Proceedings of the 2nd International Conference on Interdisciplinary Humanities and Communication Studies
DOI: 10.54254/2753-7064/20/20231349

Exploring the "Mongolian Spoken Language Corpus" Mongolian Vowels Phonetic Experimental Research

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Abstract: Based on the Mongolian Spoken Language Corpus, this paper analyzes the phonological phenomena encountered in the construction of the corpus and explores the phonological patterns and features of the Mongolian spoken language flow in Mongolia by using theories of experimental phonetics and phonology and acoustic analysis methods. In the paper, natural dialogues are chosen as the acoustic corpus, and the resonance peaks are analyzed to determine the phonetic phenomena encountered in the corpus construction. A comparative analysis is attempted with the experimental results of the read-aloud corpus. The acoustic experiments and was used to analyze the resonance peaks and lengths of vowels in the Mongolian Spoken Corpus, and the acoustic characteristics of word-initial and non-word-initial syllable lengths, short vowel phonemes, and compound vowel phonemes were described.

Keywords: Mongolian language, oral corpus, voice, experimental research, phonetic change

1. Introduction

1.1. Research Background, Significance, Method

In this paper, we developed a "Mongolian Spoken Mongolian Corpus" based on the natural Mongolian spoken language as a corpus, on the basis of which we conducted acoustic analyses of the phonetic phenomena in the Mongolian spoken language, in order to acoustically analyze and describe the phonetic changes in the Mongolian Mongolian speech in the natural language stream, and to summarize the phonological conditions for the production of variants and other phonetic changes. Other phonetic conditions that produce variants and other phonetic changes. The research methodology of this paper is descriptive, comparative and statistical. The acoustic parameters adopted are used to describe the phonetic characteristics of Mongolian natural spoken language in Mongolia, to summarize its phonological system, and to summarize the phonemic variants and phonological changes that exist through statistical methods. It is hoped that this study will provide Mongolian language researchers with reliable information on the phonological phenomena occurring in the natural language, and that it will provide corpus resources for future linguistic research on Mongolian language, both at the segmental and suprasegmental levels of phonology and in the fields of grammar, semantics, pragmatics and other linguistic research.

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2. Manuscript Preparation

Firstly, this paper selects six participants, and they are divided into three groups of conversations, and each group of audio files contains the free conversations of two acquaintances, with no specific restrictions on the content of the conversations. 3 groups of conversations are used, and the length of each group was about 70 minutes, totaling 200 minutes of corpus. Each of the six experimenters is asked to read the vowel phonemes individually and the duration is recorded. The recordings are made in a professional recording studio in a favorable environment. the duration of each vowel is recorded in the case of standard vowel reading, and secondly, the words are extracted, and the duration data are counted in the Natural Speech Corpus and used for the following analysis.

2.1. Acoustic Analysis of Vowels

In experimental phonetics, the position of the tongue high point of a vowel is often utilized to map the tongue position of the vowel, and in this paper, the Joos-type acoustic vowel map was used to map the vowel tongue position. In this paper, the Joos-type acoustic vowel map is used to plot the vowel tongue highs [1].

2.1.1. Acoustic Analysis of Short Vowels

In this experiment, the short vowel [ɐ] appeared 426 times in word-initial syllables.F1=669-947Hz XF1=800Hz，F2=1369-2033Hz XF2=1614Hz. The word-initial short vowel [ɐ] belongs to the low and central vowels.The short vowel [ɐ] occurs 160 times in non-word-initial syllables. The non-word-initial short vowel [ɐ] belongs to the sub-low and central vowels. From the results of this experiment, the short vowel [ɐ] is strongly influenced by syllable position in the spoken speech stream, and there is an obvious centralization phenomenon.

The short vowel [ɜ̆] occurs 729 times in this experiment and all of them are in non-word-initial positions. F1= 310-573Hz XF1= 369Hz; F2= 1328-2082Hz XF2=1653HzThe short vowel [ɜ̆] belongs to the second highest, front vowels.The non-word-initial short vowel [ɔ], which appeared in this study, is somewhat higher and more backward in tongue position.

The short vowel [i] appeared 453 times in word-initial position. F1=284-395Hz XF1=311Hz , F2=1865-2535Hz XF2=2303Hz.The word-initial syllable short vowel [i] is a high, front vowelThe short vowel [i] occurs 313 times in non-word-initial positions.The resonance peak values of the word-initial short vowel [i] obtained in this experiment are lower for F1 and higher for F2 compared to these resonance peak values, which means that the tongue position is slightly higher and more forward [2].

The short vowel [ɞ] occurs 401 times in word-initial position.F1=555-802Hz XF1=670Hz F2=1143-1852Hz XF2=1400Hz. The word-initial short vowel [ɞ] is a sub-low, central vowel.The short vowel [ɞ] occurs 83 times in non-word-initial positions. The non-word-initial short vowel [ɞ] is a low-mid and central vowel.

The short vowel [ʊ] occurs 131 times in word-initial syllables. F1=454-632Hz XF1=503Hz, F2=1011-1300Hz XF2=1172Hz. The word-initial syllable short vowel [ʊ] is a back and central vowel. The short vowel [ʊ] occurs 55 times in non-word-initial syllables. The non-word-initial syllable short vowel [ʊ] is a high-mid and central vowel.

The short vowel [ɵ] occurs 72 times in word-initial position. F1=356-520Hz XF1=411Hz, F2=1151-1702Hz XF2= 1466Hz. The short vowel [ɵ] is a high-mid and central vowel. The short vowel [ʉ] occurs 233 times in this experiment and all of them are in word-initial syllables. The short vowel [ʉ] is a high, central vowel.

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The short vowel [y] occurs 32 times in word-initial position, this vowel does not occur in non-word-initial syllables F1=211-410Hz XF1= 311Hz, F2=1423-2052Hz XF2=1686Hz. The short vowel [y] belongs to the high, front vowels. This vowel is seldom mentioned in previous studies of the Khalkha dialect [3].

Furthermore, we find that in this study, the mean vowel length of short vowels in word-initial syllables is 87 msec, and the mean vowel length of short vowels in non-word-initial syllables is 46 msec, which shows that in word-initial syllables, the short vowels in the natural spoken corpus are shorter than those in the read corpus. And in non-word-initial syllables, the short vowels in the natural spoken corpus are somewhat longer than the total short vowels in the read-aloud corpus on average. That is, in the read-aloud corpus, the sound length of short vowels in word-initial and non-word-initial syllables differed more. In the natural spoken corpus, the difference in the sound lengths of word-initial, non-word-initial syllable short vowels is not very large [4].

2.1.2. Acoustic Analysis of Long Vowels

The long vowel [ɐː] occurs 133 times in word-initial position. F1= 654-869Hz XF1= 758Hz, F2= 1432-1829Hz XF2=1581Hz. The word-initial syllable long vowel [ɐː] is in the second-lowest, central vowel position.The long vowel [ɐː] occurs 215 times in non-word-initial positions. The non-word-initial syllable long vowel [ɐː] is also a sub-low, central vowel.

The long vowel [æ ː] occurs in word-initial syllables 95 times in this experiment. F1=511Hz-700Hz XF1=640Hz, F2=1585Hz-2119Hz XF2=1866Hz. The word-initial syllable long vowel [æ ː] is a low-mid and front vowel. The long vowel [æ ː] occurs 32 times in non-word-initial syllables. , and the non-word-initial syllable long vowel [æ ː] is a low-mid, front vowel.

The long vowel [eː] occurs 82 times in word-initial syllables. F1=317-507Hz XF1=377Hz, F2=1774-2408Hz XF2=2157Hz. The word-initial syllable [eː] is the second highest, front vowel. It occurs many times in conversation as an intonation, pronounced /tʰeː/, and often indicates an interaction with the other person or an expectation of affirmation after a point has been made. The long vowel [eː] occurs 90 times in non-word-initial syllables. The non-word-initial syllable long vowel [eː] is the second highest, front vowel.

The long vowel [iː] occurs 53 times in word-initial syllables. F1=220-359Hz XF1=268Hz, F2=2038-2529Hz XF2=2374Hz. It is a high, front vowel. The long vowel [iː] occurs 90 times in non-word-initial syllables. The non-word-initial syllable long vowel [iː] is a high, front vowel.

The long vowel [ɞː] occurs 18 times in word-initial syllables. F1=598-730Hz XF1=671Hz,F2=1215-1773Hz XF2=1415Hz. The word-initial syllable long vowel [ɞː] is a sub-low, central vowel. The long vowel [ɞː] occurs 148 times in non-word-initial syllables. The non-word-initial syllable long vowel [ɞː] is a low-mid and central vowel.

The long vowel [ʊː] occurs 36 times in word-initial syllables. F1=346-516Hz XF1=431Hz, F2=886-1253Hz XF2=1094Hz. Word-initial syllables in non-word-initial syllables [ʊː] are high mid and back vowels. The long vowel [ʊː] occurs 39 times in non-word-initial syllables. Non-word head vowels [ʊː] are high mid and back vowels.

The long vowel [oː] occurs 33 times in word-initial syllables. F1=333-495Hz XF1=415Hz, F2=852-1192Hz XF2=971Hz. The word-initial syllable long vowel [oː] belongs to the high mid and back vowels. The long vowel [oː] occurs 68 times in non-word-initial syllables. The word-initial syllable long vowel [oː] belongs to the high mid and back vowels.

The long vowel [uː] occurs 64 times in the word-initial syllable, F1= 261-432Hz XF1= 325Hz, F2= 802-1313Hz XF2=967Hz. The word-initial syllable long vowel [uː] is a high mid and back vowel. The long vowel [uː] occurs 52 times in non-word-initial syllables. The non-word-initial syllable long vowel [uː] is a high mid and back vowel.

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The difference between the tongue position distribution of long vowels in word-initial and non-word-initial syllables is not very large. The long vowels [ɐː], [ɞː], [ʊː], and [uː] have a more pronounced centralization in non-word-initial syllables. The tongue positions of the remaining non-word-initial syllable long vowels overlapped largely with those of word-initial syllable long vowels, although there were varying degrees of centralization [5].

2.2. Acoustic Analysis of Vowel Sound Changes

The phonological changes in the "Mongolian spoken language corpus" are complex and changeable. The complexity of sound change is also the main feature of natural spoken language data which is different from spoken language data [6]. The following is a list of typical and high frequency phonetic changes in this experiment.

2.2.1. The Formation of Transitional Sounds

In the spoken speech stream, when the previous rhyming word ends with a vowel and the next rhyming word begins with a different vowel, the connection between the two forms a transitional compound vowel [7]. However, this transitional sound does not become a compound vowel at the phonemic level. Transitional phonological process has three characteristics: first, the front word ends with a vowel, and the back word begins with a vowel; second, the transitional sound possesses the phonological characteristics of the front word and the back word at the same time; third, after the formation of the transitional sound, it is not possible to segment syllables or rhyming words in the traditional way, because it belongs to the front word as well as to the back word.For example, the conjunction of the final long vowel /iː/ in "BIби 我" and the initial short vowel /ʊ/ in "VLAGANBAGATVR Улааан бааатар 乌兰巴托" becomes a transitional compound vowel [iʊ].

2.2.2. Interchange Phenomenon of Long and Compound Vowels

Vowel lengthening is relatively obvious in the natural spoken speech stream. In this experiment, the length of the vowel /æː/ in the word "AYVMARаймаааp 显然" is 222msec, and the length of the whole word is 341msec, which is 62% of the length of the whole word. The lengthening of /æː/ here is no longer about the length of the long and short vowels, but rather about the degree of profundity that the speaker is subjectively trying to convey with it. The second example is "BURбүр 所有" where the speaker extends the vowel /u/ as much as possible to express the degree. Here the length of vowel /u/ is 0.582sec, and the length of the whole word is 0.743, and the lengthened vowel /u/ takes up 73% of the length of the whole word. Again, the length of the sound here is not about the nature of the long and short vowels, but rather about the speaker's description of the degree [8]. In addition, vowels are also lengthened when the speaker is thinking and is hesitant to be completely sure of what is to follow [9].

3. Conclusions

Based on the statistical analysis of the resonance peaks obtained in the experiment, the sound quality of short and long vowels was analyzed. In the experimental results, it was concluded that there are eight short vowel phonemes in word-initial syllables such as /ɐ/, /ɛ/, /i/, /ɞ/, /ʊ/, /ɵ/, /ʉ/, /y/, etc.; and five non-word-initial syllabic short vowel phonemes such as /ɐ/, /e/, /i/, /ɞ/, /ʊ / and 5 others; the word-initial syllable long vowel phonemes are /ɐː/, /æː/, /eː/, /iː/, /ɞː/, /ʊː/, /oː/, /uː/ and 9 others; and the non-word-initial syllable long vowel phonemes are /ɐː/, /æː/, /eː/, /iː/, /ɞː/, /ʊː/, /oːː/. ː/, /uː/, and 8 others. The tongue position distribution of short vowels is more centralized and fronted than that of long vowels, and the centralization feature of short vowels is more obvious in the tongue position

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contrast of non-word-initial syllables. Compared with the results of previous phonoacoustic studies of the Khalkha dialect, the vowels in this experiment have fewer phonemic positions and shorter lengths [10]. At the same time, the overall centralization of vowel articulatory tongue positions in the present study was higher, not only in non-word-initial syllables. We believe that the speakers of the read-aloud corpus have a tendency to "broadcast standard" or "read standard" in the process of reading aloud, and thus strive to pronounce words clearly.

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