/ (*deokor* ‘transportation duty’), /oa/ (*qoa* ‘taste’), and /ui/ (*kui* ‘steal’ (IMP), *ɲui* ‘cry’ (IMP)).

6 Conclusion

Summing up the primary findings, Brokpa shows eleven vowel and 35 consonant phonemes; it phonemically distinguishes vowel length; and it features two register and a contour tone. It lacks

¹¹ Cf. Written Tibetan གཤང་པོ་ཆེ *glang po che* ‘elephant’.

¹² Bodt (2012: 311) posits five diphthongs: /ai/, /au/, /oi/, /ui/, and /iu/. Dondrup (1993: 1) mentions /au/, /ui/, /iu/, as well as /ei/ and /ou/.

open vowels and exhibits front rounded vowels only marginally; there are five series of plosives with a three-way laryngeal contrast, though almost no voiced fricatives.

An important caveat concerning the preceding presentation is that data come from only one speaker, and more data from further speakers will be needed for a more robust description. Many more issues remain, and have been alluded to throughout. Some of the more important ones pertain to the language's tonology, especially the potential of a further tonal value. The presence of tone in positions other than open syllables has also not been studied systematically; as have other features such as the status of breathiness, the presence of glottal plosives, or the possibility of additional vowel allophonies. It is hoped that further studies, including more data coming from more speakers, will be able to answer these questions in the future.

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APPENDIX: WORD LIST

p^h	<i>p^hâ</i>	'Gho pocket'	<i>p^hu:</i>	'small container'
	<i>p^hu</i>	'village deity'	<i>p^ho:</i>	'bird chest'
p	<i>pa</i>	'cow'	<i>pa:</i>	'wool'
	<i>pâ</i>	'curry'	<i>pú</i>	'body hair'
b	<i>ba</i>	'tree burl'	<i>bu</i>	'insect'
	<i>ba:</i>	'goiter'		
t^h	<i>t^hî</i>	'bottom'	<i>t^hô</i>	'storey' / 'meteorite'
	<i>t^ha</i>	'endpoint'	<i>t^ho:</i>	'hammer'
	<i>t^hû</i>	'mind' (HON)		
t	<i>té:</i>	'navel, umbilical cord'	<i>tú</i>	'vagina'
	<i>ta</i>	'now'	<i>tú:</i>	'yak crossbreed'
	<i>tá</i>	'horse'	<i>tó</i>	'cooked rice'

	<i>tâ</i>	‘tiger’	<i>to:</i>	‘luggage transport’
	<i>ta:</i>	‘moon’	<i>tó:</i>	‘water container’
d	<i>da</i>	‘arrow’	<i>do:</i>	‘friend’
	<i>do</i>	‘stone’		
k^h	<i>k^{hi}</i>	‘you’ (2PL)	<i>k^{ha:}</i>	‘snow’
	<i>k^{he}</i>	‘potato’ / ‘you’ (2SG.AGT)	<i>k^{hu}</i>	‘sperm’
	<i>k^{ha}</i>	‘mouth’	<i>k^{ho}</i>	‘he’ (3SG.M)
	<i>k^{hâ}</i>	‘responsibility’		
k	<i>kí</i>	‘dog’	<i>ka:</i>	‘pillar’
	<i>kî</i>	‘language’	<i>kú</i>	‘body’ (HON)
	<i>ká</i>	‘instruction’	<i>ko</i>	‘head’
g	<i>ga</i>	‘saddle’	<i>go</i>	‘door’
	<i>gu</i>	‘nine’		
c^h	<i>c^{hu}</i>	‘group of animals’	<i>c^{ho}</i>	‘you’ (2SG)
c	<i>ce:</i>	‘gift’		
ɟ	<i>ɟa</i>	‘wild goat’	<i>ɟu</i>	‘wealth’
t^h	<i>t^{hi}</i>	‘throne’	<i>t^{ha:}</i>	‘duty’
	<i>t^{hâ}</i>	‘blood’	<i>t^{ho}</i>	‘angry divine expression’
t	<i>tí</i>	‘knife’	<i>te:</i>	‘mule’
	<i>te</i>	‘yeti’	<i>tó:</i>	‘suggestion’
ɖ	<i>ɖa</i>	‘enemy’		
s	<i>si</i>	‘dzi bead’	<i>so</i>	‘yak hybrid’
	<i>se:</i>	‘son’ (HON)	<i>só</i>	‘tooth’ / ‘big bamboo’
	<i>sa</i>	‘fruit seed’ / ‘week day’	<i>sô</i>	‘spring’
	<i>sá</i>	‘soil’	<i>so:</i>	‘butter container’
	<i>sâ</i>	‘small bamboo’	<i>só:</i>	‘brown rice’
	<i>sú</i>	‘who’		
ɛ	<i>ɛi</i>	‘four’	<i>ɛa:</i>	‘swamp deer’
	<i>ɛe</i>	‘penis’	<i>ɛú</i>	‘bow’
	<i>ɛe:</i>	‘mouth’ (HON)	<i>ɛû</i>	‘strength’
	<i>ɛé:</i>	‘glass’	<i>ɛo</i>	‘yoghurt’

	<i>ɛa</i>	‘meat’		<i>ɛó</i>	‘dice’
ʂ	<i>ʂí</i>	‘first milk’		<i>ʂa</i>	‘head hair’
h	<i>hú</i>	‘small teapot’			
ts	<i>tsé</i>	‘top’		<i>tsá</i>	‘grass’ / ‘nerves’
ts^h	<i>ts^he</i>	‘life’		<i>ts^ho</i>	‘lake’
	<i>ts^hê</i>	‘date’		<i>ts^ho:</i>	‘nephew’
	<i>ts^ha</i>	‘salt’			
tɕ	<i>tɕí</i>	‘what’		<i>tɕa</i>	‘tea’ / ‘bird’ / ‘rainbow’
	<i>tɕé</i>	‘tongue’		<i>tɕâ</i>	‘iron’
	<i>tɕe:</i>	‘rat’			
tɕ^h	<i>tɕ^hi</i>	‘outside’		<i>tɕ^hâ</i>	‘arm, hand’ (HON)
	<i>tɕ^he</i>	‘powder’		<i>tɕ^hu</i>	‘water’
	<i>tɕ^he:</i>	‘fangs’		<i>tɕ^hô</i>	‘side’
	<i>tɕ^ha</i>	‘pair’			
m	<i>mi</i>	‘person’		<i>ma</i>	‘wound’
	<i>me</i>	‘fire’ / COP.EX.NEG.EGO		<i>mâ</i>	‘war’
	<i>mê</i>	‘buttocks’		<i>mo</i>	‘she’ (3SG.F)
n	<i>ne:</i>	‘barley’ / ‘disease’		<i>na:</i>	‘forest’
	<i>na</i>	‘nose’		<i>no:</i>	‘younger brother’
ɲ	<i>ɲí</i>	‘we’ (1PL.EXCL)		<i>ɲe:</i>	‘thigh’
	<i>ɲî</i>	‘two’		<i>ɲé:</i>	‘snare trap’ / ‘thresher’
	<i>ɲe</i>	‘I’ (1SG.AGT)		<i>ɲa</i>	‘fish’
ŋ	<i>ŋa</i>	‘I’ (1SG)		<i>ŋú:</i>	‘silver’
	<i>ŋá</i>	‘five’ / ‘drum’		<i>ŋó</i>	‘shrubby’
r	<i>ri</i>	‘mountain’		<i>ru:</i>	‘snake’
	<i>re:</i>	‘thin cloth’		<i>ro</i>	‘corpse’
	<i>ra</i>	‘goat’ / ‘root’		<i>ro:</i>	‘husband’
	<i>ru</i>	‘horn’			
l	<i>la</i>	‘mountain pass’		<i>lo</i>	‘year’
	<i>lá</i>	‘rhododendron leaf’		<i>lô</i>	‘light’
	<i>lú</i>	‘song’		<i>ló:</i>	‘lung’

l l̥á ‘god’

l̥ó ‘south’

j jâ ‘yak’

jo COP.EX.EGO

w we ‘starlight’