

Mongolian schwa

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This paper treats the problem of Mongolian schwa from a phonetic as well as a phonological point of view.

There are seven basic vowels in Khalkha Mongolian as spoken in the capital Ulaanbaatar (the Cyrillic Mongolian orthographic form is given in addition to the IPA transcription):

i <и>	u <у>
	υ <ү>
e <э>	o <ө>
a <а>	ɔ <о>

Long and short vowels contrast in word-initial syllables, and long vowels are written with double letters (aa, ээ, etc.), except that /i:/ is written ий. An example of the contrast is ca:s <цаас> 'paper' vs. cas <цас> 'snow'. The quality of initial short and long vowels are approximately the same, the short ones being slightly centralized. The only exception is /o/, where the short vowel has much higher F₂ than the long one, and is more like [ə] or even [u] than [o].

In non-initial syllables, the Cyrillic script also makes a distinction between long and short orthographic vowels, e.g. <оpoox> 'to wrap' vs. <оpox> 'to enter'. Because of vowel harmony, the number of contrasting vowels is much smaller in non-initial than in initial syllables. The basic vowel harmony rule (see e.g. Svantesson 1985) is given in Table 1 showing which (orthographic) vowels are possible when the preceding syllable contains a certain basic vowel:

Table 1. Mongolian vowel harmony

Basic vowel in the first syllable	Possible vowels in the next syllable
i <и> e <э> u <у>	ий үү ээ э и
o <ө>	ий үү өө ө и
a <а> u <ү>	ий уу аа а и
ɔ <о>	ий уу оо о и

As this table shows, all seven 'double' vowels <ий, ээ, үү, өө, аа, уу, оо>, but only five 'single' vowels <и, э, ө, а, о> occur in non-initial syllables. Non-initial 'double' vowels are traditionally regarded as long and 'single' vowels as short, in analogy with the situation in initial syllables. Because of vowel harmony, the four open vowels (e <э>, o <ө>, a <а>, ɔ <о>) and the two non-open rounded vowels (u <ү>, υ <ү>) do not contrast in non-initial syllables.

In the rest of this article, acoustic data on the 'single' vowels in non-initial syllables is presented, and a phonological analysis which eliminates them from underlying forms is presented.

Acoustic data

The acoustic investigation is based on recordings of three male native speakers of Mongolian (BB, DD and XB), born in Ulaanbaatar and still living there at the time of recording. A list of disyllabic words illustrating all 56 (7·2·4) possible combinations of initial and final monophthongic vowels (except those with <и> in the second syllable) was designed. The words were embedded in a carrier sentence and were read twice by each speaker. The recordings were analyzed using the ESPS-Waves+ environment on a Sun workstation at the Department of Linguistics, Lund University.

The duration of each vowel was measured from spectrograms and waveform displays, and the results are summarized in Table 2 and Figure 1.

Table 2. Mean vowel duration (ms)

	first syllable		second syllable	
	double	single	double	single
BB	154	78 (51%)	97	53 (55%)
DD	128	64 (50%)	78	46 (59%)
XB	127	56 (44%)	76	40 (53%)

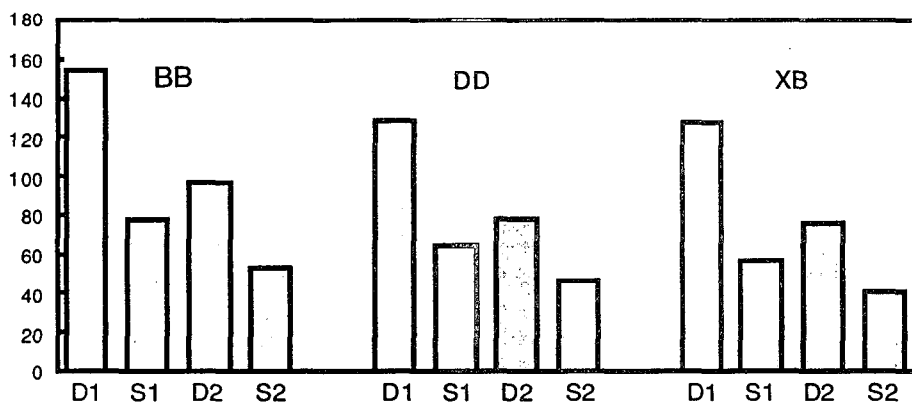


Figure 1. Mean vowel duration (ms)

On the average, the duration of a 'single' vowel is 49% of the duration of a 'double' vowel in the initial syllable, and in the second syllable, this ratio is 55%, so the duration ratio is approximately the same in initial and final syllables. It can also be noted that the duration of a 'double' vowel in a non-initial syllable is only slightly longer than the duration of a 'single' vowel in the initial syllable, and much shorter than the duration of a 'double' vowel in the initial syllable.

As is suggested by the Cyrillic Mongolian orthography, the quality of a 'single' vowel in the second syllable (except <и>) is heavily influenced by the quality of the vowel in the first syllable and may be regarded as a reduced variant of this. Thus we will write [ǎ] for a reduced vowel if the vowel in the first syllable is [a(:)], etc. (e.g. <баарap> 'hero' [ba:tǎr], <хурал> 'meeting' [xurǎl]).

Table 3. Average formant values for initial vowels and for reduced vowels for each speaker.

	BB		DD		XB	
	F ₁	F ₂	F ₁	F ₂	F ₁	F ₂
i	322.5	1983.0	356.5	2062.4	326.5	2153.4
ĩ <э>	356.3	1707.5	389.8	1932.2	354.7	2012.0
e	368.0	1947.7	384.5	2029.9	362.0	2183.6
ě <э>	376.0	1492.5	397.0	1702.5	317.5	1673.5
u	331.1	947.2	363.9	999.9	323.8	1065.9
ũ <γ>	352.5	1667.2	363.7	1731.7	333.7	1483.0
o	359.2	1234.6	380.6	1182.6	361.1	1304.7
õ <ө>	351.2	1450.5	379.7	1455.0	426.5	1490.2
a	608.4	1297.2	798.6	1382.8	688.2	1478.6
ǎ <a>	537.5	1412.7	637.2	1546.5	529.2	1386.0
υ	404.9	903.7	461.0	952.1	451.3	1000.6
ű <γ>	401.7	1051.2	471.7	1087.7	492.7	1149.2
ɔ	530.2	992.3	584.1	1000.7	536.9	1079.5
ǔ <o>	484.5	1130.5	510.2	1170.7	502.5	1204.0

The first two formants of reduced vowels were measured (in the middle of the vowel) and compared to the formants of the vowels in the first syllable. Table 3 shows the mean values of F₁ and F₂ for each vowel in the first syllable (average over long and short vowels) and for reduced vowels in the second syllable. The results are summarized in Figure 2.

The results show that a reduced vowel acoustically is a centralized variant of the vowel in the first syllable. The only exception is [ũ], which is more or less identical to [ě]. This is consistent with the Cyrillic Mongolian script, which writes [ũ] as <э>, i.e. in the same way as [ě] and [ĩ]. On the other hand the Cyrillic script implies that [õ] is identical to [ǎ], since both are written <a>, and this is not confirmed by the acoustic data, which show that the quality of [õ] is rather close to [υ], and quite different from [ǎ] and [a]. Thus, a spelling like <*хурул> 'meeting' would be more accurate than the official spelling <хурал>.

Phonological behaviour

As seen above, the quality of the reduced vowels can be predicted from the quality of the vowel in the preceding syllable, so they do not contrast, and all reduced vowels can be regarded as variants of a schwa vowel [ə]. Street 1963 adopts an analysis where schwa is a separate phoneme /ə/. There is another reduced vowel [ɪ] <и>, which is found only after alveopalatal sibilants (š, č, ž) and palatalized consonants (p^j, t^j, b^j, d^j, g^j, x^j, m^j, n^j, l^j, r^j, w). Since [ə] occurs only after other consonants, [ɪ] and [ə] can be regarded as positional variants of a schwa vowel. Examples of [ɪ] are *ažil* 'work' <ажил> and *адил* 'same' <адил>.

Since the quality of reduced vowels is predictable, they can be regarded as non-phonemic if the place where they occur is predictable as well. That this is in fact the case was shown in Svantesson 1994, 1995, which we will review briefly here, omitting many details. The basic rule for schwa insertion refers to the well-

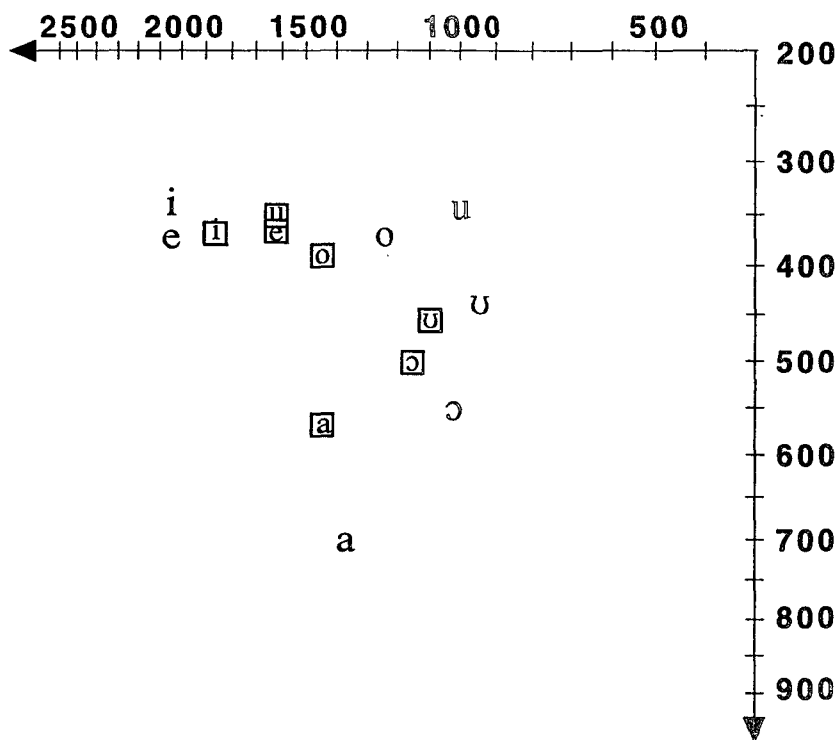


Figure 2. Diagram showing the average F_1 and F_2 values for the vowel in the first syllable and a reduced vowel in the second syllable in disyllabic words (average over the three speakers).

known 'sonority law' saying that sonority is maximal at the syllable nucleus, and decreases towards the edges (see e.g. Clements 1990).

The Mongolian version of the sonority law says that a syllable final consonant cluster (with some exceptions) consists of a sonorant (high sonority) plus an obstruent (low sonority), and other final consonant combinations require the insertion of a schwa:

sonorant + obstruent:	ard	'people'	<ард>
sonorant + sonorant:	arəl	'island'	<арал>
obstruent + obstruent:	xʲatəd	'China'	<Хятад>
obstruent + sonorant:	gʊtəl	'boots'	<гутал>

When the underlying form of a word ends in three or more consonants, the schwa (if necessary) is always inserted as far to the left as possible. This means that the schwa comes before the two last consonants if they can form a cluster (i.e. consist of a sonorant+obstruent): *gʊdəmʒ* 'street' <гудамж> (not **gʊdməʒ*). In other cases, the schwa comes between the two last consonants: *gʊrwəl* 'lizard' <гүрвэл>.

This syllablification and schwa insertion rule holds for monomorphemic words, and it often applies to derived or inflected words as well. There are, however some cases when the morphology must be taken into account when determining the place of schwa insertion (see Svantesson 1995).

As a consequence of the elimination of schwas from underlying forms, there is no quantity contrast between long and short vowels in non-initial syllables. For this reason, and also because the full non-initial vowels are closer in duration to short than to long initial vowels, we will regard them as short. Thus, the underlying form of <баарап> 'hero' is /ba:tr/ and that of <санаа> 'thought' is /sana/.

Conclusion

In conclusion, we have shown that the quality of Mongolian schwa can be predicted from the quality of the vowel of the preceding syllable, or the quality of the preceding consonant if it is palatalized or alveopalatal. The place of schwa insertion can be predicted from the phonological form of the other segments of a word and its morphological structure. Taken together this implies that schwas can be eliminated from underlying forms and be inserted by rules.

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