The Analysis of Rich and Vast Alashan in Mongolia Long Tune Based on the Acoustic Characteristics

Guo-Qiang CHEN¹,a,*, Mei-Li LIU¹,b

¹Northwest University for Nationalities, Lanzhou, Gansu, China,

a877867573@qq.com b769779307@qq.com

*Corresponding author

Keywords: Mongolia Long Tune, Fundamental Frequency, Energy.

Abstract. This article extracts the parameters of male's and female's Mongolia Long tune of "Rich and Vast Alashan", aims at analyzing fundamental frequency parameter, energy parameter, and some parameters of acoustic changes with the representative song. The conclusion of this article reveals the relationship between the expression of emotion and voice acoustic parameters in Mongolia art, investigates the physiological performance of Mongolia opera singing skills, and summarizes the different characteristics of Mongolia Long tune and the parameters relationship by analyzing the similarities and differences in characteristics of the male's and female's sound, for providing basis of more in-depth and systematic study, and providing technical guidance for the inheritance and protection of long tune.

Introduction

The Mongolia Long tune of "Wu ri tu daso", the Chinese words for long song, characterized by fewer words cavity length, high charge and distant, relieve free, high pitched tune, wide range, large capacity, the lyrics are generally up and down the two sentences. With the distinctive characteristics of the nomadic culture and the unique form of singing about the history and culture of Mongolia, cultural customs, ethics, philosophy and the art of sentiment, called as the "Prairie Music alive", Long tune is the most beautiful and typical style of culture in Mongolia. It is the art display of the way in life for the Mongolian people. And it has long, clever and great artistic forms and the concept of profound human to seek survival and development, so the research of Mongolian folk songs will enrich human art and promote the development of cultural diversity in the world. However, the Mongolia Long tune is facing the crisis of inheritance with the development of society and the change in life style, this requires us to make efforts to carry out the protection and inheritance of Mongolia long tune.

At present, there are some differences in the domestic and foreign research angle of long Mongolia. In music, according to the analysis of Fan Qiyu in Mongolia long tune's folk style and singing skills, analyzing the style and characteristics of Mongolia long tune folk songs and causes, and expounds the main concert in Mongolia long tune song skills. Analysis of the characteristics of Li Shixiang in Mongolia drawl body relatively long tune folk melody, from the start to the long drag phenomenon from a new perspective to explore, and more reasonable to explain the long melody characteristics, and the researchers from the region of the study area, such as the area of Hulun Buir, Cole, MI Xilingole area, Ordos area and Alashan area. In Linguistics, mainly using acoustic and physiological instruments to research the long tune in multiplex mode, exploring the physiological performance of the Mongolia folk songs, and to compare and analyze the characteristics of male and female voice, resulting the relationship between the voice characteristics and parameters of different phonation mode in long and short tune, and the pronunciation, voice and breath of three aspects of multidimensional signal of Mongolian Folk Song Collection and all aspects of digital analysis.

With the development of modern technology, Phonological Studies has also stepped into a digital research road by means of acoustic and physiological technology. The research field is constantly expanding, it has not limited to the language itself, the inheritance and protection of modern oral
culture also depends on the technology and the most advanced methods, such as long Mongolia acoustic research some new research fields are constantly emerging. In particular, the use of the most advanced acoustic technology to analyze the characteristics of Mongolia long tune of voice, can provide a more comprehensive scientific approach to the protection of Mongolian folk songs.

**Experimental Method**

This experiment recorded a total of 2 pronunciation of the sample, men and women each one, two person have a good pronunciation of folk songs singing skills, especially for Mongolia long tune folk songs, they has a unique understanding and skilled singing skills. It primarily take consideration to the representative of the selected songs in the design of the recording material, from Alashan long Mongolia selected the "rich and the vast Alashan"; it is the representative works of the Alashan long tune folk songs in Alashan and the famous eight long song of the first.

This experiment uses the hardware equipment mainly includes the Adobe (the EGG), the external sound card, the collar clip type microphone, computer, sound mixer, sound recording software is Audition1.5 and so on.

<table>
<thead>
<tr>
<th>Singer</th>
<th>Sex</th>
<th>Song</th>
<th>Style</th>
<th>Singing skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bbu Jin Batu</td>
<td>male</td>
<td>Rich and the Vast Alashan</td>
<td>Distant desolation</td>
<td>Falsetto, Nogora (Qu Zhe) &quot;Ode to Nogora&quot;, trembling voice</td>
</tr>
<tr>
<td>Ngaz G Gio Dema</td>
<td>female</td>
<td>Rich and the Vast Alashan</td>
<td>Distant desolation</td>
<td>Falsetto, Nogora (Qu Zhe) &quot;Ode to Nogora&quot;, trembling voice</td>
</tr>
</tbody>
</table>

Praat and 3700 were used to extract the fundamental frequency and energy values of the “rich and vast Alashan”, to analyze the acoustic characteristics of the male and female singers when they were singing the same song and carried on the contrast research.

**Acoustic Analysis**

"The rich and vast Alashan" with a wide range, long in tune the rhythm, the melody is in five tune scale as the foundation. It’s a typical long tune folk songs free rhythm and represent for the Alashan long tune folk song, standing first on the eight long tune folk songs in Alashan. According to legend, this song is sung by Alashan and Shuote tribe originally came to settle in Alashan in order to appease the people, unite will, build homes produced.

![Figure 1. The Language of the Rich and Vast Alashan (Female) the Whole Song.](image1)

![Figure 2. The Language of the Rich and Vast Alashan (Male) the Whole Song.](image2)
From Figure 1, we can conclude that female singer sang the rich and vast Alashan, singing energy is mainly concentrated between 0 and 3000Hz. But in Figure 2, when male singer sang the Rich and Vast Alashan, the energy distribution of singing is more extensive and more uniform, between 0 and 5000Hz. Through the picture of long tune can be seen that male singer singing deep and loud, more vigorous and stable, the sound volume is good when sing high. The female singer’s energy scattered, singing more changes, with low energy when sing the treble.

**Energy Analysis**

Energy represent the high or low volume, it is related to the strength of the gas flow in the singing process. Using the praat to extract energy values. Figures 3-6 are male and female singers singing the overall distribution map of this energy transfer heads. Among them, the horizontal coordinate is the time, the vertical coordinate is the energy value. Analyzing energy of the two sentences from the song by using the audio software called Cool Edit Pro, we got a comparison of male and female singers singing energy.

![Energy distribution map](attachment:image1)

Figure 3. Rich and Vast Alashan (Female) the First Sentence Energy Distribution Map.

![Energy distribution map](attachment:image2)

Figure 4. Rich and Vast Alashan (Female) the Second Sentence Energy Distribution Map.

![Energy distribution map](attachment:image3)

Figure 5. Rich and Vast Alashan (Male) the First Sentence Energy Distribution Map.

![Energy distribution map](attachment:image4)

Figure 6. Rich and Vast Alashan (Male) the Second Sentence Energy Distribution Map.

It can be seen from figure 3, the maximum value of the first sentences of the female singer is 85dB, the minimum value is 55 dB, energy is mainly concentrated in the 60 dB - 80 dB, the energy peak appears in the 29s, and from the 20s-30s appears a sustained energy peak, 50s-60s is the energy trough. It can be seen from figure 4, female singers sang the long tune second sentences for maximum energy is 87dB, the minimum value is 57dB, energy is mainly concentrated in the 60 dB to 80 dB, the energy peak at 30s, 45s - 60s has sustained low energy. Comparing the female singer’s first and second sentences, the energy in second sentence is higher than the first, illustrating the
climax of the long tune is mainly in the second sentence, is also a female singer to sing the best state. The maximum value of the first sentences of the male singer is 83dB, the minimum value is 51 dB, energy is mainly concentrated in the 60 dB - 75 dB, the energy peak appears in the 53s, and from the 45s-55s appears a sustained energy peak, 11s-20s is the energy trough in the Figure five. And in the Figure six, male singers sang the long tune sentences for maximum energy of second is 83dB, the minimum value is 53dB, energy is mainly concentrated in the 60 dB to 75 dB, the energy peak appears in the 50s and from the 43s-53s appears a sustained energy peak, 10s - 16s has sustained low energy.

From figure 3 and figure 5, we can see that male and female singers sing the long tune of the first sentence of the maximum energy difference of 2dB, female singer's energy maximum value is higher than the male singer 2dB, the time of the peak of energy is also different. Female singer energy peak appeared in 29s, male singer's energy peak appeared at 53 dB. Energy trough appeared in the time is different, female singer's energy trough appeared in 60s - 50s, male singer's energy trough appears time is 20s - 11S. From figure 4 and figure 6, we can see that male and female singers sing the long tune of the second sentence of the maximum energy difference of 4dB, female singer's energy maximum value is higher than the male singer 4dB, the time of the peak of energy is also different. Female singer energy peak appeared in 30s, male singer's energy peak appeared in 50s, male singer's energy trough appears time is 10s – 16s.

**Fundamental Frequency Analysis**

The vibration of an object produces a sound. The Mongolia Long is associated with the singer's vocal cord vibration, fundamental frequency is the vibration frequencies of vocal cords. During Mongolia long tune singing, there are great differences between male and female singers’ singing style, male singing voice is generally vigorous loud, female singing voice is filling soft. Picture 9 to picture10 is the extraction of the fundamental frequency graph:

![Figure 7. The Rich and Vast Alashan (Female) the First Sentence of the Fundamental Frequency Distribution Figure.](image)

![Figure 8. The Rich and Vast Alashan (Female) the Second Sentence of the Fundamental Frequency Distribution Figure.](image)

It can be seen from figure 7, the highest frequency of female singers singing the first sentence of the highest frequency is 500Hz, the highest frequency of the peak appears in the 30s, the lowest frequency is 120Hz, appears in the 9s, and from 10s - 5S continued emergence of the fundamental frequency of the low. It can be seen from figure 8, we can see that in the long tune of the second female singer singing the highest frequency is 500Hz, the fundamental frequency peak appears in the 31s, the lowest fundamental frequency value is 120Hz, appeared in the 10s, and 12S - 8s continued emergence of the fundamental frequency trough. We can see from figure 9, male singer singing the long tune the first sentence of the highest frequency is 500Hz, frequency peak at 37s, the lowest frequency value is 110Hz, in 15s, and from 11s - 16s continued emergence of the fundamental frequency trough. As can be seen from Figure 10 the highest frequency of the male singers long tune the value is 500Hz, the fundamental frequency peak at 33s, the lowest frequency value is 110Hz, in 14s, and from 11s - 15s sustained fundamental trough.
Comparison between figure 7 and figure 9 can be seen that male and female singers sing the first sentence of the highest fundamental frequency values are close to 500Hz or so, but the peak time difference between the fundamental frequency peaks, the highest frequency of female singers appeared in 30s, 7s earlier than male singer. Minimum fundamental frequency difference 10Hz, and the time is also different, the female singer's lowest frequency appears in the 9s, than male singer in advance of the 6s. From figure 8 and figure 10 comparison between men and women can be seen singing the long second peak time appeared word frequency is 2S, the peak frequency of female singers appeared in 31s, 2s earlier than male singer. The lowest fundamental frequency difference of 10Hz, and the time is also different, the lowest frequency of female singers appear in the 10s, than the male singer in advance of the 4s.

**Discussion**

There are differences when male and female singers are singing the long tune of the first sentence and the second sentence, in the second sentence, singing energy was significantly higher than that in the first sentence, male and female singers have high pitched voice when they are singing the second, volume relatively enough to achieve the best condition, but also to sing the long tune climax. Male and female singers sing the long tune each has their own characteristics, female singer's energy is significantly higher than male singer, male singer's energy change less, energy distribution is more uniform. From the overall, male and female singers’ singing energy is very high, little fluctuation of energy intensity, alternating phenomenon is less, the whole song sound loud tune, wide range, large capacity, long range, emotional tension, and make sounds of great momentum. It’s illustrated that the two singers can smoothly control breathing and strength in the singing. For a long time, the stability and continuity of energy need a good voice physiological mechanism and strong singing skills, which is necessary to sing Mongolia long tune.

There is no obvious difference between the first and the second sentences of the male and female singer singing the long tune, but when singing the second sentences, the fundamental frequency fluctuation than the first sentence. It explains that emotional change is relatively large when the two singers sing the second sentence. When the male and female singers sing the long tune, the female singer's singing fundamental frequency value is generally higher than the male, which is decided by the female physiological structure. Generally, female's vocal cords are thinner and the vibration speed is quicker. From the whole long tune, it has long and slow melody in concert, making the concert can easily reach a higher fundamental frequency. The full expression of the song cavity stretch, free rhythm, melody is beautiful and smooth, ups and downs, more melodic line waves, the sound have endurance and penetration, showing the day heights width of the natural space.

Totally, fundamental frequency and energy as important acoustic parameters, singing style and performance form have close relationship. Only can we fully understand this relationship, it’s not so
long for researching the national oral culture in-depth and promoting the inheritance and protection of it.

Peroration

Since I first study the acoustic characteristics of long Mongolia, there may be insufficient in the research method, the research content is also limited to men and women sing the same song "the Rich and Vast Alashan" to analyze the acoustic characteristics. The results may be individual differences, hope that the future research will gradually more scientific and more comprehensive, gradually expanded in the research content and the research results more general significance. Meanwhile, sincerely hope that more researchers to join the ranks of Mongolia long tune, let our research should be more extended vision. Studying on acoustic problems of Mongolia folk songs and physiological mechanism of long tune singing from multi angle and high level. Laying a theoretical foundation and provide data basis for Mongolia long tune singing and learning, in order to better Mongolia long tune heritage.

Acknowledgement

This research was financially supported by the Gansu Youth Science and Technology Foundation Program (156RJYA277).

References