Vowel restructuring under retroflex trill suffixation in JingMen Mandarin

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Abstract

This study employs acoustic and descriptive analyses to investigate how the rhotic trill [r], representing the -zi suffix, influences the monophthongal vowel system of Jingmen Mandarin. The analysis compares monosyllabic words representing the base vowel system with their -zi-suffixed counterparts, based on F1 and F2 formant measurements. The results show that underlying monophthongs tend to shift systematically toward [r], with front and back vowels undergoing resyllabification, while mid vowels exhibit stable shifts without resyllabification. These findings suggest that in Jingmen Mandarin, frontness plays a crucial role in the restructuring of the vowel system, as speakers adjust their articulation to accommodate the low-mid rhotic [r].

Keywords: vowel change, morphophology, rhotic suffix

Introduction

Rhotic suffixation represents a common morphophonological process in Chinese, typically associated with the *-er* suffix meaning 'son'. In the Jingmen context, however, there is no morphological realization of *-er*; instead, the suffix *-zi* ('son') carries a rhotic sound. Both suffixes have played crucial roles in derivational morphophonological processes since Middle Chinese, historically contributing to lexical expansion through the formation of disyllabic and polysyllabic words. In modern Chinese, although these suffixes have largely lost their semantic content and now function as empty morphemes, they remain phonetically significant in expressing pragmatic meanings such as diminutiveness, familiarity, and naturalness in everyday speech.

From a phonetic perspective, the rhotic suffix [r] in Jingmen Mandarin is characterized as an apical, trilled, voiced, and syllabic consonant when suffixed to a noun phrase (Liu 2017). On the one hand, its phonetic properties [+rhotic] and [+apical] correspond more closely to those observed in studies of the *er* suffix (for example, in Beijing Mandarin (Lee 2005) than to the *zi* suffix. On the other hand, its distinct manner of articulation (a trill) and its unspecified vowel quality make it particularly valuable for acoustic comparison with the plain vowel system, in order to explore how rhotic suffixation influences vowel production. Such a comparison allows us to determine whether the phonological processes in Jingmen Mandarin align with those associated with *er* suffixation. Specifically,

this study examines the acoustic characteristics of vowels in monosyllabic contexts (the plain vowel system) and in zi-suffix contexts (the zi system).

Methodology

Speech data were collected from two female native speakers of Jingmen Mandarin. Both speakers were born and raised in Shayang County, Jingmen City, and have lived there throughout their lives.

For the base vowel system, two meaningful monosyllabic words were selected to represent each rime. These words were embedded in a fixed carrier sentence, "把__再说一遍" ("say __ again"). For the *zi*-suffixed system, two disyllabic or trisyllabic phrases corresponding to each base vowel rime were selected and produced in isolation. All recordings were made using a Zoom H1n stereo recorder at a 44.1 kHz sampling rate, with four repetitions per token.

Acoustic analyses were conducted in Praat (version 6.0.19). Each monophthong token was divided into four equal intervals by five timepoints. For plotting, values from the middle timepoints were used, as well as the averaged values between the 75% and 100% timepoints. For the suffix [ɾ], formant values were extracted from the midpoint of the entire syllabic portion, using only tokens with preceding onsetless vowels [i], [u], and [a] to minimize consonantal influence.

Results

Firstly, to understand the relationship between the plain vowel system and the rhotic [ɾ], we examine Figure 1. It shows that [ɾ] aligns with vowels [a], [ɳ], and [ə] in terms of frontness, forming the middle category. The vowel [i] is front, [y] is mid-front, and [u] and [o] are back vowels. Regarding height, [i] and [y] are high vowels, while [u], [o], [ɳ], and [ə] share a mid height. The vowel [a] is noticeably low, with an F1 value exceeding 1100 Hz, whereas [ɾ] falls in the mid-low range. Overall, when comparing the plain vowel system with the rhotic suffix [ɾ], we can identify four degrees of frontness and four degrees of height contrast.

After understanding the feature contrasts between the plain vowel system and the rhotic [ɾ], we can observe two distinct patterns of change when suffixation occurs. As shown in Figure 2 (left panel), the dashed lines, which represent the average formant values from the final 25% of the vowel in F1 and F2, shift more centrally toward [ɾ] compared with the solid lines representing the midpoint values. This indicates a dynamic shifting of vowel quality over time.

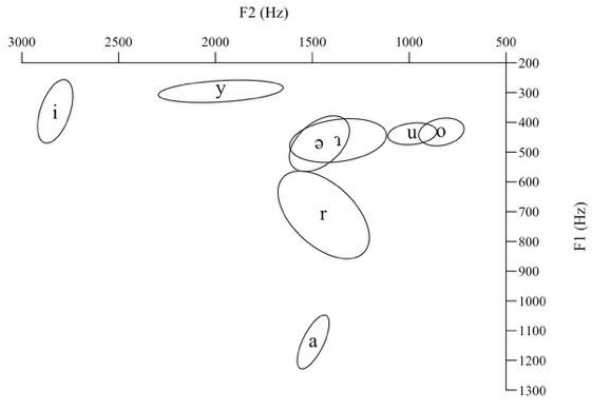

Figure 1. 1-sigma ellipses for Jingmen vowels [i, y, u, o, a, ɿ, ə] without suffixation, with rhotic [r] shown for reference

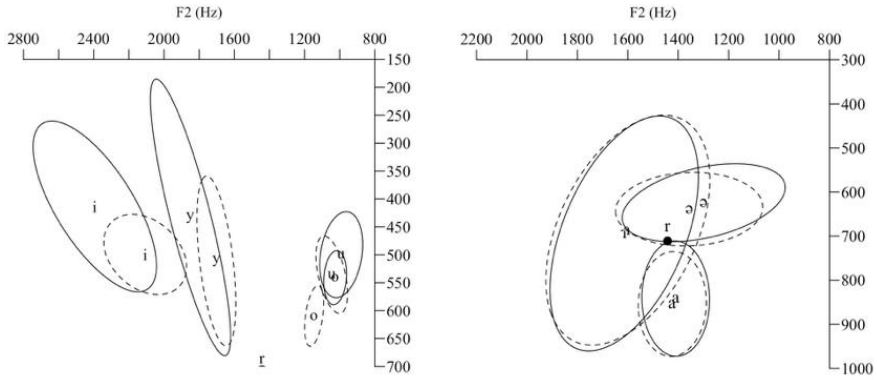

Figure 2. 1σ ellipses for Jingmen vowels with suffixation: front/back vowels [i, y, u, o] (right) and mid vowels [a, ɿ, ə] (left), in relation to rhotic [r]. Solid = 3/5 point; dashed = 4/5–5/5 average.

More specifically, for [y], [i], and [u], the trajectories of their final 25% overlap considerably with their midpoint values, suggesting that the influence of [r] extends beyond the vowel offset and already affects the vowel quality during its middle portion. In contrast, [o] displays a more distinct displacement between the midpoint and the final 25%, indicating a more consistent shift toward [r] at the offset.

The right panel of Figure 2 illustrates another pattern of rhotic influence. Unlike the gradual transitions seen on the left, these vowels [a], [ɿ], and [ə] exhibit little to no dynamic change between their midpoint and offset positions. Instead,

the entire vowel quality has shifted as a whole toward [r], forming a stable new phonetic realization. In addition to the diversity in whether resyllabification occurs, which is conditioned by the feature of frontness, there is also variation in how closely the vowels approach [r]. The front and back vowels move near [r], while the middle vowels largely overlap with it.

Discussion

The acoustic examination of plain and rhotic-suffixed vowels generally confirms the vowel centralization tendencies. However, unlike Beijing Mandarin, where resyllabification introduces an additional [ɚ] for most vowels except [u] (Lee 2005), the pattern in Jingmen Mandarin corresponds more closely to that observed in Southwestern Mandarin, where non-high vowels are entirely replaced by [ɚ], and high vowels exhibit gliding trajectories toward [ɚ] (Huang, Hsieh, & Chang 2020). Therefore, Jingmen Mandarin exhibits similar types of phonological patterns but with its own distinctive characteristics—namely, the rhotic suffix is realized as a low-mid [r] rather than a central [ɚ]; the vowels [o] and [u] are mid rather than high in height, yet they still exhibit gliding tendencies toward [r]. Overall, the pattern appears to be more sensitive to frontness. Besides, this suggests that although the suffix is morphologically realized as *-zi*, its phonetic and phonological effects on the vowel system are more comparable to those of the *-er* suffix.

References

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