Preliminary Phonological Analysis of Denjongka of Sikkim

Juha Yliniemi

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Contents:

Transcription and abbreviations

The phonetic symbols in this thesis are adopted from the 1993 version of the *International Phonetic Alphabet* (IPA). Below is a list of other symbols and abbreviations used. Note the difference in the use of the same symbol between the phonetic and phonemic transcription.

[pʼ] slight aspiration in the phonetic transcription, devoiced consonant in the phonemic transcription
[é] high(er) level pitch in the phonetic transcription, high register level pitch in the phonemic transcription
[è] low(er) level/slightly rising pitch in the phonetic transcription, low register in the phonemic transcription
[ê] high falling pitch in the phonetic transcription, high register falling pitch in the phonemic transcription
C consonant
ERG ergative case
F1 first formant, concentration of energy in the spectrogram by which the height of a vowel sound may be evaluated
G glide
h. honorific (lexical item)
V vowel
WT Written Tibetan

Language assistants

KB Khichung Bhutia
RGL Rinchen Gyatso Lachungpa
RB Rabden Bhutia
TB Topzar Bhutia

Linguistic examples are from my main informant RB unless otherwise indicated in brackets, e.g. /tsʰóm/ [ʈʂʰóm] ‘big wooden mortar’ (TB). I refer to Stephen Watters, whose articles are often discussed, as Watters and to David Watters, whose book is rarely discussed, as D. Watters.

Monosyllabic words in Denjongka can be divided into high and low register (see 2.). Words beginning with the voiced or devoiced (see 4.1.)

obstruents or /r/ belong always to the low register and those beginning with initial voiceless (aspirated or unaspirated) plosives or affricates, /h/, /l̥/, or /r̥/ belong always to the high register.

In the phonemic transcription, high register level tone is marked by /ˊ/ and high register falling tone by /ˆ/ over the vowel. Because of this register internal pitch contrast, high register words are always marked for pitch/tone. Low register is marked by /ˋ/ only in those words where register is not predictable from the initial consonant. The term *tone* is used for phonologically distinctive pitch and the term *pitch* is a purely phonetic term. If the phonemic transription lacks pitch/register assignment, it means that I am not yet sure about the register. Disyllabic words are not marked for register because pitch assignment works in them differently than in monosyllabic words and they have not been sufficiently investigated (see 5.5.2.).

When discussing the intricate relationship of /e/ and /ɛ/ in 3.1., the phonemic transcription is absent because the relationship of the two phonemes is not yet fully unraveled. Elsewhere, the phonemic transcription for the front unrounded mid vowels /e/ and /ɛ/ is highly tentative, and further research is likely to revise the transcription in this respect. As a general rule, when an example lacks the phonemic transcription, the phonemic analysis of that word is incomplete. Examples containing only one word are included in the text, but those consisting of two or more words are presented on a separate line with a number. Alternative pronunciations are separated with a slash inside the phonetic transcription, e.g. /sə̀n/ [sə̏ː/sə̀n] ‘to plant’.

1. Introduction

1.1. Background

> *"It [Denjongka] differs in many particulars from Tibetan but on examination will be found full of interest, and by no means so barbarous a speech as is supposed."* (Sandberg 1895:7) (addition in square brackets mine)

This thesis is a preliminary phonological analysis of Denjongka, or Sikkimese, a Tibeto-Burman language spoken in the Indian state of Sikkim. Previously, the language has been described by Graham Sandberg (1895). Sandberg, however, focuses on grammar and his treatment of phonology is very limited. Later, Grierson (1967 [1909]) devotes a few pages of his huge survey of Indian languages to Denjongka. His work includes some detailed diachronic phonological observations, i.e. how Denjongka differs from Written Tibetan (WT). The same diachronic perspective is seen in Shafer's (1974) historical-comparative study of Tibeto-Burman languages, which includes some Denjongka words. To my knowledge, however, there has been no attempt to write a comprehensive, synchronic description of Denjongka phonology.

Unlike Denjongka, some of the related languages have been well documented and are appreciated as fruitful points of comparison in this paper. I will often refer to analyses of Lhasa Tibetan (e.g. Hari 1979) and Dzongkha of Bhutan (e.g. van Driem 1992), the latter of which is the closest related language to Denjongka. Van Driem (personal e-mail 2 Nov 2004), who uses the name Dränjoke for Denjongka, claims that grammatically "Dränjoke and Dzongkha are very, very close. Graham Sandberg's 1895 Dränjoke grammar could for all intents and purposes have been a grammatical sketch of Dzongkha."

The differences between the two languages, however, appear to be greater on the lexical and phonological level. Chamberlain & Chamberlain (1997) carried out a study on lexical similarity between Denjongka, Dzongkha and Lhasa Tibetan using a 210-item word list. Basing their analysis on an article by Milliken & Milliken (1993), they found out that the percentage of lexical similarity between Denjongka and Lhasa Tibetan was 42%, and between Denjongka and Dzongkha 65%.

There seems to be a partial intelligibility between Dzongkha and Denjongka speakers. Hellin Hukka-Dukpa (personal communication 11th July 2004) reports that a Dzongkha-speaking man was able to communicate with speakers of Denjongka in the 1960s. Partial mutual intelligibility between the languages is also affirmed by Gordon (ed. 2005).

The current research has inherent value in being the first study to concentrate exlusively on the phonology of Denjongka. As a synchronic description, it will also benefit those who are studying the historical developments of Tibeto-Burman languages, and southern Tibetan languages/dialects in particular. I will also briefly address the issue of Denjongka dialects, which has not been addressed by previous research, by presenting a short comparative word list in Appendix 2.

This paper is organised as follows: After introducing the language informants (1.2.), I will give some basic ethnographic information about the language and the people who speak it (1.3.). Section 2 is devoted to discussing the methodology. The next two sections discuss the segmental phonology of Denjongka and present the evidence for vowel phonemes (3.) and consonants

phonemes (4.). Then, I will deal with the suprasegmental phonology and address such issues as the syllable, nasalisation, length, phonation type, pitch/tone and stress (5.). Section 6 summarises the thesis.

I deemed it most helpful to discuss relevant literature and theory while presenting the results rather than in a separate section afterwards. Several strands of further research on Denjongka are suggested as occasion arises. Now I continue by presenting the people without whom the research would have been impossible.

1.2. The language informants

The linguistic data for this thesis were gathered in Gangtok, the capital of Sikkim, between the 22nd of March and 13th of May 2004. During this time, I worked with four mother-tongue speakers of Denjongka, who spoke four different but mutually intelligible dialects of the language. The people who speak Denjongka are called *Denjongpas*.

Rabden Bhutia (24), the informant from whom I recorded the most data, was born in Tashiding, a Denjongpa community in Eastern Sikkim (see Map 3 in Appendix 1). He was a student at the Institute of Tibetology in Gangtok, where he used the Denjongka language with other students and teachers who came from Denjongka-speaking communities. On holidays he visited his home village, Tashiding.

The second language informant, Topzar Bhutia (29), comes from Ralang, a Denjongpa community in the Southern district (but geographically on roughly the same latitude as Gangtok and Tashiding). At the time of the research, he had been out of Ralang for five years, using mainly the Nepali language.

The third language informant, Rinchen Gyatso Lachungpa (18), was born and raised in Lachung, Northern Sikkim. At the time of the research, he was a student at the Institute of Tibetology in Gangtok and visited his home village during holidays.

The fourth language informant, Khichung Bhutia, 82, lived in a village near Gangtok. He had spent his whole life in Eastern Sikkim. Khichung Bhutia speaks Denjongka to his children, who have gained a passive knowledge of the language but have better active competence in Nepali. From here on, I refer to the language informants by their initials RB, TB, RGL and KB respectively.

I am grateful to all my language informants for their time, patience and friendship. A big thanks also goes to KB's family for hospitality, the principal of the Institute of Tibetology for letting me "borrow" two of his students in the midst of a busy schedule, and Lama Karma Tashi at Bhutia Busty Gompa in Darjeeling for introducing me into written Denjongka.

1.2. The people and their language

The full language family information for Denjongka is recorded in Gordon (ed. 2005) as Sino-Tibetan, Tibeto-Burman, Himalayish, Tibeto-Kanauri, Tibetic, Tibetan, Southern. In this language family classification Tibetan and Bodish, together with Dhimal and Tamangic, are subclasses of the Tibetic branch. Shafer (1974:87) classifies Denjongka as Southern Bodish, a subgroup of Central Bodish, but for him Bodish is a more general term than for Gordon. Some of the other languages listed under Gordon's Southern Tibetan are Dzongka (Bhutan), Sherpa (Nepal) and Jirel (Nepal).

The Denjongka-speaking population lives in the Indian state of Sikkim in the southern slopes of the Himalayas, close to the third highest peak in the world, Kanchenjunga. Gordon (ed. 2005) lists the Denjongka language under the name Sikkimese and gives such alternative names for the language as Sikkim Bhotia, Sikkim Bhutia, Dandzongka, Danjongka, Danyouka, Denjong, Denjonkha, Denjongpa, Denjonke, Denjonka, Lachengpa, Lachungpa and Sikami.

I have chosen to use the name Denjongka of the language because it is the most indigenous name for the language and has been established by previous researchers. The form *Denjongka* is preferable to *Denjonka* because the former makes it clear that the nasal in the name is indeed a velar. According to Sandberg (1895:12), *Denjong* is the Tibetan name for Sikkim and literally means "rice-district". So, Denjongka is the language and the Denjongpas the people of the rice district, i.e. Sikkim.

In Chamberlain & Chamberlain's (1997) study, the language informants referred to their language as Denjong, Sikkimese or Bhutia. O'Malley (1907:188, cited in Chamberlain & Chamberlain 1997:6) explains the background of the term Bhutia in the following way: "The Bhutias are of Tibetan stock, the name meaning the people of Bhot, the India name for Tibet (which is a corruption of the Mongoloid Thubot)." In the villages of Lachen and Lachung in northern Sikkim, where the majority of inhabitants are Bhutias, the terms *Lachenpa* and *Lachungpa* refer both to the people and the language of northern Sikkim. RGL, my language informant who came from Lachung, tended to associate the name Denjongka with the southern speakers of the same language and referred to his own language as Lachungpa. The Denjongka language is spoken in all parts of Sikkim, but it is

strongest in the Denjongka-speaking communities (like Tashiding, Ralang, Lachung, Lachen, northern Sikkim in general). According to TB, even Nepalis in Ralang use Denjongka. Outside Sikkim, the language is reported (Gordon, ed. 2005) to be spoken in Darjeeling, West Bengal in general and possibly also on the other side of the Indo-China border. Refer to Appendix 1 for maps of the language area.

The earliest inhabitants of Sikkim were the Lepchas while the Denjongpas are said to have begun their migration to the area around the sixteenth century (Verma 1990:17, Sandberg 1895:12). According to Grierson (1909:119), the inhabitants of the northern half of Sikkim were said to have come from Tsang in Tibet. Bhasin (1989:6) asserts generally that the ”Bhutias came from Tibet and Bhutan” and more specifically (1989:86) that the people of Lachen and Lachung in the north “claim descent from immigrants from Ha in Bhutan.” Bhadra (1992:2), on the other hand, claims that according to the tradition the Bhutia kings of Sikkim originally came from the neighborhood of Lhasa. According to Verma (1990:17) the Bhutias migrated to Sikkim “through Bhutan.”[1]

It is difficult to estimate the amount of Denjongka speakers. Not all ethnic Bhutias or Denjongpas can speak Denjongka. Outside Denjongpa-communities, many have a passive knowledge of the language but will not transmit the language to their descendants. Chamberlain & Chamberlain (1997) base their estimate of the amount of Denjongka-speakers on Census of India 1991 and conclude that there are approximately 28,600 speakers of the language. I suspect that many

[1] There is no agreement on the origin of the name *Bhutan*. The name most likely comes from Sanskrit *Bhotant* ‘the end of Tibet’ or *Bhu-uttan* ‘highland’. Source: Chai Chia-shan, http://taipei.tzuchi.org.tw/tzquart/2003su/qs2.htm, consulted May 12th, 2005.

speakers included in this amount don't speak the language very well and will not transmit it to their children.

2. Methodology and terminology

The theoretical background for this paper is best described as American structuralism (of especially Pike 1947, 1967 [1948]), which suits well with initial phonological analysis. The main working method was substitution, with the help of which *phonemes*, the distinctive sound units of the language, were extracted from the data. In practice, this was done through finding word pairs with a difference in meaning and a minimal sound contrast, i.e. minimal pairs. If two sounds occurred in *conditioned variation* (there were no minimal pairs and each sound only occurred in environments were the other one did not) they were in *complementary distribution*. If any two or more sounds were, in addition to being in complementary distribution, also phonetically similar, they were *allophones* of the same phoneme. If two sounds appeared in the same phonological environment without being in opposition, they were in *free variation*.

The linguistic data for this thesis consist of about 1000 different Denjongka words elicited in isolation from four speakers: c. 900 words from RB, c. 750 words from TB, c. 500 words from RGL, and c. 250 words from KB. In the sessions with the language assistants, I first wrote down the words in my notebook and then recorded the words, each three times, on a minidisc. Later, I recorded the minidisc tracks on the computer and analysed them using the Praat-program. Having three tokens of the same word proved to be helpful for the analysis because in this way mistakes in pronunciation and sudden background noises

were not as damaging as with fewer examples. Having three instances of each word also increased the possibility of recording free variation. Often, however, words in isolation were pronounced using "list intonation". Then, the pitch pattern in the last instance of a disyllabic word often turned into the opposite (high-low) from what it was in the two first examples (low-high).

In order to see how the same words behaved in context I also recorded some sentences from each informant: c. 530 sentences from RB, 226 from TB, 57 from RGL, and 100 from KB. Many of these sentences also worked as tone frames.[2] Recording words in context proved beneficial because in some words there were both segmental and suprasegmental differencies between the isolated and contextual pronunciations.

A few words need to be said about the suprasegmental features. The researchers of the Himalayan languages have found it helpful to divide the languages suprasegmentally into two *registers*. Some have used the term *register* to refer to one binary suprasegmental feature like voice quality, and call the different registers modal vs. lax, clear vs. breathy, or plain vs. murmured (D. Watters 2002:37). Hari (1979:61) uses the term differently. She notes that the suprasegmental contrasts in Lhasa Tibetan are built on two binary features: voice quality and pitch movement. She then defines register as a "convenient abstract term for such a correlation of pitch and voice quality." Thus, for Hari register involves two features: voice quality and pitch. Similarly, Mazaudon (1977:100) uses "'register' as a phonological term, and 'phonation type' as a cover term for the laryngeal features usually present in the phonetic realisation of the registers

[2] See Figures 4 and 5 on page 53 for examples of a simple tone frame.

(breathiness, creakiness…).” Register, as I use it here, is a phonological term involving pitch and phonation type/voice quality. High register is phonetically realised as higher pitch and modal/tense voice. Low register is realised as lower pitch and modal/breathy voice. The terms voice quality and phonation type are used interchangeably. Phonation type and pitch and are discussed in more detail in 5.4.

3. Vowels

This section presents evidence for the vowel phonemes, gives interpretations for vowel clusters and describes vowel assimilation processes. Vowel duration and voice quality (breathy vs creaky) are discussed later in sections 5.3. and 5.4. under Suprasegmental phonology.

3.1. Vowel phonemes

The vowel qualities in Tibetan-related languages have been a source of frustration for many researchers. Watters (2002:16), for instance, comments that 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.” According Hari (1979:28), on the other hand, it is difficult to determine the underlying vowels of Lhasa Tibetan because of the “extensive and intricate processes of vowel height approximation in polysyllabic words” and, in some cases, “rounding assimilation” (see 3.3.). The following analysis of Denjongka vowels is tentative in nature and ought to be followed by a more rigorous study.

The vowel phonemes of Denjongka are shown in Table 1 below. Table 2 gives evidence for the contrasts between the vowels. The phonemic status of /ɛ/ is unclear, and therefore /ɛ/ is in brackets in Table 1 and does not appear in Table 2. Phonetically speaking, Denjongka vowels can be described as short or long (and sometimes half long), but because the phonemic status of phonetically long vowels is not yet firmly established, the words with long vowels in Table 2 appear only in phonetic transcription. Vowel length is discussed in depth in section 5.3.

	Front		Mid	Back
	Unrounded	Rounded	Unrounded	Rounded
Close	i	y		u
Mid	e	ø		o
Open	(ɛ)		ɐ	

Table 1: Denjongka vowels

Vowel phoneme	Short	Long
/i/	/di/ [ⁿd̪i] ‘this’	[k̟ĩ̟ː] ‘circle with a rope’
/e/	/ɖe/ [ⁿɖe] ’ghost, demon’	[ké:] ‘to deliver’
/y/	/dyʔ/ [ⁿd̪yʔ] ‘demon’	[ký:] ‘to drive’
/ø/	/døʔ/ [ⁿd̪øʔ] ‘to sit’	[kǿ:] ‘to boil’
/ɐ/	/dɐ/ [ⁿd̪ɐ] ‘arrow’	[k’ɐ̤ːʔ] ‘mountain’
/u/	/ɖuK/ [ⁿɖuk] ‘thunder, dragon’[3]	[ᵑgu:] ‘to wait’
/o/	/do/ [ⁿd̪ɒ] ‘stone’	[kó:] ’to throw’

Table 2. Evidence for vowel contrasts.

The close front unrounded vowel phoneme /i/ varies in realisation between [i] and [ɪ]. One conditioning factor appears to be register. The low register favours [ɪ] whereas in the high register the realisations of /i/ are closer to [i]. When /i/, for instance, follows voiced or devoiced plosives (which appear only in

[3] /K/ is an archiphoneme which neutralises the four-fold velar plosive opposition word-finally (see 4.2.2.). /P/ is the equivalent archiphoneme for the bilabial plosives.

the low register) it tends to be realised as [ɪ], whereas after unaspirated and aspirated plosives (which appear only in the high register) /i/ tends to be realised as [i].

The phonemes /i/ and /e/ are sometimes difficult to distinguish from each other. The overlap between the low realisations of /i/ and high realisations of /e/ is also noted in the related language Humla Bhotia (Nepal) by Wilde (2001:12), who comments that one of his informants in Humla Bhutia "occasionally confused between [ɪ] and [e] when repeating words after another native speaker."

The relationship between the mid vowel **/e/** and the open **/ɛ/** is one of the most problematic areas of Denjongka vowel phonology. Both Dzongkha (Mazaudon & Michailovsky 1988:118, van Driem 1992:53) and Lhasa Tibetan (Hari 1979:28) are reported to have a three way opposition between the front unrounded vowels /i/, /e/ and /ɛ/. According to Mazaudon & Michailovsky (1988:118), /ɛ/ in Dzongkha originates mainly from the fronting of /ɐ/ before final dentals. They also claim that there is no opposition between /e/ and /ɛ/ in short, open monosyllables. This is confirmed by van Driem's (1992:54) comment that /ɛ/ is always long.

At the initial stages of my Denjongka analysis, I could not find evidence for a three-way opposition between the front unrounded vowels. Later, however, some evidence was found. Consider first Table 4 below.

/i/ [i]	/dʑi/ [ⁿdʑi] 'to change'	
/e/ [ɪ]	/dʑe/ [ⁿdʑɪʔ] 'to forget'	/dze?/ [ⁿd̪ʐ̪ɪʔ] 'leprosy'
/ɛ/ [e]	/dʑɛmpu/ [ⁿdʑempu] 'wet'	/dzɛʔ/ [ⁿd̪ʐ̪eʔ] 'bullet'

Table 4. Evidence for a three-way opposition between front unrounded vowels.

In Table 4, the three-way difference in the vowel quality after the alveolo-palatal affricate /dʑ/ is clearly audible on the recording. An analogous opposition between [ɪ] and [e] was found following the dental affricate /dz/. It is noteworthy that the words [ⁿdʑɪʔ] and [ⁿd̪ʑ̪ɪʔ] were written in the Tibetan script with the vowel /e/.[4] Although one needs to be extremely careful in making conclusions about written forms, the writing appears to suggest that [ɪ] in the words above is considered an allophone of /e/ rather than /i/. The minimal pair [ⁿd̪ʑ̪ɪʔ]/[ⁿd̪ʑ̪eʔ], on the other hand, provides evidence for the different phonemic status of [ɪ] and [e] in these words. Thus, the data in Table 4 is in favour of a three-way phonemic opposition between the front unrounded vowels.

Another informant, TB, pronounced the word [dʑeɕe] 'to forget' with a more open vowel ([dʑe] is the verb root and [ɕe] a verbal suffix). The openness of the vowel, however, may be the result of vowel height assimilation (cf. 3.3.) caused by the verbal suffix [ɕe]. TB also pronounced the word [ⁿdzi:ɕe] 'to change' with a long vowel but RB with a short vowel. Another complicating factor is that the vowel in [ⁿd̪ʑ̪eʔ] 'bullet', although short when pronounced in isolation, was long when pronounced in context. Unfortunately, there are no examples of the words [ⁿd̪ʑ̪ɪʔ] 'leprosy'and [ⁿd̪ʑ̪eʔ] 'bullet' from other informants than RB.

The second piece of evidence for the existence of a three-fold division of the front unrounded vowel phonemes comes from the words [k̟ĩ̟:] 'circle with a

[4] The written form for [ⁿd̪ʑ̪ɪʔ] was derived from RB, the same informant who produced the spoken words under investigation. The written form for [ⁿdʑɪʔ] 'to forget', on the other hand, was derived from a different Denjongka speaker whose spoken language is not recorded.

rope', [kɛ́ː/kíː] 'to deliver', and [kɛ̂ʔ/kɛ̂ː][5] 'a cry'. When the words were pronounced in isolation, the difference in vowel quality between [kɛ́ː]/ [kíː] and [kɛ̂ʔ/kɛ̂ː] was hardly audible for my ear, and the main contrast between the two words lay in vowel duration, pitch and tenseness. In context, on the other hand, the opposition in vowel duration disappeared and vowel quality became the contrastive feature instead. As a consequence, there was a clearly audible vowel quality difference in the three words.

Thirdly, the words [ᵐbɛ̤ːpˀ][6] 'frog' and [ᵑgeːpˀ] 'king' give evidence for the existence of /ɛ/ because there [e] and [ɛ] contrast in analogous environment. In [ᵐbɛ̤ːpˀ], the F1 value of the vowel is approximately 500 Hz and in [ᵑgeːpˀ] 370 Hz.

In conclusion, there may be a marginal opposition between /e/ and /ɛ/ in Denjongka, but the relationship between the front unrounded vowels needs to be covered by more research. The second issue worthy of a more detailed study is the relationship between vowel quality and duration. Thirdly, the front unrounded vowels will also prove to be a fertile ground for investigation on the differences between Denjongka dialects. Table 5 below illustrates the differing pronunciations of the word for 'sand' derived from the four informants.

RB	TB	RGL	KB	Gloss
[pe̤m]	[pɛ̤ːm]	[pʰi̤m/pʼi̤m]	[pjɐ̤m]	Sand

Table 5. Dialect differences for the word 'sand'.

[5] [kɛ̂ʔ] when recorded in isolation, [kɛ̂ː] when recorded in context

[6] Normally voiced plosives are followed by modal voice (cf. 5.4.), but for some reason [ᵐbɛ̤ːpˀ] is followed by breathy voice. The difference in voice quality between [ᵑgeːpˀ] and [ᵐbɛ̤ːpˀ] can be seen in the spectrogram.

The close front rounded vowel phoneme **/y/** is realised as [y] and the mid front rounded vowel phoneme **/ø/** as [ø]. In some cases, it was very difficult to decide whether one was hearing [e] or [ø] because the vowel was not clearly rounded or clearly unrounded (e.g. [ɕø̞ː m] 'cockroach').

The open central unrounded vowel phoneme **/ɐ/** is usually realised as [ɐ], but when preceded by the palatal glide /j/ or the alveolo-palatal affricates and sibilants /tɕ, dʑ, tɕʼ, ɕ, ʑ/ it tends to be fronted to [ɐ̟/æ] as exemplified in 1) below.

1) /ɕéɐ/ [ɕé̞ɐ̟] 'meat'
/gjɐro/ [ᵑgjæro?] 'beard, moustache'

The fronting, however, doesn't appear after the aspirated alveolo-palatal stop /tɕʰ/. This is probably so because the aspiration intervenes between the affricate and the vowel. As a consequence, the vowel is not as immediately affected as when preceded by the unaspirated affricates. In [ɕé̞ɐ̟] 'meat' one can hear a slight glide [j] between the initial consonant and the vowel. This is a natural consequence of the tongue moving from the sibilant position to low mid vowel position.

In unstressed second syllables in disyllabic words, /ɐ/ tends to be lowered to [ɜ], e.g. /buːnɐ/ [ᵐbuːnɜˑ] 'middle, in the middle'. When followed by /r/ in the same environment, /ɐ/ may be further lowered to [ə].

2) /ɐkɐr/ [ʔɐkəɹ] 'chilli'
/tɕɐNɕɐr/ [tɕɐ̃ɕəɻ] 'northeast'[7]

[7] Nasalised vowels are interpreted as sequences of a nasal plosive and the vowel. The archiphoneme /N/ neutralises the difference between /n/ and /ŋ/ (see 4.4. and 5.2.).

The close back rounded vowel phoneme **/ʉ/** shows some height variation and is usually realised as [u] or [u̟], but when preceded by the vowel /i/ palatal glide /j/ it tends to be fronted to [ʉ].

3) /bíw/ [ᵐbíʉ] 'snake'
/kʰjû/ [cʰjʉ̂] 'to wash, to bathe'

The alveolo-palatal affricates and sibilants also tend to front /u/ somewhat fronted.

The mid back rounded vowel phoneme **/o/** is most often realised as [ɔ] and sometimes as a higher variant [o] and rarely as the low allophone [ɒ]. The exact relationship between the different variants of /o/ is quite elusive. In disyllabic words, for instance, vowel height assimilation (see 3.3.) obscures the picture. Thus far, I have not found any conditioning factors that could systematically explain the differences in the realisations of /o/. Wilde (2001:13) reports that in Humla Bhotia (Nepal) [o] and [ɔ] are in free variation and that [ɔ] is more frequent "in syllables with more prominence", but in Denjongka prominence appears not to be an important factor in allophone distribution. A few observations, nevertheless, can be made. First, when followed by the glottal stop, /o/ is regularly realised as the close-mid allophone [o], cf. /lóʔ/ [l̪óʔ] 'lightning' but /lɔ̀/ [l̪ɔ̀] 'year'. Second, word-initial /o/ is realised as an open variant [ɒ], as in /óm/ [ʔɒm] 'milk, nipple'. Thirdly, [ɒ] is always short, whereas [o] and [ɔ] may be either long or short.

The high realisations of /u/ and low realisations of /o/ are very close to each other, e.g. /lóʔ/ [l̪óʔ] 'lightning' and /lú/ [lʉ́] 'song'. In the related languages, /u/ and /o/ are known to lose their opposition in certain environments. In Kagate (Hoehlig & Hari 1976:37), for instance, the contrast between /u/ and /o/

in closed syllables is neutralised before the velar nasal /ŋ/. Hari (1979:36), on the other hand, reports that although there appears to be a contrast in Lhasa Tibetan between /u/ and /o/ in the second syllable of disyllabic words, this opposition is not "immediately evident". Sandberg (1895:20) may be referring to this overlap of /u/ and /o/ in Denjongka in observing that in "two-letter syllables ending in o, as *bo*, *mo*, the o is heard rather as an abrupt u (oo) yet still an o sound." Further research is needed to find out the exact relationship between the back rounded vowels.

3.2. Vowel clusters

The following vowel clusters were found in the data: [iu], [ɐu], [ou], [ɐi]. Examples are given in 4) below.

4) [ᵐbiʉ] 'snake'
[léu] 'lungs'
[ʈʰóu] 'dirt, dust'
[ʈʰéu] 'dirt, dust' (TB)
[ʔéi] 'older sister' (RGL)[8]

The final member in these clusters is interpreted as the approximant /w/ or /j/, which appear independently elsewhere. This analysis is more economic than the alternative, which complicates Denjongka phonology by introducing diphthongs. The phonemic interpretations of the vowel clusters are given in 5).

[8] In the data from RB, [éi/éj] occurred only before the alveolo-palatal fricative [ɕ] and affricate [tɕ]. The glide could have been interpreted as an assimilation of the vowel quality to the following consonant. Examples from the other informants, however, prove that the cluster [éj/éi] occurs at least in some dialects of Denjongka, e.g. [gɐbɐj] 'testimony' (TB). Sandberg (1895:19) observes that the Denjongka /ɐ/ may be "followed rapidly by a very short i (ee)." There was also one example of the cluster [uj/ui] ([kujtɕɐʔ] 'you pl.'). The phonemic status of the glide in this word, however, is highly unlikely because the glide was very short, it occurred only once in the whole data from all informants and it may have been caused by the following consonant.

5)	[ᵐbiʉ]	>	/biw/
	[lɘ́u]	>	/lɘ́w/
	[t̪ʰóu]	>	/tʰów/
	[t̪ʰéu]	>	/tʰéw/ (TB)
	[ʔɘ́i]	>	/ɘ́j/ (RGL)

In KB's pronunciation of the word for 'snake', the latter vowel was long, [biu:] (KB). In this case, the vowels are interpreted to occur in different syllables, [biu:] > /bi.u:/ (KB). The different syllabic status is reflected in the pitch, which is level in [ᵐbiʉ] but rising (similarly to many disyllabic words) in [biu:].

In [kɔ̪upˀ] 'convex', the vowel cluster is followed by a final consonant. In this case, the vowels are considered to belong to different syllables, [kɔ̪upˀ] > /k'o.uP/. This interpretation is again confirmed by pitch, which is basically level in all syllable-internal vowel clusters above but rising in /k'ɔ.up/.

3.3. Roundedness, frontness and height assimilation

In Denjongka, a vowel may influence the quality of another vowel in an adjacent syllable. Firstly, an unrounded vowel in the preceding syllable may decrease or undo the rounding of the next vowel. For instance, when the word [t̪ʰønɕeʔ] 'to go out, take out'[9] was pronounced in isolation, the rounding in [ø] was clear. However, when preceded by an unrounded vowel in 6 a) below, the rounding in [ø] was reduced to [ø̞]. In /tøn/ [t̪øn] 'to take out' in 6 b), on the other hand, the vowel is realised as an unrounded variant [e].

6 a) [mi:d̪i: ˈ**t̪ʰø̞ŋ**gu: n̪ɔ:ʑyŋge:]
man this go.out wants
'The man wants to go out."

[9] [tʰøn] is the verb root and [ɕeʔ] is the suffix usually attached to the verb when an isolated form is elicited.

b) [mi:ḍi: ˈcʰi **teŋ**gu: nɔ:ʑyŋge:]
man this dog take.out wants
‘The man wants to take the dog out.’

In 6a), the sentence stress falls on [tʰøŋgu:] and the rounding on [ø] is partly saved. In 6 b), in contrast, the sentence stress falls on the preceding prominent word /kʰí/ [cʰí] ’dog’ and [i] causes a total loss of rounding in the next vowel.

In addition to roundedness assimilation, there is some evidence for frontness assimilation. When pronounced in isolation, the verb root /ɕû/ [ɕû] ‘peal’ has a back vowel, but when the verbal suffix [ɕe] is added to the root form, the vowel in the verb root is fronted, [ɕyɕeʔ]. As seen from [ɕu] ‘to peal’ and [kuɕu] ‘apple’, the fronting of [u] in [ɕyɕeʔ] is not caused by the preceding or the following alveolo-palatal sibilant. The fronting is likely caused by the following front vowel or the combined effect of the adjacent alveolo-palatal sibilants and the following front vowel.

Thirdly, there are also examples of vowel height assimilation in Denjongka. The vowel in the word [tʰu̬] ‘to take, pick’, for instance, is lowered by the preceding lower vowel in 7) below.

7) [ˈkʰu: mīðˈ:ɔ: **tɔ**ko nɔ:ʑyŋge:][10]
he flower pick.up wants
’He wants to pick up a/the flower.’

In 7), The vowel height assimilation occurs across word boundary. The vowel height assimilation in Lhasa Tibetan (Hari 1979:169), on the other hand, is reported to occur inside disyllabic words. According to Hari, the general principle

[10] Here [tʰu̬] is pronounced without aspiration. The hypothesised reason for this is that the sentence stress falls on the previous syllable.

of vowel height assimilation in Lhasa Tibetan is that the vowel height values of the two vowels in a disyllabic word must be "within a reasonable proximity." Hari adds that reasonable proximity is impossible to define in absolute terms because it is dependent on the vowels involved and the style of speech. The slower and more explicit the speech, the less impact height assimilation has on vowels. Furthermore, it is the higher vowel that causes the approximation (or raising) in the lower vowel. For instance, /ɐ/ followed by /i/ in the next syllable of a disyllabic word is realised as [ə]. If the vowels in the disyllabic word are already reasonably close in height, no noticeable assimilation takes place. According to Chang (1992:159), the assimilation in noun compounds works occasionally in the opposite direction: the higher vowel may be lowered.

These observations by Hari and Chang need to be remembered when continuing research on vowel assimilation processes in Denjongka. Because words pronounced in isolation are ordinarily examples of careful speech, they are not the best starting point for investigating vowel height assimilation. Further research on vowel height assimilation in Denjongka will need to be based on longer stretches of naturally occurring speech.

4. Consonants

The consonant phonemes of Denjongka are presented in Table 6 on the next page. One should note that the symbols in Table 6 are abstractions and so don't represent the exact phonetic realisations of the phonemes. The phonetic descriptions of the consonant phonemes follow below.

		Bilabial	Dental/ Alveolar	Retroflex	Alveolo-palatal/ Palatal	Velar	Glottal
Plosive	Voiceless unaspirated	p	t	ʈ		k	ʔ
	Voiceless aspirated	pʰ	tʰ	ʈʰ		kʰ	
	Voiced	b	d	ɖ		g	
	Devoiced	p’	t’	ʈ’		k’	
Affricate	Voiceless unaspirated		ts		tɕ		
	Voiceless aspirated		tsʰ		tɕʰ		
	Voiced		dz		dʑ		
	Devoiced				tɕ’		
Fricative	Voiceless		s		ɕ		h
	Voiced		z		ʑ		
Nasal	Voiced	m	n			ŋ	
	Voiceless		n̥			ŋ̊	
Liquid	Voiced		l	r			
	Voiceless		l̥	r̥			
Central approximant		(w)			j	w	

Table 6. Consonant phonemes in Denjongka

The consonant phonemes in Table 6 were found to contrast in word-initial position.[11] Some oppositions, however, are neutralised word-medially and word-finally. These neutralisations will be discussed below. But before giving evidence for the contrastive consonants, I will discuss the greatest problem related to the consonant sounds, the so-called devoiced consonants.

4.1. The “devoiced” consonants

A major problem in interpretation was how to treat the so-called *devoiced* series of consonants, /p’, t’, ʈ’, k’, tç’/, phonemically. The devoiced consonants refer to the series of Classical Tibetan consonants which were originally voiced but have become voiceless as a later development (e.g. van Driem 1992:65).

[11] The glottal stop is an exception. It is considered phonemic only wordfinally, see 4.2.2..

Phonetically, the devoiced stops and affricates are very close to the voiceless stops and affricates. Often, however, the devoiced consonants are followed by a slight aspiration which differs in duration from both the unaspirated and aspirated consonants. However, the most reliable cues for separating the devoiced stops and affricates from their voiceless counterparts are the phonation type and pitch of the following vowel. The vowels following the devoiced series are breathy and (naturally) low in pitch whereas the vowels following the voiceless series are modal/tense and pronounced with a higher pitch. Although an important aural cue, breathiness is more difficult to hear on short closed syllables than on open syllables.

The main question concerning the devoiced consonants was whether to treat them segmentally as a series of distinct consonants or whether to describe the phenomena related to them (slight occasional aspiration, breathiness, low pitch) suprasegmentally and thus diminish the phoneme inventory. Both types of analysis have been documented in the related languages. Van Driem (1992) and Watters (2002), for instance, treat the devoiced stops in Dzongkha as distinct consonant phonemes.

An alternative to analysing the devoiced series as distinct phonemes is to merge the devoiced consonants together with their voiceless counterpart under the same phoneme and describe the occasional slight aspiration in the consonant and the following low pitch and breathy voice on the vowel as qualities of the the vowel or the syllable.[12] The benefit of this analysis is that it decreases the number of phonemes significantly. The drawback, on the other other hand, is that the low

[12] Hari (1979) does so in her study of Lhasa Tibetan. She (1979:viii), however, does not describe the devoiced consonants as slightly aspirated but as "either very weakly voiced or voiceless with lenis articulation."

pitch and breathy voice on the following vowel become unpredictable and the historically distinct identity between the voiceless and devoiced consonants is lost.

Watters (2002:264), however, maintains that the phonetic phenomena related to the devoiced consonants (slight aspiration, breathiness, low pitch) are caused by the consonant itself. He claims that, in contrast to what some have said, the devoiced series in Dzongkha is not a sequence of consonant [+stiff] followed by a breathy vowel [-stiff]. Instead, the devoiced consonants have an additional feature [spread]. Then, he describes the devoiced consonants as [-stiff, +spread] and claims that the slight aspiration and breathiness on the vowel are the natural consequences of this type of consonant. This paper follows Watters's and van Driem's analyses in treating the devoiced consonants as distinct phonemes. As a consequence, pitch assignment and voice quality become more predictable and the historical distinction between the devoiced and voiceless consonants is retained on the segmental level.

Although both van Driem and Watters include the devoiced consonants in their phonemic inventories of Dzongkha, their analyses concerning the sibilants appear to differ. Whereas van Driem (1992:52) posits separate devoiced phonemes among the sibilants, devoiced sibilants are absent in Watters's (2002:12) common phoneme chart for five Tibetan languages[13] (including Dzongkha).[14] The difference between the interpretations is likely caused by different purposes of the linguists. Van Driem, who is writing a grammar of

[13] Dzongkha, Lhomi, Sherpa, Dolpo Tibetan and Mugom Tibetan

[14] The observation about the lack of devoiced sibilants in the phoneme chart seems to be contradicted by Watters' (2002:3) claim that each studied language had a four-way voicing contrast among the obstruents (and sibilants are obstruents).

Dzongkha, wants to have separate devoiced sibilants because the Tibetan script, which is used for writing Dzongkha, has separate characters for the devoiced and voiceless sibilants. Watters, on the other hand, does not find any phonetic difference between the voiceless /s/ and /ɕ/ and their so-called devoiced counterparts and so posits only one voiceless sibilant phoneme for dentals and alveolo-palatals. This paper follows Watters's analysis in recognising devoiced consonants only among the plosives and affricates.

4.2. Plosives

4.2.1. Word-initial plosives

Watters (2002:3) claims that in all the five southern Tibetan languages he studied (Dzongkha, Lhomi, Sherpa, Dolpo Tibetan and Mugom Tibetan) there is a four-way contrast of voicing/aspiration in plosives and affricates: 1) voiceless unaspirated, 2) voiceless sometimes slightly aspirated and usually followed by breathy voice (devoiced), 3) voiceless heavily aspirated, and 4) voiced (voiceless preceded by voicing). The Denjongka initial plosives and affricates fall in these four categories.

Table 7 on the next page presents minimal/analogous sets, which give evidence for the four-fold contrast between the plosives in the four places of articulation.

Minimal/analogous set for bilabial plosives:	Minimal/analogous set for dental plosives:
/pér/ [pér] ‘camera’ /pʰém/ [pʰém] ‘parents’ /bɐr/ [ᵐbɐ̯r] ‘pineapple’ /pʼɐ/ [pɐ̯] ‘cow’	/tó/ [t̪ɔ́] ’food’ /tʰó/ [t̪ʰɔ̟́ː] ’hammer’ /do/ [ⁿd̪ɒ] ’stone’ /tʼoʔ/ [t̪ʼɔ̟̈ˑʔ] ’load’
Minimal/analogous set for retroflex plosives:	Minimal/analogous set for velar plosives:
/ʈɐkʈɐ/ [ʈɐkˀʈɐ̯ʔ] ‘hard’ /ʈʰóm/ [ʈʰóm] ‘market’ /ɖuK/ [ⁿɖukʰ] ‘dragon, thunder’ /ʈʼom/ [ʈɔ̈ːm] ‘friend (female)’	/ké:/ [ké:] ‘to deliver’[15] /kʰéː/ [kʰéː] ‘payment, tax’ /ge:/ [ᵑgeː] ‘to cross, to win’ /kʼeː/ [kʼɐ̈ː] ‘to divorce’

Table 7. Contrastive sets for the plosive phonemes in the four places of articulation

As seen in Table 7, the word-initial voiced plosives /b, d, ɖ, g/ are prenasalised when pronounced in isolation. In sentential context, however, they usually occur without prenasalisation. Neither are word-medial voiced plosives prenasalised. Figure 1 below, extracted from Praat, gives the wave form of the prenasalised word /gu/ [ᵑgu̯] ‘nine’.

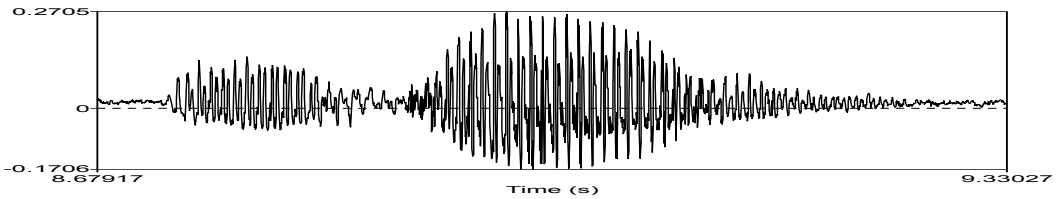

Figure 1. Wave form of the prenasalised word /gu/ [ᵑgu̯] ‘nine’.

[15] The phonemic transcription for the long vowels is tentative. Section 5.3. provides evidence for the opposition between /e/ and /e:/.

In Figure 1, the amplitude of the sound wave decreases to nearly zero between the prenasalisation and the release of the plosive. This indicates decreased voicing. A more accurate phonetic transcription for [ᵑgu̬] would actually be [ᵑg̬u̬], the circle under the bilabial plosive referring to the decresed voicing. There was also variation between different words, some voiced plosives being more clearly voiced throughout the pronunciation than others. Moreover, there were individual differences in pronouncing the voiced consonants. KB's voiced plosives, for instance, were more clearly voiced throughout their pronunciation than RB's.[16]

The retroflex plosives, as testified by WT, derive historically from a complex onset where a plosive was followed by /r/. Especially after the devoiced retroflex, one can still hear some friction after the release of the plosive (cf. van Driem 1992:81 for Dzongkha).

The velar plosives tend to be fronted to when followed by /j/ or /i/, e.g. /gjuK/ [ᵑɟukˀ] 'to run' and /kʰí/ [cʰí] 'dog'. The fronting of the velars is also noted by Sandberg (1895:10), who found that in order to pronounce the word "gyuk-she"[17] rightly, it was advisable to try to pronounce the word as "dyukshe".

The differing voice onset times (VOT) of the aspirated, slightly aspirated and voiceless unaspirated velar stops are demonstrated in Figure 2 below which is extracted from Praat.

[16] Watters (2002:4) describes the corresponding consonants in Sherpa as voiceless preceded by voicing, e.g. /dɐ/ [dtɐ]. He also notes that some speakers pronounce this series as fully voiced.
[17] 'to run'

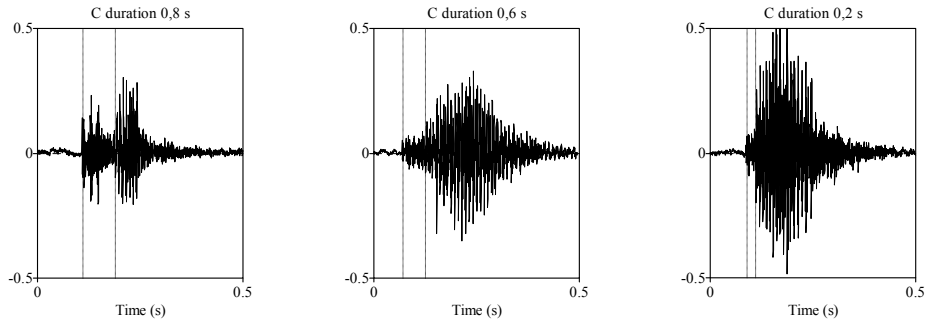

Figure 2: Duration of the aspirated, slightly aspirated (devoiced) and the unaspirated velar plosives in [kʰɐpˀ] 'needle', [kʼ̤ɹ] 'what?' and [kɐ] 'who?'

In Figure 2, the boundary between the velar consonants and the following vowel can be seen as sudden growth in the sound wave. The dotted lines in each diagram mark the beginning and the end point of the initial consonant. The VOT in the fully aspirated stop in /kʰéP/ [kʰépˀ] 'needle' is about 0,08 seconds, whereas the slightly aspirated stop (devoiced stop) in /kʼɐr/ [kʼ̤ɹ] 'what?' lasts 0,06 seconds, being about 0,02 seconds shorter than the fully aspirated stop. The VOT for the voiceless unaspirated stop in /kə̂ʔ/ [kə̰ʔ] 'who?' is about 0,02 seconds. The same phenomenon also occurs with /kʰí/ [cʰí] 'dog', /kʼi/ [cʼɪ̤] 'knife' and [k̤î̤ː] 'to circle with a rope', where the aspirated stop lasts 0,11 s, the devoiced stop 0,06 s and the voiceless stop 0,02 s.

Watters (2002:4-6) shows the same aspiration variation between the three types of stops in Sherpa. He also observes that the articulation of the slight aspiration in the devoiced series is inconsistent[18], and when the aspiration is

[18] According to Sprigg (1990:43), aspiration in the high register in Tamang is "invariant", i.e. pronounced consistently by all speakers. Aspiration in the low register, however, is called

lacking, the devoiced plosive is impossible to distinguish from its voiceless counterpart in terms of VOT. It is not obvious whether Watters means that the articulation of the slight aspiration is only inconsistent between different words or whether the different pronunciations of the same word are also pronounced inconsistently. Whichever the case, the latter is true for Denjongka. The VOT in the devoiced stops varies a lot even between the different pronunciations of the same word. The VOTs in the three pronunciations of the word /k'un/ [k'ṵn] 'roof', for instance, were 0,03 s, 0,05 s and 0,08 s. One should, however, keep in mind that saying the same word three times in a row was not a natural setting.

4.2.2. Word-medial and word-final plosives

Word-medial plosives are challenging for phonemic analysis. A reliable analysis necessitates a good knowledge of Denjongka morphology. Because this knowledge is not available to me at present, the suggestions below should rather be taken as hypotheses based on my impression on the data than as the final word on the matter.

No minimal pairs were found in the data to prove any phonemic voicing or aspiration oppositions among word-medial plosives. Voiced and voiceless plosives, however, contrast in analogous environment as exemplified in 8-9).

8) /nɐko/ [nɐko] 'black'
/n̥ɐguʔ/ [n̥ɐguʔ] 'nose'

9) /çɐmbu/ [ɕɐmbṵ] 'hat'
/dɐmpo/ [d̪ɛmpɔ] 'cheek'

"variant" because some speakers pronounce it and some not. At this stage, I cannot say whether the "inconsistency" mentioned by Watters refers to the same phenomenon as "variance" in Sprigg.

At the same time, the voicing of word-medial plosives varies considerably. In /dʑɐŋku:/ [ⁿdʑɐŋku:/ⁿdʑɐŋgu:] 'green', for instance, both the voiced and voiceless variant were recorded to occur. It is yet unclear whether word-medial voicing is phonemically contrastive.

Intervocalically, the voiced plosives /b/, /d/ and /g/ may be realised as voiced fricatives [β], [ð], and [ɣ] respectively. At present, I do not know whether the example words in 10) below are mono- or bimorphemic.

10) /pʼoNbu/ [pɔ̰̃:βu̯] 'donkey'
/kʰedi/ [kʰe̯di/kʰeði] 'kidney'
/tɕʰige:/ [tɕʰiɣe:] 'foreign'

The relationship between word-medial voiced and voiceless plosives needs more investigation. The questions that will need to be answered are: How are voiced and voiceless plosives distributed word-medially and are there conditioning factors for this distribution or are the phones in free variation on a flexible cline of word-medial voicing? Are the the realisation rules (or tendencies) for word-medial plosives different morpheme-medially and morpheme initially? Does register have a significant role to play (e.g. favouring the voiced variant in the low register)?

Most aspirated plosives occur word-initially, but in some words, such as /tukpʰym/ [t̪ukˀpʰym] 'thick (of books)', the aspiration occurs word-medially. Analogically to Lhasa Tibetan, word-medial aspirated plosives are hypothesised to occur only at morpheme boundary.[19]

[19] Hari (1979:27) asserts that the aspirated stops in Lhasa Tibetan "occur only morpheme initially and therefore medial aspiration is evidence for compounding. Chang (1992:159), on the other

Word-medial (and morpheme initial) aspirated plosives, especially in the low register, tend to be weakly aspirated, and the plosive closure also becomes weak. Consequently, the word-medial aspirated plosives /pʰ/, /tʰ/ and /kʰ/ at morheme boundary are sometimes realised as fricatices [ɸ/f], [θ] and [x], as seen in 7).

11) /t'ɐ:pʰɐ:/ [t̪ɐ̈:ɸɐ:/t̪ɐ̈:fɐ:] 'to flutter (of a prayer-flag)'[20]
/ɖupʰuʔ/ [ⁿɖufuʔ] 'cave'
/tʰɐ:tʰɐʔ/ [tʰɐ:θɐʔ] 'back of the neck' (KB)
/sèkʰɐN/ [sɐ̈kʰɐ̃:/sɐ̈xɐ:] 'restaurant'
/dukʰuN/ [d̪ukʰũ:/d̪uxũ:] 'tree' (RGL)[21]

Curiously, all word-medial sequences of a bilabial plosive and /j/ were realised as aspirated [pʰj], e.g. /tsʰɐpʰju/ [t̪s̪ʰɐpʰjʉ] 'grandson'.

Word-finally, the four-way plosive opposition is neutralised. Word-final bilabial plosive is realised as a voiceless unreleased stop [pˀ]. The velar plosive is realised as an voiceless unreleased velar stop [kˀ] or as a glottal stop [ʔ].[22] Phonemically, the bilabial and velar finals may be represented by the archiphonemes /P/ and /K/, in which the four-way plosive contrast is neutralised. The velar /K/, labial /P/ and the glottal stop /ʔ/[23] are the only plosive phonemes which occur word-finally.

According to Richter (1964:33-36, as cited in Mazaudon 1977:64), the word-final /g/ of WT may be unpronounced or be realised as a velar or a glottal

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hand, claims that in Lhasa Tibetan "Compounds show high tone or absence of aspiration in a second syllable, where an isolated form has low tone."

[20] Vowel length in the phonemic transcription is still a controversial issue, see 5.3.

[21] The word for 'tree' given by RGL was completely different from /ɕiŋ/ (TB, KB) or /ɕiŋdoN/ (RB) recorded from the other informants.

[22] However, in /ɖuK/ [ⁿɖukʰ] 'dragon, thunder', was clearly released.

[23] In addition to being an allophone of /k/, the glottal stop /ʔ/ also occurs independently.

stop in modern Lhasa Tibetan. He notes that the velar, when pronounced, doesn't affect the pitch contour. The unpronounced and glottal realisations of /g/, on the other hand, cause a fall in pitch. This seems to be also true for Denjongka, as exemplified by /tɕíK/ [tɕík˥/tɕî:ʔ] 'one', which also illustrates the fact that sometimes the pronunciation with the glottal has a longer vowel.

The word-initial glottal stop in Denjongka is phonetic, and it indicates that the word-initial vowel belongs to the high register (see example 15 on page 37). The word-final glottal stops, however, are more problematic. In Denjongka writing, they corresponded most of the time to ག[24]. There are, however, also many examples of the final glottal corresponding to ད[25] in writing. Thirdly, there are cases where the glottal stop is not represented by any character in writing. Because the goal of this paper is a synchronic rather than a diachronic description, the glottal stops are preserved as such in the phonemic transcription unless there is an alternative synchronic pronunciation with a velar or dental plosive, in which case the non-glottal variant is preserved in the phonemic transcription (e.g. /tɕíK/ [tɕík˥/tɕî:ʔ] 'one').

Most of the time, the words which have a short vowel and a final glottal stop when pronounced in isolation have a long vowel when pronounced in a context. It remains to be established whether the glottal stop affects the word in any other way than to lengthen the vowel. The pitch pattern of a word is not predictable on the basis of the final glottal stop (when pronounced in isolation)

[24] Traditionally, this character is written with 'g' in the Latin alphabet. In the written words in my data, the character corresponds either to the voiced /g/ or the devoiced /k'/. The writing system in Denjongka is not phonemically consistent.
[25] Traditionally 'd' in the Latin alphabet. In Denjongka, it corresponds to either /d/ or /t'/.

nor does the occurrence of the glottal stop seem to correpond with only one of the registers (high vs low). The intricacies of the glottal stop need more investigation.

4.3. Affricates and fricatives

The Denjongka affricate and fricative phonemes are the alveolo-palatal affricates /tɕ, tɕʰ, dʑ, tɕʼ/, alveolo-palatal fricatives /ɕ, ʑ/, dental/alveolar affricates /ts, tsʰ, dz/, dental/alveolar fricatives /s, z/, and the glottal fricative /h/. The minimal/analogous series are presented in 12-13):

12) /tɕêK/ [tɕê?/tɕêk˥] ‘to break’
/tɕʰê?/ [tɕʰê?] ’hand (honour.)’
/tɕʼɐ/ [tɕɐ̤] ‘tea’
/dʑɐːm/ [ⁿdʑɐːm] ‘squirrel’[26]
/tsê/ [t̪s̪ê] ‘pasture, football ground’
/tsʰé/ [t̪s̪ʰé] ‘salt’
/dzo/ [ⁿd̪z̪ɔ] ‘cross between a yak and a cow’

13) /sê/ [sê] ‘mud’
/zo/ [zɔʰ] ’to make
/ɕê/ [ɕê] ‘meat’
/ʑɐ/ [ʑɐ] ’rainbow’

In the data, there are no examples of /tsʼ/, the devoiced variant for the dental affricate series. This gap calls for another careful look at the data. The dental/alveolar series sibilants are considered alveolar because of the assumption that it is physiologically easier to pronounce them non-dental. In the dental affricates, on the other hand, the sibilant assimilates to the place of articulation of the preceding plosive.

The contrastive status of /z/ and /dz/ is further attested in 14):

[26] Length is a complex matter and the phonemic transcription for length in this word is highly tentative.

14) /zoɕe?/ [zɔɕe?] ‘to make, repair’
/dzo:ɕe?/ [d̪z̪o:ɕe?] ‘to finish’

An aural cue for distinguishing the aspirated alveolo-palatal affricate /tɕʰ/ from the unaspirated /tɕ/ is the fact that the non-aspirated stop imposes a slight glide [j] on the following vowel. This glide is not present in the aspirated palatal affricate.

Similarly to the plosives (cf. 4.1.1.), there is often a difference in the VOT between the voiceless and devoiced affricates. In the tense voiceless affricate in /tɕêK/ [tɕê?/tɕêkˀ] ‘to break’, for instance, the VOT in the first pronunciation of the word in isolation was about 0,04 s and in the devoiced affricate in /tɕ’ɐ/ [tɕɐ̥] ‘tea’ about 0,09 s. The VOT in the aspirated affricate in /tɕʰê?/ [tɕʰê?] ’hand (honor.)’ was roughly the same as in the devoiced variant, but the sounds were notably different in that the devoiced sound imposed a glide (which can be seen as a rise in the first formant) on the following vowel whereas the aspirated affricate did not.

The voiceless glottal fricative /h/, which occurs only in the high register (similarly to Dzongkha, see van Driem 1992:95), is word-initially contrastive with the phonetic glottal stop, which precedes word-initial high-register vowels. In the low register, the glottal fricative is very short and weak as if to just prevent glottal closure in the beginning of the word. Because the glottal stop doesn’t appear word-initially in the low register, the opposition is neutralised and /h/ is non-contrastive there. The opposition of /h/ with the phonetic glottal stop in the high register and the behaviour of the phonetic [h] of low register are illustrated in 15) below:

15) /hép/ [hépˀ] ‘to bark’
/ép/ or /øp/ [ʔe̤pˀ/ʔø̤pˀ] ‘to push (e.g. with one’s body)’
/è:m/ [hɐ̤:m] ’fox’

Fricatives do not occur word-finally. Van Driem (1992:98), however, claims that in Dzongkha the alveolo-palatal sibilant /ɕ/ may occur word-finally in a certain imperative form of the verb. No such forms are recorded in the Denjongka data at present, but this is clearly an issue for further research.

4.4. Nasals

The nasal stops in Denjongka are the voiced nasals /m, n, ŋ/ and the voiceless nasals /n̥, ŋ̊/, of which /n/ and /n̥/ are phonetically dentals. Tibetan writing, on the other hand, has single characters for the four nasals /m, n, ɲ, ŋ/. Sandberg (1895:17-18) also lists these four phonemes as the nasal stops of Denjongka, including the palatal nasal in the phonemic inventory.

This analysis, however, is not a necessary one. According to the alternative analysis adopted here, Denjongka has only three phonemic nasals /m/, /n/ and /ŋ/, and the palatal [ɲ] is the realisation of the archiphoneme, which is formed as a result of neutralisation of the contrast between /n/ and /ŋ/. The opposition between /n/ and /ŋ/ disappears before the close front vowels /i/ and /y/ and the glide /j/. Then, the archiphoneme /N/, realised as [ɲ], appears in the nasal position. In the data, there are no instances of a dental or velar nasal preceding a close front vowel. Moreover, [ɲ] doesn’t appear word-finally, unlike the other nasals. The palatal nasal [ɲ], however, also appears preceding other vowels than /i/ and /y/.

Then [ɲ] is interpreted as a sequence of the nasal archiphoneme and /j/. This interpretation is not far-fetched as [ɲ] is pronounced with a strong glide. The following examples in 16) show how to analyse the nasals followed by /ɐ/.

16) /mɐ́/ [mɐ́] ‘wound’
/nɐ̀/ [n̪ɐ̀] ‘here’
/ŋɐ̀/ [ŋɐ̀] ’I’
/Njɐ̀/ [ɲjɐ̀/ɲɐ̀] ‘fish’

In his study of the Limi dialect of Humla Bhotia, Wilde (2001:18) considers the possibility of this analysis, but refrains from it because the palatal glide in Limi CC-clusters occurs only after velar consonants. He also asks why /j/ doesn’t appear after bilabial, dental, post-alveolar and retroflex consonants in Limi. In Denjongka, the situation is different. As shown in (17), the glide /j/ may also appear after bilabials in CC-clusters, and so this interpretation of [ɲ] doesn’t introduce any new syllable patterns.

17) /mjoŋɕeʔ/ [mjɔŋɕeʔ] ’to finish (a meeting)’
/pʼjɐ/ [pʼjɐ̟] ‘chicken’

In summary, the reasons for not interpreting [ɲ] as a phoneme are the following: This analysis saves one phoneme and doesn’t introduce any new syllable patterns. It also describes the distribution of nasals more consistently, because the palatal nasal, unlike other nasals, doesn’t appear word-finally. In this interpretation, furthermore, the nasal series is more analogous with the stop series, which doesn’t include a phonemic palatal stop. Analogously with the nasals, a velar stop followed by /j/ is realised as a palatal stop as in /kjuɕeʔ/ [cjʉˑɕeʔ] ‘to vomit’.

In addition to having three voiced nasals, Denjongka also has two voiceless nasals /n̥/ and /ŋ̊/. The voiceless palatal nasal [ɲ̊] is considered a sequence of the nasal archiphoneme /N̥/ and the glide /j/. Watters (2002:15) calls the corresponding dental nasal in Dzongkha an "aspirated nasal". These phonemes in Denjongka consist phonetically of a short period of voiceless nasal followed by voiced nasal.

Nasalisation on vowels derives historically from final nasals that are retained in writing but lost in speech. Sometimes, as in /sòn/ [sə̀ː/sòn] 'to plant', the old nasal may surface in speech. I suspect that the variant with the nasal stop may be an example of what Sprigg (1991) calls "spelling style pronunciation", a style available for literate speakers of Tibetan dialects. The drop of the nasal lengthens and nasalises the preceding vowel.

4.5. Liquids

Denjongka has four liquid phonemes: voiced /l/ and /r/, which appear either in the high or low register, and voiceless /l̥/ and /r̥/, which occur only in the high register. The following four examples in (18) provide evidence for the opposition between voiceless and voiced liquids.

18) /l̥óN/ [l̥ɔ̃́ː] 'money gathering'
/lóN/ [l̥̈ɔ̃́ː] 'to search'
/r̥ém/ [ɹ̥ém] 'to destroy'
/rɐ/ [ɹɐ/ɾɐ] 'goat'

Word-initially, the rhotic /r/ tends to be realised as [ɹ̝], a close alveolar approximant that often causes some friction. Word-medially, /r/ is a flap [ɾ] and

word-finally a trill [r] or a flap [ɾ]. The voiceless variant /r̥/ is realised as [ɻ̊], where the voiced approximation is preceded by voiceless friction. A curious detail about /r̥/ is that when preceded by the final /m/ of the previous word in a sentence, the voiceless friction was replaced by the aspirated /pʰ/, e.g. /om r̥o/ > [ɔmpʰɹɔ].[27]

The lateral /l/, too, appears in all three positions in the word, but only two examples of word-final /l/ were countered. Both occurred after the close back vowel /u/ and had alternative pronunciations with long [y:] instead of [ul]. The laterals are usually realised as apico-dental [l̪] but word finally as laminal [l̻]. The two words with the word-final /l/ are presented in 19).

19) /ŋúl/ [ŋúl̻] or /ɲỹ/ [ɲỹ:] 'money, silver'[28]
/ne:tsul/[ne:t̪s̪ul̻] or /ne:tsy/ [n̪e:t̪s̪y:] 'message'

According to van Driem (1992:96), final liquids in Dzongkha "are limited to literary pronunciations." Considering the rareness of the word-final /l/ and the existence of the alternative forms, this is most likely true of Denjongka too.

4.6. Central approximants

Two central approximants occur in Denjongka: the palatal approximant /j/ and the labio-velar approximant /w/. Both approximants appear word-initially, word-medially and word-finally.[29] The palatal approximant also occurs as the second member of consonant clusters. The labio-velar approximant proved to be a rare phoneme. Only one example of word-initial /w/ (from TB) was found in the whole

[27] /om/ 'milk', /r̥o/ 'to churn'
[28] /y/ is short because length in /y/ and /ø/ is hypothesised to be non-contrastive (see 5.3., p. 44).
[29] Occurrences of [i] and [u] as the last members of word-final vowel clusters were interpreted as /j/ and /w/ (see 3.2).

data. The words in 20) illustrate the occurrences of /w/ in the initial, medial and final positions:

20) /wɛtɛ/ [wɛt̪ɛ] ‘downhill’ (TB)
/Njɐ wɐ/ [ɲɛ̃wɐ] ‘hell’
/léw/ [léu] ‘lungs’

5. Suprasegmental Phonology

5.1. Syllable structure

Denjongka syllable patterns with examples are presented in Table 8 below.

Short vowel		
Open syllable	V	/ɐ.loN/ [ʔɐl̪õː] ‘hook’
	CV	/ɕé/ [ɕé̞] ‘meat’
	CGV	/kjê/ [kj̟ê̞] ’hair’
Closed syllable	VC	/ǿn/ [ʔǿn] ‘left (vs right)’
	CVC	/geP/ [ᵑgepˀ] ’bag’
	CGVC	/gjɐP/ [ⁿgj̟ɐ̞pˀ] ‘upper back’
Long vowel		
Open syllable	V:	/éː/ [ʔé̞ː]
	CV:	/ʑiː/ [ʑiː] ’four’
	CGV:	/kʼjoːʔ/ [cʼjo̤ːʔ] ’discuss’
Closed syllable	V:C	/èːm/ [hɐ̤ːm] ’fox’
	CV:C	/geːP/ [ᵑgeːpˀ] ’king’
	CGV:C	/kjúːm/ [cjʉ́ːm] ‘sour’

Table 8. Denjongka syllable patterns

All consonants (see Table 6, p. 23) may function as an initial C. In the complex onset (CG), the glide position (G) is filled by /j/. Surprisingly, there was also one example of /r/ occurring as the second member of a complex onset (G) in the

alternative pronunciation /pri/ [pɹi] for /pi:/ [pi:] ‘long grass’[30]. The possible syllable final consonants are /P, K, r, l, m, n, ŋ, ʔ/, of which /l/ is very rare (see 4.5.).

5.2. Nasalisation

The vowels following or preceding nasals are nasalised to some degree. This nasalisation is phonetic and is not ordinarily marked in the phonetic transcription for too many diacritics above the same vowel make things unclear rather than clear. This conditioned nasalisation does not affect the duration of the vowel.

In addition to conditioned nasalisation, there is also phonemic nasalisation caused by the loss of the historical final nasals. This type of nasalisation is heard more clearly, partly because these phonemic nasalised vowels are typically long.[31] Although there are some words, such as /sòn/ [sə̀̃:/sòn] ‘to plant’ and /léŋ/ [léŋ/lɛ́̃:] ‘ox’, in which the two varying pronunciations reveal the underlying nasal, in most cases the place of articulation of the underlying nasal cannot be deduced from aural cues. The nasal is then best represented by the archiphoneme /N/ (see 4.4.), which neutralises the distinction between /n/ and /ŋ/, e.g. /tsɛ́N/ [t̪s̪ɛ́̃:] ‘thorn’[32].

Interpreting nasalised vowels as sequences of a short vowel and the nasal archiphoneme saves the analyst from increasing the phonemic inventory with the

[30] This word was not recorded on minidisc. Therefore it lacks pitch in the transcription.
[31] In some cases, the nasalised vowel may be short (e.g. [ⁿd̪ɛ̃ʔ] ‘yesterday’) when pronounced in isolation. In context, however, it is lengthened (e.g. [ⁿd̪ɛ̃:]).
[32] The bilabial nasal /m/ seems to be more resistant to disappearing word-finally than /n/ and /ŋ/. Hence, /N/ neutralises only the difference between /n/ and /ŋ/.

nasalised vowels. All vowel phonemes (except perhaps for /ɛ/) can be nasalised. Examples in 21) show that nasalisation in Denjongka is contrastive.

21) /tsɐʔ/ [t̪s̪ê:ʔ/t̪s̪êʔ] 'rust'
/tsɐ́N/ [t̪s̪ɐ́̃:] 'thorn'
/tʰo:ɕeʔ/ [tʰɔ:ɕeʔ] 'to hear'
/tʰoNɕeʔ/ [tʰɔ̃:ɕeʔ] 'saw (past tense of 'to see')'

5.3. Length

Analysing vowel duration in Denjongka and the related languages is far from straight-forward. Van Driem (1992:53), for instance, maintains that Dzongkha has long and short vowels and adds that the difference between them is not only one of duration but also of vowel quality. He comments, furthermore, that the difference between what he calls short and long /e/ is "more often" in vowel quality than in length.

Watters (1999:57), on the other hand, claims that what some have called a long/short vowel distinction in Sherpa is actually a difference in vowel quality. Based on an acoustic study, he further observes that the difference in duration between the long vowels and short vowels is conditioned by syllable type and register so that the vowel duration difference is greatest in high register closed syllables and smallest in low register open syllables. In the low register, the "short" and "long" vowels are sometimes almost overlapping in duration. Watters, moreover, notes that the distinction between short and long vowels in Sherpa is not consistently pronounced. He ends up suggesting that there is no need for the category of length in the description of Sherpa vowels.

Vowel duration in Denjongka conforms to Watters's description of Sherpa in that the duration of Denjongka vowels is not always consistently articulated. Especially in words ending with a glottal stop, there is considerable variation in vowel duration between the different pronunciations of the same word. The word /tsê?/ [ʦ̪ʂ̪ê:?/ʦ̪ʂ̪ê?] 'rust', for instance, was recorded in two separate sentences. In one, the vowel is short, [ʦ̪ʂ̪ê?], but in the other, the vowel is long [ʦ̪ʂ̪ê:?].

It was difficult to find word pairs in which the only contrastive feature would have been vowel duration. Nevertheless, I managed to find some evidence for phonemic vowel length in Denjongka. First, consider 22) below.

22) /geP/ [ᵑgepˀ] 'bag/backpack'
/ge:P/ [ᵑge:pˀ] 'king'

The words in 22), however, contrast not only in length but also in pitch. The pitch in [ᵑgepˀ] 'bag/backpack' is level while in [ᵑge:pˀ] 'king' it is rising. Now look at 23).

23) /ɕî:/ or /ɕê:/ [ɕî:] 'to catch, understand, know'[33]
/ɕî/ [ɕî] 'to die'

The length opposition in 23) is retained in sentential context. Both words appear in the high register and have a falling pitch. The third word pair that gives evidence for phonemic length is presented in 24).

24) /gu/ [ᵑgu̟] 'nine'
/gu:/ [ᵑgu:] 'to wait'

[33] Denjongka writing and the equivalent word in Dzongkha (van Driem 1992:58) are in favour of interpreting the vowel phoneme as /e/.

According to Hari (1979:38) and van Driem (1992:54), length is not contrastive in the three vowels /ɛ/, /y/ and /ø/. Van Driem reports that these vowels are always long in Dzongkha and Hari maintains that in Lhasa Tibetan their phonetic realisation is contingent on the environment. In Denjongka, /y/ and /ø/ tend to be long especially in open syllables (e.g. [ʔy:] 'village', [t̪ø̤:] 'nets'). In closed syllables they are often short (e.g. [sỳn] 'to burn', [ʔøn] 'left'), but both long and short /y/ and /ø/ appear in both open and closed syllables. However, no minimal contrasts between long and short /y/ or /ø/ were found in the data. It is yet too early to say anything conclusive about the duration of the questionable phoneme /ɛ/.

In the light of the above discussion and examples, one may call vowel length in Denjongka an incipient contrastive feature, only marginally contrastive. In this way, Denjongka lines up with Hari's (1979:43) observation about Lhasa Tibetan that vowel length is phonemic at the moment and is likely to gain more significance in the future. At present, a more careful study on the effect of pitch, voice quality and stress on vowel duration is needed.

There are no lengthened consonants in Denjongka, but at least one phonetic geminate, [bb], occurs at word boundary when the final plosive of the previous word assimilates to the voiced plosive in the next word, as shown in 25).

25) /di: zuK be?/
[di: zu**b** **b**e:?]
this body is
'This is a/the body'

5.4. Phonation type and pitch

As noted by Anderson (1978:137), "tonal phenomena are closely related to other aspects of laryngeal control, and particularly voice quality." Denjongka and Tibeto-Burman languages in general are prime examples of this interlinking of pitch and voice quality. Tonogenesis in Central Tibetan (of which Denjongka is a southern member) is attributed to the loss of word-initial voicing distinctions (DeLancey 1992:447). The formerly voiced initial consonants developed into the so-called devoiced consonants with their corollaries of low pitch and breathy voice. We will now consider the phonations types (i.e. voice quality).

Phonation types in Denjongka can be placed in three categories: breathy/lax, modal, and tense/creaky. The breathy/lax phonation corresponds always to the low register and the tense/creaky phonation to the high register. In breathy voice, the glottis is vibrating but also more open than in modal voice. This causes a higher rate of airflow which can be heard as the characteristic "murmuring" on the vowel.

In creaky voice, there is tension in the glottis and the vocal cords are vibrating only partly. The airflow is reduced compared to the modal voice. Having given these definitions, it must be noted that laryngeal settings form a continuum from creaky to stiff to modal and from breathy to slack to modal voice (Ladefoged & Maddieson 1997:47-66). Whereas creaky voice is strongly laryngealised, stiff voice is only slightly laryngealised. Slack voice, on the other hand, has higher airflow and more constriction than modal voice but lower airflow and less constriction than breathy voice. Consequently, some words in Denjongka which according to the three-fold division of phonation types would be called creaky or

breathy may in actual phonetic terms be closer to stiff and slack voice respectively.[34]

Words uttered with a modal voice appear in both registers. Voiced consonants, for instance, belong to the low register but are usually followed by modal voice.[35] The devoiced consonants, on the other hand, also belong to the low register but are followed by breathy voice. These observations are in line with what happens in Dzongkha. According to Watters's (2002:46) phonetic study, which was based on measuring the difference in amplitude between the fundamental frequency and the second harmonic (cf. Maddieson & Ladefoged 1985), the voice quality following the voiced stops in Dzongkha was not different from that following voiceless stops.

At this stage, it is not yet clear when the phonation type in high register words is tense/creaky and when modal. Although some high register words seem to be consistently tenser than other words in the same register, I have also observed that in Denjongka the different pronunciations of the same word may vary quite considerably on the continuum from modal to tense voice. This would suggest that the distinction between tense and modal high register words is phonetic rather than phonemic. It is, however, reported (Glover, as cited in Weidert 1987:261) that in the related languages Tamang, Gurung and Thakali, all spoken in Nepal, high register words can further be divided into two categories, fortis and lenis, both of which are pronounced with non-beathy voice.

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[34] Vesalainen and Vesalainen (1976:45), following Ladefoged (1971:21), distinguish nine degrees of glottal stricture (i.e. nine phonation types) in their analysis of Lhomi, varying from the open glottis of voiceless sounds to the glottal stop. Phonological "lax voice" was then reported to occur on four phonetically different levels (breathy voice, murmur, lax voice, voice) and tense voice on three levels (creaky voice, tense voice, voice). Thus, phonologically bipolar (tense vs. lax) phonation formed a six-fold distinction on the phonetic level.

[35] Some words, such as [ᵐbɛ̤ːpˀ] 'frog', are exceptions.

Maddieson & Ladefoged's (1985) study will be a useful starting point for further investigation on the nature of phonation types. They studied the tense/lax opposition in four minority languages of China and found out that two of the languages (Hani and Yi) derived tense vowels from former closed syllables which have dropped the final consonant. In these languages vowel duration was "a prominent factor in the tense/lax difference" (Maddieson & Ladefoged 1985:449). The other two of the languages (Jingpo and Wa) derived lax vowels as a result of devoicing of the former voiced initials, and in these languages vowel duration was not a prominent factor in the tense/lax distinction.

Denjongka has certainly evolved in the same way as Jingpo and Wa. The so-called devoiced consonants, which are followed by breathy voice, have their origin in the devoicing of formerly voiced initials. Moreover, similar type of development to the one represented by Hani and Yi, where the loss of final consonants has given rise to tense voice, has been reported in Dzongkha. Mazaudon & Michailovsky (1988) have shown how the loss of final consonants and syllables has affected Dzongkha tone contour. It would be an interesting line of research to find out whether the tone type and the exceptionally tense voice in some high register words in Denjongka can be traced back to the loss of certain consonants or syllables (similarly to Hani and Yi).

If indeed Denjongka has evolved in both ways described above, it is easier to understand why the analyst is drawn into two directions concerning vowel duration: On the one hand, one is prone to considering vowel length as a phonetic feature co-occurring together with certain pitch and phonation type phenomena (as in Hani and Yi). On the other hand, one is forced to see vowel length as

phonemically significant segmental feature, unrelated to the phonation type distinction (as in Jingpo and Wa).

Yet another interesting line of investigation on voice quality would be to find out whether there is variation in the phonetic implementation of the phonation type differences between different speakers of Denjongka. Wayland & Jongman (2003:181), for instance, found that in one dialect of Khmer the female and male speakers had differing ways of realising the bipolar phonation type difference in the language.

5.5. Pitch

Pitch in Denjongka is partly predictable on the basis of the initial consonants (e.g. aspirated stops occur always in the high register). In those cases where the register is not predictable from the initial consonant (which is the case, for instance, with nasals), the contrast between the registers is formed by voice quality and pitch (Watters 2002:23). Since pitch is interlinked with voice quality, it is difficult to say which is primary. Furthermore, pitch and voice quality in some related languages (e.g. Tamang, Gurung, Thakali) can be interlinked with yet other phonetic phenomena such as length and intensity (Weidert 1987:265). D. Watters (2002:36) concludes that in East Asian and Southeast Asian areal typology "tone is best described as a composite of complex tonal features."

However, if tone is defined as a distinctive pitch and pitch is predictable on the basis of other phonetic phenomena, it is questionable whether a language is truly tonal. Kjellin (1976), for instance, claims that there is no lexical tone in Lhasa Tibetan. Nevertheless, if it can be shown that there are minimal tonal pairs

inside either the high or the low register, it will prove that pitch assignment is not always predictable on the basis of initial consonant or phonation type/register. This, in turn, will provide evidence for calling the language in question a tone language.

Mazaudon & Michailovsky (1988) show that there are register-internal tonal oppositions in Dzongkha which correlate with old rhyme contrasts. Van Driem (1992:100), on the other hand, does not take this phenomenon into consideration in his description, because the register-internal tone contrast does not appear in all dialects of Dzongkha, and even when the contrast appears, its distribution is limited and it is not consistently pronounced by all speakers. It will be shown below that there are some register-internal pitch contrast in Denjongka, suggesting that the language may be justly called an incipient tone language. This is also what Watters's (2002:20) concludes in his article *Sounds and tones of five Tibetan languages* about the languages studied: there is an "emergent tone accompanied by phonational and length contrasts."

Watter's article proved to be particularly helpful for pitch analysis because it provides a detailed description of pitch in five languages which are closely related to Denjongka. Watters's findings served as a point of comparison and also shed light on what could be expected to be found.

5.5.1. Pitch in monosyllabic words

The three words /ŋé/ [ŋ̋é] 'five', /ŋè/ [ŋ̏è] 'I' and /ŋê/ [ŋ̋ê] 'drum' illustrate the three pitch patterns in Denjongka monosyllabic words. At the same time, these words give evidence for a register-internal pitch contrast in the high register. Now

look at Figure 3 below where the words are pronounced one after another. The first rectangle depicts the sound wave and the second the pitch trace.

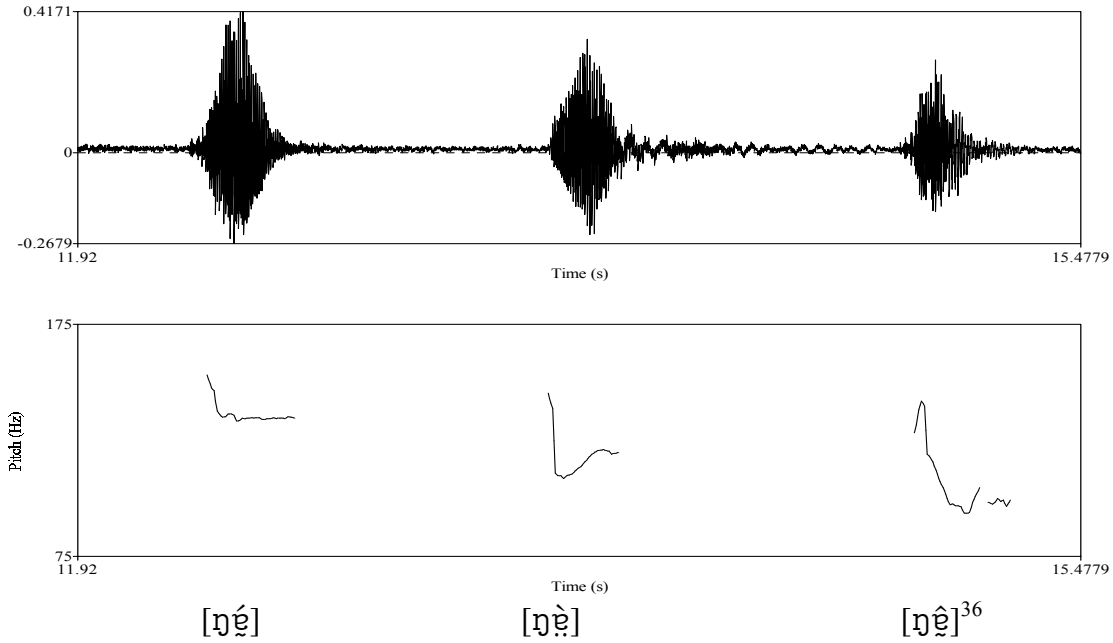


Figure 3: The three pitch patterns in Denjongka monosyllables illustrated by /ŋé/ [ŋǵ] 'five', /ŋè/ [ŋȅ] 'I' and /ŋê/ [ŋê̋] 'drum'

The defining pitch patterns in Figure 3 occur during the vowel nucleus. The falling pitch in the beginning of [ŋǵ] and [ŋȅ] and the rising pitch in the beginning of [ŋê̋] occur during the pronunciation of the initial nasal and are irrelevant for the present pitch analysis. The pitch in the high register words /ŋé/ [ŋǵ] and /ŋê/ [ŋê̋] is high level and high falling respectively. The pitch in the low register word /ŋè/ [ŋȅ] is rising.

[36] The word is marked for tense altough it is not tense here in the end of the stretch of speech. When pronounced in isolation, however, /ŋê/ is tense.

The three words above show that there can be register-internal pitch contrasts in the high register. Moreover, the breathy voice on the short vowel in /ŋè/ [ŋ̤è] ‘I’ is not as easily discernable as on long vowels. This indicates that pitch is also an important factor in distinguishing the high and low register words from each other. Now I will continue with some more evidence for register-internal pitch contrasts.

As already noted in 4.2.2. (see p. 33), WT final /ɡ/ imposes a glottal stop and a falling pitch on the syllable. It also often makes the vowel longer. This is exemplified in the two word pairs in 26) below, where the historical phoneme /ɡ/ is represented by the glottal stop in the phonemic transcription.

26) /kʰé / [kʰé] ’mouth’
/kʰêʔ/ [kʰêʔ/kʰê:ʔ/kʰê:] ’liquid’
/té/ [t̪é̤] ‘horse’
/têʔ/ [t̪ê̤ʔ/t̪ê̤:ʔ/t̪ê̤:] ‘tiger’

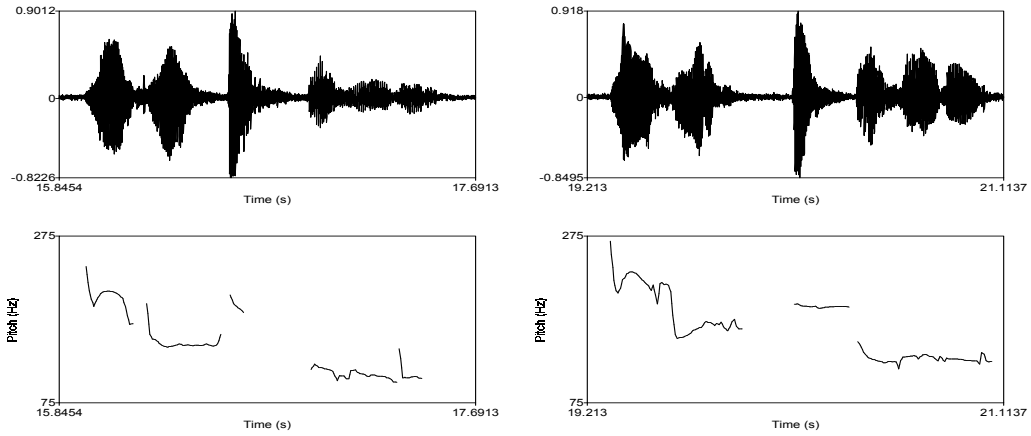
Whereas the vowel in /kʰɐ/ ‘mouth’ and /tɐ/ ‘horse’ is almost always pronounced as short, the vowel duration in /kʰêʔ/ ‘liquid’ and /têʔ/ ‘tiger’ varies between short and long. The glottal stop in these words, on the other hand, is absent when the words are pronounced with a long vowel in a sentence. The initial consonant of the following word seems to “swallow” the glottal. There is, however, always a consistent opposition in pitch: /kʰé/ ‘mouth’ and /té/ ‘horse’ have high level pitch, and /kʰêʔ/ ‘liquid’ and /têʔ/ ‘tiger’ have a high falling pitch.

Eliciting the words /té/ ‘horse’ and /têʔ/ ‘tiger’ in context proved to be extremely useful because these words behaved differently in context than when

pronounced in isolation. The pitch in /tɛ́/ was falling and in /tɛ̂ʔ/ basically level when pronounced in isolation, but in context the pitch in /tɛ́/ proved to be level and in /tɛ̂ʔ/ falling. Vowel duration was another changing factor. In isolation, the words had a clear contrast in vowel duration. In context, however, the contrast in vowel duration became blurred when the vowel in /tɛ̂ʔ/ was occasionally realised as a short one or the vowel in /tɛ́/ as a long one. Therefore pitch became the main contrastive feature. Figures 3 and 4 on the next page illustrate the pitch difference of these two words in context. The upper rectangles, again, give the sound wave, and the lower rectangles the pitch trace. Details of verb morhology have been overlooked due to insuffient knowledge of the language.

The length of the pitch trace in in Figure 4 is deceiving in being much longer in [t̪ɛ̪́] ‘horse’ than in [t̪ɛ̪̂ʔ] ‘tiger’. The audible duration is better seen in the wave forms, which are quite similar. In Figure 4, the vowel is short in both words. Strictly speaking, the opposition between the words is not only in pitch, because [t̪ɛ̪̂ʔ], unlike [t̪ɛ̪́], involves a clear glottal stop.

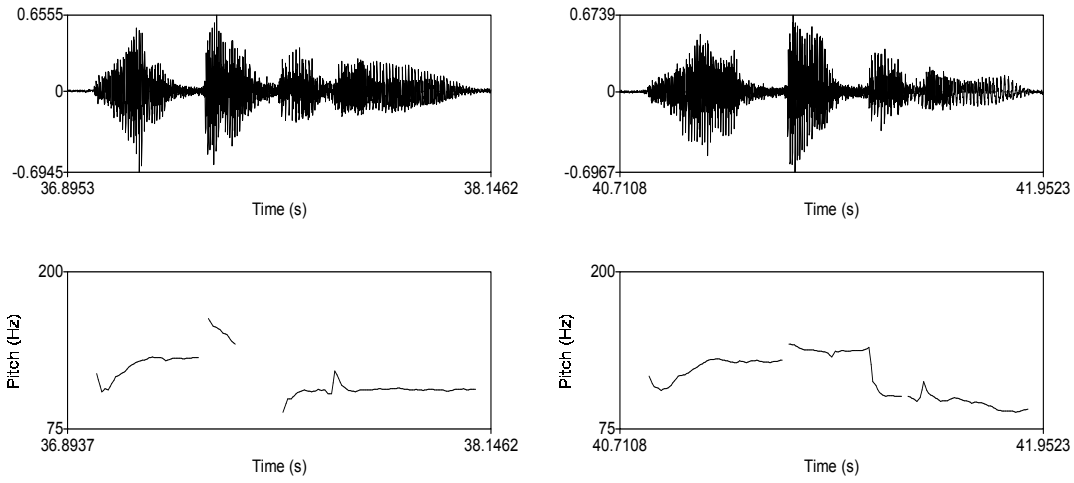
In Figure 5, however, the vowel in /tɛ̂ʔ/ ‘tiger’, and also surprisingly in /tɛ́/ ‘horse’, is longer than in Figure 4, and the glottal stop from /tɛ̂ʔ/ has been dropped. Pitch appears to be the only contrastive feature between the words. Once again, vowel duration is better seen in the wave form than in the pitch trace.



[mi: gie t̪ɛ̰ʔ t̪ɐ:ʑend̪u:]
man -ERG tiger look
'The man is looking at the tiger.'

[mi: gie t̪é t̪ɐ:ʑend̪u:]
man - ERG horse look
'The man is looking at the horse

Figure 4. Register-internal pitch opposition between [t̪ɛ̰ʔ] 'tiger' and [t̪é] 'horse'.



[ŋ̈ɐ: t̪ɛ̰: t̪ɐ:t̪ɐ:t̪ɔĩ:]
I tiger look
'I am looking at the tiger.'

[ŋ̈ɐ: t̪é: t̪ɐ:t̪ɔĩ:]
I horse look
'I am looking at the horse

Figure 5. Register-internal pitch opposition between [t̪ɛ̰:] 'tiger' and [t̪é:] 'horse'.

As seen in Figure 5, there is a register-internal level vs falling contrast in the high register. In Dzongkha, Mazaudon and Michailovsky (1988:118) find the level vs falling pitch opposition also in the low register and posit four tones for Dzongkha: low level and low falling tones in the low register, and high level and high falling tones in the high register.

Although the Denjongka data are similar to Dzongkha in the high register, I have as yet no persuasive evidence for contrastive pitch in the low register. When pronounced in isolation, the pitch in low register words is quite consistently level, and when pronounced in sentential context, the pitch is quite consistently rising.[37] One word pair, however, came close to giving evidence for low register pitch contrast. Consider 27) below.

27) /geP/ [ᵑgepˀ] 'bag/backpack'
/ge:P/ [ᵑge:pˀ] 'king'

The pitch in [ᵑgepˀ] is level whereas in [ᵑge:pˀ] it is rising. The pitch type, however, forms only part of the contrast, because the opposition is also in vowel length.

In summary, the tonal analysis in this paper deviates from the traditional four-tone system, which has been often used in describing Tibetan languages.[38] In the four-tone system, pitch is contrastive both in the high and low register, whereas in the present analysis pitch has been established to contrast only in the high register. However, in the light of the purported pitch contrasts in the related

[37] The word /dzeʔ/ [ⁿdzeʔ] 'bullet', however, was an exception to this rule in having a long vowel and a level pitch in the same sentential environment where other low register words had a rising pitch. This exceptional pitch pattern may be caused by the glottal stop, which gives rise to a falling pitch in the high register and is rare in the low register.
[38] For instance Vesalainen & Vesalainen (1976), Hari (1979), D. Watters (2002).

languages, the possibility of low register pitch contrast is best left open for further research.

Another pitch-related research topic for future concerns closed high register monosyllables that have a falling pitch. Since the great majority of the closed syllables in the high register have a level pitch, the occurrences of a falling pitch in this environment call for a diachronic explanation. According to Mazaudon & Michailovsky (1988:130), the falling pitch in Dzongkha closed monosyllables has its origin in lost WT syllables. WT disyllabic words which have been reduced to monosyllables in Dzongkha have a falling pitch, e.g. WT /kɐ.bɐ/ > Dzongkha /kêu/ 'pillar' and WT /tɕʰɐr.pɐ/ > Dzongkha /tɕê:p/ 'rain'. The development of pitch in Denjongka, however, differs from Dzongkha: the pitch in the corresponding Denjongka words is level instead of falling, /kéw/ [kéu] 'pillar' and /tɕʰé:P/ [tɕʰé:pˀ] 'rain'.

5.5.2. Pitch in disyllabic words

A reliable analysis of pitch/tone in disyllabic words requires some knowledge of morphology because pitch in compounds and genuine disyllabic words may behave differently. Sprigg (1990:34), moreover, shows that the tone of the verb base in Lhasa Tibetan depends on the type of the following verbal particle.[39] My knowledge of Denjongka morhology does not qualify me for treating the pitch in disyllabic words thoroughly. Therefore, I restrict myself to giving a preliminary

[39] For instance, the pitch in *shi* 'to die' is high falling when followed by –*song*, as in *shi-song* '(he) died'. On the other hand, when followed by –gi as in *shi-gi-red* '(he) will die', the pitch in *shi* is high level.

table of pitch patterns in disyllabic words and making three small observations on pitch in Denjongka disyllabic words.

Table 9 below, presents the results of a sketchy analysis of the syllable patterns in disyllabic Denjongka nouns. In the table, L means level pitch and F means falling pitch. The sequence FL, for instance, refers to a disyllabic word in which the first syllable has a falling pitch and the second syllable a level pitch. If this syllable occurs in the column with the heading "Equal syllable height", it means that the starting point of the falling pitch in the first syllable is roughly on the same level as the level pitch on the second syllable. If, on the other hand, FL occurs in the column with the heading "First syllable higher", it means that the starting point of the falling pitch in the first syllable is clearly higher than the level pitch on the second syllable. It ought to be noted that Table 9 does not make any difference between the high and low register and is only a sketch of relative pitch levels between the syllables.

Equal syllable height	First syllable lower	First syllable higher
LL	LL	LL
FL	LF	FL
FF		

Table 9. Pitch patterns in Denjongka disyllabic nouns.

Table 9 lists seven different syllable types. Future studies will show how these types correlate with the high and low registers. At this time, I cannot say anything conclusive about the domain for tone in Denjongka. I will now, however, present what has been said about tone domains in the related languages and make a couple of remarks in comparison to Denjongka.

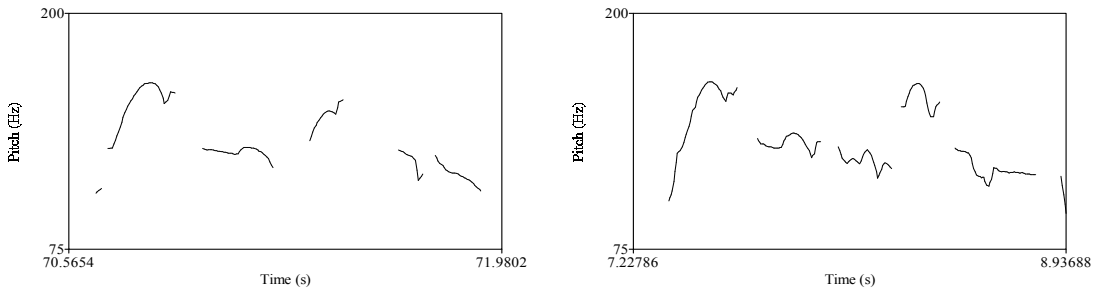
Watters (2002:32) claims to have found three tonal systems among the five Tibetan languages he studied: two different word tone systems (Dolpo and Mugom Tibetan, Sherpa) and a syllable based system that has not been described before (Dzongkha, Lhomi). Watters's (2002:40-44) examples of a syllable based system come only from Lhomi, but the reader is left to assume that Dzongkha behaves in an analogous way.

According to Watters, the pitch in the first syllable of disyllabic words in Lhomi is determined by "heaviness". In the high register, the "heavy" (i.e. long or closed) first syllable is high level and the "light" first syllable is high falling. The second syllable is always falling. In the low register, the "light" first syllable is mid falling and the "heavy" syllable mid rising/level. The overall pitch level of the word is set by the first syllable. On the basis of syllable pattern and incipient pitch, Watters finds eight distinct syllable patterns in Lhomi disyllabic words.

The Denjongka word [ʈ̪îŋpó] 'heel' illustrates two differences between Denjongka and the above Lhomi description. First, unlike in Lhomi, the second syllable in disyllabic words in Denjongka is not always falling but may be also level. Second, the pitch in the first syllables differs from Lhomi in that the "heavy" first syllable in the high register is can be also falling. It is, however, worth noting that the pitch in the pronunciation of my main informant, RB, differed from the other informants, whose pitch in the first syllable was level and lower than with RB, [ʈ̪ìŋpó] 'heel'.

The third observation (which is unrelated to Watters's findings in Lhomi) concerns pitch in compounds. When appearing alone in a sentence, the word /tsʰóm/ [ʈ̪ʂʰóm] 'big wooden mortar' (TB) is higher than the previous high

register word /kʰóŋ/ [kʰóŋ/kʰő:] 'he'. In contrast, when [t̪ʂʰɔm] appears in an identical sentence in the compound [t̪ʂʰɔmpʰju:] 'wooden pestle', the pitch on [t̪ʂʰɔm] is lower than on the previous word [kʰɔŋ] 'he' and the following syllable [pʰju:] is extra high. The pitch traces from the two sentences are presented in Figure 6 below.



d̪ɐ: kʰɔŋ t̪ʂʰɔm tɸi d̪u:
yesteday he mortar one saw
'Yesterday he saw a mortar.'

d̪ɐ: kʰɔŋ t̪ʂʰɔmpʰju: tɸi d̪u:
yesterday he pestle one saw
'Yesterday he saw a pestle.'

Figure 6. The pitch traces of [t̪ʂʰɔm] 'mortar' alone and in a compound.

5.6. Stress

Stress, defined as prominence due to intensity, vowel duration, vowel quality and pitch, seems to be a non-significant category in Denjongka words. It is difficult to find consistent stress patterns in multisyllabic words. When one syllable in a disyllabic word has more intensity, a longer vowel and a higher pitch than the other syllable, it is easy to conclude that this syllable is stressed. These features, however, occur sometimes with conflicting values (e.g. more intensity on the syllable with lower pitch), and then it is difficult to decide which syllable is stressed. Moreover, sometimes stress seemed to differ between different

pronunciations of the same word. The preliminary analysis here is in line with Hoehlig & Hari's (1976:49) observation about Kagate stress, which "is of minor significance", and with Vesalainen & Vesalainen's (1976:57) conclusion that there are "no fully consistent stress patterns in Lhomi."

6. Conclusion

This section summarises the main results of the analysis of Denjongka phonology and points out which topics need more investigation. Eight vowel phonemes were found to be contrastive (3.1.). However, the relationhip between the front unrounded vowels and especially the phonemic status of /ɛ/ need more investigation. Among the back vowels, the allophonic variation of /o/ calls for further research. Vowel length (5.3.) and nasalisation (5.2) were found to be phonemic. Breathiness was interpreted as a suprasegmental feature involved in complex tonal phenomena (5.4.). Vowel assimilation processes (3.3.) need more research

Denjongka has a rich inventory of initial consonant phonemes. There is a four-fold voicing/aspiration distinction among the plosives and affricates (voiceless unaspirated, voiceless aspirated, voiced and devoiced). It was shown that there is a difference in VOT between the voiceless unaspirated, voiceless aspirated and the slightly aspirated devoiced plosives (4.2.1.). The distribution and phonemic status of word-medial stops need further investigation (4.2.2.).

Denjongka words can be divided into the high and low registers (5.4.). Three phonetic voice qualities were observed: lax/breathy, modal and tense/creaky. Lax/breathy voice occur only in the low register and tense/creaky in

the high register. Modal voice appears in both registers. Future studies should aim to find out whether there are phonemic voice quality differences (tense vs modal) inside the high register.

Pitch in Denjongka is one factor in the complex tonal phenomena involving also phonation type and possibly length and vowel quality (5.5.). Pitch is largely predictable on the basis of the initial consonant and voice quality. In some cases, however, there are register-internal pitch contrasts where pitch is not predictable from the initial consonant and voice quality. In these instances, pitch is the only contrastive feature, and consequently Denjongka can be called an incipient tone language. A question related to pitch that needs to be answered by future studies is whether the register-internal level vs falling pitch difference in the high register is somehow conditioned and can so be predicted (5.5.1.). Moreover, pitch assignment in disyllabic words is complex and ought to be covered by further research (5.5.2.).

Lastly, the comparative word list of Denjongka dialects in Appendix 2 shows that there are significant lexical differences between the dialects. Future studies ought to aim at systematising these differences.

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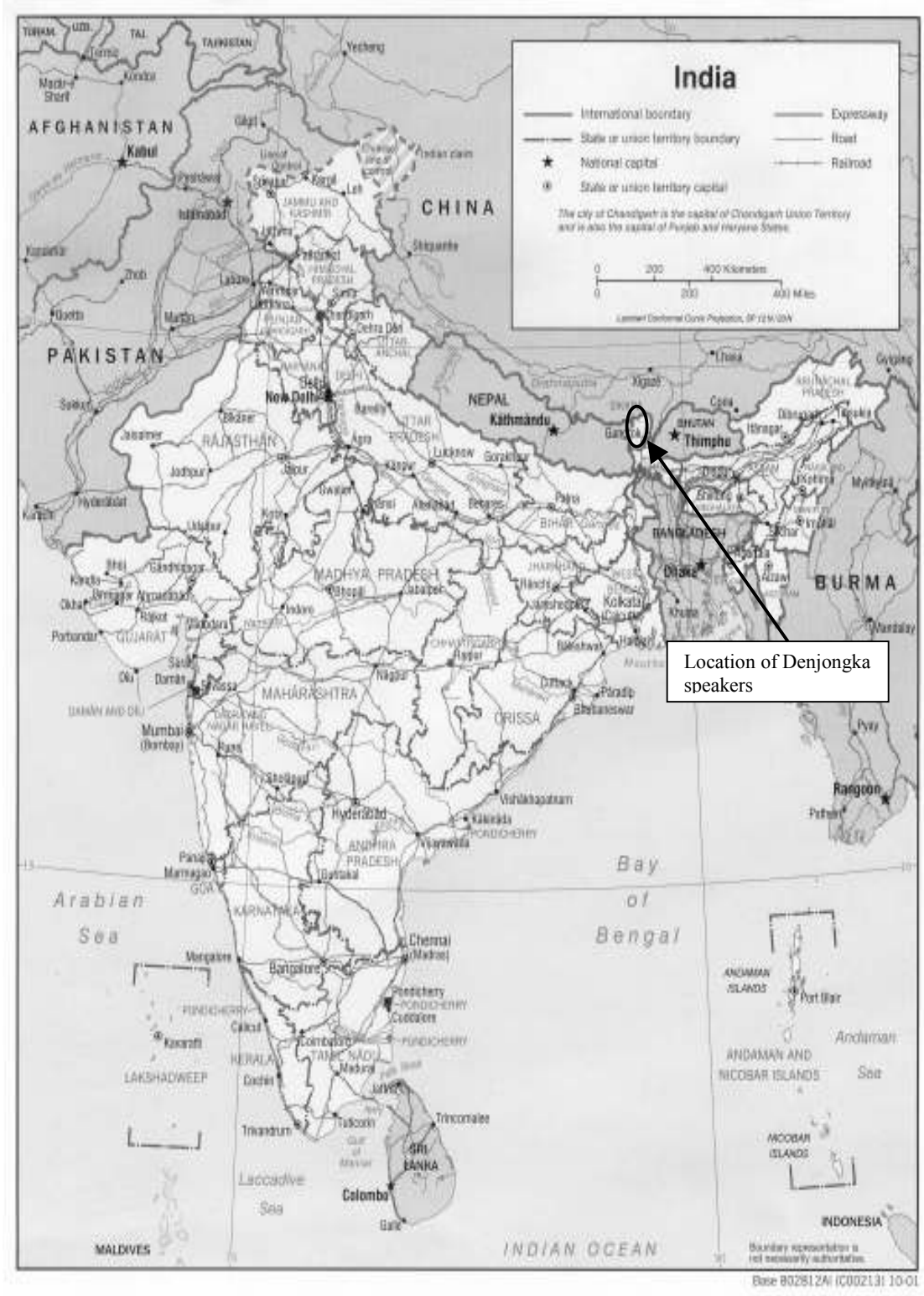
Appendix 1: Maps of India and Sikkim

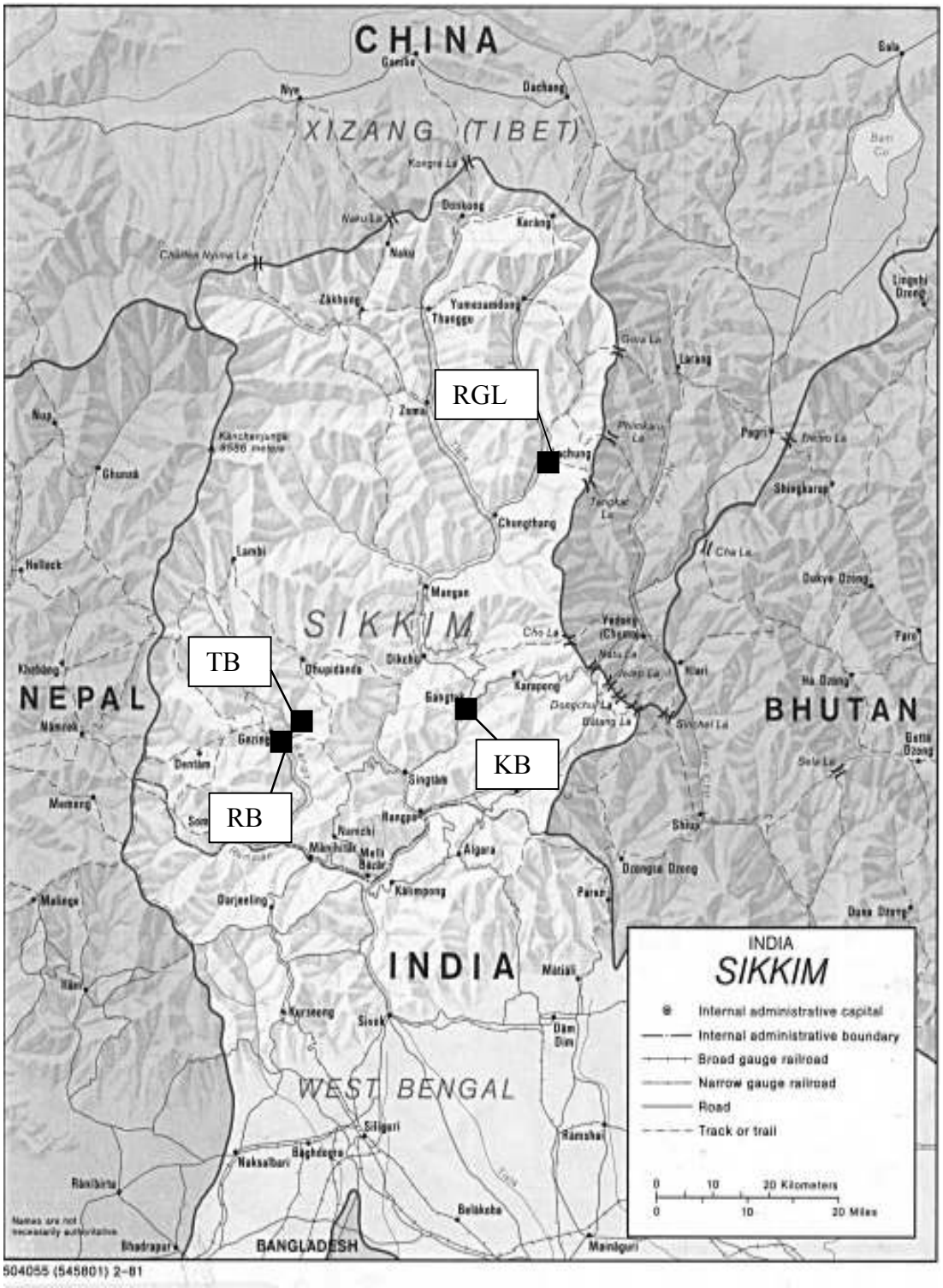
The geographical location of Denjongka speakers is marked with an ellipse.



Map 1: India

Source: http://www.lib.utexas.edu/maps/middle_east_and_asia/india_pol01.jpg (29 Jul 2005)

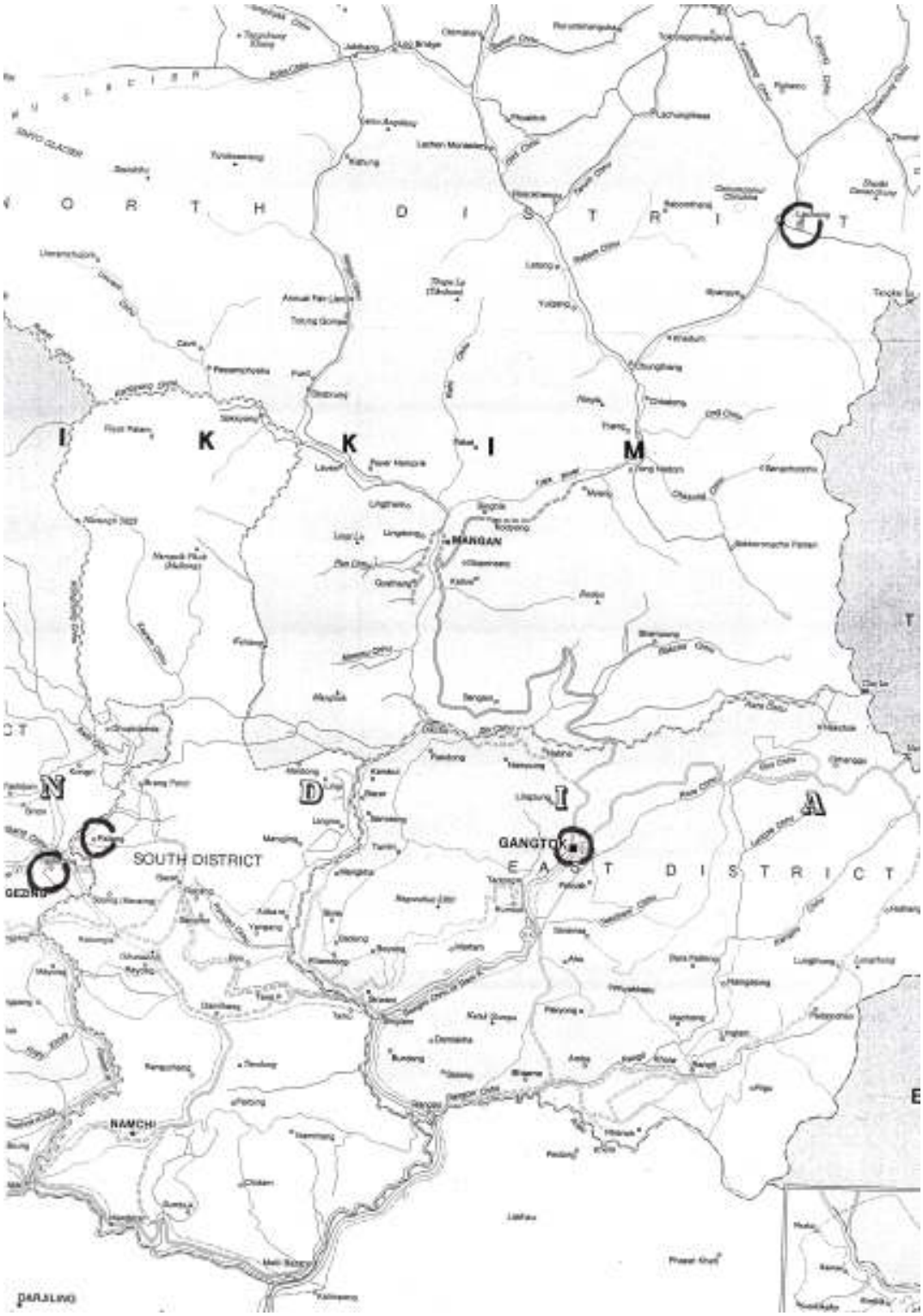
Map 2 below, locates the language informants' home villages in Sikkim (with black squares).



Map 2: Sikkim

Source: http://www.lib.utexas.edu/maps/middle_east_and_asia/sikkim.jpg (29 Jul 2005)

Map 3 below presents a detailed map of the relevant areas of Sikkim. The language informants' home villages are circled.



Map 3: Sikkim in detail

Source: Extracted from *A Road Guide to Sikkim.* 2003. Chennai: TTK Healthcare Limited Printing Division.

Appendix 2: Comparative wordlist of Denjongka dialects

In Table A below, I gathered miscellaneous words that differed in pronunciation between the language informants. Table B identifies the codes with the help of which one can find the words on the accompanying CD.

	RB	TB	RGL	KB	Gloss
1	ʔyːku	ʔyːkuʔ	jyːgu/ jyːɣu	iːku	Chin
2	zukˀ/zuʔ	dzuʔ	ⁿdzuʔ/ zuʔ	zuːʔ	Body
3	pʰumpɔ/ pʰuŋpɔ	puŋpɔ/ pumpɔ	puŋkɔː	pumpɔʰ	Shoulder
4	ⁿdzɪmu	dzumu	dzumu	zumuː/ dzumuː	Finger
5	pjæŋgoʔ	pjæŋgoʔ	pʼjæŋkɐ	jiŋkʰɐ/ d̪iŋkʰɐ	Chest
6	migd̪oʔ	miːd̪oʔ	mɪːnuʔ	mɪːd̪uʔ	Eye
7	ᵑgõːd̪oʔ	ⁿgõːd̪oʔ	ᵑgoːnuʔ	gɔːd̪uʔ	Egg
8	ɾɪt̪oʔ	ɾit̪oʔ	ɾot̪uʔ	ɾit̪uʔ	Bone
9	ʔøːpˀ	ʔe̝ːpˀ	ʔøːmo/ ʔeːmo	ʔeːpɔ	Right
10	ʔøn	ʔemːɔ	ʔewɐ/ ʔøwɐ	ʔemːɔ	Left
11	n̥õũ		nɔlɪʔ	n̥õu	Snot
12	ɕeːpˀ	ɕiːpˀ	ɕipɔ		Urine
13	kɔt̪ʰɔu	kɔt̪ʰeu	kʼɔ̤t̪ɪɔː	kɔ̤t̪ʰeou	Ashes
14	ɾɪˈʑʲõˈ	ɾɔdʑuː	ɾuzu	ɾɔdʑuː	Horns
15	dʑukmɐʔ	dʑumɐʔ	d̪ʑumoʔ	ɟjumɐʔ	Tail
16	tʼɔ̤ːpɐ	tʼɔ̤ːpɐ̯ˈ	ŋɔːɾu		Morning
17	ɾiŋkjɐm	ɾiŋkjɐm	ɹinku	ɾiŋku	Long
18	jɐŋjɐː	jɛ̃ːjɜ̃ː	jõːjõː	jõːtɐ	Light (of weight)
19	t̪o̤wɐ	t̪ṳːβɐ	t̪o̤kɐʔ	t̪ṳwɐ	Smoke
20	t̪s̪ɛ̃ː	tsɛ̃ː	t̪s̪emoʔ	t̪s̪õː	Thorn
21	pʼɔ̤ːgjɐʔ/pʼɔ̤ːɣjɐʔ	pʼɔ̤ːgjɐ̯ʔ	gɐpu	pʼo̤gjɐː	Husband
22	sɐɾpo	sɐːpˀ	sɪːpu̯	sɪːpu	Yellow
23	hoːlɛː		hoːlɔ	huteː	Below
24	pʼjæːpo	pɐ̯ːpu̯	pʰjæːpu̯		Feather

Table A. Comparative word list of Denjongka dialects.

Table B below contains the codes for the words in the comparative word list. See Appendix 3 for instructions on how to find the right word and listen to it on the accompanying CD.

	RB	TB	RGL	KB	Gloss
1	RBw118	TBw(3)174	RGLw27	KBw34	Chin
2	RBw1	TBw1	RGLw1	KBw1	Body
3	RBw6	TBw(3)157	RGLw5	KBw5	Shoulder
4	RBw9	TBw17	RGLw8	KBw9	Finger
5	RBw12	TBw12	RGLw10	KBw11	Chest
6	RBw40	TBw6	RGLw30	KBw39	Eye
7	RBw217	TBw91	RGLw118	KBw175	Egg
8	RBw59	TBw21	RGLw45	KBw58	Bone
9	RBw(2)13	TBw141	RGLw165	KBw213	Right
10	RBw(2)14	TBw142	RGLw166	KBw214	left
11	RBw68		RGLw54	KBw67	snot
12	RBw74	TBw24	RGLw55		urine
13	RBw187	TBw63	RGLw90	KBw138	ashes
14	RBw221	TBw94	RGLw121	KBw179	horns
15	RBw222	TBw95	RGLw122	KBw180	tail
16	RBw247	TBw120	RGLw147		morning
17	RBw(2)8	TBw134	RGLw161	KBw208	long
18	RBw(2)26	TBw149	RGLw172	KBw220	light (of weight)
19	RBw186	TBw62	RGLw89	KBw137	smoke
20	RBw196	TBw69	RGLw97	KBw151	thorn
21	RBw244	TBw116	RGLw140	KBw194	husband
22	RBw81	TBw157	RGLw179	KBw74	yellow
23	RBw(2)29		RGLw174	KBw223	below
24	RBw(3)153	TBw(2)4	RGLw(2)15		feather

Table B. Codes for the words in Table A.

Appendix 3: Listening to the examples on the accompanying CD

All recorded Denjongka data are included on the CD accompanying this paper. Below is a list of example words and sentences used in this paper. Each example is followed by a code number by which the listener can find the example on the CD.

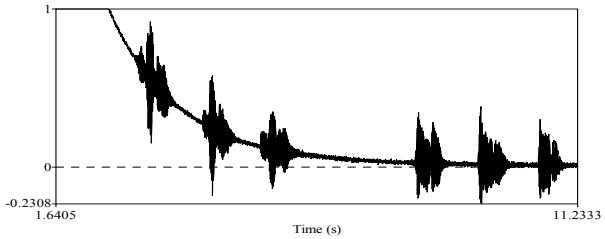
The CD also includes the Praat-program, with the help of which the examples can be heard. Start by clicking the Praat-icon to start the program. Then click "Read" in the "Praat objects" window and "Read from file" to browse the contents of the CD to find the right example. Data files from each of the informants are given in a separate directory. Files under each directory contain all data from that informant in the order of recording. Below are two examples of file names.

TBw21-40
RBwc(2)248-254

File names are codes which are arranged in the following way: The first two (capital) letters are the initials of the informant in question. The next abbreviation is either "w" for *word* or "wc" for *word in context*, "w" meaning that the files contain words pronounced in isolation and "wc" meaning that the files contain sentences. The number in brackets refers to the number of minidisc and notebook. The first minidisc is always uncoded for number, as in TBw21-40. The last numbers in the code with a hyphen in between refer to the words or sentences in the file. RBwc(2)248-254, for intance means that the file is recorded from Rabden Bhutia. The file contains sentences 248-254 from the second minidisc with recorded sentences.

When the right file is chosen, it appears in the "Praat objects" window. Then click "Edit" to see all the words on the file in wave form. Words in isolation were pronounced three times and sentences two times. As seen in the picture below, the three pronunciations of a word form a bundle of three increases in the amplitude of the wave form. Then, knowing the number of the first and last word, one has to count to find the right word.

Due to difficulties recording from the minidisc on the computer, the first word on the file did not record properly but was bent in wave form. The word with a bent wave form is not counted except when it is the first word on a minidisc. The picture below is extracted from the beginning of the file containing examples number 161-174. The word with a bent vawe form is not counted. Its number is 160.



When the desired word has been located, it needs to be "painted" with the mouse. When the word/sentence has been painted, it appears inside pink boundary lines. Now the word can be listened to by clicking the small rectangle above the uppermost part of the pink boundary line.

The examples used in this paper are presented below in the order of appearance.

Example	Code in Praat	Page number
/tsʰɔ́m/ [t̪s̪ʰɔ́m] 'big wooden mortar' (TB)	TBw35	2
/di/ [ⁿd̪ɪ] 'this'	RBw107	13
/de/ [ⁿɖe] 'ghost, demon'	RBw(3)199	13
/dy?/ [ⁿd̪y?] 'demon'	RBw(4)50	13
/dø?/ [ⁿd̪ø?] 'to sit'	RBw(2)230	13
/dɐ/ [ⁿd̪ɐ] 'arrow'	RBw134	13
/ɖuk/ [ⁿɖuk] 'thunder, dragon'	RBw179	13
/do/ [ⁿdɒ] 'stone'	RBw145	13
[kɪ̃̂ː] 'circle with a rope'	RBw(3)38	13
[ké:] 'to deliver'	RBw(3)13	13
[ký:] 'to drive'	RBw(4)140	13
[kǿ:] 'to boil'	RBw(2)239	13
[k'ɐ̟:?] 'mountain'	RBw(2)140	13
[ᵑgu:] 'to wait'	RBw(3)218	13
[kó:] 'to throw'	RBw(3)5	13
/dʑi/ [ⁿdʑi] 'to change'	RBw(3)197	15
/dʑe/ [ⁿdʑɪ?] 'to forget'	RBw(3)61	15
/dʑɛmpu/ [ⁿdʑempu] 'wet'	RBw(2)4	15
/dze?/ [ⁿd̪z̪ɪ?] 'leprosy'	RBw(4)72	15
/dzɛ?/ [ⁿd̪z̪e?] 'bullet'	RBw(2)216	15
[ⁿdzi:ɕe] 'to change' (TB)	TBw(2)163	15
[kɪ̃̂ː] 'circle with a rope'	RBw(3)38	16
[k̟é:]/ [kɪ́:] 'to deliver'	RBw(3)13	16
[kɪ̃̂?]/[kɪ̃̂:][40] 'a cry'	RBw(3)58	16
[ᵐb̪ɛ̟:pˀ][41] 'frog'	RBw(2)88	16
[ᵑge:pˀ] 'king'	RBw(3)143	16
[p̪ɐ̟m] 'sand'	RBw183	17
[p̪ɛ̟:m] 'sand'	TBw60	17

[40] [kɪ̂?] when recorded in isolation, [kɪ̂:] when recorded in context

[41] Normally voiced plosives are followed by modal voice (cf. 5.4.), but for some reason [ᵐb̪ɛ̟:pˀ] is followed breathy voice. The difference in voice quality between [ᵑge:pˀ] and [ᵐb̪ɛ̟:pˀ] can be seen in the spectrogram.

[pʰi̤m/pʼi̤m] ‘sand’	RGLw87	17
[pjɐ̤m] ‘sand’	KBw136	17
[ɕɔ̀ːm] ‘cockroach’	RBw(2)85	17
/ɕé/ [ɕɛ̰́] ‘meat’	RBw139	17
/gjɐrɔ/ [ᵑgjærɔʔ] ‘beard, moustache’	RBw37	17
/buːnɐ/ [ᵐbuːnɜˑ] ‘middle, in the middle’	RBw(3)227	18
/ɐkɐr/ [ɐkəɹ] ‘chilli’	RBw207	18
/tɕɐNɕɐr/ [tɕɐ̃ɕəɻ̩] ‘northeast’	RBw(2)189	18
/biu/ [ᵐbiʉ] ’snake’	RBw224	18
/kʰjû/ [cʰjʉ̂] ’to wash, to bathe’	RBw(2)241	18
/lóʔ/ [lóʔ] ‘lightning’	RBw178	19
/lɔ/ [l̤ɔ̀] ‘year’	RBw150	19
/óm/ [ʔɒm] ‘milk, nipple’	RBw220	19
/lú/ [lṵ] ‘song’	RBw136	19
/biw/ [ᵐbiʉ] ’snake’	RBw224	20
/léw/ [léu] ‘lungs’	RBw53	20
/tʰɔ́w/ [tʰɔ́u] ‘dirt, dust’	RBw190	20
/t̤ʰéw/ [t̤ʰéu] ’dirt, dust’ (TB)	TBw65	20
/éj/ [ʔéi] ’older sister’ (RGL)	RGLw138	20
/gɐbɐj/ [gɐbɐj] ‘testimony’ (TB)	TBw(3)51	20
[kujtɕɐʔ] ‘you pl.’	RBw105	20
/bi.uː/ [biuː] (KB)	KBw145	21
/kʼɔ.up/ [kɔ̰upˀ] ‘convex’	RBw(2)120	21
/tʰønɕeʔ/ [tʰønɕeʔ] ‘to go out, take out’	RBw(3)188	21
/tøn/ [tøn] ‘to take out’	RBw(3)193	21
Sentence in 6a)	RBwc(2)112	21
Sentence in 6b)	RBwc(2)113	22
/kʰí/ [kʰí] ‘dog’	RBw164	22
/ɕû/ [ɕû], /ɕuɕeʔ/ [ɕyɕeʔ] ‘peal’	RBw(2)237	22
/kuɕu/ [kuɕu] ‘apple’	RBw(2)112	22
[tʰṵ] ‘to take, pick’	RBw(3)192	22
Sentence in 7)	RBwc(2)122	22
/pér/ [pɛ́r] ‘camera’	RBw(4)25	28
/pʰém/ [pʰɛ́m] ‘parents’	RBw(2)66	28
/bɐr/ [ᵐbɐ̤r] ‘pineapple’	RBw(2)115	28
/pʼɐ/ [pɐ̤] ‘cow’	RBw218	28
/tó/ [t̤ɔ́] ’food’	RBw144	28
/tʰó/ [t̤ʰɔ̰́ː] ’hammer’	RBw162	28

/do/ [ⁿd̪ɒ] 'stone'	RBw145	28
/t'o/ [t̪'o̤:ʔ] 'load'	RBw(4)68	28
/ʈɐkʈɐ/ [ʈɐkˀʈɐ̰ʔ] 'hard'	RBw(2)130	28
/ʈʰóm/ [ʈʰóm] 'market'	RBw(2)183	28
/ʈ'om/ [ʈo̤:m] 'friend (female)'	RBw(2)62	28
/ké:/ [ké:] 'to deliver'	RBw(3)13	28
/kʰé:/ [kʰé:] 'payment, tax'	RBw(4)71	28
/ge:/ [ᵑge:] 'to cross, to win'	RBw(3)6	28
/k'e:/ [k'e̤:] 'to divorce'	RBw(4)151	28
/gu/ [ᵑgu̪] 'nine'	RBw90	28
/kʰɐ́p/ [kʰɐpˀ] 'needle'	RBw167	30
/k'ɐr/ [k'e̤ɹ] 'what?'	RBw122	30
/kɐ̂ʔ/ [kɐ̰ʔ] 'who?'	RBw126	30
/kʰí/ [kʰɪ́] 'dog'	RBw164	30
/k'i/ [k'ɪ̤] 'knife'	RBw163	30
[kî:] 'to circle with a rope'	RBw(3)38	30
/k'un/ [k'u̪n] 'roof'	RBw156	31
/nɐko/ [nɐko] 'black'	RBw78	32
/n̥ɐguʔ/ [n̥ɐguʔ] 'nose'	RBw42	32
/çɐmbu/ [ɕɐmbu̪] 'hat'	RBw(4)12	32
/dɛmpɔ/ [d̪ɛmpɔ] 'cheek'	RBw34	32
/dʑɐŋku:/ [ⁿdʑɐŋku:/ⁿdʑɐŋgu:] 'green'	RBw80	32
/p'ɔNbu/ [pɔ̤̃:βu̪] 'donkey'	RBw(2)87	32
/kʰedi/ [kʰed̪i/kʰeði] 'kidney'	RBw56	32
/tɕʰige:/ [tɕʰiɣe:] 'foreign'	RBw(4)87	32
/tukpʰym/ [t̪ukˀpʰym] 'thick (of books)'	RBw(2)129	33
/t'ɐ:pʰɐ:/ [t̪ɐ̤:ɸɐ:/t̪ɐ̤:fɐ:] 'to flutter (of a prayer-flag)'	RBw(3)97	33
/d̪upʰuʔ/ [ⁿd̪ufuʔ] 'cave'	RBw(3)231	33
/tʰɐ:tʰɐʔ/ [tʰɐ:θɐʔ] 'back of the neck' (KB)	KBw4	33
/sɐkʰɐN/ [sɐ̤kʰɐ̃:/sɐ̤xɐ:] 'restaurant'	RBw(2)182	33
/dukʰuN/ [d̪ukʰũ:/d̪uxũ:] 'tree' (RGL)	RGLw94	33
/tsʰɐpʰju/ [t̪s̪ʰɐpʰjʉ] 'grandson'	RBw(2)77	33
/ɕiŋ/ [ɕiŋ] 'tree' (TB)	TBw66	33
/ɕiŋdoN/ [ɕiŋd̪õ:ʔ] 'tree'	RBw193	33
/d̪uk/ [ⁿd̪ukʰ] 'dragon, thunder	RBw(3)129	33
/tɕíK/ [tɕíkˀ/tɕî:ʔ] 'one'	RBw82	34

/tɕêK/ [tɕê?/tɕêkˀ] ‘to break’	RBw(2)35	35
/tɕʰê?/ [tɕʰê?] ’hand (honour.)’	RBw50	35
/tɕ’ɐ/ [tɕɐ̤] ‘tea’	RBw130	35
/dʑɐm/ [ⁿdʑɐ:m] ‘squirrel’	RBw(4)58	35
/tsê/ [t̪s̪ê] ‘pasture, football ground’	RBw(2)169	35
/tsʰé/ [t̪s̪ʰé] ‘salt’	RBw(2)165	35
/dzɔ/ [ⁿd̪z̪ɔ̤] ‘cross between a yak and a cow’	RBw(3)139	35
/sê/ [s̪ê] ‘mud’	RBw138	35
/zo/ [zɔʰ] ’to make	RBw(3)18	35
/ɕê/ [ɕê] ‘meat’	RBw139	35
/ʑɐ/ [ʑɐ̤] ’rainbow’	RBw180	35
/zɔɕe/ [zɔɕe?] ‘to make, repair’	RBw(4)133	36
/dzɔɕe/ [dzɔ:ɕe?] ‘to finish’	RBw(4)134	36
/hɐp/ [hɐpˀ] ‘to bark’	RBw(3)106	37
/ép/ or /ǿp/ [?e̞pˀ]/[?ø̞pˀ] ‘to push (e.g. with one’s body)’	RBw(3)28	37
/èm/ [hɐ̤˙m] ’fox’	RBw(3)165	37
/mé/ [mé] ‘wound’	RBw(3)127	38
/nè/ [n̪è] ‘here’	RBw109	38
/ŋè/ [ŋè] ’I’	RBw99	38
/Njè/ [ɲjè/ɲè] ‘fish’	RBw215	38
/mjoŋçe/ [mjɔŋçe?] ’to finish (a meeting)’	RBw(4)135	39
/p’jɐ/ [p’jɐ̤] ‘chicken’	RBw216	39
/kjuçe/ [cjɥ̤˙çe?] ‘to vomit’	RBw(3)101	39
/sòn/ [sõ:]/[sòn] ‘plant’	RBw(3)21	39
/l̥õ/ [l̥õ:] ‘money gathering’	RBw(4)77	40
/lő/ [l̪ő:] ‘to search’	RBw(4)76	40
/r̥ém/ [ɻ̥ém] ‘to destroy’	RBw(3)178	40
/rè/ [ɹè/ɾè] ’goat’	RBw223	40
Sentence containing /om r̥o/ [ɔmpʰɹɔ]	RBwc(2)206	40
/ŋúl/ [ŋúl̪] or /ɲỹ:/ [ɲỹ:] ‘money, silver’	RBw(3)154	41
/ne:tsul/[ne:t̪s̪ul̪] or /ne:tsy:/ [n̪e:tsy:] ’message’	RBw135	41
/wɐtɛ/ [wɐt̪ɛ] ‘downhill’ (TB)	TBw(2)78	41
/Njɐ wɐ/ [ɲẽwɐ] ‘hell’	RBw(4)51	41
/léw/ [léu] ‘lungs’	RBw53	41
/pi:/ [pi:] or /pri/ [pɹi] ‘long grass’	RBw(4)185	42
/û?/ [?û?] ‘breath’	RBw62	42

/ɕé/ [ɕé̱] ‘meat’	RBw139	42
/kjê/ [kjê̱] ’hair’	RBw36	42
/ǿn/ [ʔǿn] ‘left (vs right)’	RBw(2)14	42
/gep/ [ᵑgep˥] ’bag/backpack’	RBw(2)207	42
/gjɐp/ [ⁿgj̱ɐp˥] ‘upper back’	RBw27	42
/é:/ [ʔé̱:] ‘yawn’	RBw(2)247	42
/ʑi:/ [ʑi:] ’four’	RBw85	42
/k’jo:/ [k’j̱o:ʔ] ’discuss’	RBw(3)51	42
/ǿ:p/ [ʔǿ:p˥] ‘right (vs left.)’	RBw(2)13	42
/ge:p/ [ᵑge:p˥] ’king’	RBw(3)143	42
/kjú:m/ [cjú̱:m] ‘sour’	RBw(2)166	42
/søn/ [sø̃:]/[søn] ‘to plant’	RBw(3)21	43
/lɐŋ/ [lɐŋ]/[lɐ̃:] ‘ox’	RBw(2)101	43
/tsɛ́N/ [t̪s̪ɛ́̃:] ‘thorn’	RBw196	43
/tsɐʔ/ [t̪s̪ê:ʔ]/[t̪s̪êʔ] ‘rust’	RBw(3)137	43
/tʰɔ:ɕeʔ/ [tʰɔ:ɕeʔ] ‘to hear’	RBw141	43
/tʰɔNɕeʔ/ [tʰɔ̃:ɕeʔ] ‘saw (past tense of ‘to see’)’	RBw142	43
[ⁿd̪ɛ̃ʔ]/[ⁿd̪ɛ̃:] ‘yesterday	RBw118	43
/tsɐʔ/ [t̪s̪ê:ʔ]/[t̪s̪êʔ] ‘rust’	RBw(3)137	44
/gep/ [ᵑgep˥] ’bag/backpack’	RBw(2)207	45
/ge:p/ [ᵑge:p˥] ’king’	RBw(3)143	45
/ɕî:/ or /ɕê:/ [ɕî:] ‘to catch, understand, know’	RBw(3)119	45
/ɕî/ [ɕî] ‘to die’	RBw(3)84	45
/gu/ [ᵑgu̱] ‘nine’	RBw90	45
/gu:/ [ᵑgu:] ‘to wait’	RBw(3)218	45
[ʔy:] ’village’	RBw154	45
[t̪ø̱:] ‘nets’	RBw(2)218	45
[sỳn] ‘to burn’	RBw(2)46	46
[ʔøn] ‘left’	RBw(2)14	46
Sentence in 25)	RBwc1	46
[ᵐbɛ̱:p˥] ‘frog’	RBw(2)88	48
/ŋé/ [ŋé̱] ‘five’	RBw86	51
/ŋè/ [ŋè̱] ‘I’	RBw99	51
/ŋê/ [ŋê̱] ‘drum’	RBw137	51
Words in figure 4	RBwc98	52
/kʰé / [kʰé] ’mouth’	RBw43	53
/kʰêʔ/ [kʰêʔ/kʰê:] ’liquid’	RBw(4)95	53

/tɛ́/ [t̪ɛ̪́] ‘horse’	RBw243	53
/tə̂ʔ/ [t̪ə̪̂ʔ/t̪ə̪̂ː] ‘tiger’	RBw(3)138	53
Sentences in Figure 4	RBwc119-120	54
Sentences in Figure 5	RBwc158-159	55
/gep/ [ᵑgepˀ] ’bag/backpack’	RBw(2)207	56
/geːp/ [ᵑgeːpˀ] ’king’	RBw(3)143	56
/dzeʔ/ [ⁿdzeʔ] ‘bullet’	RBw(2)216	56
/kɛ́w/ [kɛ́u] ’pillar’	RBw(2)196	57
/tɕʰéːp/ [tɕʰéːpˀ] ’rain’	RBw175	57
[t̪îŋpɔ́] ‘heel’	RBw23	59
/tsʰɔ́m/ [t̪s̪ʰɔ́m] ‘big wooden mortar’ (TB)	TBw35	59
/kʰɔ́ŋ/ [kʰɔ́ŋ]/[kʰõː] ’he’ (TB)	TBw219	59
[t̪s̪ʰɔmpʰjuː] ‘wooden pestle’ (TB)	TBw36	59
Sentences in Figure 5 (TB)	TBwc30-31	60