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# Rhythmical and accentual structure of Mongolian

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## ABSTRACT

The duration, formant frequencies and f0 course of vowels in focused words in Mongolian declaratives are measured. No evidence is found for any of these three acoustic parameters to signal prominence on the word level. The tonal courses are analyzed as functioning on the phrasal level. To account for the alignment of tonal gestures with the segmental level, a mora analysis is proposed for Mongolian.

## 1. INTRODUCTION

The object of investigation is Halh Mongolian spoken in Ulaanbaatar, the capital of Mongolia. A description of the prosodic system of Mongolian as well as a common opinion about its rhythmical features are still lacking.

Mongolian possesses no contrastive lexical stress, and typologically the placement of the stress should be fixed. Mongolian is a vowel-harmonic language, and the vowel of the initial syllable is phonologically strong due to its decisive role in vowel harmony. The phonological opposition between long and short vowels is found in initial syllables, while vowels of non-initial syllables are analyzed as phonologically short or epenthetic (non-phonologic). The insertion of epenthetic vowels is governed by syllabification rules (J-O Svantesson et al). However in the fluent speech the insertion seems to follow other principles, rhythmical in their nature.

In our previous investigation of Mongolian declaratives, the acoustic cue of focus is found to be greater f0 values (A. Karlsson). The present study gives a phonological account for the focal gesture as well as for its alignment with the segmental level.

## 2. EXPERIMENTAL STUDY 1

Material 1 consists of 22 target words in focused context: *I said TARGET WORD* (SOV word order), each utterance read by three male speakers. The material was recorded on a portable cassette recorder and later analyzed in the PRAAT program.

The number of phonetic syllables in the target words is from two up to four with different combinations of vowel lengths. All the vowels are *a*.

Measurements of vowel durations, F1-F2 frequencies as

well as f0 values in the target words were performed. F0 values have been measured manually at three points – in the onset, middle and the offset of the vowels. If the difference between the f0 values was less than 5Hz, the number of points was reduced to two or one. The measurement data consists of 55 occurrences of the vowel *a*, read three times by each of the three speakers.

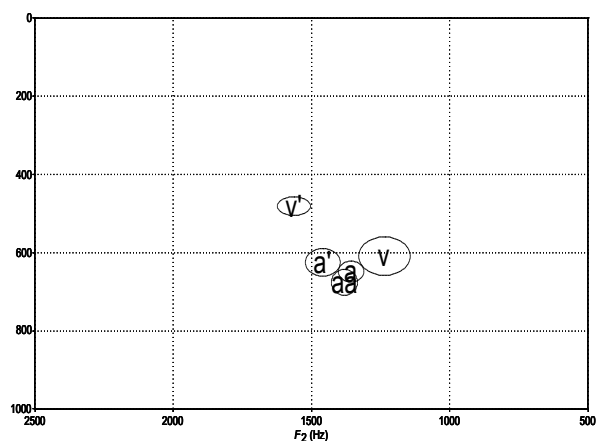
## 3. RESULTS

The results are presented in the tables and figures below.

|   | vv  | v   | v/vv | v1  | v1/vv | ə  | ə/vv |
|---|-----|-----|------|-----|-------|----|------|
| A | 163 | 124 | 76%  | 102 | 63%   | 54 | 33%  |
| B | 127 | 100 | 79%  | 67  | 53%   | 34 | 28%  |
| C | 133 | 89  | 67%  | 75  | 56%   | 29 | 22%  |

**Table 1.** Duration means in ms of vowels in target words and their relation in percentages to the long vowel. Speakers A, B, C. Symbol *vv* stands for long vowel, *v1* for short vowel in initial syllable, *v* for short vowel non-initially and *ə* for epenthetic vowel.

The relation between vowel lengths can be summarized as follows: a phonologically long vowel (always in the initial syllable) is the longest one. If there is no long vowel in a word the non-initial short vowel is longest and the duration relation varies between them if there are two or more short vowels. Epenthetic vowels are shortest.



**Figure 1.** F1-F2 means plot. The symbol *aa* stands for long vowel, *a* for short vowel in initial syllable, *a'* for short vowel non-initially and *v/v'* for epenthetic vowel in non-final/final syllable. Speaker A.

Vowels of non-initial syllables undergo different degrees

of centralisation for all three speakers. Epenthetic vowels are most centralised, and the epenthetic vowels in the final syllable are more centralised and closed than non-final epenthetic vowels. This is probably the result of assimilation of the former to the word final velar /g/ that occurs in all target words.

As was mentioned above, greater f0 values are supposed here to signal an accentuated syllable. The relation between the f0 maxima within the target words can be summarised as it follows: in CVV.CV/ə ... words, high values are found in the first syllable, while the other syllables can have both higher and lower values. In the CV.CV/ə ... type words the high f0 values are aligned with the second syllable, and the first syllable has lower values. Thus it is the first and the second syllable that show a systematic distribution of f0 maxima.

To see if the f0 maxima correlate with greater duration a correlation test has been performed, see Table 2. Variable 1 are durations of vowels of the first and second syllables of the target words and Variable 2 are f0 values of the same syllables.

|   | vv.v | vv.ə | v.v | v.ə  |
|---|------|------|-----|------|
| A | 0.5  | 0.4  | 0.7 | -0.3 |
| B | 0.1  | 0.5  | 0.5 | -0.1 |
| C | 0.6  | 0.2  | 0.4 | -0.5 |

**Table 2.** Coefficients of correlation between f0 maxima and duration. Speakers A, B, C.

The results of the correlation test do not show any significant correlation between f0 maxima and the greater duration.

#### 4. DISCUSSION

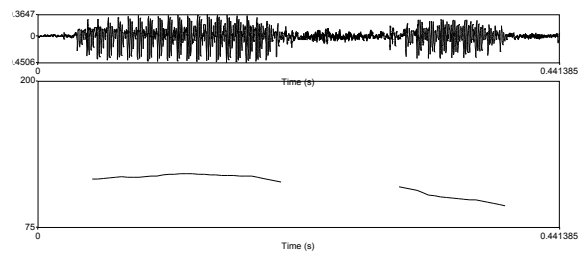
The three acoustical parameters do not coincide to signal a fixed syllable as most prominent. The quality of the vowel in the initial syllable is most stable, while the others undergo different grades of centralisation. However the contrast between initial and non-initial short vowels is not strong enough to be seen as a sufficient cue for prominence of the first syllable. The quality seems to be depended on the phonological status of the vowel and not on its position in the word, as is the case in languages with reduction of non-stressed vowels (e.g. Russian).

Vowel harmony is supposed to have an important rhythmical role. Some linguists have earlier compared vowel harmony with Indo-European stress in that both have the same function – to signal the word as an entity in the speech (V. B. Kasevitj). Vowel harmony does it by assimilating all vowels within a word. Vowel harmony also functions in building the lexicon through its contrastive possibility. So the rhythmical and lexical function of lexical stress seems to be redundant in harmonic languages. We assume that there is no lexical stress in Mongolian, and one should search prominence on the phrasal level instead of the lexical one.

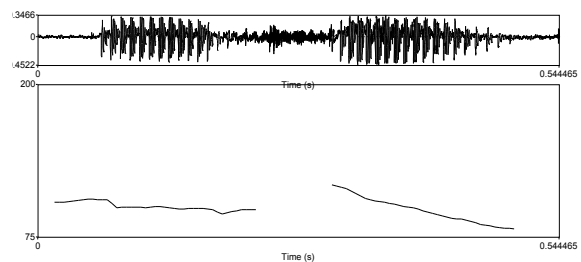
The tonal course has an obvious phrasal role in that greater f0 values signal focused words. The negative correlation between the f0 maxima and the greater duration in words with CV.Cə...structure is interesting in that we do not find any lengthening of the vowel in connection with greater f0 movement which is instead placed on the ə in these words. This indicates that the synchronisation between tonal course and the vowel length is organised phonologically.

In terms of auto-segmental theory the focal gesture can be analysed as H. To describe systematically its synchronisation with the segmental level a mora analysis seems to be suitable. Mongolian long vowels can be counted as two morae and short and epenthetic vowels as one mora each. With this analysis the H focal gesture is placed on the second mora. Phonetically this is a step from lower to higher f0 values, and it can happen within a toneless segment. The H gesture is not necessarily phonetically signalled by the greatest f0 value in the focused word, since the following syllables can get higher values.

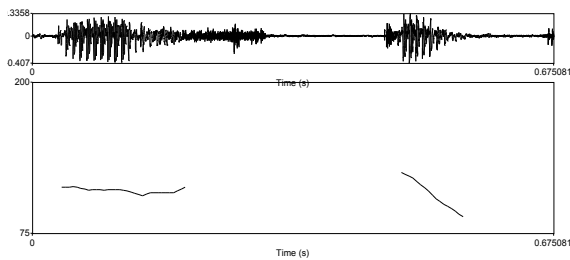
In the Figures below, the actual courses of three focused words with different distributions of vowel length are presented. Speaker A.



**Figure 2.** Focused word with CVV.CVC structure [pa:ɣar]. The focal H is synchronized with the initial long vowel counted as two morae.



**Figure 3.** Focused word with CV.CV structure [paɣa]. The focal H is synchronized with the second short vowel which is also the second mora in the word.



**Figure 4.** Focused word with CVCC.CəC structure [paḡḡtəḡ]. The focal H is synchronized with the final schwa which is the second mora.

## 5. EXPERIMENTAL STUDY 2

To find more phonetic evidence for mora counting in Mongolian another material was analysed.

Material 2 consists of 13 utterances of the type *I did not say TARGET WORD A, but I said TARGET WORD B*. F0 values in the vowels in 26 focused words with different distribution of vowel length were measured. Each utterance was read by two female speakers from Ulaanbaatar. The material was recorded on a DAT recorder and analysed in the PRAAT program.

## 6. RESULTS

The long vowels (always in initial syllables) are characterised by an f0 rise, which is missing in initial short vowels. In Table 3, f0 values of all vowels in the first and second syllables are presented.

|   | speaker D | speaker E |
|---|-----------|-----------|
| short vowel initially   | 205 Hz    | 196 HZ    |
| vowel in the syllable after an initial short vowel  | 320 Hz    | 239 Hz    |
| long vowel, f0 minimum  | 247 Hz    | 212 Hz    |
| long vowel, f0 maximum  | 296 Hz    | 221 Hz    |
| vowel in the syllable after an initial long vowel   | 299 Hz    | 242 Hz    |
| excursion of the rise in long vowel   | 65 Hz     | 30 Hz     |
| f0 rise from an initial short vowel to the vowel in the following syllable (maximum to maximum) | 73 Hz     | 41 Hz     |

**Table 3.** F0 means of vowels of the first and second

syllables. Speakers D and E.

## 7. CONCLUSIONS

The comparison of f0 values of the long, short and epenthetic vowels brings more evidence for a mora analysis proposed for Mongolian. The mean values of the excursion of the rising gesture of the initial long vowel are close to the rise between an initial short vowel and the following one. No systematic rise was found in initial short vowels. This indicates that the focal gesture is realised in a long vowel and, if there is none, it is synchronised with the two first vowels. If we choose to analyse the gesture as composed of two tones – L and H, we get the following picture: the L is synchronised with the first mora and the H with the second mora. The gesture is found in a contrastive context and is not found in Material 1 above. The phonetic realisation of the bitonal structure of the contrastive gesture is seen here as a strong evidence for the mora analysis of Mongolian.

## 8. SUMMARY

No acoustical evidence is found to conclude that there is a prominence on the lexical level. The more stable quality of the vowel of the initial syllable is seen here as the result of its decisive role in vowel harmony, and different degrees of reduction of the non-initial vowels are governed by their phonological status and not by their non-prominent position.

Our data indicates that the focal accent can be analysed as H and LH in cases with contrastive focus. Mora counting gives the most systematic picture in describing the synchronisation of the H gesture with the segmental level. Long vowels are analysed as two morae and short and epenthetic vowels as one mora. The focal H is synchronised with the second mora.

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