Study on Airflow Interactions in Children's zero initial Syllables Based on Cooperative Pronunciation Theory

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Abstract: Based on the theory of cooperative pronunciation, this paper explores the interaction of different components in children's utterance of zero-initial syllables in Mandarin. It was found that [i] [u] had a " consequent inhibition" on the air flow of articulation in the posterior connected rhyme. The pronunciation air flow of [u] will be affected by the connected rhyme at the back, resulting in "inverse inhibition". The round or spread of lips has a certain influence on the air flow of vowel pronunciation. In the same pronunciation environment, the average air velocity of the final pronunciations is higher than that of the final pronunciations. And the fluctuation range of the average air velocity of the same phoneme in different syllable structure positions.

1. Introduction

Coarticulation is a new phenomenon that is different from traditional phonetics that was gradually discovered after the 1960s. It means that in the stream, the segments are not static, separate sounds, and the segments will affect adjacent segments. [1] The flow of Mandarin Chinese is based on the Chinese syllables. The Chinese syllables are composed of different phonemes, and the connected phonemes also have an influence. It is because of the influence of pronunciation that the airflow at the time of pronunciation also has an effect. This paper uses the theory of collaborative pronunciation to study the interaction between the rhyme head, rhyme belly and the rhyme tail in the process of children's zero-initial syllables.

There are many scholars in China who study the collaborative pronunciation of Mandarin Chinese and dialect. Wang Maolin (2011) investigated the phenomenon of coordinated pronunciation between two vowels in the Chinese syllable two-syllables "vowel-stop-vowel" sequence by means of acoustic analysis. It is found that when the vowels are aerated between the two vowels, the synergistic effect of the vowels is relatively small due to the longer value of the aspirating sound, and the aspiration is an important factor to suppress the synergistic effect; When the post vowel is / I /, the cross lip sound has a greater synergistic effect, while the cross tongue sharp sound has a smaller synergistic effect. However, the interaction between the post vowel and the post vowel is greater than the unilateral effect of the post vowel. [2] He ye (2012) has the superposition of pronunciation posture among the syllables of Mandarin. The generation of the cooperative pronunciation mode is related to the pronunciation position of C2, which is mainly manifested in the influence of the stop consonant of the back syllable on the front syllable, and the degree of its influence is also related to the pronunciation method, which shows that the unaspirated sound is greater than the aspirated sound.[3] Luo Yu (2017) studied the pronunciation characteristics of adverbial and Miao consonants and the influence on tongue position when different vowels were followed by them through EPG research techniques.[4] Meihua (2018) analyzed and compared the frequency parameters of the pre and post transition section of the formant of the target position of the stressed syllable short vowels of Mongolian standard speech, explored the problem of the

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coordinated pronunciation between vowels caused by word stress, and verified the rule of "the intensity of reverse assimilation is greater than that of the smooth assimilation".

In this paper, the air pressure meter is used to collect the air flow of the zero initial Syllables section of Chinese from 7-year-old children, and mark the beginning, the belly and the end of the vowel respectively to analyze their mutual influence.

2. Experiment explanation

2.1 Experimental Materials

According to the four calls, Chinese Mandarin zero initial syllables can be divided into the following four mouth opening patterns. In order to avoid the influence of different tones on the experimental data, all syllables are 55 tones.

2.2 Participants

The main speaker is a 7-year-old first-year boy, standard Mandarin, without any laryngeal disease, good vocal fold conditions, normal hearing ability and normal sound characteristics. All the pronunciation people were trained in pronunciation before the experiment, and they were asked to read each sound five times according to the pronunciation table. This experiment was conducted with the consent of the guardian.

2.3 Instruments

The aerodynamic data acquisition device of this experiment consisted of a circular ventilatory breathometer mask connected to a narrowband pressure sensor (PTL-1) and a separate broadband pressure sensor (PTW-1) (Glottal Enterprises MS 110). The calibration gas flow volume was 1.4 L and the flow rate was 0.5 L/s. The data collection work was carried out in the professional studio of Northwest University for Nationalities. The following figure shows the original airflow pattern collected by the MS110.

The aerodynamic parameters selected in this paper are mainly:

Expiratory airflow duration (ms): refers to the length of time that the voiceless consonant is pronounced in the syllable.

Average airflow speed (ml/s): refers to the change of the velocity of the airflow over time in a relative time.

Airflow volume (ml): refers to the total amount of airflow exhaled during the process of pronunciation. The size of the airflow depends on the speed of the airflow and the length of the pronunciation.

3. Experiment results

First of all, from the perspective of preposition, the preposition of Mandarin is mainly three vowels [i] [u] [y]. The figure below is a histogram of the average air velocity of each phoneme in the zero vowel section with a preposition.

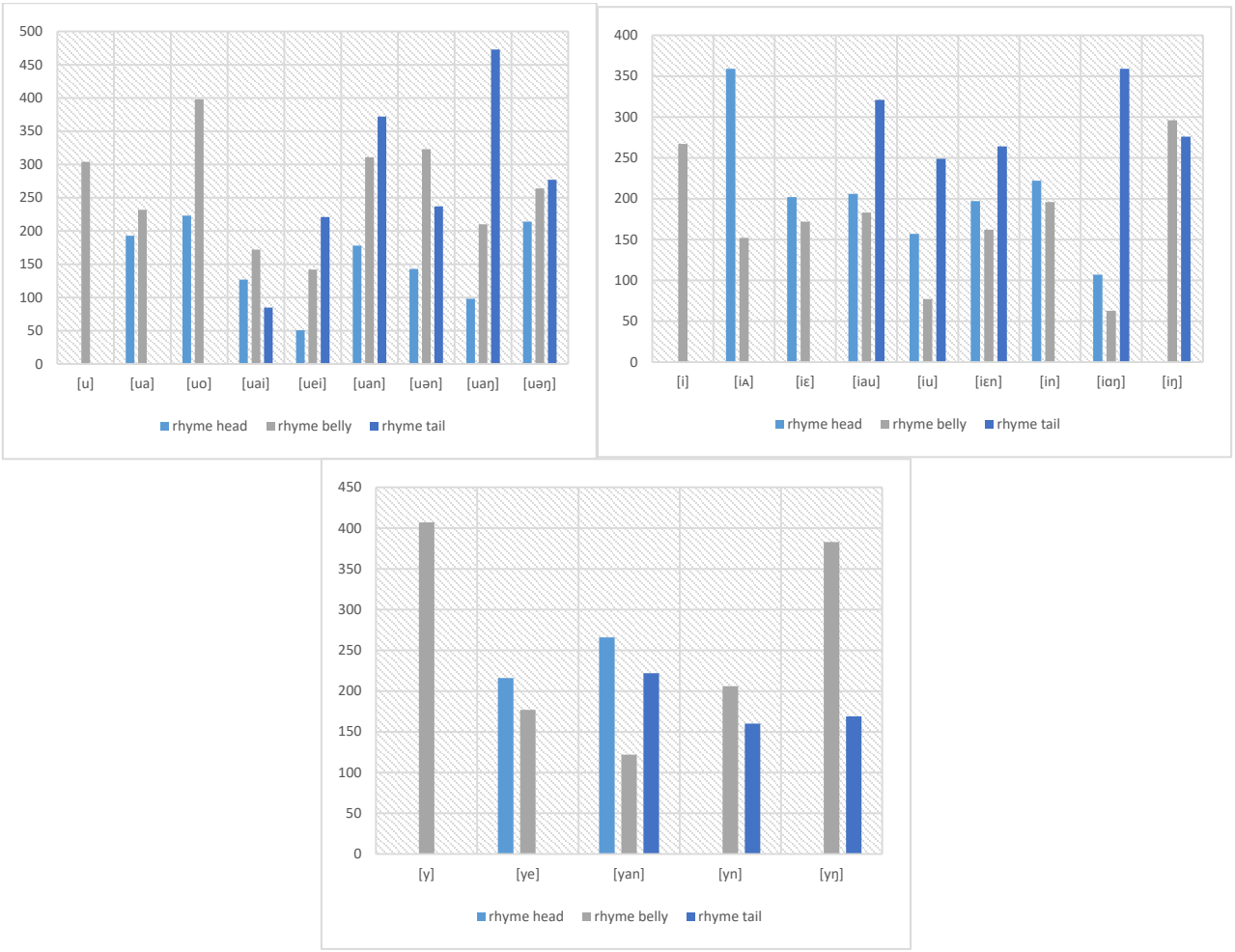

Fig. 1 Histogram of homogeneous tooth. closing mouth and Round mouth

According to the above chart, we can get the following conclusions:

1. When [i] is used as a preposition, the influence of the vowel on the ventral part of the rhyme will cause the average air velocity to become smaller than that when it is used alone. When [u] is used as a preposition, the average air velocity of the preposition [u] will be less affected by the rhyme than when it is used alone. When [y] is used as a preposition, the ventral part of the rhyme will also be affected by the vowel, and the average air velocity will become smaller than when it is used alone. Therefore, it can be inferred that [i] [y] because the pronunciation part is in front, it will affect the pronunciation air flow of the later connected rhyme and produce " Consequent inhibition". On the contrary, when the pronunciation part of [u] is backward, its pronunciation air flow will be affected by the connected rhyme at the back, resulting in "inverse inhibition".

2. When [i] [u] [y] is self syllable, the relation of the average air velocity is: [y] > [u] > [i]. It can be seen that the round spread of lips has a certain influence on the air flow of vowel pronunciation.

3. From the perspective of nasal ending, in[uan] [uaŋ], [ŋ] > [n]; in [uən] [uəŋ], [ŋ] > [n]. It can be seen that in the same pronunciation environment, the average air velocity of the final pronunciation of the posterior nasal sound is greater than that of the final pronunciation of the anterior nasal sound.

4. [u] in syllable structure, the average air velocity of pronunciation is less than that of self syllable.

Secondly, from the perspective of phoneme, without distinguishing the position of each phoneme in syllable, draw Figure 4 according to the value of average air velocity of each tone, and draw Figure 5 using the average value of average air velocity of each tone.

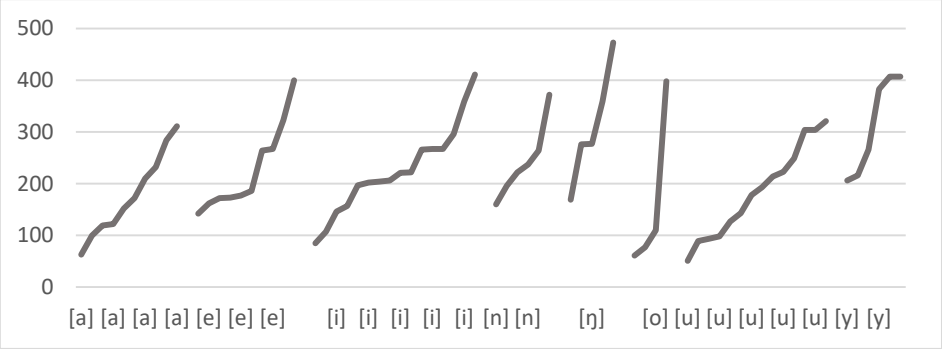

Fig. 2 Line chart of average air velocity.

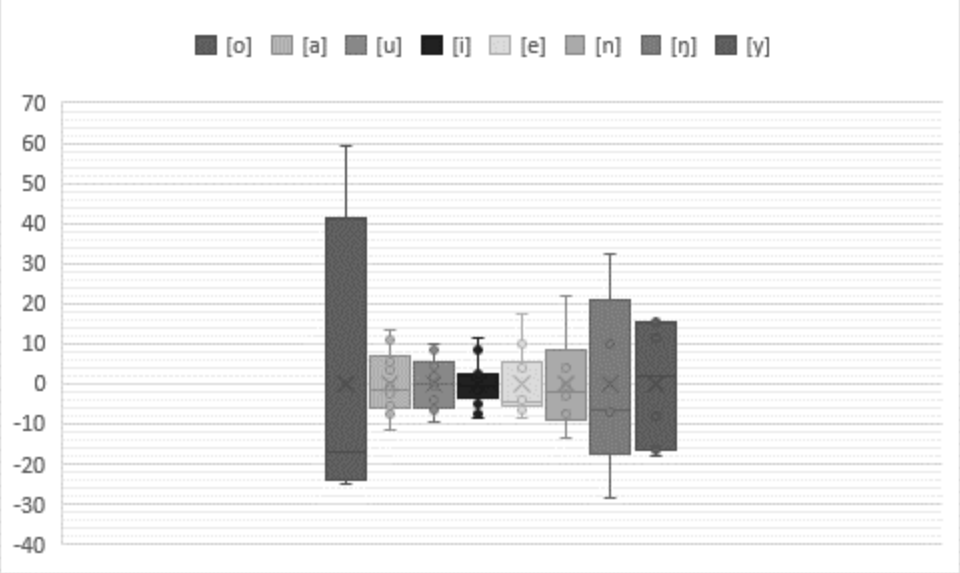

Fig. 3 Box chart of mean air velocity variance.

According to the above figure, we can get the following conclusion:

1. According to figure 2, in the zero-initial syllables section, the order of the average air velocity of pronunciation is roughly as follows: [y]>[ŋ]>[n]>[e]>[i]>[u]>[a]>[o]. It can be seen that there is a certain relationship between the average air velocity of vowels and the height of tongue position. The average air velocity of high vowels is larger, but it is not absolute. But it is certain that the air flow of vowel pronunciation is greatly influenced by the position of tongue and the shape of lip, which is consistent with the acoustic conclusion of vowel pronunciation.

2. According to figure 3, [i] [ŋ] has a large fluctuation range of average air velocity. The range of average air velocity of posterior nasal sound [ŋ] is higher than that of anterior nasal sound [n]. The fluctuation range of the average air velocity of [a] [e] [u] is similar, but the range of the average air velocity of [e] is larger than [a] [e]. The average air velocity of [y] is the highest, and its pronunciation is stable.

4. Conclusion

This based on the principle of cooperative pronunciation, this paper analyzes the data of the average air velocity of the zero initial Syllables of children's Mandarin. At present, there are few studies on children's phonation air flow in China and they are still in a basic stage. Although some conclusions are drawn in this study, the pronunciation mechanism behind these conclusions needs to be further explored. The study of speech aerodynamics should be helpful for the development of linguistics on the basis of exploring the mechanism of pronunciation. I hope this paper can provide some reference for the follow-up study.

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