The Research on Breath Signal of Tibetan Motto Poem

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Abstract. This paper sets the recitation of Sajia Motto as the study focus; researches its rhythm by the respiratory physiological equipment. During the study, a recitation data is built, which contains two speakers' (a man and a woman) recitation breathe of 40 poems of Lasa dialect in Tibetan. The breath of chest signals have been the main content in this paper, we have extracted the parameters of duration and amplitude in the beginning of a single respiratory period, and a statistics about their features have been done, meanwhile, so is the contrast analysis of male and female. Based on the results in our study, it is found that there are four typical breathing patterns in recitation of poem, which provides basis data for the deep acoustics and physiological study about recitation of poem.

1. Introduction

Poetry with profound ideological level and high artistic quality holds a very special place in the history of Tibetan literature. Therefore, Tibetan poetry has always been the focus of scholars. In addition to Lu style and harmonic style folk songs, Tibetan poetry includes Niana style, alphabetical poem and so on. Poetry is a verse which has its fixed form, and has strict rules on the number of sentences and words. Poetry recitation should follow its unique rhythmic rule. As an important part of Tibetan culture, motto poem reflects the life of Tibetan people. It is known for the following characteristics: profound, vivid, moving, comprehensive, and so on. Motto poem wins general Tibetans' like. Sajia Motto is the first collection of motto poems for Tibetan, has been ended at the first half of thirteenth Century. Sakya Pandita as the writer uses motto poems to observe and discuss various social phenomenon, and put forward a series of propositions on how to deal with life, pursue studies, identify and treat people. Block book of Sajia Motto is around all scripture printing lamasery in Tibet. Soon after the publication, Sajia Motto has been translated into Phags-pa script, Mongolian and Chinese at first, and then translated into English, French, Japanese, Czech, Hungarian and other foreign languages, has a great influence at home and abroad. It is a work not only required reading for Tibetan scholars, but also spread far and wide among the masses. Most of books on the study of Sajia Motto is to focus on author's life, theme, translation, philosophical thought, ethic and other areas, rarely to focus on the artistic expression of motto poem rhythm from recitation point [1]. The breath and rhythm study of the famous Tibetan poem Tsangyang Gyasto Love Song has been done [2]. This paper focus on famous Sajia Motto, adopts breathing physiology equipment to do breathe and rhythm research. To reveal the rhythmic feature of poem preferably though the acoustical or physiological research methods.

2. Research method

2.1 Acquisition of breathe signal

The acquisition equipment in this experiment includes: Bioelectricity collector Powerlab produced by ADInstruments enterprise in Australia, MLT1132 piezoelectric breathing zone sensor, laryngeal instrument and neck-style microphone. The software for signal acquisition is Chart 7 which comes with Powerlab. The first channel is voice signal, the second channel is throat signal, the third channel is chest breath signal and the fourth channel is belly breath signal. The

relationship between chest breath and belly breath is complicated. Chest breath is the main breathing pattern, so this experiment focus on parameter of chest signal. This paper chooses 40 poems in Sajia Motto, each poem consists of four sentences, and each sentence is made of seven Tibetan syllables. There are totally 160 verses and 1120 Tibetan syllables. Two speakers, a male and a female, do the recording. Motto form as follow [3]:

མཁས་པ་ཡོན་ཏན་ཀུན་བསྡུས།།	Smart people learns all the acknowledges,
མཐར་ཕྱིན་གཅིག་གིས་འཇིག་རྟེན་གསལ།།	Proficient in one study can know a world;
བློ་ངན་ཤེས་པ་མང་ནས་ཡང་།།	Although a fool knows a thing or two,
རྒྱུ་སྐར་བཞིན་དུ་གསལ་མི་ནུས།།	Like stars faint flicker of light.

2.2 Parameter setting of breath signal

Before poem reading, speaker's breathing is even, flow is smooth, air pressure in the body is consistent with the outside air pressure, and the signal is zero. Signals climb from zero up to the peak point accompanied by deep inhale when reading the first sentence. Signal fall slowly with reducing airflow and decrease of atmospheric pressure. Until finishing the sentence, signals fall to the valley and the first respiratory cycle is achieving. Then repeat suction process to prepare the second sentence poetry reading, until finishing the total poem reading and the entire breathing process.

Each poem consists of two couplets, totally four sentences. When reading the poem, each sentence has a complete breath cycle which includes an inspiratory phase and an expiratory phase. The curve of inspiratory phase is rising, corresponds to silence period of voice signal. The curve of expiratory phase is declining, ordinarily corresponds to voice period of voice signal. Breath signal of poem includes four breath cycles, among them, peak point P1, P2, P3 and P4 are transition points of inhale and exhale. Zero V0 is initial point of inhale and V4 is end point of exhale. Valley point V1, V2 and V3 are not only transition points of exhale and inhale, but also demarcation points of breath cycle. Inspiratory phase is also called breath-reset. The most direct and basic parameters of breath signal are breath-reset duration and region. Breath-reset duration means the duration of breath process. Inspiratory phase is shown as ID and expiratory phase is shown as ED. Breath-set region means change value of signal numbers, which is equal to the difference between peak point P and valley point V [4]. Figure 1 for the parameter diagram of breath signal.

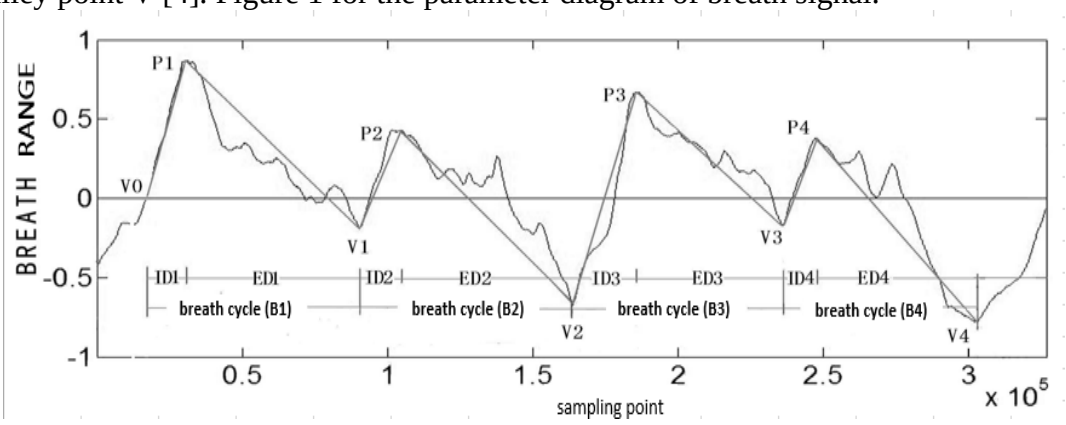
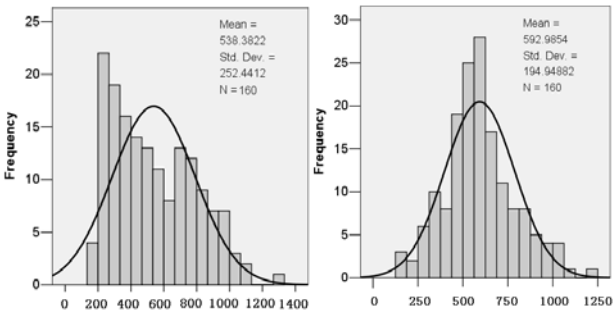


Fig 1 Parameter diagram of breath signal

3. Breath signal analysis of poetry

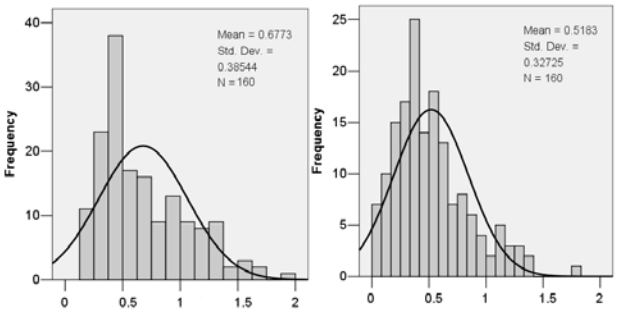
3.1 frequency distribution analysis of breath-reset

There are 160 breath-resets in 40 poems totally. Extracting the breath-reset duration and amplitude of male and female respectively. Figure 2 is frequency distribution diagram of reset duration, and Figure 3 is frequency distribution diagram of reset amplitude.



Male Female

Fig 2 Frequency distribution of reset duration



Male Female

Fig 3 Frequency distribution of reset amplitude

From the duration and amplitude of breath reset of the whole motto poem, the minimum duration of male is 154.1ms, the maximum duration is 1288.8ms and the average duration is 538ms. The minimum amplitude of male is 0.14, the maximum amplitude is 1.97 and the average amplitude is 0.68. The minimum duration of female is 135.7ms, the maximum duration is 1204.7ms and the average duration is 593ms. The minimum amplitude of female is 0.02, the maximum amplitude is 1.76 and the average amplitude is 0.52. From an overall perspective, reset duration and amplitude have change on the consistency, the more reset duration is the more reset amplitude is.

3.2 Breath parameter in different verses

A pome is made up of four sentences and each sentence consists of the same number of words which makes the pome a strong rhythm. From the acoustics and voice theory perspective, poem has a fixed rhythm scheme. To divide the recitation into different groups according to the breath-reset position in sentences, each group has 40 breath-resets, and then analyze the reset duration and amplitude of each group. Figure 4 is the variation diagram of reset duration from the first sentence to the fourth sentence. Figure 5 is the variation diagram of reset amplitude from the first sentence to the fourth sentence.

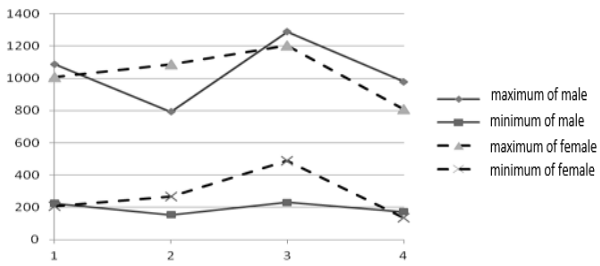


Fig4 Variation diagram of reset duration

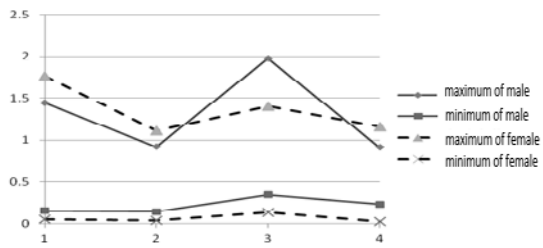


Fig 5 Variation diagram of reset amplitude

As can be seen from Figure 4 and Figure 5, the reset duration of the first and the third sentence is longer than the second and the fourth sentence, and the reset amplitude of the first and the third sentence is bigger than the second and the fourth sentence. Therefore, the breath-reset of motto can be divided into two levels. Reset duration and amplitude of male have a high degree of consistency and relevance, the bigger respiratory signal grows, and the bigger reset amplitude is. There is weaker dependency with reset duration and amplitude of female. The range of male reset duration and amplitude are close to female.

4. Breath form of poetry

From the macro view, the rhythm conditionality in the poetry itself forms a characteristic breathe pattern of poetry. During reciting, speaker could control the breathe pattern according to expression of need consciously. The size of signal's peak point and valley point shows a well-regulated change, which forms a different breathe pattern of poetry. Except V0 as zero remains unchanged, P1 and P2 are positive values, V2, V3 and V4 are negative values. V1, P3 and P4 can be both positive values and negative values. By analyzing and compare the breath signal of 40 motto poems, four typical breathe patterns have been found. The first one is the most commonly used as shown in Figure 6.

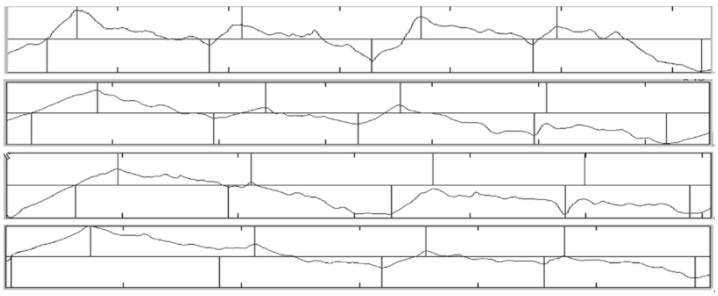


Fig 6 Typical mode pattern of breath signal

Type 1: The most typical breathe pattern, the values of peak point P1, P2, P3 and P4 are greater than zero, and P1>P2, P3>P4; the values of valley point V1, V2, V3 and V4 are less than zero, and V1>V2, V3>V4. Every verse of expiratory and inspiratory phase is stable, two signals are basically the same. Each part of the first sentence has enough inspiratory capacity and short expiration; the second sentence has less inspiratory capacity and longer expiration, leading to tow sound on listening.

Type 2: The values of peak point P1, P2 and P3 are greater than zero except P4. When reading the fourth sentence, less gas is inhaled in a short period of time, the whole process of pronunciation has finished in negative pressure condition, so the voice is relatively short. The connection is more closely between the third sentence and the fourth sentence.

Type 3: The values of peak point P1 and P2 are greater than zero, P3 and P4 are less than zero. The second sentence has more expiration capacity and the value of valley point V2 is less, which lead to tow sound on listening.

Type 4: The value of valley point V1 is greater than zero, and the value of P1 is much greater. The first sentence has more inspiratory capacity, and airflow hasn't been exhaled absolutely in expiration phase, so the air is enough in the whole process of reading. The reading of last two sentences can be modified flexibly.

5. Conclusion

On the basis of a large study of breathe signal, this paper researches the breathe signal of Tibetan seven-character motto poems, shows the breathe pattern of motto poem. According to the analysis of male and female, four major breathe pattern have been found. We need to do a deeper research of the relationship between chest breathe signal and belly breathe signal for the more comprehensive research in breathe pattern of poetry. Furthermore, the relationship between prosodic hierarchy of voice signal and breathe signal will be the key point of research in the future.

Acknowledgments

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