

Speech Signal Processing and Analysis Based on Mongolian long-tune Folk Songs

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Abstract: This paper mainly analyzes the speech signal of Mongolian long-tune folk songs through the method of speech acoustic analysis. From the perspective of duration, it studies the changes in the length of the passages, sentences and vocabulary of Mongolian long-tune folk songs, discusses the phonetic and acoustic characteristics of Mongolian long-tune folk songs, provides basic data for the protection and digital inheritance of oral culture, and explores the establishment of oral culture database.

1 INTRODUCTION

Both Chinese national vocal music and western bel canto pay attention to the important role of breath in singing. Mongolian long-tune folk songs have the characteristics of wide range, long rhythm, huge structure and diverse singing methods, so it is very important to regulate the breath during lengthening. It can be said that breath is the lifeline of Mongolian long-tune folk songs. No wonder that Mongolian long-tune masters Hazab and Baoyin Deger both attach great importance to the special role of breath in the singing of long-tune folk songs [1]. Hazab believes that the interpretation of breath is mainly realized by breathing, and the most basic feature of Mongolian long-tune is "long". Abundant breath is the basic skill of good "long" interpretation. Aiming at the problem of breath, Hazab put forward the breath theory of long-tune folk song singing - the theory of "three gases connected". He believed that only by correctly using the "qi of saddle bridge", "qi of belt" and "qi of chest buckle", can a good long-tune folk song be performed. From the perspective of methods and means, the current international research on singing acoustics shows a trend of close integration with modern science and technology [2]. From the perspective of the unit nature of researchers, most of them belong to computer, singing performance, language communication, electronic engineering, psychology and other disciplines.

The definition of Mongolian long-tune mainly comes from three aspects [3]: first, the popular concept used by the people; Second, the concept put forward by the older generation of long-tune singing artists; The third is the new concepts and technical terms proposed by music theorists. Among them, on the basis of inheriting the unique singing method of long-tune folk songs, Hazab, an outstanding artist of long-tune folk songs, proposed a

set of appropriate concepts and terms, and applied them to his singing and teaching activities, which promoted the development of long-tune folk song singing art towards systematization, standardization and nationalization.

The oral culture of any nation has been gradually formed in the long river of human evolution for millions of years. Therefore, the process of the emergence and development of this "cultural species" is no less than the formation of natural species, and it is the precious wealth of human wisdom. The extinction of natural species should be protected mainly by establishing seed banks and gene banks. However, there is no consensus on the protection of such "cultural species" as Mongolian long-tune in the world. How to effectively rescue and protect our national vocal language and oral culture is an urgent problem we face. In 2005, Mongolian long-tune was selected into the world-class intangible cultural heritage list, and the research on Mongolian long-tune has become a worldwide topic.

At present, the research on long-tune mainly focuses on music theory, artistic expression, historical development, cultural connotation, performance methods, etc., with rich research contents and fields [4]. However, due to the limitation of research technology and means, there is little research on the production principle and pronunciation mechanism of Mongolian long-tune, which is the basis for revealing the physiological mechanism of emotional expression of long-tune [2]. With the help of modern phonetics methods based on medicine, computer and language science, a number of physiological acoustic parameters of pronunciation are extracted, an oral cultural parameter model is established, the relationship between parameters and pronunciation actions is analyzed, and the mechanism of voice production is explored. This provides new inspiration for the research and protection of Mongolian long-tune and

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other oral cultures, and also finds new applications for the accumulation of modern phonetics research for many years. It can deepen the theory of speech production and open up a new field of oral culture research and protection.

The research on the noumenon of Mongolian long-tune mainly includes the following categories: the first category is the collection and induction of Mongolian long-tune, the second category is the research on the historical origin and generation context of long-tune, the third category is the research on the noumenon form of long tune music, the fourth category is the research on the singing art of long-tune, the fifth category is the aesthetic research on long-tune, the seventh category is the research on the music culture of long-tune, and the eighth category is the interdisciplinary research on long-tune. These works provide cultural accumulation for the research on the mechanism of long-tune [5]. Therefore, the courseware uses modern instruments to analyze data, and uses the methods of linguistics and other disciplines to explore the physiological performance of the vocal skills of Mongolian long-tune folk songs. This multi-disciplinary and multi-modal research will be a new research trend in the field of long-tune research in recent years.

2 METHODS

The experimental design is to complete the selection, recording and segmentation of corpus in the pre-

processing stage, clarify the rules for file naming and preservation, and establish a database. Save the recorded voice files before analysis, classify them according to different themes, and save them in the same folder to form a corpus. Then use the cooledit software to segment the recording results. Divide the whole song into sections, sentences, and vocabulary to prepare for later analysis and research. There are 2 speakers, Ao Erigeji Dema is a female, one of the three national long-tune inheritors in Alxa; Mao Bayier is a male, teacher of the Alxa long-tune folk song inheritance base.

3 ANALYSIS OF CAROL DURATION

The first paragraph of the male and female vocal carols "Fu", "Xu" and "Jiang" was selected, and the duration of the first paragraph of the three Mongolian long-tune was calculated in the praat speech analysis software.

From Table 1, it can be concluded that the first paragraph of "Jiang" in the Mongolian long-tune consists of four sentences, and the female vocal carol is the longest, because each sentence of the Mongolian long-tune has drag tune, nogula and falsetto singing. The order of duration of male voices is the same as that of female voices. However, compared with the female Mongolian long-tune "Jiang", the male Mongolian long-tune "Jiang" is longer, because the male Mongolian long-tune is generally more vigorous and stable.

Table 1. Statistics on the duration of the first segment of male and female carols.

Theme	Long-tune name	Female voice duration	Male voice duration
Carol	Xu	66.63	86.10
	Fu	52.81	71.86
	Jiang	87.47	153.87

3.1 Length analysis of carol sentences

The breath is related to the strength, speed, continuous and relaxation of the song. Therefore, it requires the ability to inhale, "knot", connect, and relax. According to the needs of the song content and the length of the sentence, inhale or exhale. breath. In singing, the breath must form a strong support point in order to control the uniformity of the breath and use the change of strength freely, that is, the abdominal breathing method and the so-called "Dantian Qi method" [3]. From Table 2, in terms of the sentence duration of male and female carols, the three Mongolian long-tune sentences of male voices are all longer than those of female voices. The length of each sentence is consistent with the length of each

Mongolian long-tune. When analyzing the length of the passage, it is found that the male Mongolian long-tune is longer than the female Mongolian long-tune, because the breath of the male voice is thicker and calmer than that of the female voice. The sentence length of each carol is very stable, usually only a few seconds apart. The length of the seventh sentence of the female Mongolian long-tune "Xu" is not very different from the length of the previous six sentences, but the seventh sentence of the male Mongolian long-tune "Xu" is the same as There is a big difference in the length of the first six sentences, which shows that the male voice skillfully uses the dragging tone at the end of the last sentence of the long-tune.

Table 2. Comparison of the sentence lengths of male and female vocal carols

Long-tune name	Sentence	Female voice duration	Male voice duration
Fu	first sentence	33.86	44.42
	second sentence	32.28	40.79
Xu	first sentence	6.88	7.39

Long-tune name	Sentence	Female voice duration	Male voice duration
Fu	first sentence	33.86	44.42
	second sentence	32.28	40.79
	second sentence	6.31	6.75
	third sentence	6.30	6.12
	fourth sentence	6.30	6.77
	fifth sentence	5.26	5.85
	sixth sentence	6.50	7.26
	seventh sentence	12.86	27.52
Jiang	first sentence	17.42	39.88
	second sentence	22.81	38.09
	third sentence	19.37	36.08
	fourth sentence	23.32	36.41

3.2 Analysis of carol vocabulary duration

The word is the most basic grammatical unit in the Mongolian long-tune, and it has its own prosody characteristics, so the stress position of the word plays a very important role in the rhythm of singing [4]. In terms of the analysis of the duration of carol vocabulary, the first paragraphs of the three carols were counted, and a comparison table of duration was listed, as shown in Table 3.

From Table 3, it can be concluded that the male Mongolian long-tune and the female Mongolian long-tune cannot correspond to individual vocabulary, which is due to the fact that the Mongolian long-tune is sometimes improvised, and the lyrics mastered by the two singers are not the same, but the tune is exactly the same. For example, there are four or five words in the first and second sentences of the female long Mongolian tone "Fu", while the first and second sentences of the male Mongolian long-tune "Fu" have only three words. From the statistics of the length of time, it can be concluded that the vocabulary length of the male Mongolian long-tune is longer than that of the female Mongolian long-tune. The length of the Mongolian long-tune vocabulary of male and female voices can basically correspond, but the seventh word of female voice is only 3.49s, while the seventh word of male voice is 20.36s, because the seventh word of male voice is the end of the

second sentence, so use the arrival time to Nogula is longer. When the vocal cords vibrate due to the impact of breath during singing, the Adam's apple can be seen vibrating from the outside of the singer's throat. Many of the beautiful "little nogula" (little folds) in Wuringduo are related to the throbbing of the Adam's apple. "Xiao Zhe" is a variety of pleasing and pleasing folds created and expressed by the movement skills of various organs. "Zhe" means bending and bending, and the Mongolian long-tune refers to the sound pattern of bending into a curved line like a subtle wave, that is, folded sound [5]

4 ANALYSIS OF THE DURATION OF MONGOLIAN LONG-TUNE FOLK SONGS WITH DIFFERENT THEMES

Based on the above methods, this paper selects wedding songs and historical songs to conduct acoustic analysis of three Mongolian long-tune with different themes, and obtains the differences in the acoustic characteristics of Mongolian long-tune with different themes from Table 4.

For each subject matter of male voices, the use of the Mongolian long-tune is longer than that of female voices, which is closely related to the breath of the speaker. The long-tune duration of the three themes is from long to short: carols, wedding songs, and historical songs.

Table 3. Comparison of the vocabulary duration of male and female vocal carols

Long-tune name	Sentences	vocabulary	Female voice duration	Male voice duration
Fu	first sentence	first word	8.48	10.57
		second word	10.13	12.19
		third word	7.48	20.45
		fourth word	7.81	8.09
	second sentence	fifth word	8.74	10.00
		sixth word	8.04	10.08
		seventh word	3.49	20.26
		eighth word	2.98	3.55
		ninth word	8.98	10.44
Xu	first sentence	first word	3.13	3.25
		second word	3.30	4.10

Long-tune name	Sentences	vocabulary	Female voice duration	Male voice duration
Fu	first sentence	first word	8.48	10.57
		second word	10.13	12.19
		third word	7.48	20.45
		fourth word	7.81	8.09
	second sentence	fifth word	8.74	10.00
		sixth word	8.04	10.08
		seventh word	3.49	20.26
		eighth word	2.98	3.55
		ninth word	8.98	10.44
	second sentence	third word	1.59	1.63
		fourth word	1.67	1.68
		fifth word	2.90	3.32
	third sentence	sixth word	1.58	1.58
		seventh word	1.60	1.48
		eighth word	0.73	0.69
		ninth word	2.22	2.12
	fourth sentence	tenth word	1.57	1.58
		eleventh word	1.64	1.63
		twelfth word	3.33	3.38
	fifth sentence	thirteenth word	0.89	0.67
		fourteenth word	0.76	0.66
fifteenth word		3.44	4.34	
sixth sentence	sixteenth word	1.71	1.61	
	seventeenth word	1.70	1.59	
	eighteenth word	3.22	3.92	
seventh sentence	nineteenth word	8.32	17.72	
	twentieth word	2.12	9.28	
	Twenty-first word	2.36		
Jiang	first sentence	first word	2.65	3.81
		second word	7.46	20.47
		third word	5.07	7.19
		fourth word	3.48	7.49
	second sentence	fifth word	4.35	6.52
		sixth word	6.70	9.95
		seventh word	3.76	7.21
		eighth word	7.21	12.92
	third sentence	ninth word	2.07	2.89
		tenth word	9.75	17.02
	fourth sentence	eleventh word	5.01	7.33
		twelfth word	3.78	7.86

Table 4. Statistics on the duration of the first segment of male and female carols

Theme	Quantity	Masterpiece
Wedding song	3	Handsome purplish red horse
Carol	3	The rich and vast Alxa
Historical song	3	Altay Hange

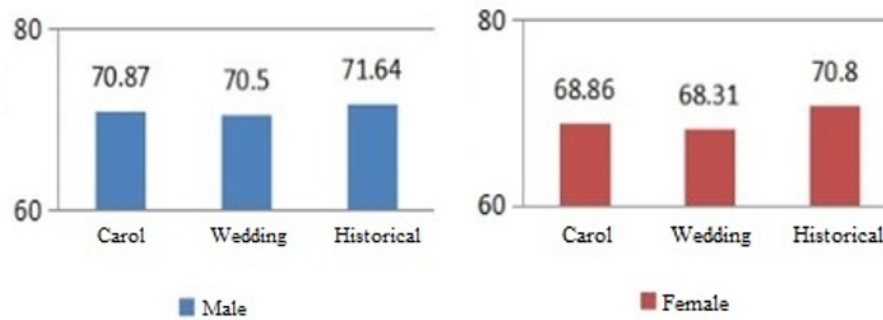


Figure 1. Comparison of the average duration of male and female voice Mongolian long-tune.

5 CONCLUSION

In terms of the length of Mongolian long-tune, the use of Mongolian long-tune for each subject matter of male voices is longer than that of female voices. The three Alxa long-tune with different themes are from long to short: carols, wedding songs, and historical songs. Because the carol is more solemn and solemn, and pays great attention to *nogula* and *falsetto* singing, there is a corresponding dragging situation after each sentence. Compared with the other two themes, carols are relatively calm, condensed, slow and long. When singing the carol, both singers were solemn and full of emotion. In terms of the duration of special singing methods, among the three Alxa long-tune with different themes, the one with the largest number of special singing methods and the longest duration is carol.

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