Preaspiration in Mongolian dialects: acoustic properties of contrastive stops

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Abstract

The present description concentrates on the realisation of the two series of dental stops in three Mongolian dialects spoken in China, Horcin, Baarin and Shiliin Gol. Acoustic investigation shows that the stops contrast as aspirated – unaspirated, t^h and *t*. Voicing is a facultative feature of the unaspirated stops. More interesting is that the aspiration is realised as preaspiration when the aspirated stops are preceded by a vowel. Acoustically, preaspiration is realised differently from what was found for Halh Mongolian (Svantesson et al. 2005). While preaspiration is mainly realised as devoicing of the last part of the preceding vowel in Halh, preaspiration influences the phonation of the preceding vowel in Baarin, Horcin and to some degree in Shiliin Gol, making it laryngealised or creaky.

Background

The present investigation is a part of a project in which we investigate how the differences between the two series of stops in different Mongolic and Turkic languages are realized phonetically, more specifically what are the roles of aspiration (including preaspiration) and voicing in the production of stops and if is it possible to establish an east-to-west cline in the phonetic manifestations of this phonological contrast.

The problem how to analyse the two contrasting manners of articulation for Mongolian stops and affricates has been debated since the first studies of Mongolian phonetics, and there has been no consensus about the articulatory phonetic correlates of the two manners of articulation in the literature. In phonemic transcriptions, the two series have often been rendered with symbols for voiceless and voiced consonants. The Cyrillic Mongolian script also treats them in this way. Most mongolists have used terms as fortis ~ lenis, strong ~ weak or tense ~ lax; see the review in our book *The Phonology of Mongolian* (Svantesson et al. 2005), p. 220–221.

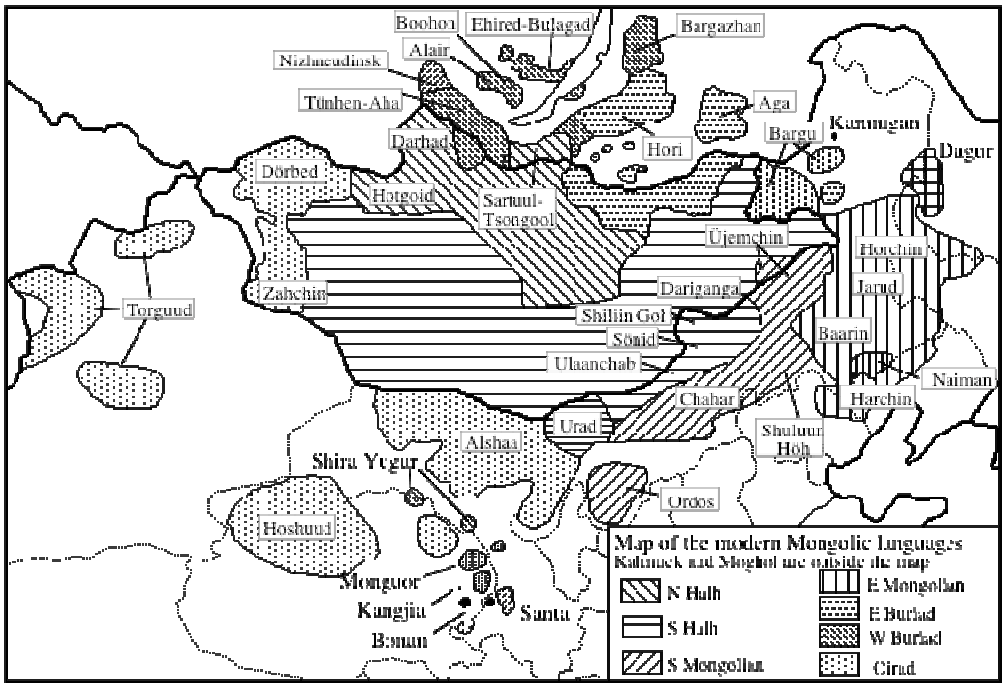
Very few instrumental phonetic investigations of this have been made, however. Our previous investigations of Ulaanbaatar Halh (Khalkha) Mongolian (Karlsson & Svantesson forth., Svantesson et al. 2005) show that the difference between the two series relies on aspiration rather than voicing: one series is preaspirated (except in utterance-initial position where it is postaspirated) and the other one is voiceless

unaspirated. An analysis of this kind was proposed already by John Ramstedt in his pioneering 1902 description of Halh Mongolian phonetics.

Phonetic investigation

Method

We recorded and analysed the words listed in (2), which illustrate the two series of stops in different positions in a word. The words are given in broad transcription based on Halh Mongolian, though their actual pronunciation varies between the dialects. The lateral has varied realisation as [l], [ɮ] and [ɬ] ([ɮ] in Halh), but is given as [l] here. The recordings were made in Hohhot (2009) and Beijing (2010), using a portable Edirol R-09 digital recorder and a lapel microphone. Data from 11 speakers of Eastern Mongolian are presented here: two male speakers of Shiliin Gol, four female and two male speakers of Horchin, and two female and one male speaker of Baarin. Their age ranges between 22 and 50. The geographic areas where the three dialects are spoken are presented in (1).



1. Map of the modern Mongolic languages (from Svantesson et al 2005 p.141).

(2) Material for the acoustic investigation (C = consonant, V = vowel, # word boundary).

initial: t^hV $t^hɔs$ ‘butter’

	tV	teele	‘gown-RFL’
	t^hV	t^hawən	‘five’
	tV	torwən	‘four’
	t^hV	t^hat^hla	‘to pull-PAST’
medial:	Vt^hV	at^ha	‘camel gelding–RFL’
	VtV	mɔtɔ	‘tree–RFL’
before consonant:	Vt^hC	t^hat^hla	‘to pull-PAST’
	VtC	itle	‘to eat -PAST’
after consonant:	Ct^hV	alt^ha	‘gold-RFL’
	Ct	int	‘here’
between consonants:	Ct^hC	ʊnt^hən[1]	‘to sleep-PRES’
	CtC	altla	‘to drop-PAST’
word final:	Vt^h#V	at^h	‘camel gelding’
	Vt#V	mɔt	‘tree’
absolute final:	Vt^h#	at^h	‘camel gelding’
	Vt#	mɔt	‘tree’

The words were put into different carrier sentences, and were read three times by each speaker. The recordings were analysed in the Phonetics Lab at Lund University, using the *Praat* speech analysis program. The duration of the occlusion phase, voice onset time and voice offset time (preaspiration) were measured from wave form plots and spectrograms. The duration of the occlusion phase was measured in all positions, initial, medial and final.

Voice onset time (VOT) was measured from the stop release to the onset of voicing in the following vowel. It includes the release and the aspiration phase of the stops. Measuring of VOT in absolute word-final position was not performed. In the word *mɔt* ‘tree’ a schwa vowel was often added after the stop (in Horcin and Baarin dialects), while in the word *at^h* ‘camel gelding’ the schwa was added only twice in the Horcin and Shiliin Gol dialects.

A vowel preceding an aspirated stop was measured as consisting of two parts, a modal voice part, and the following aspiration noise.

The final part of a vowel (or a sonorant) preceding an aspirated stop is devoiced and usually pronounced with clearly audible aspiration noise. This is analysed as preaspiration. The duration of preaspiration, indicated here as voice offset time VOffT, was measured from the beginning of the devoicing of the vowel to the beginning of the occlusion phase of the consonant. Preaspiration was thus measured

[1] *ʊnt^{h}ən* is realised as *ʊnt^{h}n* with no schwa insertion

in all positions. It does not occur with unaspirated stops. Preaspiration often manifests itself as laryngealisation of the preceding vowel; this is taken into consideration in the present account. An example of the segmentation of vowel and the following aspirated stop is given in Figure 1.

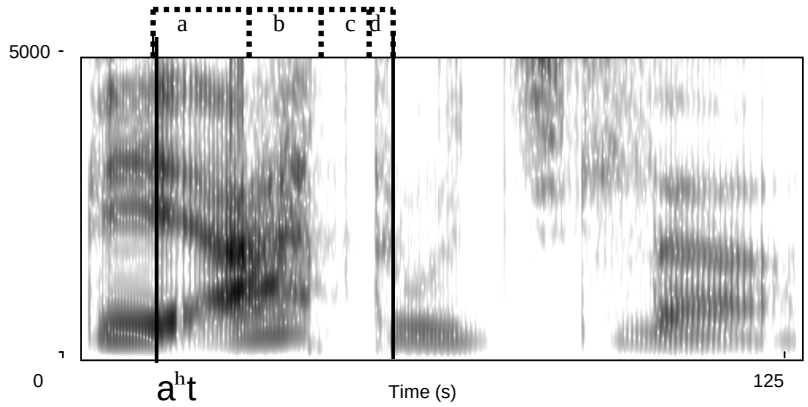


Figure 1. Illustration of segmentation of t^h after a vowel. The word is /at^h/ "camel gelding", realised as [a^{h}t] in a frame sentence /pi at^h ucle/ "I saw camel gelding". The beginning and end of the word are shown with straight lines. The dotted lines indicate a) modal voice period of the vowel; b) voice offset time VOffT; c) occlusion of the stop d) VOT. Creaky phonation (laryngealisation) of the vowel before the stop can be observed. Female Baarin speaker.

Results

The results of the measurements are shown in (3). The values given are the means for the three readings by each speaker.

For all dialects, in word-initial position, VOT is always larger for the aspirated than for the unaspirated stops, VOT the average for all speakers is 65 ms for t^h and 13 ms for *t*.

In medial position, the difference in VOT is smaller, 27 ms for t^h and 10 ms for *t* and there is variation between the dialects. The difference in VOT between aspirated and unaspirated stops is largest in Horcin (VOT mean 11 ms for *t* and 37 ms for t^h) and the mean of 37 ms indicates that the aspirated stops are postaspirated (in addition to their preaspiration). The difference in VOT in Baarin is insignificant. In wordfinal position, VOT is larger for aspirated than for unaspirated stops, the VOT mean for all dialects is 40 ms for t^h and 11 for *t*. The difference is again largest for Horcin, 53 ms for t^h and 11 ms for *t*. Postaspiration is thus consistent and most salient in initial and final, but not in medial, position. Postaspiration is most salient in initial position. In medial position, there is no postaspiration in Baarin. Of the three dialects, Horcin has the most consistent and salient use of postaspiration in all positions.

As is well known, Chinese, Thai and many other East and Southeast Asian languages use postaspiration of stops and affricates as a distinctive feature. In these languages, VOT of aspirated consonanats is larger than in Mongolian, around 100 ms in Standard Chinese stops (Svantesson 1987).

All aspirated stops have preaspiration, though there is variation in absolute wordfinal position. Preaspiration is realised as devoicing of the last part of the vowel preceding the aspirated stop, perceived as breathiness. In position between vowels, preaspiration occurs in all speakers of the three dialects. What is interesting is that the duration of the non-breathy part of the vowel preceding the aspirated stop (here called "modal voice period", see fragment (a) in Figure 1) is close to the duration of the vowel before an unaspirated stop, the means are 74 ms and 76 ms, respectively. The duration of preaspiration is on the average 51 ms. This may indicate that preaspiration is a property of the consonant, being an additive feature and not merely influencing the preceding vowel. Because of this, description of preaspiration as devoicing of the preceding vowel is somewhat misleading. Shiliin Gol has the shortest preaspiration, on the average 39 ms, compared to 61 ms in Baarin and 50 ms in Horcin.

The average duration of word-final preaspiration is 47 ms, but it is not found for one Horcin and one Shiliin Gol speaker. The words investigated were *at^h* 'camel gelding' and *mɔt* 'tree' in frame sentence *Pii at^h/mɔt ucle* i.e. the stops occurred before an onset vowel of the next word. In same words preaspiration does not occur in absolute final position in the Horcin dialect (except for one speaker). The vowel before the aspirated stop is considerably longer (140 ms) than the vowel before an unaspirated stop (95 ms) in Horcin. What is interesting is that beside preaspiration, voice quality is also used to contrast the two types of stops. Thus, aspirated stop often causes laryngealisation of the preceding vowel. Laryngealisation is optional in intervocalic position in Baarin and Horcin and does not occur in Shiliin Gol. In word-final position, laryngealisation occurs in all cases in Baarin and often in Horcin and Shiliin Gol. For Horcin, the contrast seems to rely on the presence of laryngealisation or on difference in vowel length in this position (longer vowel before the aspirated stop). In addition, a schwa is often inserted after the unaspirated stop resulting in [mɔtə].

Thus, preaspiration is a consistent phonetic correlate differentiating aspirated and unaspirated stops. Laryngealisation is also employed, either as an extra feature or on its own. Laryngealisation is a tentative term for the voice quality observed in our material and more investigation is needed to give a precise definition.

After a sonorant, aspiration is often realized as devoicing of the preceding segment. The following words (uttered in different frame sentences) were investigated: *alt^{h}a* 'gold-RFL', *altla* 'to drop-PAST', *ent* 'here' and *ʊnt^{h}ən* 'to sleep-PRES'. Aspirated stops often cause

devoicing of the lateral and laryngealisation (in Baarin and Horcin) of the preceding vowel [a˷ɬtʰɬa]. An aspirated stop following a nasal is realised as a voiceless postaspirated stop or (in Baarin) it causes devoicing of the surrounding sonorants [ʊn̥tʰn̥a]. An unaspirated stop after a nasal is often realised with voice.

Voicing of unaspirated stops varies both within and between speakers and is found in approximately half of the realisations except in absolute final position.

Voice is thus a facultative feature in the realisation of unaspirated stops, and the feature preaspiration should be chosen as the primary one for the contrast between the stops.

Preaspiration is not very common in the world's languages. It is found in some languages in Northern Europe, including Icelandic, Faroese, Swedish and Norwegian dialects, Scottish Gaelic and some Sámi languages; see Ladefoged and Maddieson (1996:70) and Helgason (2002) for surveys. Medial and final preaspiration and initial postaspiration seems to be a common pattern, though see Suzuki (2011) about preaspiration in Tibetan dialects. Preaspiration in the Shiliin Gol dialect of Mongolian has recently been treated by Qascimeg (2009).

(3) Duration measurements (means in ms).

INITIAL						
dialect	modal voice vowel	VOffT	occlusion		VOT	
		/tʰ-/	/tʰ-/	/t-/	/tʰ-/	/t-/
Horcin_1			48	59	51	11
Horcin_2			55	59	81	18
Horcin_3			71	91	55	10
Horcin_4			149	146	93	14
Horcin_5			63	87	81	10
Horcin_6			40	59	67	13
Horcin_all			71	84	71	13
Baarin_1			77	88	61	10
Baarin_2			79	71	82	15
Baarin_3			70	71	60	13
Baarin_all			75	77	68	13
Shiliin Gol_1					41	20
Shiliin Gol_2			55		42	8
Shiliin Gol_all			55		41,5	14

MEDIAL							
dialect	modal voice vowel		VOffT	occlusion		VOT	
	/-tʰ-/	/-t-/	/-tʰ-/	/-tʰ-/	/-t-/	/-tʰ-/	/-t-/
Horcin_1	91	57	28	61	54	32	9
Horcin_2	52	68	69	96	68	62	13
Horcin_3	72	77	81	64	60	36	15
Horcin_4	85	86	23	65	73	14	11

Horcin_5	103	81	40	83	90	47	9
Horcin_6	62	68	61	58	55	31	9
Horcin_all	78	73	50	71	67	37	11
Baarin_1	58	71	77	97	71	9	11
Baarin_2	55	93	50	111	74	16	9
Baarin_3	67	71	57	92	70	10	8
Baarin_all	60	78	61	100	72	12	9
Shiliin Gol_1	71	84	33	94	83	21	17
Shiliin Gol_2	97	78	45	96	82	22	3
Shiliin Gol_all	84	81	39	95	83	22	10
Vt^h / Vt							
dialect	modal voice vowel		VOffT	occlusion		VOT	
	/-t^h/	/-t/	/-t^h/	/-t^h/	/-t/	/-t^h/	/-t/
Horcin_1	110	82	-	65	54	25	14
Horcin_2	102	75	35	79	75	66	12
Horcin_3	86	91	47	59	51	35	15
Horcin_4	94	92	31	83	66	46	18
Horcin_5	131	95	74	38	67	59	8
Horcin_6	143	101	61	26	52	88	2
Horcin_all	111	89	50	58	61	53	11
Baarin_1	79	80	67	78	65	21	8
Baarin_2	99	88	23	87	77	22	9
Baarin_3	68	77	38	80	73	23	13
Baarin_all	82	82	43	82	72	22	10
Shiliin Gol_1	95	107	46	109	78	36	21
Shiliin Gol_2	129	92	-	83	78	22	3
Shiliin Gol_all	112	100	46	96	78	29	12
Vt^h# / Vt#							
dialect	modal voice vowel		VOffT	occlusion		VOT	
	-t^h#	-t#	-t^h#	-t^h#	-t#	-t^h#	-t#
Horcin_1	158	90		88	77		
Horcin_2	98	90		155	143		
Horcin_3	126	89		100	110		
Horcin_4	119	89	60	81	102		
Horcin_5	150	95		168	159		
Horcin_6	191	114		123	125		
Horcin_all	140	95	60	119	119		
Baarin_1	87	89	82	121	90		
Baarin_2	98	95	42	132	100		
Baarin_3	109	93	34	119	103		
Baarin_all	98	92	53	124	98		
Shiliin Gol_1	56	111	40	136	164		
Shiliin Gol_2	144	115	48	109	115		
Shiliin Gol_all	100	113	44	123	140		

Illustrations

Aspiration is illustrated here with wave form plots and spectrograms of target words. The figures were made with the *Praat* analysis program.

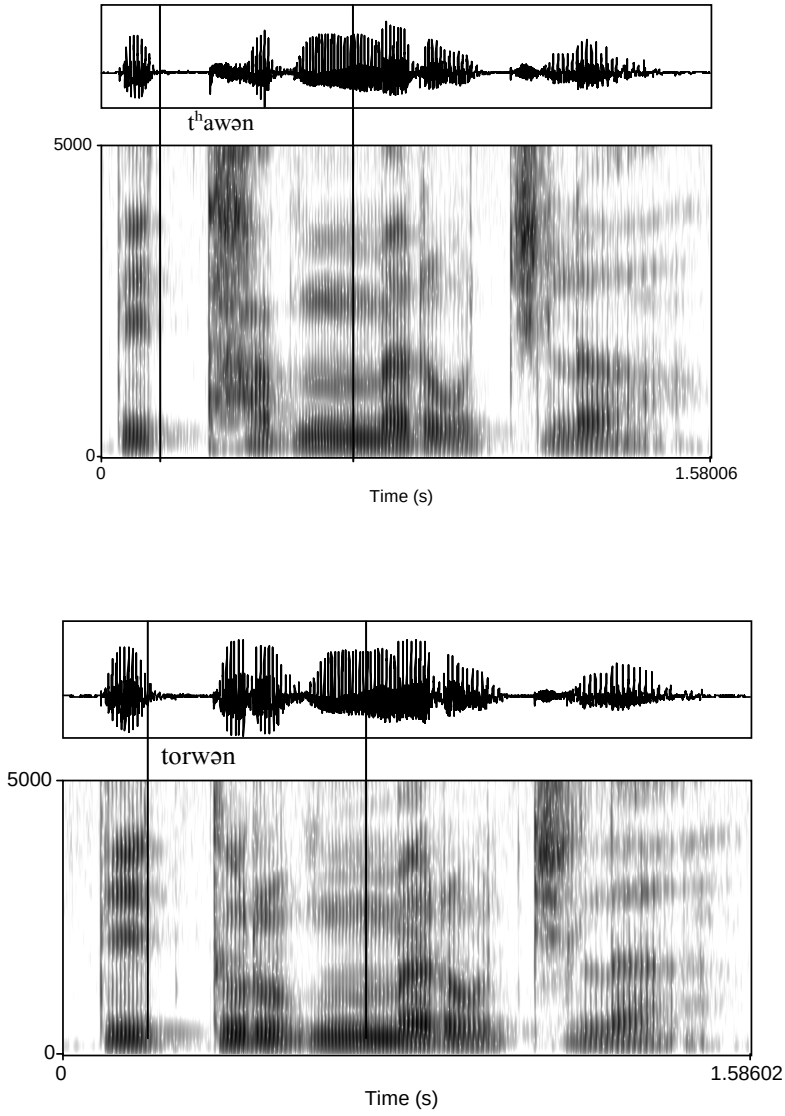


Figure 2. Postaspiration contrasting to no aspiration in utterance-initial position: *tʰawən* 'five' (top) and *torwən* 'four' (bottom) uttered in the frame sentence *Pi tʰawən/torwən mərʲ ucle* 'I saw five/four horses'. Beginnings and ends of target words are shown with straight lines. Aspiration is seen as high frequency noise in the spectrograms. There is a clear difference in VOT between [tʰ] and [t]. Speaker Horcin 4.

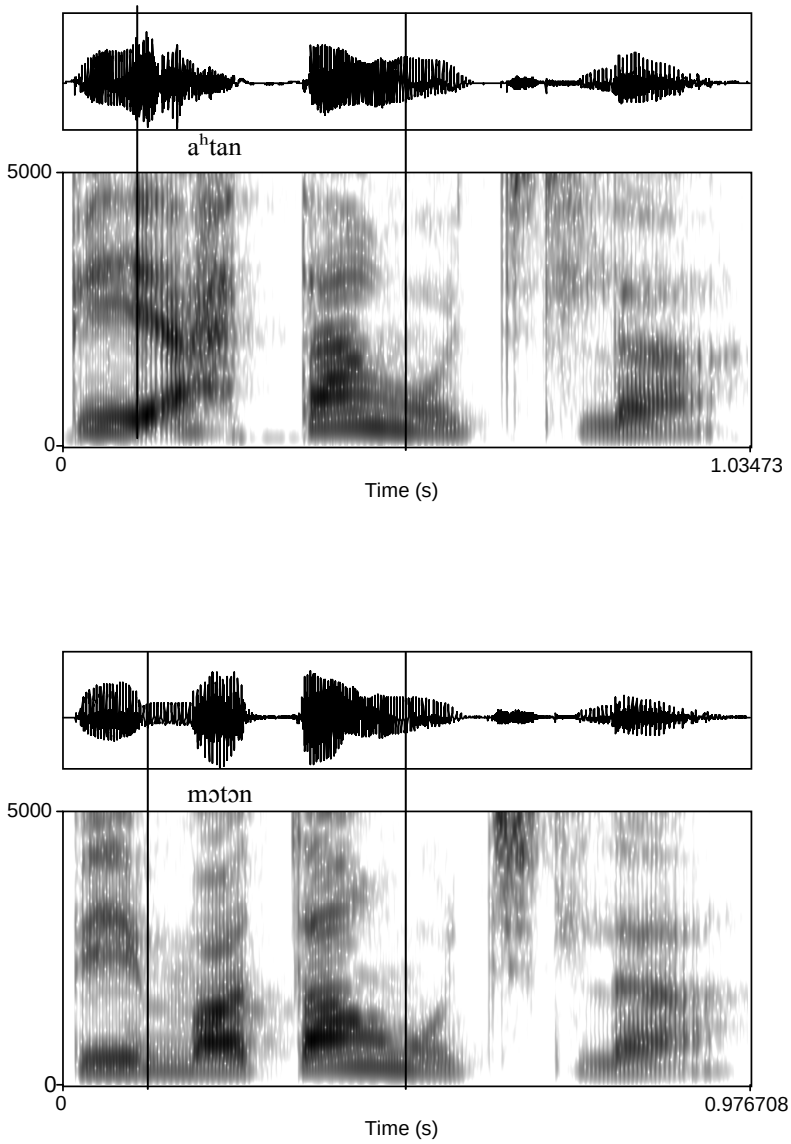


Figure 3. Preaspiration in medial position in *aʰtan* ‘camel gelding–RFL’ (top) and no aspiration in *mɔtɔn* ‘tree–RFL’ (bottom). Preaspiration is seen as high-frequency noise in the second half of the vowel preceding the aspirated stop, and also as laryngealisation causing pulse phonation of the initial vowel in *aʰtan*. The releases are similar for the two stop series, and there is no contrastive postaspiration. Beginning and end of target words are shown with straight lines. Speaker Baarin 1.

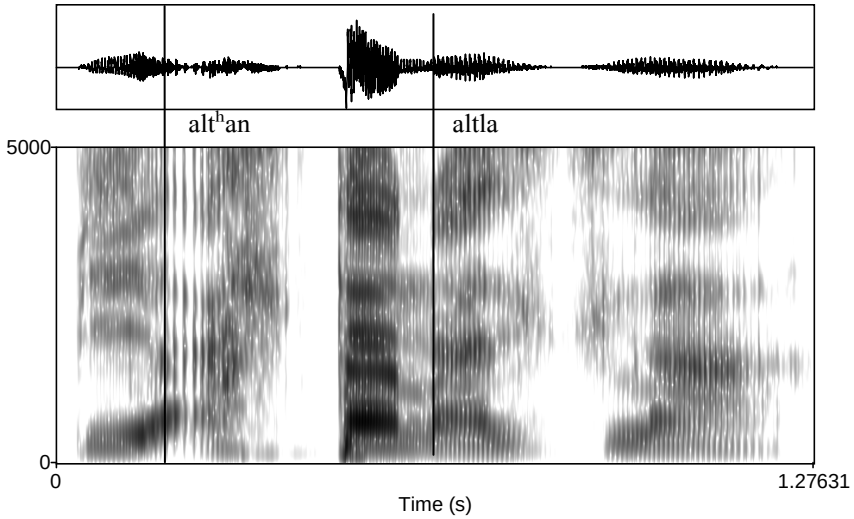


Figure 4. Devoicing and fricativisation of a lateral preceding a preaspirated stop in *alt^{h}an* 'gold-RFL' in the sentence *Pi alt^{h}an altla* 'I dropped my gold'. Preaspiration is realised as devoicing and fricativisation of the lateral /l/ and as laryngealisation of the intial *a* in *alt^{h}an* (observed as pulse phonation). In *altla* 'drop-PST' no devoicing or fricativisation occur. Beginning and end of target words are shown with straight lines. Speaker Baarin 2.

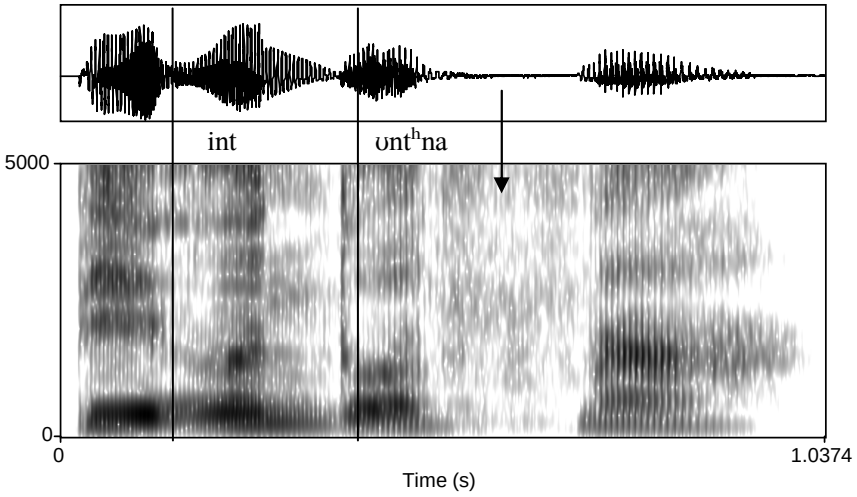


Figure 5. Devoicing of nasals before and after a preaspirated stop in *ʊnt^{h}na* 'sleep-PRES' in the sentence *Pi ent ʊnt^{h}na* 'I am sleeping here'. Preaspiration is realised as devoicing of nasals surrounding the aspirated stop (shown with arrow). In *ent* 'here' no devoicing occurs. Beginnings and ends of target words are shown with straight lines. Speaker Baarin 2.

Conclusion

Our acoustic investigation shows that presence vs. absence of aspiration is the main phonetic property distinguishing the two series of stops in the Mongolian dialects Horcin, Baarin and

Shiliin Gol. Both series are basically voiceless. In word-initial position, aspiration is realized as postaspiration. In word-medial and final position, aspiration is realized as preaspiration and/or laryngealisation of the preceding vowel.

Preaspiration is thus the main distinctive property, which is realized as such in those positions where that is possible. A similar situation is found for Halh Mongolian, though we did not observe laryngealisation (Svantesson et al 2005, Karlsson & Svantesson to appear). Thus preaspiration is found in Mongolian dialects spoken in China as well as in Mongolia.

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