

PHONETIC EXPLANATION FOR INITIAL AND TONAL EVOLUTION IN WU DIALECTS OF CHINESE

Jianfen Cao

Institute of Linguistics, Chinese Academy of Social Sciences, China
jianfencao@163.com

ABSTRACT

This study tries to explore phonetic mechanism of the evolution both for initials and tones taken place in Wu Dialects of Chinese, so that to find out why the developments of the two aspects are always tangled one another. The preliminary perspectives drawn here are based on a brief survey to some relevant investigations. Both acoustic and physiological evidences gathered so far lead to a suggestion that the evolution either of initials and tones might be originated from the same source, i.e., they are all motivated by phonation type distinction existed around the boundary between initial consonant and following vowel of a syllable, and the contrasts of voiced vs. voiceless initials and Yin vs. Yang tones were both originated by such particular characteristics, which seems exist already at latest in the mid stage of Middle Chinese.

Keywords: phonetic mechanism, evolution, initial, tone, Wu dialects of Chinese

1. INTRODUCTION

1.1. The initials, finals, tones and their phonological functions in Chinese

Usually, a syllable in Chinese consists of initial (声母), final (韵母) and tone (声调). Phonologically, they all have the function in lexical distinction. However, it is result of an evolutionary process.

It is commonly supposed that voiced initial consonants in Ancient Chinese were real voicing, so we may accept this hypothesis before further discussion, though we are impossible to examine the nature of ancients' speech. Under this presupposition, some sound changes are examined here accordingly. One of them is the phonetic manifestation of historical voiced consonants from Ancient Chinese to modern Wu Dialects, the other is the split of the Four Tones (so-called 四声) from Middle Chinese to modern Wu Dialects.

1.2. Phonological contrasts of VL vs. VD initials and Yin vs. Yang tones

Historical literatures usually suggested that there was systematic contrast on voiceless (清) vs. voiced (浊) (hereafter, abbreviated as VL vs. VD) initials in Ancient Chinese, but no stationary tonal contrast until Middle Chinese. The clear documentary of Four Tones distinction was discovered in Qieyun (《切韵》) [8], which is commonly regarded as phonological representations of Middle Chinese.

1.2.1. On the phonemic function of the four tones

In the fact, Ancient Chinese, even in remote time, must have tonality features, just because the tone was a redundant feature at that time, thus, the tonal conception must have a developing process. According to relevant investigation [14], it was beginning about the later period of Han dynasty (in Ancient Age) to use tonal feature to distinguish lexical meaning. It must occurring even earlier in daily speech, and maturing gradually as Four Tones not later in Middle Chinese as what documented in the 《切韵》.

1.2.2. On the phonemic distinction of Yin vs. Yang tones

According to the phonological system shown in the 《切韵》, there still no clear distinction of Yin vs. Yang of tones, though did have four tones distinction in Middle Chinese, at least, it is true until the mid period of Mid Ancient Age. Consequently, from the viewpoint of phonemic function, the lexical meaning was still mainly distinguished by the contrast of VL vs. VD initials at that time.

Nevertheless, according to the information reflected in relevant literature [1], the process of tones split into Yin and Yang had initiated since 9th century at latest, that is the mid period of Mid Ancient Age. At first, the Ping tone (平声) was divided into Yin ping and Yang ping conditioned

by historical category of initials, i.e., Yin ping matching with voiceless initial and Yang ping with voiced initial respectively, and then were expanded into other tones gradually.

Almost at the same time, a distinguished evolution, i.e., the devoicing of voiced initials occurred. According to Shao [12], that was started around mid or late stage of 10th century, and it should exist much earlier in daily speech.

Along with the further devoicing of voiced initials and the expanding of tone split, the phonemic function on the contrast of Yin tone vs. Yang tone was strengthened gradually, and obtained the same distinctive status as the contrast of VL vs. VD initials at last.

2. PHONETIC ANALYSIS TO THE CONTRAST OF VL vs. VD INITIALS

2.1. What's the phonetic base of VL vs. VD contrast in Wu dialects

Generally, VL vs. VD contrast in Chinese Wu dialects was supposed to be based on whether there is vocal cords vibration or not during the consonant articulation, and that was maintained originally from Ancient Chinese. However, early in 1920s, Chao, Y-R had found that voiced stops in Wu Chinese were not "real voicing", but a voiceless consonant followed by some murmur/breathiness (so-called 清音浊流). Since then, the discussion was concentrated on how to understand the essence of 清音浊流, while the dispute were mostly based on perceptual impression and limited by subjective assumption until the experimental investigations conducted since 1980's. Obviously, it is impossible to directly examine the phonetic details of the ancients' articulation, thus, in order to understand the essence of 清音浊流, experimental analysis to the speech of modern Wu dialects has become the most practical strategy reasonably.

2.2. Phonetic analysis to VL vs. VD contrast

To explore the phonetic characteristics of VL vs. VD contrast, various experimental studies were conducted since 1980s [e.g., 2, 14, 3, 10, 13].

All the results obtained from above investigations have shown that, from Ancient Chinese to modern Wu Dialects, the phonetic base for the VL vs. VD contrast has changed from simple voice distinction (i.e., 带音/不带音, real voicing vs. un-voicing) to the conditional

alternation between the voice distinction and phonation type distinction. Specifically, in the case of domain start positions or stressed status, the contrast will display as the difference between breathy voice (so-called 气声 or 气嗓音) and normal voice of the following vowel, as well as the distinction of pitch register (see specified below) simultaneously; however, when it is in the domain inner positions or unstressed status, it will exhibit as the distinction between real voicing and un-voicing of consonant itself, while both distinctions on phonation type and pitch register will disappear immediately.

3. PHONETIC ANALYSIS TO THE CONTRAST OF YIN vs. YANG TONES

3.1. The phonetic manifestation of Yin tone and Yang tone

Phonetically, in domain-start positions or stressed status, Yin tone manifests as high tone or a tone with high-onset, and Yang tone as low tone or with low-onset. This phenomenon is so-called 阴高阳低, or further called 清高浊低 based on the phonotactic fact that voiced initials regularly coordinate with Yang tones, and the voiceless ones with Yin tones. Therefore, it was commonly suggested that voiceless initials will drive up pitch register and voiced ones lower the register. However, there was lack of specified explanation on why and how the influence takes place.

3.1.1. How true the 阴高阳低 or 清高浊低 is?

Relevant experimental results showed that [3,5], so-called 阴高阳低 or 清高浊低 is only limited in the case of domain-start positions or stressed status, while disappeared at once in domain-inner positions or unstressed status, where the pitch pattern of Yang tone will manifest similar as their Yin tone counterpart, moreover, has the Yin tone impression in perception.

Specifically, in the latter case, the pitch register of original Yang tone is not lowered but raised up instead. Thus, either of pitch register and the shape for both of Yang and Yin tone become alike, namely, the H vs. L feature for the Yin vs. Yang contrast has been neutralized. In addition, it is interesting that, the initial consonant becomes real voicing at the same time. Obviously, so-called 阴高阳低 or 清高浊低 is true only in phonological sense and limited in certain positions, in stead of the phonetic realization in all possible cases.

3.1.2. The physical and physiological mechanism of low or low-onset tones in Wu Dialects

According to phonetic analysis [3, 5], the breathiness is produced by a special phonation type during articulation, that the larynx usually to be lowered and the aryepiglotticus were tensed, and more resistance to the vibration of vocal cords will be produced. As the result, the fundamental frequency will be lowered reasonably, and a low or low-onset tone will be formed naturally.

After that, a physiological study [7] further verified this viewpoint. The results from the tests of fiberscope and myoelectricity measurements show that the activity of vocal cords muscles and cricothyroid are inhibited, while that of sternohyoideus muscles are increased during the articulation of voiced initials, especially at their onset. Generally, the activities of external muscles including sternohyoideus will introduce contraction of the aryepiglotticus and move downward of the larynx. These activities will cause the muscles of vocal cords become shorter and thicker, and its adversion tension will be reduced as well. Thereby, the velocity of vocal cords vibration must be lowered naturally. These findings provide us a well explanation for why and how the voiced consonants lower the pitch register.

4. THE RELATIONSHIP BETWEEN CONTRASTS OF VL vs. VD AND YIN vs. YANG IN WU DIALECTS

Why the contrasts of VL vs. VD initials always entangle with that of Yin vs. Yang tones in Wu Dialects? Is there any intrinsic relationship existed between the evolutions of the two aspects?

4.1. Conjunct lever between the contrasts of initials and tones in Wu Dialects

Based on the results obtained from relevant investigations so far, some distributional relationship between the contrasts of the two aspects could be seen that, on one hand, VL vs. VD of initials is distinguished *either* by phonation types *or* voice difference; on the other hand, Yin vs. Yang tones is distinguished *both* by phonation types *and* pitch features. It is obvious that here the phonation type distinction should be the conjunct lever for the contrasts of the two aspects.

4.2. Phonetic correlations between VL vs. VD and Yin vs. Yang in Wu Dialects

As described before, different phonation type is caused by different glottis state during articulation; for the case of Wu dialects, phonation type distinction is manifested as breathy voice and normal voice. Accordingly, the distinction between presence and absence of the breathiness is the mutual base both for the contrast of VL vs. VD and that of Yin vs. Yang. This correlated dependence reveals that phonation distinction is the bridge that exactly forms the inevitable connection between the evolutions of initials and tones from Ancient Chinese to modern Wu dialects.

5. DISCUSSION

5.1. Motivated factor of the sound changes

The relationship described above shows that the breathiness always co-occur with Yang tones, when Yang tones become Yintone-like tones in non-start position or unstressed status, not only the pitch register being raised systematically, but also the breathiness is disappeared and initial consonant becomes real voicing immediately. This fact revealed that sound changes both of initials and tones are essentially related to the distinction of phonation types, instead of voicing or un-voicing.

In addition, according to the perception test in general, the perceived feature of tonal patterns (such as high, low, rising or falling) mainly depend on the pitch feature of the final, but fewer on that of initial consonant (if there is any). For instance, the nasal or lateral themselves are all with voicing, while they can occur either in Yin tone or Yang tone syllables, and do not affect the distinction of H and L in perception, though the pitch of nasal or lateral themselves is relative lower in acoustics. This fact indicates again that sound changes either of initials and tones were not motivated by whether there is vocal cords vibration or not, but by phonation type difference.

Therefore, we would suggest that, phonation distinction is the strongest motivated factor for the changes of initials and tones, at least it is true in Wu Dialects. In the fact, according to some historical literature[1], such distinction seems exist already at latest in the mid stage of Middle Chinese, thus, it might also influence the evolution of initials and tones in other Chinese dialects, though the evolutionary direction and style are quite different. Of course, it is a more complicated challenge and has to be left open temporary.

5.2. Origination of phonation type distinction

In succession, another issue might be put forward is that, which constituent is responsible for the phonation type distinction, initial or final? Actually, it is a dated query issued since its phonological function to be found in Wu dialects early from 1980's [3, 5, 10] to recent decades [6]. Phonologically, it should be related to initial consonant, but phonetically seems not. The real matter was that, the main parameters for stop consonants were measured indirectly from earlier part of following vowel, instead of the consonant itself due to the difficulty in acoustic measuring to its closure.

To solve this limitation and deepen our cognition, and considering of the similarity both in auditory impression and phonological function referred to the contrast of VD vs. VL or Yin vs. Yang between stop and nasal initials, a mimesis investigation was taken to the nasal initials in Yin vs. Yang tone syllables [4], where the advantage was that, in addition to the data from following vowels, the harmonic data could be measured directly from closure phase of the nasals.

It was surprised that, the result was egregiously similar to the case of stop consonants, the perceptually contrast of plain vs. breathy nasals is also related to the phonation distinction that lied on the following vowel, rather than the nasal itself. Therefore, it confirmed the assumption made for the case of stops again [5], that phonation difference may be inherently belonging to the vowel, but spread to its previous consonants due to coarticulatory overlapping.

However, the issue was still remained as uncertain, because there was no enough evidence to reveal the phonation distinction is inherently belonging to the vowel, thus, this assumption is arguable. Perhaps, we need to change the angle of view and further checkup the data obtained so far. At first, the air dynamic data employed to determine phonation types in Cao [3, 5] were measured from the closure period and release phase of initial consonants; secondly, Ren's [10] fiberoptic and transillumination study had revealed the existence of glottis state difference during the closure of consonant articulation; and the third, Iwata's investigation [7] found that the muscle activity related to different glottal state takes place even earlier than the closure of initial consonants. More interested is that, these evidences, together with the harmonic feature in following vowel, are

all pointed to a particular area that around the boundary between initial consonant and following vowel, and just like the transition phase serving as the P-center (perception center) for the place of articulation, here this particular area could serve as the cue for discriminating the phonation types. Therefore, a new assumption might be proposed, that is, neither the consonant alone nor the vowel alone, but the whole syllable, is responsible for the phonation type distinction, and especially focused on the area nearby the boundary between initial consonant and following vowel.

6. REFERENCES

- [1] An Ran, 880. <悉曇藏>.
- [2] Cao, J.F. 1982. Phonetic characteristics of the voiced consonants in Changyinsha dialect. *Chinese Linguistics* 2.
- [3] Cao, J.F. 1987. On the relationship between voiced vs. voiceless and voicing vs. unvoicing. *Chinese Linguistics* 2.
- [4] Cao, J.F. 1990. On phonation types of initial nasals and some related considerations in Chinese Wu Dialects. *Proc. Of ICSLP Kobe, Japan*.
- [5] Cao, J.F., Maddieson, I. 1992. An exploration of phonation types in Wu dialects of Chinese. *Journal of Phonetics*, 20(1). (First appeared in UCLA Working Papers in Phonetics 72, 139-160. 1989.)
- [6] Hu, F. 2001. Acoustic analysis to the voiced stops of Wenzhou dialect. *Proc. of 5th Conference of Chinese Phonetics*.
- [7] Iwata, R. 1995. Physiological characteristics of the voiced consonants in Suzhou dialect. In Shi, F. (ed.), *Chinese Research Abroad*.
- [8] Lu, F.Y. 601. <切韵>.
- [9] Ren, N.Q. 1987. *An Acoustic Study of Shanghai Stops*. Unpublished manuscript, University of Connecticut, Storrs.
- [10] Ren, N.Q. 1988. *A Fiberoptic and Transillumination Study of Shanghai Stops*. Paper presented at the *International Conference on Wu Dialects Hong Kong*.
- [11] Rose, P. 1988. Phonetics and phonology of Yang tone: Phonation types in Zhenhai. *Proc. Of the International Conference on Wu Dialects Hong Kong*.
- [12] Shao, R.F. 1979. *A Course on the History of Chinese Phonetics*. Tianjin Renmin Press.
- [13] Shen, Z., Wooters, C., Wang, W.S.Y. 1987. Closure duration in the classification of stops: A statistical analysis. *The Ohio State University Working Papers in Linguistics* 35, 197-209.
- [14] Shi F. 1983. Acoustic characteristics of the voiced consonants in Suzhou dialect. *Yuyan Yanjiu* 1.
- [15] Zhou, Z.M. 1966. Explanation for the lexical distinction of the four tones. In Zhou, Z.M. (ed.), *Collected Works on Study and Research*. Beijing: Zhonghua Press.